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VIA ELECTRONIC & U.S. MAIL

October 4, 2016

Matt Chirdon, Senior Environmental Scientist (Specialist)
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
P.O. Box 1797
Ojai, California 93024
Em: matthew.chirdon@wildlife.ca.gov

RE: Devil's Gate Sediment Removal & Management Project.

Dear Mr. Chirdon,

On behalf of the Arroyo Seco Foundation ("ASF") and the Pasadena Audubon Society ("Audubon") (collectively referred to as "Commenters"), my Office is submitting comments regarding the Los Angeles County Flood Control District's ("County") Streambed Alteration Agreement ("SAA") Application to the California Department of Fish And Wildlife ("CDFW" or "Department") for the Devil's Gate Reservoir Sediment Removal and Management Project (collectively "Project").

The Arroyo Seco Foundation is a community-based 501(c)(3) nonprofit organization that advocates for an integrated, harmonious approach to watershed and flood management, water conservation, habitat enhancement, and the expansion of recreational opportunities through action projects, recreation, and environmental awareness activities. ASF has conducted a watershed coordination and education program in the Arroyo Seco Watershed for more than ten years. ASF members live, work, and recreate in the area surrounding the Devil's Gate Reservoir ("Reservoir").

Pasadena Audubon Society is a California nonprofit corporation that aims to bring the excitement of birds to their community through birding, education, and the conservation of bird habitats serving the communities of Alhambra, Altadena, Arcadia, Azusa, Duarte, El Monte, La Cañada, Monterey Park, Monrovia, Montrose, Pasadena, Rosemead, San Gabriel, San Marino, Sierra Madre, South Pasadena, and Temple City. Audubon members live and work near the Project site and frequently live, work, and recreate in the areas immediately surrounding the Devil's Gate Reservoir.

Commenters request that the Department reject the County's application for a SAA and Incidental Take Permit and instead order the preparation of a supplemental or subsequent environmental impact report ("SEIR"). The Project would destroy precious habitat for Federally and State Endangered Species and State Species of Concern just when those species are beginning to reestablish themselves in the Reservoir. The Project being proposed under the SAA is significantly different from the Project that was originally analyzed in the original environmental impact report and does not even comply with the original approvals issued by the County. Finally, the SAA itself is insufficiently protective of wildlife in the Reservoir.

In particular, this letter raises a number of questions and concerns about the Proposed Project, including:

I. PROJECT BACKGROUND.

II. BACKGROUND ON THE CALIFORNIA ENVIRONMENTAL QUALITY ACT.

III. SIGNIFICANT NEW INFORMATION REQUIRES PREPARATION OF A SUPPLEMENTAL, SUPPLEMENTAL, OR ADDENDUM ENVIRONMENTAL IMPACT REPORT.

IV. THE STREAMBED ALTERATION AGREEMENT SUBSTANTIALLY DIFFERS FROM THE ENVIRONMENTAL IMPACT REPORT.

a. The Project's Environmental Impact Report Does Not Analyze Impacts to Several Sensitive Species Covered Under the Streambed Alteration Agreement.

b. Since The Certification of the Environmental Impact Report, A Significant Presence of Federally and State Endangered Species Has Been Discovered On the Project Site.

c. Moreover, The Streambed Alteration Agreement Fails To Protect A Number Of Sensitive Species Identified In The Project's Environmental Impact Report.

d. The Project's Environmental Impact Report Does Not Accurately Reflect The Vegetation Communities On The Project Site.

e. The Streambed Alteration Agreement Should Limit Project's Routine Maintenance Year Is Limited To Those Timeframes Established In Other Sections Of The Streambed Alteration Agreement And The Conditions Imposed By The Board of Supervisors Prior to Certification of the Project's Environmental Impact Report.

f. The Streambed Alteration Agreement Presents Work Periods That Are Not Consistent with Other Environmental Assessments of the Project.

g. The Streambed Alteration Agreement Must Contain Meaningful Bypass Flow Provisions in Order to Comply with Fish and Game Code Section 5937.

h. The Streambed Alteration Agreement Must Reconcile Its Pre-Work Survey Requirements With Those Found in the Environmental Impact Report.

i. The Streambed Alteration Agreement Seasonal Restriction Does Not Conform to the Additional Conditions Imposed by the County Board of Supervisors Before Certifying the Environmental Impact Report.

j. The Streambed Alteration Agreement's Inventory of Native Oak Trees Does Not Comply with the Project's Environmental Impact Report and Incidental Take Permit and Does Not Discuss Compliance with County and City Oak Tree Ordinances.

k. The Streambed Alteration Agreement Discusses Nighttime Project Activities That Are in Conflict with the Expected Work Hours Presented In The Application For Incidental Take.

l. The Streambed Alteration Agreement Vegetation Maintenance Work Period Must be Reconciled with that in the Project's Environmental Impact Review and Incidental Take Application.

m. The Project's Environmental Impact Report Does Not Analyze The Draft Streambed Alteration Agreement's Proposed Mitigations.

V. THE DRAFT STREAMBED ALTERATION AGREEMENT DOES NOT CONFORM WITH THE COUNTY'S APPROVALS FOR THE PROJECT.

a. The Streambed Alteration Agreement Does Not Reflect The Conditions Of Approval By The County's Board Of Supervisors.

VI. THE STREAMBED ALTERATION AGREEMENT IS INSUFFICIENTLY PROTECTIVE.

a. The Significant Presence of Federally and State Endangered Species on the Project Site Mandates More Protective Measures.

b. The Streambed Alteration Agreement Should Not Be Entered into Until The County Has Submitted a Complete Mitigation Plan that Has Been Approved by the California Department of Fish and Wildlife.

c. The Off-Site Mitigation Option Should Be Available Before the Agreement is Executed.

d. The Habitat Restoration and Management Plans Should Be Completed Before Execution of the Streambed Alteration Agreement.

e. The Streambed Alteration Agreement Should Delay Temporary Impacts Until Mitigation Habitat is Fully Functioning.

VI. CONCLUSION.

This letter includes comments from T'Shaka Touré, a senior level regulatory specialist / biologist with experience in wetlands and regulatory permitting with an emphasis in resource management ("Mr. Touré"). Mr. Touré has 25 years of professional experience in research biology and wetland ecology. For the past twelve years, Mr. Touré have served as an environmental consultant focusing on biological and regulatory permitting (i.e., wildlife surveys, jurisdictional delineations, restoration and conservation biology, and Sections 1600, 404, and 401 permits). Prior to environmental consulting, Mr. Touré worked ten years for the U. S. Geological Survey (USGS), Biological Resource Division (Maryland and California) and six years for the Smithsonian Institution Museum of Natural History, Division of Vertebrate Zoology in Washington, D.C. In addition to his professional experience as a regulatory specialist and research biologist, Mr. Touré serves as an adjunct professor instructing courses in general biology, cellular biology, and human anatomy for the Rancho Santiago Community College District in Southern California. Mr. Touré's educational background includes a Masters of Science in Biology/Ecology and a Bachelors of Science in Zoology/Chemistry from Howard University, Washington, DC.

I. PROJECT BACKGROUND.

The Project (Public Notice/Application No.: SPL-2014-00591-BLR) is a sediment removal project in the Reservoir proposed by the County to remove sediment from behind Devil's Gate Dam ("Dam"). Built in 1920, the Dam is the oldest dam constructed by the County and provides flood protection to the cities of Pasadena, South Pasadena, and Los Angeles and promotes water conservation efforts. The Dam had an original storage capacity of approximately 7.42 million cubic yards ("mcy") at the time of its opening. Now, with sediment having accumulated behind the dam, it has an unused reservoir capacity of 3.72 mcy.

The Project is set to occur within Hahamongna Watershed Park ("Park" or "Project Site"), a well-known and widely used City of Pasadena designated nature preserve and recreational area. The 250-acre Park offers magnificent views of the San Gabriel Mountains and supports a wide variety of recreational uses, including hiking, bicycling, birding, horseback riding, picnicking, soccer, baseball, softball, disc golf, and other activities. The Park has also become home to a number of federally and state endangered species, including Least Bell's Vireo and the Southwestern Willow Flycatcher; as well as California listed Species of Concern Yellow Warbler, Yellow-breasted Chat, and Loggerhead Shrike.

The Project will destroy habitat for these federally and state endangered species, permanently decrease the recreational and aesthetic value of the Park, and displace recreational activities for a five-year period during which sediment removal is expected to be conducted.

Originally proposed as a 1.67 million cubic yards ("mcy") emergency sediment removal following the 2009 Station Fire, the Project has since ballooned into a massive 2.4 mcy sediment removal project. The sediment excavation would occur over a five-year period, and would span over 120 acres – almost half the size of the 250-acre Park – by removing sediment from a 76-acre area and establishing a permanent 52-acre maintenance area within Park, largely in the riparian streamzone.

The County has opted not to do a large scale sediment removal at the Project Site since 1994, when they removed a mere 0.19 mcy. This was in part due to improvements at the Dam that significantly increased the Reservoir's flood control capacity. Now, with the ready availability of State grant funds and the revival of the long-dead Eaton Canyon Pipeline Project, the County has suddenly decided that it is necessary to reduce the sediment level in the Reservoir to a level that it has not maintained since 1935. All despite the fact that the County's own Sediment Management Strategic Plan, released just in 2013, show that the Dam currently meets the County's flood control standards. The Los Angeles County Flood Control District, County of Los Angeles Department of Public Works (2013) Sediment Management Strategic Plan: 2012 – 2032 at 8 – 42.

The County of Los Angeles Board of Supervisors ("BOS") approved the Project and certified the Project's California Environmental Quality Act, Cal. Public Resources Code ("Pub. Res. Code") § 21000, *et seq* ("CEQA") Environmental Impact Report ("FEIR") on November 12, 2014.

In May 2016, application for the incidental take of endangered species under the California Endangered Species Act ("CESA") was submitted to the Regional Manager of Region 5: South Coast California Department of Fish and Wildlife.

II. **BACKGROUND ON THE CALIFORNIA ENVIRONMENTAL QUALITY ACT**.

CEQA was enacted by the California state legislature to "[d]evelop and maintain high-quality environment now and in the future, and take all action necessary to protect, rehabilitate, and enhance the environmental quality of the state." Pub. Res. Code § 21001(a). The legislature further declared that it is the policy of the state to:

> Prevent the elimination of fish or wildlife species due to man's activities, insure that fish and wildlife populations do not drop below self-prepetuation [*sic*] levels, and preserve for future generations representations of all plant and animal communities and examples of the major periods of California history.

Pub. Res. Code § 21001(c). In order to affect this policy, CEQA requires that governmental agencies give "major consideration to preventing environmental damage when regulating activities affecting the quality of the environment." *Citizens for Quality Growth v. City of Mount Shasta*, 198 Cal. App. 3d 433, 437 (1988). Agencies normally undertake a three-step process in deciding how CEQA's requirements will be satisfied. 14 Cal. Code of Regulations ("CCR") § 15002(k).

First, the lead agency on a project determines whether CEQA applies at all. 14 CCR § 15002(k)(1). CEQA applies to "discretionary projects proposed to be carried out or approved by public agencies…." Pub. Res. Code § 21080. "Project" is defined broadly to include "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment." 14 CCR § 15378. CEQA also provides a number of exemptions in Public Resources Code Section 21080. If the project is exempt, the process does not need to proceed any further and the agency may prepare a Notice of Exemption. 14 CCR § 15002(k)(1).

If the project is not exempt, the lead agency then conducts an Initial Study to determine whether the project may have a significant effect on the environment. If the Initial Study indicates that there is no substantial evidence that the project may have a substantial effect, the lead agency prepares a Negative Declaration. 14 CCR § 15002(k)(2). This must be based on a lack of substantial evidence, in light of the whole record before the agency, that the project may have a significant effect on the environment. Pub. Res. Code § 21080(c).

However, if the Initial Study reveals substantial evidence indicating that a project may have a significant environmental effect, the agency shall prepare an Environmental Impact Report ("EIR"). 14 CCR § 15002(k)(3); Pub. Res. Code § 21080(d). An accurate and detailed evaluation of a project's impacts through an EIR is extremely important to the public's interest in environmental resources because, under CEQA, a lead agency generally cannot approve a proposed project "if there are feasible alternatives or feasible mitigation measures which would substantially lessen the significant environmental effects of' the project." Pub. Res. Code § 21002.

III. SIGNIFICANT NEW INFORMATION REQUIRES PREPARATION OF A SUPPLEMENTAL, SUPPLEMENTAL, OR ADDENDUM ENVIRONMENTAL IMPACT REPORT.

Significant new information and changes to the project require the preparation of a supplemental environmental impact report. Section 15162 of Title 14 of the California Code of Regulations ("CEQA Guidelines") requires that a supplemental or subsequent environmental impact report be prepared when "[s]ubstantial changes are proposed in the project," "[s]ubstantial changes occur with respect to the circumstances under which the project is undertaken or upon the discovery of "[n]ew information of substantial importance" is discovered. *See also* Pub. Res. Code § 21166; 14 CCR §§ 15052, 15096(e), 15163 – 15164. CDFW could also assume the role of lead agency and prepare an entirely separate environmental impact report for the SAA. 14 CCR §§ 15052(b), 15162.

A supplemental or subsequent environmental impact report is required as substantial changes to the Project and the circumstances of the Project have occurred as well as new information of substantial importance has been discovered.

The SAA differs substantially from the Project's EIR, which did not analyze the presence of several sensitive species that are protected under the SAA, and the SAA reflects significant changes to the expected impact on vegetation communities.

Furthermore, since the certification of the Project's EIR, Mr. Touré, a senior-level regulatory specialist/biologist has reviewed the Project's documentation and indicated that the SAA provides insufficienct mitigation plans and does not adequately analyze impacts to sensitive and protected species, whose significant presence on the Project site has been newly documented since certification of the EIR. *See infra* Part IV(b).

IV. THE STREAMBED ALTERATION AGREEMENT SUBSTANTIALLY DIFFERS FROM THE ENVIRONMENTAL IMPACT REPORT.

a. The Project's Environmental Impact Report Does Not Analyze Impacts to Several Sensitive Species Covered Under the Streambed Alteration Agreement.

Impacts to California State Species of Special Concern Yellow-breasted Chat and Loggerhead Shrike; as well as the California and Federally listed endangered plant species Slender-Horned Spineflower, which are covered under the SAA, are not reviewed under the Project's Environmental Impact Report. Los Angeles County Flood Control District (2014) Devil's Gate Reservoir Sediment Removal and Management Project Final Environmental Impact Report ("FEIR"). Supplemental environmental review on potential impacts to these species must be made available to the public for notice and comment prior to issuance of the Streambed Alteration Agreement.

b. Since The Certification of the Environmental Impact Report, A Significant Presence of Federally and State Endangered Species Has Been Discovered On the Project Site.

The Project's EIR minimized the presence of the Federally and State listed endangered species Least Bell's Vireo, as well as completely ignored the presence of Southwestern Willow Flycatcher.

Biological documents already submitted to CDFW documents a strong and continuous presence of Least Bell's Vireo on the Project Site, with a most recent sighting on July 22, 2016. C. Darren Dowell, Checklist S30806857 (July 22, 2016). Moreover, County biological surveys observed "Two vireo family groups" on the Project Site on August 14, 2015. County of Los Angeles (2016) Devil's Gate Sediment Removal and Management Project: Application for Incidental Take of Endangered Species 34 ("Application for Incidental Take"). This observation is a critical one, because, as Mr. Touré found:

> The Project construction activities are likely to have a negative impact on the existing LBV population that occur, breed, forage, and utilize vegetative coverage within the reservoir. Recent biological reports have documented increased LBV activity within the reservoir over the course of the biological reports prepared for this project. Impacts within the known LBV locations will have an adverse affect on the individual population identified within the Project site and the surrounding area.

T'Shaka Touré, Comments on the Review of Environmental Documents (California Department of Fish and Game [Wildlife] 1600 Lake and Streambed Alteration Agreement, Incidental Take Permit 280) Prepared for the Devil's Gate Reservoir Sediment Removal and Management Project 5 (July 23, 2016) ("Touré July 23, 2016").

Finally, the Project's EIR and the SAA fail to evaluate the impact to, much less protect, the Federally and State Endangered Southwestern Willow Flycatcher, of which the County observed "one willow flycatcher family group" on August 14, 2015. Application for Incidental Take at 34.

c. **<u>Moreover, The Streambed Alteration Agreement Fails To Protect A Number Of Sensitive Species Identified In The Project's Environmental Impact Report</u>.**

The SAA fails to protect a number of species identified as potentially present in the Project's EIR. In particular, the Project's EIR identifies the Western Yellow Bat, Southern Grasshopper Mouse, American Badger, Sierra Madre Yellow-legged Frog, and Coast Range Newt (collectively "Omitted Species") as potentially occurring on the Project Site. FEIR at 106-07. The SAA should be altered to include protections for the Omitted Species.

d. **<u>The Project's Environmental Impact Report Does Not Accurately Reflect The Vegetation Communities On The Project Site</u>.**

Current vegetation communities on the Project Site are not accurately reflected in the Project's environmental impact report. The Proposed SAA states that the Project will permanently impact the following amount of vegetation communities:

- Black Willow (11.73 acres);
- Ephemeral Streambed (11.70 acres);
- Mulefat Thickets (8.49 acres);
- Bur-sage and Mustard (8.12 acres);
- Annual Forbs Riparian Herbaceous, also known as Cockebur-Ragweed (6.21 acres);
- Non-native or Disturbed, includes 2.11 acre Poison Hemlock Semi-natural Stand (5.77 acres);
- Disturbed Trails/Barren (1.80 acres);
- Mustard and Annual Brome Semi Natural Stand (1.25 acres);
- Perennial Pepperweed Semi-natural Stand (0.38 acres);
- Naturalized Ornamental Plants (0.23 acres);
- Disurbed Coast Live oak Woodlands (0.38 acres);
- California Sagebrush-California Buckwheat Scrub (0.16 acres);
- Coast Live Oak Woodlands (0.02 acres); and
- Disturbed Mulefat Thickets/Riparian Scrub (0.01 acres).

In addition, the Proposed SAA states that the Project will temporarily impact the following number of vegetation communities:

- Ephemeral Streambed (12.27 acres);
- Non-native or Disturbed (2.01 acres);
- Mustard and Annual Brome (0.45 acres);
- Perennial Pepperweed Semi-natural Stand (0.11 acres);
- Naturalized Ornamental Plants (0.05 acres);
- Black Willow Thickets (1.68 acres);
- Mulefat Scrub (1.37 acres);

- California Sagebrush-California Buckwheat Scrub (0.48 acres);
- Disturbed Mulefat (0.26 acres);
- Disturbed Coast Live Oak Woodlands (0.02 acres); and
- Coast Live Oak Woodland (0.01 acres).

These totals are not analyzed in the Project's EIR. In fact, the EIR fails to analyze the impacts that the Project will have on vegetation communities under the alternative that was eventually adopted by the County, Alternative 3, Configuration D, Option 2, and instead only analyzes impacts under Configuration A. FEIR Fig. 3.6-2; County of Los Angeles (Nov. 12, 2014) Statement of Proceedings For The Regular Meeting of The Board of Supervisors of The County Of Los Angeles Held In Room 381B Of The Kenneth Hahn Hall of Administration 500 West Temple Street, Los Angeles, California 90012 p. 40 ("Board of Supervisors Statement of Proceedings November 12, 2014").

Oral conversations with CDFW official, Matthew Chirdon confirmed that the vegetation communities on the Project Site have changed significantly from the conditions analyzed in the Project's environmental impact report.

e. <u>The Streambed Alteration Agreement Should Limit Project's Routine Maintenance Year Is Limited To Those Timeframes Established In Other Sections Of The Streambed Alteration Agreement And The Conditions Imposed By The Board of Supervisors Prior to Certification of the Project's Environmental Impact Report</u>.

The SAA should limit the County's traditional "routine maintenance year" to the periods proscribed by other sections of the SAA as well as by the County Board of Supervisors. The SAA provides that the Project's "Routine Maintenace Year" may extend from July 1 to June 30, yet also bars Project activities from occurring within 1000 feet of Least Bell's Vireo and Southwestern Willow Flycatcher habitat between March 15 through August 31 without consultation from the California Department of Fish and Wildlife. Los Angeles County Flood Control District's Streambed Alteration Agreement Application to the California Department of Fish And Wildlife for the Devil's Gate Reservoir Sediment Removal and Management Project 8 ("SAA"). Moreover, the County Board of Supervisors explicitly limited the Project hauling activities to April 15 to October 15. Board of Supervisors Statement of Proceedings November 12, 2014 at 40. The SAA should be revised to remove internal contradictions as well as conflicts with the original project approval.

f. <u>The Streambed Alteration Agreement Presents Work Periods That Are Not Consistent with Other Environmental Assessments of the Project</u>.

The SAA confines vegetation removal work to September 1 to March 14 in the years 2016 to 2018; however, the Application for Incidental Take does not list any initial vegetation removal work after February 2017. Application for Incidental Take at 12, 23. In addition, the SAA confines sediment removal to April 15 to December 31 in the years 2017 to 2022, whereas the County's Application for Incidental Take evaluated the impact of only April 15 to November 30 of approximately three to five years. *Compare* Application for Incidental Take at 23, *with* SAA at 6-7. The SAA provides for a vegetation removal and sediment removal periods in excess of those evaluated in the Application for Incidental Take. Accordingly, the SAA may result in an environmental impact greater than that previously evaluated. In order to ensure meaningful evaluation of the Project's environmental impacts, Project activity parameters must be clear and consistent across the various environmental assessment documents for the Project.

g. <u>The Streambed Alteration Agreement Must Contain Meaningful Bypass Flow Provisions in Order to Comply with Fish and Game Code Section 5937</u>.

When any dam or other artificial obstruction is being constructed, maintained, or placed in operation, Permittee shall allow sufficient water at all times to bypass dam to downstream reaches to maintain aquatic life below the dam pursuant to Fish and Game Code Section 5937. Fish and Game Code Section 5937 specifically provides that:

> The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam. During the minimum flow of water in any river or stream, permission may be granted by the department to the owner of any dam to allow sufficient water to pass through a culvert, waste gate, or over or around the dam, to keep in good condition any fish that may be planted or exist below the dam, when, in the judgment of the department, it is impracticable or detrimental to the owner to pass the water through the fishway.

The SAA notes that surface waters will be diverted around the work area to downstream reaches in a manner that will avoid siltation and pollution. SAA at 13. However, the SAA should explicitly provide for bypass flows that take into consideration not only qualitative but also quantitative water requirements of aquatic life below the dam, the raison d'être for Fish and Game Code Section 5937.

Moreover, the Project's FEIR notes the presence of and the potential for numerous fish and other aquatic species, including a number of special status animal species such as the coast range newt, to occur within and downstream of the Project Site. FEIR at 106 – 113.

h. <u>The Streambed Alteration Agreement Must Reconcile Its Pre-Work Survey Requirements With Those Found in the Environmental Impact Report</u>.

The SAA notes that the Permittee shall have the Designated Biologist survey the work area to verify the presence or absence of protected species. SAA at 8. The results of these surveys must be provided to the California Department of Fish and Wildlife prior to ground-disturbing activities. *Id.* The Project's EIR and Incidental Take Application require as a mitigation measure that this preconstruction survey be conducted within 90 days prior to ground-breaking activities. Application for Incidental Take at 64; FEIR at 127. Although the SAA is silent on the matter, the EIR and

Incidental Take Application also require that these preconstruction surveys must be repeated annually for the duration of the sediment removal. Application for Incidental Take at 64; FEIR at 127. The SAA must be edited to reflect these requirements.

i. The Streambed Alteration Agreement Seasonal Restriction Does Not Conform to the Additional Conditions Imposed by the County Board of Supervisors Before Certifying the Environmental Impact Report.

The SAA does not allow the Permittee to conduct any construction activities within 1000 feet of Least Bell's Vireo or Southwestern Willow Flycatcher habitat from March 15 through August 31 until consultation with California Department of Fish and Wildlife is complete. SAA at 7 – 8. However, the County Board of Supervisors explicitly restricted hauling to between April 15 to October 15 of each year. Board of Supervisors Statement of Proceedings November 12, 2014 at 40. Furthermore, the Project's Application for Incidental Take notes that bird-breeding season is generally from March 1 to August 31. Application for Incidental Take at 64. The SAA should ensure that seasonal restrictions are consistent with those sensitive timeframes at the heart of the Project's Incidental Take Application mitigation measures, which reasonably limit the environmental impact of the Project.

The SAA further allows all other construction activities during March 15 through August 15 that are conducted greater than 1000 feet from occupied or suitable protected species habitat until avoidance, minimization, and compensatory mitigation measures are authorized. SAA at 9. Neither the EIR nor the Application for Incidental Take for the Project evaluate whether 1000 feet distance from occupied or suitable protected species habitat is a sufficiently protective distance to avoid negative impacts. Furthermore, as noted above, the SAA should comply with the conditions imposed by the County Board of Supervisors, which expressly restrict hauling activities to between April 15 to October 15 of each year.

The SAA must clarify how its seasonal restriction is consistent with environmental assessments to date and the conditions imposed by the Board of Supervisors prior to certification of the Project's EIR. Otherwise, it is inappropriate to permit construction activities near protected species between March 15 and April 15, which is not consistent with the Project's EIR as certified by the Board of Supervisors and was not expressly evaluated as part of the Project's Application for Incidental Take.

j. The Streambed Alteration Agreement's Inventory of Native Oak Trees Does Not Comply with the Project's Environmental Impact Report and Incidental Take Permit and Does Not Discuss Compliance with County and City Oak Tree Ordinances.

While the SAA contemplates that root zone of oak trees in the Project may be impacted during Project activities, the EIR and Incidental Take Application note that the biological monitor shall implement measures to protect the root zone of oak trees that may be impacted immediately adjacent to the project site and along access roads. Application for Incidental Take at 65; FEIR at 503-04. Furthermore, the SAA must comply with the County of Los Angeles Oak Tree Ordinance, Los

Angeles, California, County Code 22.56.2050 *et seq.* and the Pasadena City Trees and Tree Protection Ordinance, Pasadena, California, Municipal Code 8.52.010 *et seq.*, which prohibit inflicting damage to or removal of native oak trees unless there is an applicable exemption or issued permit. The SAA should be edited to ensure conformity with oak tree provisions in the EIR and Incidental Take Application, and to discuss Project compliance with the County and Municipal Codes.

k. The Streambed Alteration Agreement Discusses Nighttime Project Activities That Are in Conflict with the Expected Work Hours Presented In The Application For Incidental Take.

The SAA attempts to minimize disturbance to night roosts by not allowing tree removal activities or construction activities within 100 feet of bridges between 10 p.m. and sunrise. SAA at 10. However, the EIR and Application for Incidental Take note that the expected work hours for the project is between 7:00 a.m. and 6:00 p.m. (7:00 p.m. during Daylight Savings Time). Application for Incidental Take at 11; FEIR at 22. The SAA should limit Project activities to work hours delineated in the EIR and Application for Incidental Take the or the SAA should clarify under what conditions nighttime tree removal or construction activities may occur and new environmental assessment of those impacts should be developed in an SEIR.

l. The Streambed Alteration Agreement Vegetation Maintenance Work Period Must be Reconciled with that in the Project's Environmental Impact Review and Incidental Take Application.

While the SAA notes that vegetative maintenance will be confined to July 1 to January 31 from 2022 to 2036, the Project's EIR notes that annual vegetative maintenance for the Project will occur over a three-week period in late summer or early fall. Application for Incidental Take at 12-13; FEIR at ES-8. The SAA must reconcile its allowed vegetative maintenance work period with that established in the Application for Incidental Take and the Project's EIR. In the alternative, these new parameters should be evaluated through a supplemental EIR to ensure that the Project's environmental impacts have been faithfully evaluated.

m. The Project's Environmental Impact Report Does Not Analyze The Draft Streambed Alteration Agreement's Proposed Mitigations.

Simply put, the Project's EIR and Application for Incidental Take pre-date the County's Streambed Alteration Agreement, and thus the mitigation measures proposed through the SAA were not evaluated as part of the Project's overall impacts.

CDFW must perform supplemental or subsequent environmental review to ensure that the actions selected are appropriate, the corresponding environmental impacts minimized, and more protective reasonable alternatives do not exist.

The FEIR improperly defers critical details of mitigation measures. Feasible mitigation measures for significant environmental effects must be set forth in an EIR for consideration by the lead agency's decision makers and the public before certification of the EIR and approval of a project. The formulation of mitigation measures generally cannot be deferred until after certification of the EIR and approval of a project. 14 Cal. Code Regs. § 15126.4(a)(1)(B) ("…[f]ormulation of mitigation measures should not be deferred until some future time.").

Deferring critical details of mitigation measures undermines CEQA's purpose as a public information and decision-making statute. "[R]eliance on tentative plans for future mitigation after completion of the CEQA process significantly undermines CEQA's goals of full disclosure and informed decisionmaking; and[,] consequently, these mitigation plans have been overturned on judicial review as constituting improper deferral of environmental assessment." *Communities for a Better Environment v. City of Richmond* (2010) ("*Communities*") 184 Cal.App.4th 70, 92. As the Court noted in *Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 307 "[a] study conducted after approval of a project will inevitably have a diminished influence on decision-making. Even if the study is subject to administrative approval, it is analogous to the sort of post hoc rationalization of agency actions that has been repeatedly condemned in decisions construing CEQA."

A lead agency's adoption of an EIR's proposed mitigation measure for a significant environmental effect that merely states a "generalized goal" to mitigate a significant effect without committing to any specific criteria or standard of performance violates CEQA by improperly deferring the formulation and adoption of enforceable mitigation measures. *San Joaquin Raptor Rescue Center v. County of Merced* (2007) 149 Cal.App.4th 645, 670; *Communities*, 184 Cal.App.4th at 93 ("EIR merely proposes a generalized goal of no net increase in greenhouse gas emissions and then sets out a handful of cursorily described mitigation measures for future consideration that might serve to mitigate the [project's significant environmental effects."); cf. Sacramento Old City Assn. v. City Council (1991) 229 Cal.App.3d 1011, 1028-1029 (upheld EIR that set forth a range of mitigation measures to offset significant traffic impacts where performance criteria would have to be met, even though further study was needed and EIR did not specify which measures had to be adopted by city).].

V. THE DRAFT STREAMBED ALTERATION AGREEMENT DOES NOT CONFORM WITH THE COUNTY'S APPROVALS FOR THE PROJECT.

a. The Streambed Alteration Agreement Does Not Reflect The Conditions Of Approval By The County's Board Of Supervisors.

The SAA fails to conform with the conditions of approval issued by the County Board of Supervisors and should be revised to include these conditions, upon which the County's approval of the Project is predicated.

The SAA authorizes Project activities, namely hauling vegetation and sediment from the Project Site, outside of the time periods approved by the County. The County's approval of the Project limits the Project to operate hauling operations between April 15 to October 15, "with the ability to go until December, *if* there is a late wet season and a dry fall." Board of Supervisors Statement of Proceedings

November 12, 2014 p. 40 (emphasis added). However, the SAA allows Project activities between April 15 to December 31 as well as allows vegetation removal between September 1 to February 1 for the years 2016 and 2017. Project activities were strictly limited to the interval of April 15 to October 15 by the County's conditions of approval. The SAA should similarly limit the Project's activities to be conducted between April 15 to October 15, "with the ability to go until December *if* there is a late wet season and a dry fall."

Moreover, the County explicitly requires that the Project "restore habitat in the project area that is consistent with the Hahamongna Watershed Park Master Plan. Statement of Proceedings at p. 41. However, the Project's proposed amount of sediment removal, footprint and habitat restoration plans fail to substantially conform with the Hahamongna Watershed Park Master Plan. City of Pasadena (2003) Arroyo Seco Master Plans: Hahamongna Watershed Park Master Plan ("Master Plan").

The Project's habitat restoration plans fail to conform with the Master Plan. Master Plan at pp. 3-18 – 3-42. The Master Plan requires the County to undertake 11 habitat restoration projects that include restoring Riversidean Alluvial Fan Sage Scrub, establish habitat at the City of Pasadena's nearby Spreading basins, and widening the stream channel. *Id.* at p. 3-19. The SAA should be altered to require habitat restoration in the habitat restoration areas specified in the Master Plan.

VI. THE STREAMBED ALTERATION AGREEMENT IS INSUFFICIENTLY PROTECTIVE.

a. The Significant Presence of Federally and State Endangered Species on the Project Site Mandates More Protective Measures.

As noted above, *supra* Part IV(b), biological documents submitted to CDFW note a strong and continuous presence of Least Bell's Vireo on the Project Site, with a most recent sighting on July 22, 2016. C. Darren Dowell, Checklist S30806857 (July 22, 2016). Moreover, County biological surveys observed "Two vireo family groups" on the Project Site on August 14, 2015. Application for Incidental Take at 34. After review of biological documents, Mr. Touré noted that suitable Least Bell's Vireo habitat exists onsite; the largest number of Least Bell's Vireo documented at the site occurred in 2015, indicating a growing trend in Least Bell's Vireo activity; and impacting these locations will have a negative impact on the species. T'Shaka Touré, Comments on the Habitat Utilization for the Least Bell's Vireo, Prepared for the Devil's Gate Reservoir Sediment Removal and Management Project 2 (Touré August 8, 2016). These observations are critical, because, as Mr. Touré has previously concluded:

> The Project construction activities are likely to have a negative impact on the existing LBV population that occur, breed, forage, and utilize vegetative coverage within the reservoir. Recent biological reports have documented increased LBV activity within the reservoir over the course of the biological reports prepared for this project.

> Impacts within the known LBV locations will have an adverse affect on the individual population identified within the Project site and the surrounding area.

Touré July 23, 2016 at 5. Accordingly, the Project area the Streambed Alteration Agreement must ensure that Federally and State endangered species are provided sufficient protective measures to avoid unnecessary take and to ensure the species' continued survival. To that extent, Mr. Touré recommended:

- Limit the destruction of riparian habitat within the project site where dense patches occur and along drainage courses,
- Implement a less invasive sediment removal plan,
- Avoid sediment removal within locations where LBV individuals have been documented,
- Avoid construction activities during March through July, of each calendar year,
- Implement an exotic plant species and brown-headed cowbird eradication and control measures,
- Protect and preserve willow trees and mulefat shrubs located near and adjacent standing water and flowing drainage features,
- Limit the destruction of riparian habitat within the Project area,
- Approximately 3-5 years is required for restoration habitat to exhibit features allowing nesting LBV to be supported entirely within restored sites. As such, a closer examination is required for vegetative and shrub removal.

Touré August 8, 2016 at 4.

b. The Streambed Alteration Agreement Should Not Be Entered into Until The County Has Submitted a Complete Mitigation Plan that Has Been Approved by the California Department of Fish and Wildlife.

The SAA requires the County to mitigate the acres of permanent impact in a manner to be approved by CDFW. SAA at 18-19. The SAA also notes that the County has proposed a partial mitigation plan within the Hahamonga Watershed. *Id.* The SAA further requires that the County propose a compensatory mitigation plan to offset the remaining acres impacted. *Id.* However, the SAA does not require that a complete and approved mitigation plan be in place as a precondition to allowing the Project to proceed within the watershed. Rather, the SAA only requires a "Conceptual Mitigation Package" with enough information to evaluate suitability of proposed sites for mitigation of Project impacts prior to *Project initiation*. *Id.* at 20. This elevates the risk to fish and wildlife resources by sanctioning streambed alteration in the absence of proper assurance that an actual and comprehensive compensatory remedy is feasible and will be promptly implemented.

After reviewing the SAA and Application for Incidental Take documents for the Project, Mr. Touré noted:

> The County's environmental documents conclude that mitigation measures would reduce impacts to biological resources to a level of less-than-significant. However, based on my review of the documents listed above and referenced in this comment letter, the proposed mitigation measures are not adequate to reduce the Project impacts on biological resources to a less-than-significant level. The mitigation measures proposed for this Project are incomplete, have not been satisfactorily achieved, lack substance and enforcement measures, furthermore onsite mitigation can not ensure the proposed mitigation areas will not be disturbed and/or impacted if and when future dredging activity is required in the reservoir.

Touré July 23, 2016 at 2.

The County has yet to submit a Habitat Mitigation and Monitoring Plan to either CDFW or the other permitting agencies involved with the Project, including USFWS and the U.S. Army Corps of Engineers. Oral communications with Christine Medak of USFWS confirmed that the County has yet to submit a Habitat Mitigation and Monitoring Plan to USFWS.

In order to avoid inconsistencies between the Mitigation Plans for the Project under CDFW's SAA and for USFWS, the SAA should be conditioned in part on an approved mitigation plan from USFWS and CDFW.

Accordingly, the SAA should be modified to require that a complete mitigation plan which addresses all permanent impacts, and which has been fully approved by CDFW, be in place before an agreement for streambed alteration will be approved within the watershed.

c. The Off-Site Mitigation Option Should Be Available Before the Agreement is Executed.

Similar to the shortfalls of the Mitigation Plan noted above, the County should submit a complete plan for an off-site mitigation option, and that plan should be approved by CDFW prior to execution of the SAA. At the present, the SAA only requires approval from the Department of Fish and Wildlife prior to project initiation. SAA at 20. Requiring approval prior to execution of the SAA will ensure that an actual and comprehensive compensatory remedy is feasible and will be promptly implemented to mitigate Project impacts.

d. The Habitat Restoration and Management Plans Should Be Completed Before Execution of the Streambed Alteration Agreement.

As with the Project's mitigation plan and off-site mitigation option, complete habitat restoration and management plans should be submitted to and approved by CDFW prior to execution of the SAA. This will ensure that an actual and comprehensive habitat restoration and management is feasible and will be promptly implemented to mitigate Project impacts.

e. **The Streambed Alteration Agreement Should Delay Temporary Impacts Until Mitigation Habitat is Fully Functioning.**

The SAA calls for mitigation of temporary impacts by delaying impacts to the acre area until the third year of sediment removal. SAA at 19. However, it takes approximately three to five years for restoration habitat to exhibit features allowing nesting Least Bell's Vireo to be supported entirely within restored sites. Touré August 8, 2016 at 4. Accordingly, the County should ensure mitigation of impacts to sensitive species by delaying temporary impacts until five years or until a qualified biologist can certify that the restored habitat exhibits features allowing species such as Least Bell's Vireo to be fully supported entirely within restored sites.

VI. CONCLUSION.

Commenters request that the Department reject the County's application for a SAA and Incidental Take Permit and instead order the preparation of a supplemental environmental impact report ("SEIR").

Sincerely,

Mitchell M. Tsai
Attorneys for Arroyo Seco Foundation
& Pasadena Audubon Society

CC: Christine Medak, United States Fish & Wildlife Services; Bonnie Roger, United States Army Corps of Engineers.

Attached:

Darren Dowell, Checklist S30806857 (July 22, 2016) (Exhibit A);

T'Shaka Touré, Comments on the Review of Environmental Documents (California Department of Fish and Game [Wildlife] 1600 Lake and Streambed Alteration Agreement, Incidental Take Permit 280) Prepared for the Devil's Gate Reservoir Sediment Removal and Management Project 5 (July 23, 2016) (Exhibit B);

County of Los Angeles (Nov. 12, 2014) Statement of Proceedings For The Regular Meeting of The Board of Supervisors of The County Of Los Angeles Held In Room 381B Of The Kenneth Hahn Hall of Administration 500 West Temple Street, Los Angeles, California 90012 (Exhibit C);

City of Pasadena (2003) Arroyo Seco Master Plans: Hahamongna Watershed Park Master Plan (Exhibit D); and

T'Shaka Touré, Comments on the Habitat Utilization for the Least Bell's Vireo, Prepared for the Devil's Gate Reservoir Sediment Removal and Management Project 2 (Touré August 8, 2016) (Exhibit E).

<u>EXHIBIT A</u>

Checklist S30806857

Location

Hahamongna Watershed Park (formerly Oak Grove Park), Los Angeles County, California, US

Date and Effort

Fri Jul 22, 2016 5:37 AM

Protocol: Traveling

Party Size: 1

Duration: 5 hour(s), 13 minute(s)

Distance: 3.5 mile(s)

Observers: **Darren Dowell**

Comments: full loop around, but almost entirely at basin level off main trails for southwest part. Clear, 70s to 90s F, winds light, dry, very limited water (far NW and SE). Bobcat seen where Berkshire Creek/Flint Wash channel opens to dam base.

Species

58 species (+1 other taxa) total

Hide Media

1 **Mallard** *Anas platyrhynchos*

2 **Red-shouldered Hawk** *Buteo lineatus*

1 **Red-tailed Hawk** *Buteo jamaicensis*

1 **Killdeer** *Charadrius vociferus*

40 **Rock Pigeon (Feral Pigeon)** *Columba livia (Feral Pigeon)*

1 **Band-tailed Pigeon** *Patagioenas fasciata*

35 **Mourning Dove** *Zenaida macroura*

2 **White-throated Swift** *Aeronautes saxatalis*

1 **Black-chinned Hummingbird** *Archilochus alexandri*
adult male at edge of willow forest

7 **Anna's Hummingbird** *Calypte anna*

18 **Allen's Hummingbird** *Selasphorus sasin*

7 **Acorn Woodpecker** *Melanerpes formicivorus*

4 **Nuttall's Woodpecker** *Picoides nuttallii*

1 **Downy Woodpecker** *Picoides pubescens*

30 **Red-crowned Parrot** *Amazona viridigenalis*

1 **Blue-crowned Parakeet** *Thectocercus acuticaudatus*

flyover, east to west. Observed without binoculars -- relatively large green parakeet (long tail), no red noticed on head, noticeably pale underneath wings (but didn't see orange coloring). Distinctive vocalization, unlike typical RMPA or MIPA -- more similar to RCPA's "kyew kyew kyew" with down slurred syllables, but higher and more "nasal". Vocalization a good match to several flight call recordings on xeno-canto.

6 **Black Phoebe** *Sayornis nigricans*

2 **Ash-throated Flycatcher** *Myiarchus cinerascens*

2 **Cassin's Kingbird** *Tyrannus vociferans*

2 **Western Kingbird** *Tyrannus verticalis*

1 **Bell's Vireo** *Vireo bellii*

at least one bird -- likely two -- observed in two locations 320 m (and about 2 hours) apart. Location #1: 34.189256,-118.176262 . Location #2: 34.186526,-118.176382 .

Photo taken at location #2:

ML31499851 Macaulay Library

in location #1

ML31499861 Macaulay Library

© Darren Dowell
in location #1

ML31499871 Macaulay Library

© Darren Dowell
in location #1

ML31499901 Macaulay Library

© Darren Dowell
in location #2

ML31500991 Macaulay Library

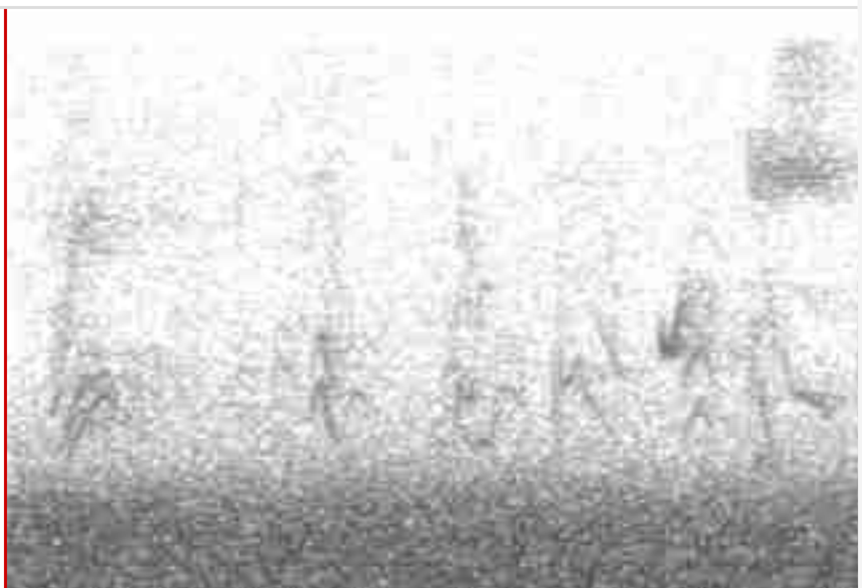
© Darren Dowell
in location #2

Behaviors:	song, call
Playback:	Not used
Recorder:	Olympus LS-10

ML31501021 Macaulay Library

© Darren Dowell
in location #2; Warbling Vireo also singing; approx. 1 sec early in recording blanked due to loud insect

Behaviors:	song, call
Playback:	Not used
Recorder:	Olympus LS-10



ML31501031 Macaulay Library

in location #1

Behaviors:	song, call
Playback:	Not used
Recorder:	Olympus LS-10

4 **Hutton's Vireo** *Vireo huttoni*

1 **Warbling Vireo** *Vireo gilvus*
along Berkshire Creek; singing (and recorded along with Bell's vireo)

10 **Western Scrub-Jay (Coastal)** *Aphelocoma californica [californica Group]*

15 **American Crow** *Corvus brachyrhynchos*

8 **Common Raven** *Corvus corax*

6 **Northern Rough-winged Swallow** *Stelgidopteryx serripennis*

3 **Barn Swallow** *Hirundo rustica*

2 **Cliff Swallow** *Petrochelidon pyrrhonota*

6 **Oak Titmouse** *Baeolophus inornatus*

30 **Bushtit** *Psaltriparus minimus*

2 **House Wren** *Troglodytes aedon*

12 **Bewick's Wren** *Thryomanes bewickii*

2 **Blue-gray Gnatcatcher** *Polioptila caerulea*

4 **Wrentit** *Chamaea fasciata*

2 **Western Bluebird** *Sialia mexicana*

3 **American Robin** *Turdus migratorius*
juvenile seen with adult in oak woodland

Breeding Code	FL Confirmed--Recently Fledged Young

ML31505961 Macaulay Library

© Darren Dowell

Age: Juvenile

6 **California Thrasher** *Toxostoma redivivum*

5 **Northern Mockingbird** *Mimus polyglottos*

5 **European Starling** *Sturnus vulgaris*

4 **Orange-crowned Warbler** *Oreothlypis celata*

5 **Common Yellowthroat** *Geothlypis trichas*

16 **Yellow Warbler** *Setophaga petechia*

2 **Wilson's Warbler** *Cardellina pusilla*
heard only (call)

1 **Lark Sparrow** *Chondestes grammacus*

10 **Song Sparrow (heermanni Group)** *Melospiza melodia [heermanni Group]*

25 **California Towhee** *Melozone crissalis*

17 **Spotted Towhee** *Pipilo maculatus*

1 **sparrow sp.** *Emberizidae sp. (sparrow sp.)*
very poor photos of possible Bell's or black-throated sparrow

8 **Black-headed Grosbeak** *Pheucticus melanocephalus*

2 **Lazuli Bunting** *Passerina amoena*

5 **Brown-headed Cowbird** *Molothrus ater*

4 **Hooded Oriole** *Icterus cucullatus*

2 **Bullock's Oriole** *Icterus bullockii*

100 **House Finch** *Haemorhous mexicanus*
many along vegetated edges of open areas

12 **Lesser Goldfinch** *Spinus psaltria*

1 **Lawrence's Goldfinch** *Spinus lawrencei*
identified by flight call; probably 3 (small flock seen in distant flight)

2 **House Sparrow** *Passer domesticus*

12 **Scaly-breasted Munia** *Lonchura punctulata*

Are you submitting a **complete checklist** of the birds you were able to identify?

Yes

<u>EXHIBIT B</u>

July 23, 2016

Mr. Mitchell M. Tsai
Mitchell M. Tsai, Attorney At Law
1055 East Colorado Boulevard, Suite 500
Pasadena, California 91106

Subject: Comments on the Review of Environmental Documents (California Department of Fish and Game [Wildlife] 1600 Lake and Streambed Alteration Agreement, Incidental Take Permit 280), Prepared for the Devil's Gate Reservoir Sediment Removal and Management Project

Dear Mr. Tsai:

This letter summarizes my review of the proposed Devil's Gate Reservoir Sediment Removal and Management Project as it relates to biological and regulatory permitting concerns. My comments are based on a review of the following environmental and regulatory documents: California Department of Fish and Wildlife Section 1600[11], and the Incidental Take Permit 20181 prepared for the proposed Devil's Gate Reservoir Sediment Removal and Management Project (Project).

The Project site is owned by the Los Angeles County Department of Public Works within the City of Pasadena, Los Angeles County, California at 1065 La Canada Verdugo Road, Pasadena, Los Angeles County, California, 91103. The proposed Project boundary encompasses approximately 120 acres within an approximately 258-acres reservoir that has wetlands, braided channels, and drainage features surrounded by an urban matrix.

The Los Angeles County Flood Control District (LACFCD, herein referred to as County) proposes to excavate 2.4 million cubic yards of sediment (inclusive of vegetation) that has accumulated behind the dam within Devil's Gate Reservoir, to restore reservoir capacity for storm and sediment inflows to minimize the level of flood risk to downstream communities along the Arroyo Seco waterway. The activities would result in temporary discharges of fill within waters of the United States through periodic excavation of accumulated sediment and removal of riparian vegetation. Activities would be conducted within an approximately 71-acre footprint, of which approximately 38 acres would directly impact waters of the United States (10.8 acres of wetland, and 27 acres of non-wetland)[1]. Recently reviewed LSAA indicate the project activity footprint has been decreased to 68.59 acres[2]. The proposed maintenance baseline would be maintained by future sediment excavation activities.

I am a senior level regulatory specialist/biologist with experience in wetlands and regulatory permitting with an emphasis in resource management. I have 25 years of professional experience

[1] Devil's Gate Reservoir Sediment Removal and Management Project, Final Environmental Impact Report (FEIR) prepared for the Los Angeles County Flood Control District by Chambers Group, Inc.
[2] CDFW 1600 Lake and Streambed Alteration Agreement., County edits and comments.

in research biology and wetland ecology. For the past twelve years, I have served as an environmental consultant focusing on biological and regulatory permitting (i.e., wildlife surveys, jurisdictional delineations, restoration and conservation biology, and Sections 1600, 404, and 401permits). Prior to environmental consulting, I worked ten years for the U. S. Geological Survey (USGS), Biological Resource Division (Maryland and California) and six years for the Smithsonian Institution Museum of Natural History, Division of Vertebrate Zoology in Washington, D.C. In addition to my professional experience as a regulatory specialist and research biologist, I've served as an adjunct professor instructing courses in general biology, cellular biology, and human anatomy for the Rancho Santiago Community College District in southern California. My educational background includes M.S. in Biology/Ecology and B.S. in Zoology/Chemistry from Howard University, Washington, DC.

For the proposed Project, I have concerns regarding the lack of required environmental documentation and analysis specifically, Conceptual Mitigation and Monitoring Plan, Habitat Restoration Plan, Habitat Management Plan, and Water Diversion Plan. Additionally, the project lacks adequate mitigation acreage and has not responded to questions presented by USFWS. The project requires USFWS Section 7, formal consultation and Biological Opinion for the LBV. These concerns are based on my review of the following documents prepared for this Project; 1) CDFW Section 1602, Lake and Streambed Alteration Agreement (LSAA) and 2) Incidental Take Permit Application.

The County must provide: 1) improved and specific language regarding the protection and mitigation measures for LBV since the species has been detected on the Project site, 2) revised maps depicting accurate impact boundaries, 3) complete regulatory permitting packages consisting of 404 (USACE), and 401 (RWQCB) permit applications, 4) mitigation measures that address the eradication and control of brown-headed cowbirds, 5) request for USFWS, formal consultation, 6) request for a Biological Opinion for the LBV, and 7) identification of 43.5 acres for off-site mitigation.

BACKGROUND

The Project proposes construction activities for the removal of sediment from the reservoir. In order to excavate sediment from the reservoir, trees and vegetation growing within the excavation area or where haul roads are located would be removed. In the areas where excavation would not take place, including the western side of the reservoir (Oak Grove area), vegetation would not be removed although a paved road is proposed for the western side of the reservoir[3].

DISCUSSION

The County's environmental documents conclude that mitigation measures would reduce impacts to biological resources to a level of less-than-significant. However, based on my review of the documents listed above and referenced in this comment letter, the proposed mitigation measures are not adequate to reduce the Project impacts on biological resources to a less-than-significant level. The mitigation measures proposed for this Project are incomplete, have not been satisfactorily achieved, lack substance and enforcement measures, furthermore onsite mitigation can not ensure the proposed mitigation areas will not be disturbed and/or impacted if and when future dredging activity is required in the reservoir. Although onsite mitigation is achievable it does not constitute full mitigation compliance based on the fact that future impacts onsite may

[3] CDFW 1600 Draft Lake and Streambed Alteration Agreement.

arise for continued reservoir maintenance activities. Adequate off-site mitigation is required and must be identified, created, established, and/or acquired for impacts that will occur to LBV, riparian and wetland habitat.

Suitable least Bell's vireo (LBV) riparian habitat exist onsite. Impacting these locations will have a negative impact on the species. Additionally, concerns regarding the invasive brown-headed cowbird have not been addressed in the LSAA and ITP application. The eradication and control of invasive species is an important component of restoration activities for wildlife species. As such, in order to protect LBV species currently occupying habitat within the reservoir, the eradication and control of brown-headed cowbird must be addressed. The currently proposed mitigation measures and implementation language regarding mitigation and protective measures for LBV, riparian and wetland habitat is not adequate enough to reduce impacts to a less-than-significant level. In fragmented landscapes, habitat corridors are of key importance for maintaining widespread wildlife populations. Riparian areas, in addition to linking natural hydrological systems, commonly provide the best opportunities for wildlife movement through urbanized areas. The mitigation measures proposed lack adequate analysis and do not address these critical elements (i.e., habitat corridors, breeding populations, eradication of invasive species).

The LSAA edits and comments proposed by the County have removed several protective measures and raise additional concerns for implementation of adequate mitigation measures. Although there are a few sections were the County has inserted language that improves protective measures the overall edits are not merited for adequate long-term protective measures and during the duration of Project activities.

The required regulatory permits (Regional Water Quality Control Board, 401 Certification (RWQCB) and U.S. Army Corps of Engineers (USACE) 404 Permit) have not been completed and are required pursuant CEQA compliance. Additionally, the LSAA edits proposed by the County do not meet required CEQA guidelines for avoidance and mitigation measures for adverse impacts to plant, wildlife, and natural resources. Therefore until adequate and acceptable mitigation measures, draft mitigation plan and/or mitigation bank, and completed regulatory permitting packages are submitted for review and approval the Project authorization for construction activities is not in compliance pursuant CEQA guidelines.

Based on my experience and knowledge of biological resources and regulatory requirements within the region of the Project site. This Project lacks adequate mitigation measures, draft conceptual mitigation plan, Habitat Restoration Plan, Habitat Management Plan, and a plant species palette list for species proposed within the restoration, enhancement, and mitigation areas. Due to the presence of least Bell's vireo activity within the reservoir and surroundings (i.e., Hahamongna Watershed Park), mitigation measures, draft mitigation plan or mitigation bank, regulatory permit applications (i.e., 404, and 401) the proposed Project has a significant impact on the environment.

SUMMARY

Concerns:
ITP

a. Prior to construction activities a defined limit on the amount of acreage of impacts should be determined in the ITP and Biological Opinion. Currently, there is no defined limit for impacts in the ITP application.

Biological Opinion

a. Based on the County request for an Incident Take Permit 2081, USFWS Section 7 formal consultation should also occur. The Project has failed to provide sufficient and adequate responses from the informal consultation.
b. Per the informal consultation a Conceptual Mitigation Plan, and/or Habitat Mitigation and Monitoring Plan (HMMP) is required and to date those documents have not been submitted.
c. A Biological Opinion for the protection of the LBV should occur based on the following criteria:
    1) Critical habitat for LBVI occurs on the project site, 2) critical habitat for LBV may be affected by project activities, 3) critical habitat may be adversely affected by project activities. As such, based on items 1-3, a request for Formal Consultation should be initiated. Additionally, based on a review of the informal consultation conducted for the project there are several questions that have still not been answered by the County[44].

Concerns:
Initial Sediment Removal Area

a. Is this area 70.84 acre or actually 68.59 acre? Although these acreage numbers are not significantly different the acreage reference should be accurate and internally consistent across all environmental documents and permit applications. Please provide updated maps depicting area to be impacted within the Initial Sediment Removal Area.

Permanent Maintenance Area

a. Is this area 51.74 acre or actually 52.59 acre? Although these acreage numbers are not significantly different the acreage reference should be accurate and internally consistent across all environmental documents and permit applications. Please provide updated maps depicting area to be impacted within the Permanent Maintenance Area.

Planting Plan

a. Planting should be completed prior to March in order to avoid any impacts to LBV habitat for species that could potentially arrive early during March.

b. Restoration and planting activities should be limited to the non-breeding season (November-February). Removal of invasive plant species within the LBV habitat should be conducted by hand and not machinery equipment.

c. A plant species palette list should be submitted and approved prior to removal and restoration activities. The plant species palette should consist of primarily native riparian species and not upland species. Based on my review of the documents the

[4] USFWS, Section 7 Informal Consultation May 1, 2015 Request for Information SPL-2014-00591.

proposed onsite restoration area is primarily upland habitat while the impacted areas are riparian. The plant palette should reflect riparian species as opposed to upland plant species. Currently it appears that riparian habitat will be mitigated with upland habitat. LBV utilize patches of riparian habitat and not upland vegetation.

Concerns:
Least Bell's Vireo (LBV)

a. The Project construction activities are likely to have a negative impact on the existing LBV population that occur, breed, forage, and utilize vegetative coverage within the reservoir. Recent biological reports have documented increased LBV activity within the reservoir over the course of the biological reports prepared for this project[5]. Impacts within the known LBV locations will have an adverse affect on the individual population identified within the Project site and the surrounding area.

b. Impacting 0.50 acre of previously occupied habitat may cause existing LBV individuals within the area to abandon this location. As such, habitat alteration would not be favorable for the species. Alternative measures and habitat enhancement should be proposed in order to avoid impacting an area where increased LBV activity has been documented.
c. The mitigation measures should ensure that a qualified biologist and not Contractor is responsible for daily monitoring during the LBV breeding season.

Pursuant to the Least Bell's vireo protocol surveys guidelines, "*If additional information (e.g., extent of occupied habitat, total number of adult and juvenile vireos in the study area) is desired or necessary surveys should be extended until August 31 and conducted in a manner as to collect the data necessary… In particular, information collected after July 15 will reflect a broader extent to the riparian habitat and other adjacent habitat types that the vireo typically utilizes during the latter phase of the breeding season, especially when the young become independent of the adults.*[6]"

Since the 2012 field surveys for LBV the species has been detected within the project footprint. The exception occurred during 2014 which was an extremely low rainfall season which may have contributed to the lack of detection in the 2014 season. The largest number of LBV observation was detected in 2015[7]. The results of bird surveys conducted prior to 2012 was not reviewed for this comment letter.

d. What is the acreage for "Suitable LBVI habitat" on ECORP map, Figure 7 of the ITP application?
e. Chambers (2013) biological reports stated 53.1 acres of riparian habitat for LBV utilization whereas ECORP 2016 ITP application did not quantify the suitable LBVI habitat.
f. The maps depicted by Chambers (2013, Attachment 4) and ECORP (2016, Figure 7) do not appear to concur regarding suitable LBV habitat and/or territory. More clarity is required for the southern portion of the project site within the reservoir spillway regarding actual LBV territory, suitable habitat, and individual observations.
g. How many acres of suitable vireo habitat will remain following completion of proposed construction activities?

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5 ECORP, 2016. Devil's Gate Sediment Removal and Management Project, Application for Incidental Take of Endangered Species.

6 USFWS 2001. Least Bell's Vireo Survey Guidelines.

7 ECORP, 2016. Devil's Gate Sediment Removal and Management Project, Application for Incidental Take of Endangered Species.

Bat Species

a. Have bats species been detected? If so, where are the locations on the maps?
b. Where does suitable bat relocation areas occur on or near the Project site? No maps have been provided to indicate a relocation area for bat species or even to indicate their current location(s) within the Project site.
c. Have bats been detected in locations where construction activities are scheduled to occur?
d. A map depicting known bat locations and/or activity should be provided.

Brown-headed Cow Bird Trapping Program

a. USFWS recommended the implementation of a brown-headed cowbird (*Molothrus ater*) trapping program in the Project area. Although, recommended by USFWS, I have not seen any indication of this program being discussed and/or proposed for Project implementation. The concern for eradication and control of invasive species needs to be addressed by the County[5].

Bullfrog Eradication and Control Program

a. Although, not mentioned in any of the environmental documents removal of the bullfrog (*Lithobates catesbeiana*) should be incorporated as part of the restoration plan for Project area. The removal of the bullfrog would enhance native amphibian and reptile populations known to occur within and create viable populations for breeding success. The concern for eradication and control of invasive species needs to be addressed by the County.

Concerns:
Regulatory Permitting Packages

The regulatory permit applications fail to provide adequate information and response to questions previously requested by USFWS. Additionally, mitigation acreage is still required for Project impacts to LBV, wetland, and riparian habitat. The proposed mitigation measures have not been achieved and lack full compliance. The RWQCB and USACE have not issued permits for the Project based on the lack of adequate protection and mitigation measures required.

Concerns:
Mitigation Measures

a. Heavy machinery should be avoided within the 0.50-acre territory where relocation will occur. Is this area representative of the largest number of LBV observations?
b. Habitat enhancement versus restoration activities may be less intrusive then machinery and heavy equipment that may be required for restoration activities.
c. Impacting 0.50 acre of LBV occupied habitat with machinery may flush out and displace LBV away from the area while hand treatment and enhancement activities may avoid further species displacement. Hand treatment for seeding and removal of exotics plants will have less of an impact then mobilization of heavy equipment during the months from March through October. The use of heavy equipment may result in the elimination of further LBV activity in the 0.50-acre territory.
d. More information is required for the 0.50-acre territory regarding drainage channels and hydromorphology.
e. A Conceptual Mitigation Plan has not been prepared and is required per regulatory permits.
f. Adequate off-site mitigation still remains to be achieved.
g. A mitigation plan that identifies locations of potential off-site conservation easement and restoration areas must be included with the permit application prior to Project approval

and implementation. The Project does not provide adequate mitigation for impacts to waters of the state and to wildlife species that benefit from the drainages onsite and in the vicinity of the Project. As an enforceable measure, a detailed revegetation (to include plant palette) and mitigation plan for impacts to the drainage features must be required prior to Project approval and implementation.

Several bird species likely nest in the Project area. Nesting birds are protected by the Migratory Bird Treaty Act ("MBTA"), and in some cases the state and federal government. The proposed mitigation does not adequately avoid and minimize potentially significant impacts to nesting birds protected by the MBTA.

h. The mitigation measures lack monitoring, reporting, and compliance mechanisms that ensure the mitigation is effective and impacts to nesting birds are effectively avoided. As it currently stands, the Project would result in significant impacts to nesting birds.

Off-Site Mitigation

1. Off-site mitigation within the Los Angeles river watershed should be implemented as a viable action and not an option. There are approximately 43.5 acres of mitigation land that has not been identified, created, and/or established.
2. What progress has occurred for resolving and/or identifying a location for the remaining acreage?

Concerns:
Regulatory Permit Issues

The County must address concerns mentioned above before permit applications are submitted for approval. The Project requires regulatory permits (i.e., Sections 404 (USACE) and 401(RWQCB)) to include a Compensatory Mitigation Plan. To date the regulatory requirements have not been completed. Additionally, the review, edits, and comment provided by the County for the LSAA are questionable. Furthermore, additional location(s) for mitigation acreage has not been identified and incorporated into a mitigation plan for the Project.

To date, it appears based on the information reviewed, the County has not responded to the following questions presented by USFWS: *"Devil's Gate Reservoir Sediment Removal and Management Project Section 7 Informal Consultation May 1, 2015 Request for Information SPL-2014-00591. I have not seen any response to the questions presented to the County*."

CDFW 1600 LSAA

Clarity is required regarding the actual project acreage footprint in order to ensure proposed mitigation measures are adequate. [6] The draft LSAA has comments from the County that are not consistent with the previously proposed and submitted environmental documents. The suggested County edits lack adequate mitigation measures.

The draft LSAA permit is not consistent with the comments received from the County and Incidental Take Permit application. The omissions outlined above preclude the ability to fully evaluate the impacts of the Project regarding correct impact acreage, suitable LBV habitat, and proposed off-site mitigation. As such, the Project is not in compliance with state and federal regulations.

CONCLUSION

As a result of the issues discussed herein and lack of specific mitigation language, it is my professional opinion that there is no substantive information for the County to conclude the Project will have less-than-significant impacts on sensitive biological resources and that adequate mitigation measures are in place to compensate for impacts to the LBV, wetland and riparian habitat that will be permanently impacted by the proposed Project activities.
As efforts to restore habitats within urban areas spread, monitoring is needed to track progress, guide ongoing actions, and identify programs that are not working. Habitat restoration efforts must be documented in order to provide meaningful results and analysis of whether or not the restoration efforts are actually working. Biological monitoring program allows objective assessment of what works, and what does not, and suggests opportunities for improvement[8]. Establishing a resource management plan, ecological modeling in advance to project implementation helps create plans that are more likely to succeed. There are no specifically outlined and reviewed restoration plans in the environmental documents prepared for this proposed project that have been deemed adequate.

In particular, it is my professional opinion the Project has the following flaws:

1. Lack of a conceptual mitigation plan and off-site mitigation acreage.

2. Lack of adequate analysis of impacts to LBV, riparian, and wetland habitat that occurs within the Project footprint and the surrounding areas.

3. Lack of Biological Opinion for Least Bell's Vireo.

4. Inconsistency in CDFW 1602 LSAA comment/edits provided by the County.

5. Lack of response to previously addressed questions from regulatory agencies, to include the *USFWS Section 7 Informal Consultation May 1, 2015*.

6. Lacks list of plant species proposed for the enhancement, restoration, and mitigation areas.

7. Lacks protection and/or minimization measures to include a completed ITP 2081, 401 Certification, 404 permit, USFWS Biological Opinion, and Stormwater Pollution Prevention Plan (SWPPP).

8. Implementation and installation plan for monitoring and maintenance of Environmentally Sensitive Areas (ESA) fencing for delineated sensitive areas and project boundaries.

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[8] USGS, 2004. Geological, Hydrological, and Biological Issues Related to the Proposed Development of a Park at the Confluence of the Los Angeles River and the Arroyo Seco, Los Angeles County California.

Minimizing the Project's impacts on LBV, riparian, and wetland habitat will require acceptable mitigation measures beyond what has been proposed by the County. Appropriate mitigation measures must be presented for LBV individuals known to occupy the area to include suitable LBV, riparian, and wetland habitat. Mitigation and protective measures have not been adequately provided. There are several missing documents (i.e., Conceptual Mitigation Plan, Habitat Restoration Plan, Habitat Management Plan, and regulatory permits) that are required to provide an analysis of how to best provide adequate mitigation, compensation, and protective measures for plant and wildlife species impacted by Project construction and dredging activities.

This proposed Project requires further analysis of the initial impact area, relocation area, and proposed mitigation to include identification of remaining acreage locations to ensure the LBV, riparian, and wetland habitats are adequately compensated and that invasive species are eradicated and controlled. Dredging and construction activities must be conducted outside of bird breeding season and bat roosting periods within locations that have identified breeding populations and increased wildlife activity and observations of LBV, bats, and other special status species. Conservation measures must be taken to restore, establish, and maintain existing LBV activity and riparian and wetland viable habitats. Furthermore, protective measures and mitigation must occur before, during, and after completion of the proposed dredging and construction activities. These protective measures must be clearly identified and not left open ended for determination during the construction phase of the project.

Sincerely,

T'Shaka Touré, M.S.,
Senior Regulatory Specialist/Biologist

T’Shaka Touré, M.S.
Senior Regulatory Specialist/Biologist

Mr. Touré has over 25 years of diverse experience in CEQA and NEPA compliance by providing biological and regulatory permitting services with an emphasis in natural resources management, environmental re-examination, wildlife studies, open space management planning, wetland ecology, and hydrology. Mr. Touré has conducted technical studies and prepared regulatory permits, jurisdictional delineations, and provided USFWS Section 7 consultation for endangered species to include mitigation and monitoring plans for impacts to special-status species.

T’Shaka has prepared and implemented natural resources management plans for artificially created wetland design planning, open space planning, and water quality control planning. He has an expansive experience in habitat assessments and regulatory permitting concerns for Federal and State endangered, threatened, special-status species, to include mitigation banks and conservancy lands. Mr. Toure is experienced in working with regional regulatory agency personnel, CDFW, RWQCB, USACE to include city and county municipalities.

T’Shaka is an experienced senior level regulatory specialist in navigating through the regulatory permitting process and identifying appropriate site locations to establish conservation to meet mitigation requirements, when appropriate. He has provided document reviews, expert testimonies, environmental re-examination, and implementation of required technical studies. He has prepared regulatory permitting packages for CDFW Sections 2081, 1602, Regional Board Section 401 Certification, and USACE 404 Permit pursuant to the Clean Water Act. His knowledge of natural resources extends from agricultural to wetlands and from temperate to tropical regions.

He has provided environmental compliance services for public works, solar energy farms, railway, and large scale linear transportation projects for Caltrans, U.S. Bureau of Reclamation, U.S. Bureau of Land Management, U.S. Geological Survey, PG&E, and multiple municipality projects throughout cities and counties of northern, bay area, southern, coastal, and central California. Additionally, Mr. Toure has conducted biological field work and technical studies in the states of Maryland, Virginia, and Washington, DC to include technical studies abroad in the Republic of Panama and the islands of Trinidad and Tobago.

Professional Experience:

- Touré Associates, Senior Biologist/Regulatory Specialist, Fresno, CA. January 2009 – present.
- Michael Brandman Associates, Senior Biologist/Regulatory Specialist, Fresno, CA December 2008 – January 2009.
- Rancho Santiago Community College, Adjunct Professor of Biology, City of Orange, CA., January 2006 – December 2009.
- Glenn Lukos Associates, Senior Biologist/Regulatory Specialist, Lake Forest, CA., July 2004 – October 2008.
- U.S. Geological Survey, Western Ecological Research Center, Research Ecologist, San Diego Field Station, Carlsbad Office, August 2000 – July 2004.
- Smithsonian Institution Museum of Natural History, Div. Vert. Zoology, Asst. Research Zoologist, Washington, D.C., August 1993 – July 2000.

Education

- MS, Biology (Emphasis in Ecology), Howard University, Washington D.C.
- BS, Zoology/Chemistry, Howard University, Washington D.C.

Registrations / Certifications

- USFWS Section 10(a)(1)(A) Recovery Permit CRLF
- CDFW SCP # 5444
- QSD/QSP Certification
- Swainson’s hawk surveys/monitoring
- Construction Management for SWPPP Compliance
- Wetland Delineation, Emphasis on Hydric Soils

Areas of Expertise

- CEQA/NEPA compliance
- Environmental re-examination
- Regulatory permitting
- Biological assessments
- SWPPP Implementation
- Water pollution control planning
- Water quality sampling and analysis
- Special-status species surveys
- Pre-construction surveys
- Construction monitoring

Training/Workshops

- Arid West Supplement Wetland Delineation. Wetland Training Institute, 2007.
- Wetland Delineation with Emphasis in Hydric Soils. Wetland Training Institute, 2005.

Water Quality Monitoring

- EnviroCert International, Inc. Certified Erosion, Sediment and Storm Water Inspector (CESSWI Number 4348). 2015
- Certificate of Training, California Construction General Permit. Qualified SWPPP QSD/QSP. (Certificate # 25370). 2015
- Applied Hydrogeological Site Characterization & Monitoring Well Construction. NETC, 2009.

PROJECT EXPERIENCE:

Moita Road Improvement Project (Regulatory Specialist/Biologist) – Contra Costa County, CA
Mr. Touré is providing biological and regulatory permitting services for road construction across a portion of the ECCC Habitat Conservancy Lands in the City of Clayton, East Contra Costa County. Environmental services include technical studies in the areas of water quality, biological assessments, jurisdictional delineation, regulatory permitting, and project coordination with lead agencies and contractor. The biological and regulatory services for the project required an understanding of CEQA compliance for construction approval within a Habitat Conservancy Plan/Natural Community Conservation Plan (HCP/NCCP) to include Regional Board, USACE, and CDFW permitting process.

Oak Creek Canyon Project (Regulatory Specialist) – Contra Costa County, CA
Conducted wetland delineation survey for an approximately 9.0–acre project site located in unincorporated Clayton. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the 9.0-acre study area. Wetland delineation report to include wetland data sheets was prepared. Coordinated with open space conservancy organizations and mitigation banks for project mitigation measures.

Riverwalk Project (Regulatory Specialist) –Solano County, CA
Conducted wetland delineation survey for an approximately 257.68–acre project site located in City of Rio Vista. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the study area. Wetland delineation report to include wetland data sheets were prepared. Additionally, Mr. Touré coordinated with open space conservancy organizations and mitigation banks for project mitigation measures.

Italian Bar Bridge Replacement Project (Regulatory Specialist/Biologist) – Fresno County, CA
Mr. Touré is providing biological and regulatory permitting services for the Italian Bar Bridge Replacement project along Redinger Lake in the Sierra National Forest. Mr. Touré prepares the regulatory permits and conducts surveys, scheduling, and supervision of staff biologists. Environmental services include technical studies in the areas of water quality, biological assessments, jurisdictional delineation, regulatory permitting, and project coordination with lead agencies and contractor. The environmental services for the project require an understanding of CEQA/NEPA compliance for construction activities above and within the San Joaquin River, surrounding natural resources, and the approval and issuance of regulatory permits to achieve project milestones.

Fresno 40 Project, Biological Resources (EIR), (Principal Biologist) – Fresno County, CA
Mr. Touré served as the Senior Project Biologist for the biological resources section of the Fresno 40 Environmental Impact Report (EIR) prepared by MBA and approved by the City of Fresno. Mr. Touré conducted San Joaquin kit fox and burrowing owl surveys on the project site and provided mitigation recommendations to meet local and regional natural resource management goals.

Avenue 416 Kings River Bridge Replacement Project (Regulatory Specialist) – Tulare County, CA
Conducted review of wetland delineation survey report prepared for the approximately 7.50-acre project site located near the City of Dinuba. Prepared and coordinated the regulatory permitting process for CFGC Section 1602 LSAA of the CDFW; RWQCB Section 401 Certification; and USACE PCN and Section 404 NWP to include Mitigation Plan for riparian re-vegetation and elderberry shrubs.

Tulare Basin Project (Regulatory Specialist) – Tulare County, CA
Conducted wetland delineation surveys for an approximately 323-acre project site located within the City of Tulare's agricultural lands. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of wetlands features and other drainage features was performed within the study area. Wetland delineation report to include wetland data sheets and biological assessment report was prepared.

Tharp Remediation Project (Regulatory Specialist) – Tulare County, CA
Provided the review of the biological reports prepared for the project and prepared the CFGC Section 1602 Lake and Streambed Alteration Notification permit application of the CDFW for unavoidable impacts associated with the projects vegetation and tree removal activities within riparian habitat along Tule River.

Calabazas Creek Bridge Project (Regulatory Specialist/Biologist) – Santa Clara County, CA
Mr. Touré provided the scheduling, surveys, supervision of staff, and environmental compliance oversight for construction activities within the Santa Clara Valley Water District (SCVWD). The construction activities required replacement of bridge structures and box culverts where BNSF tracks occurred. Environmental compliance services included document reviews, environmental re-examination, and implementation of required technical studies. The construction activities were conducted in wetland, riparian, and upland habitats. In addition to the issuance of standard regulatory permits the project required knowledge of BNSF requirements and scheduling coupled with the USFWS Biological Opinion issued for the project.

Seismic Retrofit Park Boulevard Project (Regulatory Specialist/Biologist) – Alameda County, CA
Mr. Touré provided the scheduling, supervision of staff, and environmental compliance oversight for construction activities and water quality control associated with structural improvements to three bridges along Park Boulevard in the City of Oakland, Alameda County. Environmental compliance services included the review of regulatory permits, environmental awareness training, pre-construction surveys, habitat assessments, and daily construction monitoring for the protection of special-status species. Additionally, SWPPP inspections were conducted weekly in accordance with the regulatory permits.

Modesto Junior College Project, (Biologist) – Stanislaus County, CA
Mr. Touré provided biological service for MBA by conducting a biological assessment of the 288-acre Modesto Junior College east and west campus facilities. Mr. Touré conducted onsite surveys and prepared Biological Resources Assessment reports that included habitat assessments and focused surveys for special-status species to include Swainson's hawk in compliance with the California Department of Fish and Game. The project required a field site surveys, comprehensive analysis of physical environmental impacts, and mitigation measures for proposed campus construction.

Los Banos Landfill Project (Biologist) – Merced County, CA
Mr. Touré provided on-call biological service for MBA to conduct a biological assessment of the 50-acre landfill site. Mr. Touré conducted onsite surveys and prepared Biological Resources Assessment reports that included habitat assessments and focused surveys for special-status species in compliance with the California Department of Fish and Game.

Schulte Road Bridge Replacement Project (Environmental Specialist/Water Pollution Control Manager) – Monterey County, CA
Mr. Touré provided the scheduling, supervision of staff, and environmental compliance required for construction of a bridge replacement where BNSF track occurred along the project and above the Carmel River, Monterey County. Environmental services consisted of regulatory permitting compliance and environmental awareness training to contractor, SWPPP preparation and implementation to include SMARTS data entry and reporting. Weekly inspections, sampling and analysis during storm events, monthly, quarterly, and annual reporting. Coordination with the contractor and County inspectors to ensure environmental protective measures were adequate in order to maintain compliance with RWQCB, USFWS, and CDFW regulatory permits. In addition to the issuance of standard regulatory permits the project required knowledge of BNSF requirements and scheduling protocols.

Stoneridge Ranch Project (Regulatory Specialist/Biologist) – Los Angeles County
Conducted wetland delineation survey for an approximately 238 single family residential project site located in City of Lancaster. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the project site. Wetland delineation report to include wetland data sheets were prepared. Prepared and coordinated the regulatory permitting process for CFGC Section 1602 LSAA of the CDFW; RWQCB Section 401 Certification; and USACE PCN and Section 404 NWP to include mitigation bank activities.

Caltrans District 10, North Stockton I-5 Widening Project (Environmental Specialist/Biologist) – San Joaquin County, CA
Mr. Touré provides scheduling, supervision of staff, and oversight of environmental compliance to include review of regulatory permits with contractor during construction activities occurring within or adjacent to waterbodies to ensure protection of natural resources and special-status species. Water Pollution Control Manager and environmental specialist required to attend weekly meetings with the contractor and Caltrans staff, prepare weekly, monthly, quarterly, and annual reports. Coordination of environmental compliance with Caltrans staff in accordance with the regulatory permits issued for the project.

Caltrans District 6, Cane Brake SR 178 Project (Biologist) – Kern County, CA
Mr. Touré provided the scheduling, supervision of staff, and biological construction monitoring for the bridge culvert replacement along SR-178. Monitoring services included providing environmental awareness training, pre-construction surveys, and daily construction monitoring for the desert tortoise, Mojave ground squirrel, Swainson's hawk, southern willow flycatcher, western yellow-billed cuckoo, Kern red-winged blackbird, tricolored blackbird, least Bell's vireo, and other regulated species. The monitoring was performed in accordance with Caltrans Special Provisions and regulatory agency compliance.

Caltrans District 5, State Route 17 Downdrain Rehabilitation Project (Environmental Specialist/Biologist) – Santa Clara County, CA
Mr. Touré provided the scheduling and supervision of SWPPP and biologist services required for drain improvement project along SR-17. Environmental services included providing environmental awareness training, pre-construction surveys, and daily construction monitoring for the special-status species. Environmental compliance to include the submission of the monthly SWPPP and biological reports required pursuant to the regulatory permits issued for the project.

Caltrans District 4, I-80 Truck Scale Relocation Project (Environmental Specialist/Biologist) – Solano County, CA
Mr. Touré provided the scheduling and supervision of environmental services to include initial site assessment, pre-construction, and presence/absence surveys for special-status species along I-80 within the vicinity of Fairfield, Solano County. Additional services include providing environmental awareness training, construction monitoring, monthly and annual biological monitoring reports. Mr. Touré conducted surveys and construction monitoring for the valley elderberry longhorn beetle, California red-legged frog, western pond turtle, bat species, Swainson's hawk, western burrowing owl, white-tailed-kite, loggerhead shrike, central California coast steelhead, Central Valley Chinook salmon, river lamprey, swallows, and other special-status species.

San Mateo Creek Restoration Project (Regulatory Specialist) – San Diego County, CA. Camp Pendleton Marine Base
Conducted wetland delineation surveys for a restoration project that consisted of riparian and coastal sage scrub areas. Prepared and initiated and supervised the mitigation and monitoring plan required for the restoration activities.

SCLA Lead Track and Southern Industrial Area Project (Regulatory Specialist/Biologist) – San Bernardino County, CA
Conducted wetland delineation surveys for an approximately 130-acre site in the City of Victorville. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the 130-acre study area. Wetland delineation report to include wetland data sheets and biological assessment report was prepared.

PROFESSIONAL PUBLICATIONS

Touré, T. *et al* 2005. Common Reptiles, pp. 82-87, *In* Schoenherr, A., D. Clarke, and E. Brown. 2005. Docent Guide to Orange County Wilderness, 142 pp.

Touré, T.A., 2004, Checklist of amphibians and reptiles of Arroyo Seco and Los Angeles River Basin: U.S. Geological Survey Fact Sheet prepared for Los Angeles River–Arroyo Seco Confluence Park Project.

Touré, T.A., Backlin, A.R., and Fisher, R.N., 2004, Eradication and control of the African clawed frog (Xenopus laevis) on Irvine Ranch Land Reserve, Orange County, California, 2003: U.S. Geological Survey Final Report prepared for Irvine Ranch Land Reserve, Irvine, Calif., 31 p.

Touré, T. *In* J.W. Gibbons and M. E. Dorcas. 2004. North American Watersnakes, A Natural History. University of Oklahoma Press, Norman. 438 pp.

Touré, T.A., and R.N Fisher., 2003, Quarterly Report – African clawed frog, pond turtle and spadefoot toad project: U.S. Geological Survey Technical Report prepared for The Nature Conservancy.

Touré, T. A. and G. A. Middendorf. 2002. Colonization of herpetofauna to a created wetland. Bulletin of the Maryland Herpetological Society 38(4): 99-117.

Touré, T. A. 2001. A report on the population status and conservation of Rosy boa (*Charina trivirgata*): A two-year study in Anza Borrego State Park and Joshua Tree National Monument, 19 pp.

Touré, T.A., and R.N. Fisher, 2001, Monitoring program for amphibians and reptiles in the Nature Reserve of Orange County, Summary Report 2001: U.S. Geological Survey Technical Report prepared for Nature Reserve of Orange County, Calif.

Touré, T. A. 1999. Herpetofauna of a constructed wetland and adjacent forest. Howard University, Washington DC. 20 tbs., 7 figs., 63 pp. [Also catalogued at the Smithsonian, U.S Natural History Museum, Washington, D.C.]

McDiarmid, R. W., J. C. Campbell, and T. A. Touré. 1999. Snake Species of the World Catalogue. A Geographical and Taxonomic Reference. Volume 1. The Herpetologist' League. Washington, DC. 511 pp.

McDiarmid, R. W., J. S. Savage, and T. A. Touré. 1997. The proper name of the tropical tree boa (*Hortulanus corallus*). J. Herpetology 30(3): 320-326.

Touré, T. A. 1995. Snakes: Suborder Serpentes, pp. 204-261, *In* Frank, N. and E. Ramus. 1995. A complete guide to scientific and common names of reptiles and amphibians of the world, 377 pp.

PROFESSIONAL PRESENTATIONS

2007. Wetland and aquatic habitats of Orange County. [Education Series: Donna O'Neill Land Conservancy]
2006. Aquatic and riparian restoration ecology. [Seminar: Orange County Natural History Museum/Acorn Naturalist Center]
2004. Floral and faunal species conservation and management [Seminar: Santa Ana Park Naturalist Program, Department of Parks and Recreation]
2004. Spadefoot toad habitat enhancement training [Education Series: Laguna Coast Wilderness Park]
2003. Amphibian management: Concerns and opportunities. [Seminar: Nature Reserve of Orange County]
2003. Vernal pool ecology and spadefoot toads (*Spae hammondii*) of Orange County. [Seminar: Orange County Natural History Museum/Acorn Naturalist Center]
2003. Long-term monitoring of fragmented habitats in coastal southern California. [George Wright Society and ASIH, annual meeting]
2003. Exotic amphibians, current status and possible impacts. [Western Division of the American Fisheries Society, annual meeting]
2002. What's a herp? [Education Lecture Series: The Nature Conservancy of Orange County]
2001. Vertebrate abundance and diversity in fragmented habitats of coastal southern California. [Society for Conservation Biology, annual meeting]
2000. Constructed wetland and its ability to sustain amphibian and reptile populations. [Society of Wetland Scientists, annual meeting]
2000. Herpetofauna of a constructed wetland and adjacent forest. [ASIH, annual meeting]
2000. Reptiles and amphibians of the Sands Road Wetland Sanctuary. [ASIH, annual meeting]
1996. Snake species of the world: A taxonomic view. [ASIH, annual meeting]

PROFESSIONAL AFFILIATIONS

The Wildlife Society, Western Section
Association of Environmental Professionals
American Society of Ichthyologists and Herpetologists
Society for the Study of Amphibians and Reptiles
Partners in Amphibian and Reptile Conservation

AWARDS

2000. U.S. Geological Survey, Scientific Achievement Award, Patuxent Wildlife Research Center, Maryland
1999. Smithsonian Institution Libraries, Distinguished Subject Award
1998. Graduate Symposium Award, Howard University
1990. Smithsonian Tropical Research Institution, Research Internship Award, Republic of Panama

<u>EXHIBIT C</u>

STATEMENT OF PROCEEDINGS FOR THE

REGULAR MEETING OF THE BOARD OF SUPERVISORS

OF THE COUNTY OF LOS ANGELES HELD IN ROOM 381B

OF THE KENNETH HAHN HALL OF ADMINISTRATION

500 WEST TEMPLE STREET, LOS ANGELES, CALIFORNIA 90012

Wednesday, November 12, 2014

9:30 AM

Present: Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Video Link for the Entire Meeting (03-1075)

Attachments: Video Transcript

Invocation led by Indra Zuno, Tarzana (3).

Pledge of Allegiance led by Tiffany Apodaca, Former Petty Officer, United States Navy, Compton (2).

I. PRESENTATIONS/SET MATTER

Presentation of scroll in honor of declaring November 2014 as National Adoption Awareness Month, as arranged by Supervisor Yaroslavsky.

Presentation of scrolls to members of the Third District executive secretary staff, in grateful appreciation for their outstanding service to constituents of the Third Supervisorial District, as arranged by Supervisor Yaroslavsky.

Presentation of scroll to outgoing Sheriff John Scott who has served with distinction and honor during his ten-month tenure as Sheriff of Los Angeles County, as arranged by Supervisor Knabe.

Presentation of scrolls to the team of survivor-advocates, in recognition of their leadership at the County's 3rd Annual Empowerment Conference for the victims of child sex trafficking, as arranged by Supervisor Knabe.

Presentation of awards to various County Departments, as winners of the 2014 California State Association of Counties Challenge Awards Competition, as arranged by Supervisor Knabe.

Presentation of the 2014 California State Association of Counties Circle of Service Award to William T Fujioka, as arranged by Supervisor Knabe.

Presentation of scroll to Monsignor Felix S. Diomartich, in recognition of his 100th birthday, as arranged by Supervisor Antonovich.

Presentation of scroll to the Los Angeles County Department of Parks and Recreation, in recognition of the 60th Anniversary of the Underwater Unit, as arranged by Supervisor Antonovich.

Presentation of pet(s) to the television audience for the County's Pet Adoption Program, as arranged by Supervisor Antonovich. (14-5099)

S-1. 11:00 a.m.

Report by the District Attorney with a comprehensive assessment of mental health diversion programs used by the County; and the California Victim Compensation and Victim-Witness Assistance Programs, as requested at the meetings of May 6, 2014 and July 29, 2014. (Continued from the meetings of 9-9-14 and 10-7-14) (14-3165)

Ezra Gale, Jessica Farris, Reverend Larry Foy, Reverend Peter Laarman, Luis Garcia y Ayvens, Sofia Quinones, Mary Sutton, Kwazi Nkrumah, Jayda Rasberry, Jas Wade and other interested persons addressed the Board.

Jackie Lacey, District Attorney, Donna Wills, Director of Victim Witness Assistance Program, Lydia Bodin, Deputy in Charge, Bureau of Prosecution Support Operations, District Attorney's Office, Winston Peters, Assistant Public Defender, Jim Smith, Chief of Police, City of Monterey Park, Dr. Robin Kay, Deputy Director, Department of Mental Health, and Wesley Ford, Director of Substance Abuse Prevention and Control, Department of Public Health, addressed the Board and responded to questions.

Supervisor Antonovich made a motion that the Board:

1. **Request the District Attorney to work with the Chief Executive Officer to develop a comprehensive Victims Services Strategic Plan and report back to the Board at the same time the Comprehensive Diversion Plan for the Mentally Ill report is presented, including a fiscal analysis and the following components:**

    a. **Establishing new victims sites, especially in Sheriff's stations;**

    b. **Expanding services to victims of non-violent crimes, while continuing to prioritize services for victims of violence and threats of violence;**

    c. **Increasing service levels at existing sites where necessary;**

    d. **Adding specialized advocacy units, including for victims of hate crimes, human trafficking and financial crimes;**

e. Increasing the staff within the Restitution Enhancement Program; and

f. Identifying gaps in services, which can be provided by community-based organizations.

2. Direct the Executive Director of the Countywide Criminal Justice Coordination Committee to:

a. Establish a sub-committee to make recommendations on the formation of a local restitution collection system with authority to collect restitution from offenders sentenced under Penal Code Section 1170(h) to be chaired by a representative from the District Attorney's Office and include appropriate representatives as necessary, including the Sheriff's Department, Probation Department, Department of Auditor-Controller and the Treasurer and Tax Collector;

b. Explore opportunities in which the County and/or the court can mitigate financial impacts on victims emanating from participating in the criminal justice process; and

c. Provide the report to the Board on the above at the same time the District Attorney's report is due.

After discussion, on motion of Supervisor Antonovich, seconded by Supervisor Knabe, the District Attorney's reports were received and filed; and the Board took the following actions:

1. Requested the District Attorney to work with the Chief Executive Officer to develop a comprehensive Victims Services Strategic Plan and report back to the Board at the same time the Comprehensive Diversion Plan for the Mentally Ill report is presented, including a fiscal analysis and the following components:

a. Establishing new victims sites, especially in Sheriff's stations;

b. Expanding services to victims of non-violent crimes, while continuing to prioritize services for victims of violence and threats of violence;

c. Increasing service levels at existing sites where necessary;

d. Adding specialized advocacy units, including for victims of hate crimes, human trafficking and financial crimes;

e. Increasing the staff within the Restitution Enhancement Program; and

f. Identifying gaps in services which can be provided by community-based organizations.

2. Directed the Executive Director of the Countywide Criminal Justice Coordination Committee to:

a. Establish a sub-committee to make recommendations on the formation of a local restitution collection system with authority to collect restitution from offenders sentenced under Penal Code Section 1170(h) to be chaired by a representative from the District Attorney's Office and include appropriate representatives as necessary, including the Sheriff's Department, Probation Department, Department of Auditor-Controller and the Treasurer and Tax Collector;

b. Explore opportunities in which the County and/or the court can mitigate financial impacts on victims emanating from participating in the criminal justice process; and

c. Provide the report to the Board on the above at the same time the District Attorney's report is due.

Ayes: 5 - Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Attachments: Report
Motion by Supervisor Antonovich
Report
Video
Audio

II. SPECIAL DISTRICT AGENDAS

STATEMENT OF PROCEEDINGS FOR THE MEETING OF THE COMMUNITY DEVELOPMENT COMMISSION OF THE COUNTY OF LOS ANGELES WEDNESDAY, NOVEMBER 12, 2014 9:30 A.M.

1-D. Recommendation: Approve minutes of the meetings of the Community Development Commission for the month of September 2014. (14-5016)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Knabe, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

STATEMENT OF PROCEEDINGS FOR THE MEETING OF
THE HOUSING AUTHORITY
OF THE COUNTY OF LOS ANGELES
WEDNESDAY, NOVEMBER 12, 2014
9:30 A.M.

1-H. Recommendation: Approve minutes of the meetings of the Housing Authority for the month of September 2014. (14-5015)

On motion of Supervisor Antonovich, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

STATEMENT OF PROCEEDINGS FOR THE MEETING OF THE REGIONAL PARK AND OPEN SPACE DISTRICT OF THE COUNTY OF LOS ANGELES WEDNESDAY, NOVEMBER 12, 2014 9:30 A.M.

1-P. Recommendation: Allocate $250,000 in Specified Excess Funds available to the First Supervisorial District, pursuant to the Safe Neighborhood Parks Proposition of 1996, to the Mountains Recreation and Conservation Authority (MRCA) for a grant to North East Trees (NET) for the proposed Hazard Park Riparian Restoration Project (Project) (1); authorize the Director of Parks and Recreation, in his capacity as the Director of the Regional Park and Open Space District, to award a grant to NET for the proposed Project, after the MRCA assigns its right to apply to NET, when applicable conditions have been met, and administer the grant as of the date of this action and pursuant to guidelines in the Procedural Guide for Specified, Per Parcel, and Excess Funds Projects, otherwise the funds shall remain in the Excess Funds account; and find that the proposed Project is exempt from the California Environmental Quality Act. (14-5004)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Knabe, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

2-P. Recommendation: Approve an alternative plan of expenditure to reallocate $178,500 in unspent Specified Funds, pursuant to the Safe Neighborhood Parks Proposition of 1996 and allocate $150,000 in County Excess Funds available to the First Supervisorial District, to the Department of Parks and Recreation for a grant to the San Gabriel Valley Conservation Corps (SGVCC) for the proposed Whittier Narrows Tree Planting Project (Project) (1); authorize the Director of Parks and Recreation, in his capacity as the Director of the Regional Park and Open Space District, to award a grant to SGVCC for the proposed Project, after the Department assigns its right to apply to the SGVCC, if applicable conditions have been met, and administer the grant as of the date of this action and pursuant to guidelines in the Procedural Guide for Specified, Per Parcel, and Excess Funds Project, otherwise the funds shall remain in the Assessment and Excess Funds accounts; and find that the proposed Project is exempt from the California Environmental Quality Act. (14-5005)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Knabe, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

3-P. Recommendation: Allocate $500,000 in Cities Excess Funds available to the First Supervisorial District, pursuant to the Safe Neighborhood Parks Proposition of 1996, to the City of Los Angeles for a grant amendment to Amigos de Los Rios for the proposed Wellness Center Park/Fitness Zone Project (Project) located at the University of Southern California Medical Center in Los Angeles (1); authorize the Director of Parks and Recreation, in his capacity as the Director of the Regional Park and Open Space District, to award a $500,000 grant amendment to Amigos de Los Rios for the proposed Project, after the City assigns the right to apply to Amigos de Los Rios, if applicable conditions have been met, and administer the grant amendment as of the date of this action and pursuant to procedures in the Procedural Guide for Specified, Per Parcel, and Excess Funds Project, otherwise funds shall remain in the Excess Funds account. (14-5006)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Knabe, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

4-P. Recommendation: Allocate $1,000,000 in unspent Specified Excess Funds available to the First Supervisorial District, pursuant to the Safe Neighborhood Parks Proposition of 1996, to the Mountains Recreation and Conservation Authority (MRCA) for a grant to the Los Angeles County Metropolitan Transportation Authority (Metro) for the proposed Los Angeles Plaza Park General Improvements Project (Project) (1); authorize the Director of Parks and Recreation, in his capacity as the Director of the Regional Park and Open Space District, to award a grant to Metro for the proposed Project, after the MRCA assigns its right to apply to Metro, if applicable conditions have been met, and administer the grant as of the date of this action and pursuant to procedures in the Procedural Guide for Specified, Per Parcel, and Excess Funds Projects, otherwise the funds shall remain in the Excess Funds account; and find that the proposed Project is exempt from the California Environmental Quality Act. (14-5007)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Video
Audio

5-P. Recommendation: Allocate $100,000 in County Excess Funds available to the First Supervisorial District, pursuant to the Safe Neighborhood Parks Proposition of 1996, to the Department of Parks and Recreation for the proposed Benjamin Dominguez Concrete Play Sculptures General Improvements Project (Project) at Whittier Narrows Recreation Area (1); authorize the Director of Parks and Recreation, in his capacity as the Director of the Regional Park and Open Space District, to award a grant to the Department, when applicable conditions have been met, and administer the grant as of the date of this action and pursuant to procedures in the Procedural Guide for Specified, Per Parcel, and Excess Funds Projects, otherwise the funds shall remain in the Excess Funds account; and find that the proposed Project is exempt from the California Environmental Quality Act. (14-5008)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Knabe, this item was approved.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Board Letter

6-P. Recommendation: Allocate $333,000 in Cities Excess Funds available to the Third Supervisorial District, pursuant to the Safe Neighborhood Parks Proposition of 1996, to the City of Los Angeles for a grant to the Los Angeles River Revitalization Corporation (LARRC) for the proposed La Kretz Crossing Bridge Project (Project) (3); authorize the Director of Parks and Recreation, in his capacity as the Director of the Regional Park and Open Space District, to award a grant to LARRC, after the City assigns its right to apply for the funds to LARRC, when applicable conditions have been met, and administer the grant as of the date of this action and pursuant to procedures in the Procedural Guide for Specified, Per Parcel, and Excess Funds Projects, otherwise the funds shall remain in the Excess Funds account, certify that the Board, as a responsible agency under the California Environmental Quality Act (CEQA), has independently considered and reached its own conclusions regarding the environmental effects of the proposed Project and the Mitigated Negative Declaration and Mitigation Monitoring Program adopted by the City, as lead agency, determine that the documents adequately address the environmental impacts of the proposed Project, and find that the Board has complied with the requirements of CEQA with respect to the process for a responsible agency, and adopt by reference the City's Mitigated Negative Declaration and Mitigation Monitoring Program. (14-5056)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Video
Audio

7-P. Recommendation: Approve minutes of the meetings of the Regional Park and Open Space District for the month of September 2014. (14-5018)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Knabe, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

III. BOARD OF SUPERVISORS 1 - 7

1. Recommendations for appointment/reappointment to Commissions/ Committees/Special Districts (+ denotes reappointments): **Documents on file in the Executive Office.**

Supervisor Yaroslavsky
Simon Pastucha+, Small Craft Harbor Design Control Board (14-5072)

On motion of Supervisor Antonovich, seconded by Supervisor Yaroslavsky, this item was approved.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

2. Recommendation to approve and authorize the Chief Executive Officer to execute the following agreements: **Documents on file in the Executive Office.**

Supervisor Molina
Mariachi Plaza Festival Foundation in the amount of $1,000
Mujeres de la Tierra in the amount of $1,000 (14-5033)

On motion of Supervisor Molina, seconded by Supervisor Yaroslavsky, this item was duly carried by the following vote:

Ayes:	3 -	Supervisor Molina, Supervisor Yaroslavsky and Supervisor Knabe
Abstentions:	2 -	Supervisor Ridley-Thomas and Supervisor Antonovich

3. Recommendation as submitted by Supervisor Yaroslavsky: Authorize the Director of Public Works to enter into an Agreement with LA River Revitalization Corporation (LARRC) to contribute $250,000 toward costs of the proposed Atwater Landing Project (Project) that are eligible to be funded from Measure R Local Return funds, the necessary funds are made available from the Third Supervisorial District's Road Construction Program included in the Measure R Local Return Fund Fiscal Year 2014-15 Budget; and find that the recommended authorization for the proposed Project is not a project pursuant to Section 15378(b) of the California Environmental Quality Act (CEQA) because it is an organizational or administrative activity of government and involves the creation of a government funding mechanism which does not commit to any specific project which may result in a potentially significant physical impact on the environment, the City of Los Angeles, as lead agency under CEQA, and LARRC, would be required to complete the environmental review process and make any necessary findings under CEQA. (14-5100)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Antonovich, this item was duly carried by the following vote:

Ayes: 3 - Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Abstentions: 1 - Supervisor Ridley-Thomas

Absent: 1 - Supervisor Molina

Attachments: Motion by Supervisor Yaroslavsky

4. Recommendation as submitted by Supervisor Yaroslavsky: Declare November 2014 Adoption Awareness Month and encourage interested individuals and families in the community to consider the benefits and rewards of adopting a waiting child by calling (888) 811-1121 or visiting the website www.ShareYourHeartLA.org; and instruct the Auditor-Controller to print "November is Adoption Awareness Month. Call 888-811-1121 to become a foster or adoptive parent" on all County warrants during the month of November and for the Department of Human Resources to include the same message on the electronic paystub viewer on e-CAPS. (14-5121)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Antonovich, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Motion by Supervisor Yaroslavsky

5. Recommendation as submitted by Supervisor Knabe: Establish a $10,000 reward offered in exchange for information leading to the apprehension and/or conviction of the person or persons responsible for the fatal hit and run of 20-year-old Daniel Gomez, whose body was discovered lying in the road, located in the area of Spring St. and Karen Ave. in the City of Long Beach on September 13, 2014, shortly after midnight. (14-5076)

On motion of Supervisor Knabe, seconded by Supervisor Yaroslavsky, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Motion by Supervisor Knabe
Notice of Reward

6. Recommendation as submitted by Supervisor Molina: Authorize County Counsel to explore potential legal actions against Exide Technologies either individually or in concert with other jurisdictions or public agencies and report back to the Board in one week with legal options to shutter Exide and abate the toxic conditions surrounding the facility and the affected neighborhoods. (14-5102)

Gladys Limon, Frank Villalobos and Mark Lopez addressed the Board.

On motion of Supervisor Molina, seconded by Supervisor Yaroslavsky, this item was approved.

Ayes: 5 - Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

By Common Consent, there being no objection, the foregoing motion was reconsidered to allow an additional member of the public to address the Board. Arnold Sachs addressed the Board.

On motion of Supervisor Molina, seconded by Supervisor Yaroslavsky, this item was approved.

Ayes: 5 - Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Attachments: Motion by Supervisor Molina
Report
Video
Audio

7. Executive Officer of the Board's recommendation: Approve minutes for the September 2014 meetings of the Board of Supervisors and Special Districts for which the Board is the governing body. (14-5019)

On motion of Supervisor Antonovich, seconded by Supervisor Yaroslavsky, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

IV. CONSENT CALENDAR 8 - 60

Chief Executive Office

8. Recommendation: Approve the introduction of an ordinance amending the gas pipeline franchise granted to Southern California Gas Company (SoCalGas) to extend the term of the franchise through December 31, 2015, becoming operative January 1, 2015; instruct the Chairman to sign an amendment to the Graffiti Abatement and Coordination Agreement to extend the Agreement through December 31, 2015, for the prevention and removal of graffiti from the above-ground facilities of SoCalGas; and find that the project is exempt from the California Environmental Quality Act. (Relates to Agenda No. 61) (14-5032)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

Agreement No. 77183, Supplement 3

9. Recommendation: Approve the introduction of an ordinance amending the electrical franchise granted to Southern California Edison Company (Edison) to extend the term of the franchise through December 31, 2015, becoming operative January 1, 2015; instruct the Chairman to sign an amendment to the Graffiti Abatement and Coordination Agreement to extend the Agreement through December 31, 2015, for the prevention and removal of graffiti from the above-ground facilities of Edison; and find that the project is exempt from the California Environmental Quality Act. (Relates to Agenda No. 62) (14-5051)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

Agreement No. 77184, Supplement 4

County Operations

10. Recommendation: Approve the use of $600,000 from the County's Information Technology Fund to develop a Data Center Requirement Assessment and Consolidation Strategy; authorize the Chief Executive Officer to execute a work order and any necessary change orders with Gartner Consulting at an amount not to exceed $600,000 for consulting services under the as needed Strategic Planning and Related Services Master Agreement; and approve a 60-day extension to return to the Board with a written Strategy Report. **(Chief Information Office)** (14-5055)

Dr. Genevieve Clavreul addressed the Board.

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Video
Audio

11. Recommendation: Approve a resolution to adopt Plan Amendment No. 2014-00003-(1), which among other things, adopts the East Los Angeles Third Street Plan to be part of the East Los Angeles Community Plan (Community Plan); and adopt amendments to the land use policy map of the Countywide General Plan and the Community Plan for the area governed in the Third Street Plan. **(County Counsel)** (Relates to Agenda Item Nos. 57, 58 and 59) (14-5026)

On motion of Supervisor Knabe, seconded by Supervisor Antonovich, this item was adopted.

Ayes:	3 -	Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	2 -	Supervisor Molina and Supervisor Ridley-Thomas

Attachments: Resolution

12. Recommendation: Adopt findings and conditions for approval of Conditional Use Permit No. 2013-00021-(4) and Parking Permit No. 2013-00009-(4), part of Project No. R2013-00317-(4), to authorize the development of 17 multi-family lots with 91 detached residential condominium units, seven private open space lots and one private street on 13.86 gross acres located at 1st Avenue and Candlelight Drive in the unincorporated community of East La Mirada in the Southeast Whittier Zoned District applied for by Brookfield Residential. **(County Counsel)** (Relates to Agenda Item Nos. 13 and 60) (14-3807)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Findings and Conditions

13. Recommendation: Adopt findings and conditions for approval of Vesting Tentative Tract Map No. 072216-(4), part of Project No. R2013-00317-(4), to authorize the development of 17 multi-family lots with 91 detached residential condominium units, seven private open space lots and one private street lot on 13.86 gross acres located at 1st Avenue and Candlelight Drive in the unincorporated community of East La Mirada in the Southeast Whittier Zoned District. **(County Counsel)** (Relates to Agenda Item Nos. 12 and 60) (14-5097)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Findings and Conditions

14. Recommendation: Adopt an amended resolution to the Real Estate Fraud Notification Program to revise the timeframe for notifying the party or parties subject to a Notice of Default or Notice of Sale, including the occupants of that property from 20 days to 14 days and revise the sunset clause from January 1, 2015 to January 1, 2020; and authorize the continued mailing of notices to a party or parties subject to a Notice of Default or Notice of Sale within a specific timeframe. **(Registrar-Recorder/County Clerk)** (14-5069)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

15. Recommendation: Authorize the acceptance of compromise offers of settlement from individuals who were injured in a third-party compensatory accident and who received medical care at the following County facilities: **(Treasurer and Tax Collector)**

Harbor-UCLA Medical Center
Account No. 12742713 in the amount of $1,243.12
Account No. 12742703 in the amount of $11,015.30
Account No. 12777185 in the amount of $8,165.72
Account No. 12748565 in the amount of $14,812.64
Account No. 12711887 in the amount of $4,876.14

LAC+USC Medical Center
Account No. 12849795 in the amount of $5,000.00
Account No. 12856014 in the amount of $9,610.66
Account No. 12698327 in the amount of $5,926.21
Account No. 12815407 in the amount of $5,824.45 (14-4996)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

Children and Families' Well-Being

16. Revised recommendation: Authorize the Senior Deputy Director of Children and Family Services to execute a funding agreement with Children and Families First-Proposition 10 Commission (First 5 LA) to fund the extension of nine existing Partnership for Families (PFF) contracts being administered by First 5 LA from January 1, 2015 through June 30, 2016 using $15,999,471 in State Realignment Funds; extend the funding agreement with First 5 LA on a month-to-month basis, at a monthly cost of $888,859, for the period of July 1, 2016 through December 31, 2016 until the execution of new County PFF contracts; execute amendments to the agreement for changes to the terms and conditions and any increases or decreases to the maximum annual agreement total not to exceed 10% for additional and necessary services, provided sufficient funding is available. **(Department of Children and Family Services)** (14-5071)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Revised Board Letter

17. Recommendation: Instruct the Chairman to sign an amendment to the Los Angeles Eligibility, Automation Determination, Evaluation and Reporting System Information Technology Agreement with Unisys Corporation to extend the term of the agreement for two one-year periods, commencing on May 1, 2015, authorize to increase the amount from $125,875,906 to $179,875,906 for the second extended option term and increase the aggregate Total Maximum Contract Sum for the agreement from $467,378,543 to $521,378,543, add provisions for the Data Destruction, Disabled Veterans Business Enterprise Preference Program and Transitional Job Opportunities Preference Program and update the name of the Contractor's Vice President and General Manager. **(Department of Public Social Services and Chief Information Office)** (14-5034)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Board Letter

Agreement No. 68587, Supplement 16

Health and Mental Health Services

18. Recommendation: Adopt and instruct the Chairman to execute a resolution approving the acceptance of Senate Bill (SB) 82 Investment in Mental Health Wellness Act of 2013 grant award from the California Health Facilities Financing Authority (CHFFA) for the grant period beginning April 24, 2014 and ending April 24, 2016 in the amount of $40,892,700 from CHFFA to fund capital projects associated with the expansion and implementation of Urgent Care Centers (UCCs), Crisis Residential Treatment Programs and Mobile Crisis Support Teams Countywide (Programs); and approve an appropriation adjustment for Fiscal Year (FY) 2014-15 in the total amount of $20,120,000 to increase Salaries and Employee Benefits in the amount of $1,571,000, Services and Supplies in the amount of $18,414,000 and Capital Assets in the amount of $135,000 to provide spending authority for capital projects and expand and implement Programs, fully funded with the SB 82 CHFFA grant award, State Mental Health Services Act (MHSA) revenue, Federal Financial Participation Medi-Cal, and the shift of appropriation from Other Charges; and authorize the Director of Mental Health to take the following related actions: **(Department of Mental Health) 4-VOTES**

Execute the CHFFA Investment in Mental Health Wellness Grant Program and forward them to CHFFA, effective upon execution by CHFFA;

Execute amendments to the Grant Agreement that extend the term of the Grant Agreement, allow for the receipt of additional SB 82 CHFFA grant funds, rollover of unspent funds, redirection of grant funds among the categories of SB 82 CHFFA grant services, implement any required program and/or policy changes, renew any similar CHFFA Grant Agreement for additional SB 82 CHFFA grant awards in subsequent fiscal years, accept additional SB 82 CHFFA grant funding; and

Execute Memoranda of Understanding (MOU) with local law enforcement agencies for the provision and expansion of Law Enforcement Teams outlining the roles and responsibilities of the Department and the law enforcement agency, including allowing for mutual indemnification, with no funding attached to these MOUs; and fill 19 full-time equivalent ordinance positions. (14-5012)

On motion of Supervisor Knabe, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 5 - Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Attachments: Board Letter

19. Recommendation: Authorize the Interim Director of Public Health to accept and implement a Notice of Award (NA) from the Centers for Disease Control and Prevention (CDC), in the amount of $3,520,000 to support the Chronic Disease Prevention Strategy in Los Angeles Project for the budget period of September 30, 2014 through September 29, 2015; accept future awards and/or amendments that are consistent with the requirements of the CDC NA that extend the term through September 29, 2018 at amounts to be determined by the CDC; reflect non-material and/or ministerial revisions to the award's terms and conditions; allow for the rollover of unspent funds and/or redirection of funds; adjust the term of the award through March 31, 2019; and/or provide an increase or decrease in funding by up to 25% above or below each grant term's annual base amount. **(Department of Public Health)** (14-5021)

Dr. Genevieve Clavreul addressed the Board.

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Video
Audio

Community Services

20. Recommendation: Instruct the Chairman to sign an amendment to the Option Agreement Regarding Leasehold Interest for the Anchorage at the Marina Del Rey Hotel, Parcel 43 at 13534 Bali Way in Marina Del Rey (4), granting MDR Marina, L.P. an extension for up to 12 months from November 17, 2014 to obtain certain regulatory approvals and satisfy certain other conditions for the proposed marina leasehold project; authorize the Director of Beaches and Harbors to approve required amendments to the existing Reciprocal Easement Agreement dated August 30, 2013 to coordinate the construction and operation of each of the hotel and marina projects and execute and deliver documentation, including without limitation, a lender estoppel certificate for Parcel 43 to facilitate development of the parcel. **(Department of Beaches and Harbors) 4-VOTES** (14-5002)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Board Letter

Agreement No. 77866, Supplement 1

21. Recommendation: Authorize the Director of Internal Services, as the County's Purchasing Agent, to proceed with the acquisition of two refuse trucks for the Department of Beaches and Harbors, at an estimated total of $305,000 each (3 and 4). **(Department of Beaches and Harbors)** (14-4997)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

22. Recommendation: Establish the proposed Puente Hills County Regional Park Master Plan Project, Capital Project No. 69770 (Project), to proceed with a Park Master Plan (Plan), conceptual plan alternatives, and the required environmental documents for the proposed Puente Hills County Regional Park (4) with a Project budget in the amount of $814,000, approve an appropriation adjustment to transfer Sanitation Special Districts of Los Angeles County funds in the amount of $814,000 from the Department of Parks and Recreation's Trust Account to the Project; and authorize the Director of Parks and Recreation to use a Board-approved, as-needed design consultant to provide a Plan and environmental document services for a fee not to exceed $813,382 for the Project. **(Department of Parks and Recreation) 4-VOTES** (14-5030)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

23. Recommendation: Find that security services can be performed more economically by an independent contractor; approve and instruct the Chairman to sign a contract with General Security Services, Inc. for security services at the Department of Parks and Recreation's Administrative, East, South, and Regional Headquarters, the 72nd St. Staging Area, and the Los Angeles County Arboretum and Botanic Garden, collectively known as the Central Region facilities (1, 2 and 5), at an approximate annual base amount of $418,023, increasing annually by approximately $600, effective December 1, 2014, for a five-year term with three one-year renewal options, for a maximum potential term of eight years and an approximate total of $3,364,767, not including Cost of Living Adjustments, to be exercised by the Director of Parks and Recreation; find that the approval of the contract is exempt from the California Environmental Quality Act; and authorize the Director to take the following related actions: **(Department of Parks and Recreation)**

Exercise the three contract renewal options annually, if in the opinion of the Director, the contractor has successfully performed the previous contract period, services are still required and cost effective and renewal may include a Cost of Living Adjustment, per option year;

Increase the contract cost by up to 10% during each contract year, averaging up to $42,060 annually, as a contingency amount for unforeseen services/emergencies and/or additional work within the scope of the contract, which could increase the total annual contract amount to an average of $462,655; and

Suspend, terminate, or assign the contract in accordance with the approved terms and conditions of the contract. (14-5022)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

Agreement No. 78299

24. Recommendation: Approve the request to submit a grant application to the Regional Park and Open Space District for County Excess Funds, available to the Fifth Supervisorial District, pursuant to the Safe Neighborhood Parks Proposition of 1996, in the amount of $3,700,000 to partially fund the proposed Castaic Sports Complex Olympic-Size Pool Project (Project) (5); and authorize the Director of Parks and Recreation, as agent of the County, to accept the grant funds, execute the agreement, conduct all negotiations, and submit all documents, including, but not limited to, amendments, Memorandum of Unrecorded Grant Agreement and payment requests, which may be necessary for the completion of the Project. **(Department of Parks and Recreation)** (14-4995)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

25. Recommendation: Adopt a resolution to submit a grant application to the Regional Park and Open Space District for County Excess Funds, available to the First Supervisorial District, pursuant to the Los Angeles County Safe Neighborhood Parks Proposition of 1996, in an amount of $100,000, to partially fund the proposed Whittier Narrows Dominguez Play Sculpture Rehabilitation Project (Project) at Whittier Narrows Recreation Area (1); adopt a Youth Employment Plan for the proposed Project; authorize the Director of Parks and Recreation as agent of the County, to accept the grant funds, execute the agreement, conduct all negotiations, and submit all documents, including, but not limited to, amendments, deed restrictions, Memorandum of Unrecorded Grant Agreement, and payment requests, which may be necessary for the completion of the Project; and find that the proposed Project is exempt from the California Environmental Quality Act. **(Department of Parks and Recreation)** (14-5062)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

26. Recommendation: Adopt a resolution assigning the County's right to apply for $372,500 of County Excess Funds, available to the Third Supervisorial District, allocated to the Department of Parks and Recreation by the Regional Park and Open Space District, pursuant to the Safe Neighborhood Parks Proposition of 1996, for the Greater Los Angeles Zoo Association to partially fund the estimated total project cost of $745,000 for the proposed Los Angeles Zoo General Improvements Project (Project) (3); and find that the proposed Project is exempt from the California Environmental Quality Act. **(Department of Parks and Recreation)** (14-5066)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Board Letter

27. Recommendation: Approve and authorize the Director of Parks and Recreation to execute a Memorandum of Understanding (MOU) with the Mountains Recreation and Conservation Authority for the maintenance and servicing of park and open space property in the Santa Monica Mountains, including Wilacre Park, in an amount not to exceed $930,000; and authorize the Director to execute amendments to the MOU as necessary. **(Department of Parks and Recreation)** (14-4984)

Ameer Flippin addressed the Board.

Russ Guiney, Director of Parks and Recreation, Lisa Sogher, Deputy Executive Officer, Mountains Recreation and Conservation Authority (MRCA), and Mark J. Saladino, County Counsel, responded to questions posed by the Board. Jeffrey Maloney, Chief Staff Counsel for the MRCA, was also present.

After discussion, Supervisor Antonovich made a motion, seconded by Supevisor Ridley-Thomas, to approve the item as a one-time allocation to the MRCA.

Said motion failed to carry by the following vote:

Ayes:	2 -	Supervisor Ridley-Thomas and Supervisor Antonovich
Noes:	1 -	Supervisor Yaroslavsky
Abstentions:	2 -	Supervisor Molina and Supervisor Knabe

On motion of Supervisor Yaroslavsky, this item was duly carried by the following vote:

Ayes:	3 -	Supervisor Molina, Supervisor Yaroslavsky and Supervisor Knabe
Noes:	2 -	Supervisor Ridley-Thomas and Supervisor Antonovich

Attachments: Board Letter
Video
Audio

28. Recommendation: Instruct the Chairman to sign contracts with LAC Group and AppleOne Employment Services to provide temporary librarian and library assistant personnel services for a period of four years with a one-year renewal option and six month-to-month extension options for a combined annual total not to exceed $600,000, effective upon Board approval or December 1, 2014, whichever is later; and authorize the County Librarian to take the following related actions: **(Public Library)**

Execute amendments for future unanticipated changes in the scope of work and increase the contract amount to cover the cost of such changes, up to 10% of the original contract amount;

Exercise the one-year renewal option and six month-to-month extension options under the terms of the contracts; and

Execute amendments to implement additions and/or changes of certain terms as required by the Board during the term of the contract and adjust the contract amount due to such changes, if necessary.
(14-5052)

On motion of Supervisor Ridley-Thomas, and by Common Consent, there being no objection, this item was continued to November 25, 2014.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

29. Recommendation: Accept a grant award in the amount of $123,500 from First 5 LA to expand the Family Place Libraries program, which provides information on good health, early learning, parental involvement, and access to supportive community services at the Baldwin Park, Hollydale, La Puente, Norwood and Pico Rivera Libraries (1); and authorize the County Librarian to execute any documents and agreements related to the acceptance and use of the grant funds. **(Public Library)** (14-5054)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

30. Recommendation: Approve an increase in the budget for the Martin Luther King, Jr. Inpatient Tower Renovation Project (Project) (2) from $281,430,000 to $284,313,000; approve an appropriation adjustment for the Project in the amount of $2,883,000, offset with tax-exempt commercial paper; authorize the Director of Public Works to execute change orders with Hensel Phelps Construction Company for the following; and find that the recommended actions are within the scope of the previously approved categorical exemption for the Project: **(Department of Public Works) 4-VOTES**

Removal and reinstallation of existing utilities in the intensive care units in an amount not to exceed $258,000;

Provision of additional server cabinets and associated support systems in an amount not to exceed $500,000; and

Additional work for various low-voltage systems in an amount not to exceed $350,000. (14-5058)

Dr. Genevieve Clavreul addressed the Board.

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was approved.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Board Letter
Video
Audio

31. Recommendation: Authorize the Director of Public Works to execute cost-sharing Memoranda of Understanding for the implementation of Coordinated Integrated Monitoring Programs to comply with the National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit, including necessary amendments, provided that the County's estimated average annual cost-share for each Memorandum of Understanding, including amendments and a 10% contingency, does not exceed $750,000 and an aggregate total of $3,500,000 per year; and find that the proposed actions are exempt from the California Environmental Quality Act. **(Department of Public Works)** (14-5013)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

32. Recommendation: Adopt a resolution of intention to transfer tentative subdivision territory known as Tract No. 71497 located in the City of La Mirada (4), from Tax Assessment Zone B to Tax Assessment Zone A within County Lighting Maintenance District 10045 and La Mirada Zone B to La Mirada Zone A of County Lighting District Landscaping and Lighting Act-1 (LLA-1), and order the levying of assessments within the annexed territories for Fiscal Year (FY) 2015-16; set January 27, 2015 for public hearing regarding the proposed transfer of approved tentative subdivision territory and levy of annual assessments based on the FY 2014-15 Annual Engineer's Report, which establishes assessments based on land use type for all zones within County Lighting District LLA-1 for street lighting purposes with an annual base assessment rate for a single-family home of $20 for La Mirada Zone A, which represents a $19 increase over the current $1 base assessment rate for La Mirada Zone B; and find that the project is exempt from the California Environmental Quality Act. **(Department of Public Works)** (14-5041)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

33. Recommendation: Adopt the findings and orders of the Building Rehabilitation Appeals Board, which provides for the arrest and abatement of neighborhood deterioration and the elimination of unsightly, unsafe, and unhealthful conditions, which constitute a public nuisance at the following unincorporated locations: **(Department of Public Works)**

352 Santa Mariana Ave., La Puente (1)
18814 Altario St., La Puente (1)
1254 Bannon Ave., La Puente (1)
616 S. Bonnie Beach Pl., Los Angeles (1)
1756 E. 87th St., Los Angeles (2)
1132 E. 80th St., Los Angeles (2)
3571 Olympiad Dr., Los Angeles (2)
5020 W. 135th St., Hawthorne (2)
1209 Lancewood Ave., Hacienda Heights (4)
2437 Stonyvale Rd., Tujunga (5)
29830 Central Ave., Val Verde (5)
38909 Ocotillo Dr., Palmdale (5) (14-5020)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Board Letter
Board Letter
Board Letter

34. Recommendation: Approve the proposed Crescenta Valley Skate Park Project (Project) located in the City of La Crescenta (5), Capital Project No. 69700, Specs. 7306, with a total Project budget of $2,090,000; and find that the Project is exempt from the California Environmental Quality Act. **(Department of Public Works)** (14-5024)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

35. Recommendation: Acting as the Governing Body of the County Flood Control District, authorize the Chief Engineer to enter into an agreement with the City of Los Angeles for maintenance of the Echo Park Lake Rehabilitation Project Low-Flow Diversion Structure, Project No. 481, Line B (Project) (1), and take all steps necessary to implement the agreement and accept the Diversion Structure, as part of the District's Flood Control System, and assume maintenance responsibility for the Diversion Structure and manhole; and acting as a responsible agency for the Project, consider the Final Environmental Impact Report (EIR) prepared and certified by the City as the lead agency for the Project; certify that the Board has independently considered and reached its own conclusions regarding the environmental effects of the Project, as shown in the Final EIR; adopt the Mitigation Monitoring Program (MMP), finding that the MMP is adequately designed to ensure compliance with the mitigation measures during Project implementation; find that there are no further feasible alternatives or feasible mitigation measures within the Board's power that would substantially lessen or avoid any significant effect the Project would have on the environment; and determine that the significant adverse effects of the Project have either been reduced to an acceptable level or are outweighed by the specific considerations of the Project, as outlined in the Environmental Findings of Fact and Statement of Overriding Considerations, which are adopted and incorporated by reference. **(Department of Public Works)** (14-5042)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was adopted.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

36. Recommendation: Acting as the Governing Body of the County Flood Control District, authorize the Chief Engineer of the District to execute cost-sharing Memoranda of Understanding (MOU) for the implementation of Coordinated Integrated Monitoring Programs to comply with the National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit, including necessary amendments, provided that the District's estimated average annual cost-share for each MOU, including amendments and a 10% percent contingency, does not exceed $300,000 and an aggregate $1,200,000 per year; and find that the proposed actions are exempt from the California Environmental Quality Act. **(Department of Public Works)** (14-5010)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

37. Recommendation: Acting as the Governing Body of the County Flood Control District (District), certify that the Final Environmental Impact Report (FEIR) for the Devil's Gate Reservoir Sediment Removal and Management Project (Project) (5) has been completed in compliance with the California Environmental Quality Act and reflects the independent judgment and analysis of the District; find that the Board has reviewed and considered the information contained in the FEIR prior to approving the Project; adopt the Mitigation Monitoring and Reporting Program for the Recommended Alternative, finding that the Mitigation Monitoring and Reporting Program for the Recommended Alternative is adequately designed to ensure compliance with the mitigation measures during implementation of the Project; determine that the significant adverse effects of the Project have either been reduced to an acceptable level or are outweighed by the specific considerations of the Recommended Alternative, as outlined in the Environmental Findings of Fact and Statement of Overriding Considerations, which are adopted and incorporated by reference; approve the Alternative 3, Configuration D, Option 2 of the Project in conjunction with Alternative 5 as the Recommended Alternative, which is described and analyzed in the FEIR; and authorize the District to carry out the Recommended Alternative. **(Department of Public Works)** (14-5009)

The Honorable Bill Bogaard, Mayor, City of Pasadena, Tecumseh Shackelford, Tim Martinez, Mitchell Tsai, Rhoads Stephenson, Henreen Nunley, Nina Chomsky, Timothy Brick, Kelly Gardner, Doris Davis, Don Bremmer, David Czamanske, LB Nye, Dorothy Wong, Rebecca Shields Moose and Penny Simon addressed the Board.

Gary Hildebrand, Deputy Director, Christopher Stone, Assistant Deputy Director, and Keith Lilley, Civil Engineer, Water Resources Division, representing the Department of Public Works, responded to questions posed by the Board.

Supervisor Antonovich made a motion to also instruct the Director of Public Works to:

1. **Further reduce community impacts by including the following provisions in the Devil's Gate Reservoir Sediment Removal and Management Project design plans and specifications:**

    a. **Limit hauling hours to Monday through Friday from 7 a.m. to 3:30 p.m.**

b. Hauling to occur only between April 15 to October 15 with the ability to go until December, if there is a late wet season and a dry fall.

c. Exclude work on major holidays and major Rose Bowl events.

d. Prohibit trucks from staging on city streets.

e. Balance truck traffic between the Cities of La Cañada Flintridge and Pasadena.

f. Work with the permitting agencies and stakeholders to restore habitat in the project area that is consistent with the Hahamonga Master Plan;

2. Continue collaboration on project design and implementation with the Altadena Town Council and Cities of La Cañada Flintridge and Pasadena; and

3. Implement a regular maintenance routine, consistent with the Environmental Impact Report by removing accumulated sediment annually to reduce the future frequency of major sediment removal projects.

After discussion, on motion of Supervisor Antonovich, seconded by Supervisor Knabe, this item was adopted as amended; and the Director of Public Works was instructed to:

1. Further reduce community impacts by including the following provisions in the Devil's Gate Reservoir Sediment Removal and Management Project design plans and specifications:

a. Limit hauling hours to Monday through Friday from 7 a.m. to 3:30 p.m.

b. Hauling to occur only between April 15 to October 15 with the ability to go until December, if there is a late wet season and a dry fall.

c. Exclude work on major holidays and major Rose Bowl events.

d. **Prohibit trucks from staging on city streets.**

e. **Balance truck traffic between the Cities of La Cañada Flintridge and Pasadena.**

f. **Work with the permitting agencies and stakeholders to restore habitat in the project area that is consistent with the Hahamonga Master Plan;**

2. **Continue collaboration on project design and implementation with the Altadena Town Council and Cities of La Cañada Flintridge and Pasadena; and**

3. **Implement a regular maintenance routine, consistent with the Environmental Impact Report by removing accumulated sediment annually to reduce the future frequency of major sediment removal projects.**

Said item was duly carried by the following vote:

Ayes:	4 -	Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Antonovich and Supervisor Knabe
Noes:	1 -	Supervisor Yaroslavsky

Attachments: Board Letter
Motion by Supervisor Antonovich
Public Works' PowerPoint
Video
Audio

Public Safety

38. Recommendation: Authorize the Chief Probation Officer to execute contracts with six Community-Based Organizations, including Asian Youth Center, Soledad Enrichment Action, Inc., Star View Children and Family Services, Aviva Family and Children's Services, Child and Family Guidance Center and Special Services for Groups to provide home-based services to high-risk/high-needs youth in ten service areas under the Juvenile Justice Crime Prevention Act, similar to the standardized contract, for an initial contract estimate of $94,000 each, commencing January 1, 2015 through June 30, 2015; execute contract amendments to extend the contract term for up to four 12-month periods at an estimated annual amount of $188,000 each; and execute amendments to the contracts for any decrease or increase not to exceed 10% of the contract rates and/or 180 days to the period of performance pursuant to the terms of the contract. **(Probation Department)** (14-5063)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was continued to November 18, 2014.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Motion by Supervisor Molina
Video
Audio

39. Recommendation: Authorize the Chief Probation Officer to execute contracts with three Community-Based Organizations, including Star View Children and Family Services, Asian American Drug Abuse Programs, Inc. and Asian Youth Center to provide intensive family-centered home-based gender-specific services to high-risk female youth in five clusters under the Juvenile Justice Crime Prevention Act, similar to the standardized contract, for an initial contract amount estimated at $47,000 each, commencing January 1, 2015 through June 30, 2015; execute contract amendments to extend the contract term for up to four 12-month periods at an estimated annual amount of $94,000 each; and execute amendments to the contracts for any decrease or increase not to exceed 10% of the contract rate and/or 180 days to the period of performance pursuant to the terms of the contract. **(Probation Department)** (14-5068)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was continued to November 18, 2014.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Motion by Supervisor Molina
Video
Audio

40. Recommendation: Authorize the Chief Probation Officer to execute contracts with six Community-Based Organizations, including Soledad Enrichment Action, Inc., South Bay Workforce Investment Board, Community Career Development, Inc., Jewish Vocational Service of Los Angeles, Communities in Schools-San Fernando Valley and Special Services for Groups to provide employment services to high-risk/high-needs youth in ten service areas under the Juvenile Justice Crime Prevention Act, similar to the standardized contract, for an initial contract amount estimated at $94,000 each, commencing January 1, 2015 through June 30, 2015; execute contract amendments to extend the contract term for up to four 12-month periods at an estimated annual amount of $188,000 each; and execute amendments to the contracts for any decrease or increase not to exceed 10% of the contract rates and/or 180 days to the period of performance pursuant to the terms of the contract. **(Probation Department)** (14-5070)

Eric Preven addressed the Board.

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was continued to November 18, 2014.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Motion by Supervisor Molina
Video
Audio

41. Recommendation: Authorize the Chief Probation Officer to execute an amendment to the contract with Sentinel Offender Services, LLC, extending the term of the contract to provide an Electronic Monitoring Program for the Probation Department for a 12-month period, commencing December 1, 2014 through November 30, 2015. **(Probation Department)** (14-5000)

Eric Preven addressed the Board.

On motion of Supervisor Knabe, seconded by Supervisor Yaroslavsky, this item was duly carried by the following vote:

Ayes: 3 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky and Supervisor Knabe

Abstentions: 1 - Supervisor Antonovich

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Video
Audio

42. Recommendation: Authorize the Public Defender to incur incidental expenses estimated at $10,000 above the Department's delegated authority, to host a Juvenile Delinquency Law Seminar, which will provide juvenile delinquency law training for attorneys and support staff of the Public Defender's Office, Alternate Public Defender's Office, as well as attorneys from other County Public Defender offices and the private bar, and provide State Bar required Minimum Continuing Legal Education credit to attorneys in attendance. **(Public Defender)** (14-4998)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

43. Recommendation: Approve the transfer of funds from Services and Supplies to reimburse the Sheriff's Special Appropriation Fund totaling $34,652.39. **(Sheriff's Department)** (14-4993)

On motion of Supervisor Knabe, seconded by Supervisor Antonovich, this item was approved.

Ayes: 3 - Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 2 - Supervisor Molina and Supervisor Ridley-Thomas

Attachments: Board Letter

Miscellaneous Communications

44. Los Angeles County Claims Board's recommendation: Authorize settlement of the matter entitled Jane Doe by Deborah Epperson v. County of Los Angeles, Norwalk Superior Court Case No. VC 061 354 in the amount of $675,000 and instruct the Auditor-Controller to draw a warrant to implement this settlement from the Sheriff's Department's budget.

This lawsuit concerns allegations of sexual assault and battery by a Sheriff's Deputy. (14-4992)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter
Video
Audio

45. Los Angeles County Claims Board's recommendation: Authorize settlement of the matter entitled Logan Cigrang v. County of Los Angeles, et al., United States District Court Case No. CV 12-10406, in the amount of $600,000 and instruct the Auditor-Controller to draw a warrant to implement this settlement from the Probation Department's budget.

This lawsuit alleges that due to improper supervision by Probation Department employees a former juvenile ward sustained physical injuries. (14-4991)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, the settlement was approved and the corrective action plan was continued to December 16, 2014.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

46. Request from the City of Burbank: Render specified services relating to the conduct of a Primary Nominating Election to be held on February 24, 2015 and a General Municipal Election to be held on April 14, 2015. (14-5003)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

47. Request from the City of Cerritos: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5049)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

48. Request from the City of Covina: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5044)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

49. Request from the City of Glendora: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5045)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

50. Request from the City of La Verne: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5046)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

51. Request from the City of Redondo Beach: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5047)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

52. Request from the City of San Dimas: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5043)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

53. Request from the City of Temple City: Render specified services relating to the conduct of a General Municipal Election to be held on March 3, 2015. (14-5048)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

54. Request from the City of Vernon: Render specified services relating to the conduct of a Special Municipal Election to be held on February 17, 2015. (14-5050)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, this item was approved; and the Registrar-Recorder/ County Clerk was instructed to comply with the City's request, provided that the City pays all related costs.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Board Letter

Ordinances for Adoption

55. Ordinance for adoption amending County Code, Title 5 - Personnel portions of Sections 5.27.040, 5.27.240, 5.28.040, 5.28.240, 5.33.040, and 5.37.040 to update the County contribution provisions in each of the County's cafeteria plans for health insurance purposes; portions of Sections 5.36.025 and 5.36.029 to revise the health insurance eligibility rules and County subsidy rates for certain monthly permanent part-time employees; and portions of Sections 5.27.220, 5.27.240, 5.27.500, 5.27.510, 5.28.220, 5.28.240, 5.28.500, and 5.28.510 to update the definitions of the applicable Retirement Plans and the election options of the Survivor Income Benefit available in the Flexible Benefit Plans. (14-4688)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, the Board adopted Ordinance No. 2014-0045 entitled, "An ordinance amending Title 5 - Personnel of the Los Angeles County Code, relating to fringe benefit changes." This ordinance shall take effect and become operative on and after December 1, 2014.

This item was duly carried by the following vote:

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance
Certified Ordinance

56. Ordinance for adoption amending County Code, Title 6 - Salaries, by adding and establishing the salary for one unclassified classification; restoring, establishing the salary, and changing the title of one unclassified classification; deleting two non-represented employee classifications; and adding, deleting, and/or changing certain classifications and numbers of ordinance positions in the Departments of Animal Care and Control, Beaches and Harbors, Board of Supervisors, Children and Family Services, District Attorney, Fire, Health Services, Internal Services, Mental Health, Parks and Recreation, Public Defender, Public Social Services, Registrar-Recorder/County Clerk, and Sheriff. (14-4949)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, the Board adopted Ordinance No. 2014-0046 entitled, "An ordinance amending Title 6 - Salaries of the Los Angeles County Code relating to the addition, deletion, and changing of certain classifications and numbers of ordinance positions in various departments to implement the findings of classification studies." This ordinance shall take effect November 12, 2014.

This item was duly carried by the following vote:

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance
Certified Ordinance

57. Ordinance for adoption of Advance Planning Case No. 2014-00002-(1) to amend the County Code, Title 22 - Planning and Zoning, relating to the East Los Angeles Community Standards District (CSD); the proposed amendments to the CSD revise existing development standards and establish new development standards for future development in residential, commercial and industrial zones to enhance community aesthetics, encourage pedestrian-oriented development, and reinvest in older buildings. (Relates to Agenda Item Nos. 11, 58 and 59) (14-5027)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, the Board adopted Ordinance No. 2014-0047 entitled, "An ordinance amending Title 22 - Planning and Zoning of the Los Angeles County Code, to revise and add new development standards to the East Los Angeles Community Standards District to encourage pedestrian-oriented development and investment in existing older buildings, and to enhance the aesthetics of the community." This ordinance shall take effect December 12, 2014.

This item was duly carried by the following vote:

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance
Certified Ordinance

58. Ordinance for adoption of Zone Change No. 2014-00005-(1) to change the zoning of East Los Angeles Zoned District Nos. 1, 2, and 4 to Specific Plan zoning. (Relates to Agenda Items Nos. 11, 57 and 59) (14-5028)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, the Board adopted Ordinance No. 2014-0048Z entitled, "An ordinance amending Section 22.16.230 of Title 22 - Planning and Zoning of the Los Angeles County Code, changing the regulations for the execution of the General Plan, relating to the East Los Angeles Zoned District Nos. 1, 2, and 4." This ordinance shall take effect December 12, 2014.

This item was duly carried by the following vote:

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance
Certified Ordinance

59. Ordinance for adoption of Specific Plan No. 2014-00001-(1) to adopt the East Los Angeles Form-Based Code Specific Plan as part of Title 22 - Planning and Zoning of the Los Angeles County Code for establishing standards and regulations for development in the area encompassed by the East Los Angeles Third Street Plan. (Relates to Agenda Item Nos. 11, 57 and 58) (14-5029)

On motion of Supervisor Ridley-Thomas, seconded by Supervisor Antonovich, the Board adopted Ordinance No. 2014-0049 entitled, "An ordinance amending Title 22 - Planning and Zoning of the Los Angeles County Code, to create a specific plan known as the East Los Angeles Third Street Form-Based Code Specific Plan." This ordinance shall take effect December 12, 2014.

This item was duly carried by the following vote:

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance
Certified Ordinance

60. Ordinance for adoption of Zone Change Case No. 2013-00002-(4) to change the zoning of an approximate 13.86 gross acre-site from Light Agriculture - 7,000 sq ft minimum lot size (A-1-7,000) to Residential Planned Development - 8.3 Dwelling Units Per Net Acre - Development Program (RPD-8.3U-DP), part of Project No. R2013-00317-(4), which authorizes the development of 17 multi-family lots with 91 detached residential condominium units, seven private open space lots, and one private street lot located on 1st Avenue and Candlelight Drive in the unincorporated community of East La Mirada in the Southeast Whittier Zoned District applied for by Brookfield Residential. (Relates to Agenda Item Nos. 12 and 13) (14-5098)

On motion of Supervisor Yaroslavsky, seconded by Supervisor Ridley-Thomas, the Board adopted Ordinance No. 2014-0050Z entitled, "An ordinance amending Section 22.16.230 of Title 22 - Planning and Zoning of the Los Angeles County Code, changing regulations for the execution of the General Plan, relating to the Southeast Whitter Zoned District Number 82." This ordinance shall take effect December 12, 2014.

This item was duly carried by the following vote:

Ayes: 5 - Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Attachments: Ordinance
Certified Ordinance

V. ORDINANCES FOR INTRODUCTION 61 - 62

61. Ordinance for Introduction amending the gas pipeline distribution franchise granted to Southern California Gas Company (SoCalGas) to extend the term of the SoCalGas franchise through December 31, 2015, becoming operative January 1, 2015. (Relates to Agenda No. 8) (14-5031)

On motion of Supervisor Knabe, seconded by Supervisor Antonovich, the Board introduced, waived reading and ordered placed on the agenda for adoption an ordinance entitled, "An ordinance amending Ordinance No. 6765, as amended, relating to the gas distribution franchise granted to Southern California Gas Company, a California corporation."

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance

62. Ordinance for introduction amending the electrical transmission and distribution franchise granted to the Southern California Edison Company, to extend the term of the franchise through December 31, 2015, becoming operative January 1, 2015. (Relates to Agenda No. 9) (14-5053)

On motion of Supervisor Knabe, seconded by Supervisor Yaroslavsky, the Board introduced, waived reading and ordered placed on the agenda for adoption an ordinance entitled, "An ordinance amending Ordinance No. 7062, as amended, relating to the electrical transmission and distribution franchise granted to Southern California Edison Company, a California corporation."

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Ordinance

VI. DISCUSSION ITEMS 63 - 64

63. Report by the Chief Executive Officer with a cost analysis of alternative custody and treatment programs discussed in the Sheriff's March 2014 Draft Proposed Population Management Solutions, as requested at the meeting of May 6, 2014. (Continued from the meetings of 7-15-14, 7-29-14, 9-9-14 and 10-7-14) (13-3345)

By Common Consent, there being no objection, this item was continued to January 20, 2015.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Report

Public Hearing

64. Hearing on Project No. R2007-02733-(5), Advance Planning No. 2007-00019-(5), Zone Change No. 2014-00009-(5), Advance Planning No. 2014-00009-(5) and the Environmental Impact Report, Findings of Fact and Statement of Overriding Considerations, and Mitigation Monitoring and Reporting Program associated with Environmental Assessment No. 2014-00021-(5), for the proposed Antelope Valley Area Plan (Area Plan), located in the unincorporated Antelope Valley area, which includes a comprehensive update to the existing Area Plan, and minor amendments to the Los Angeles Countywide General Plan within the Antelope Valley; authorize changes in zoning for the Project Area for consistency with the proposed Area Plan; and amend the County Code, Title 22 - Planning and Zoning for consistency with the proposed Area Plan. (The Regional Planning Commission has recommended approval of this project.) **(Department of Regional Planning)** (14-4771)

All persons wishing to testify were sworn in by the Executive Officer of the Board. Carl Nadela and Susan Tae, representing the Department of Regional Planning, testified. Opportunity was given for interested persons to address the Board. Ron Jones, Janet Lammon, Steve Kinney, Mark Majer, Cynthia Morgan, Sarah Kleinbreg, Judith Fuentes, Susan Zahnter, Margaret Rhyne, Ginger Stout, and other interested persons addressed the Board. Correspondence was presented.

Larry Hafetz, Assistant County Counsel, addressed the Board and recommended that the Board certify the Environmental Impact Report.

On motion of Supervisor Antonovich, seconded by Supervisor Knabe, the Board closed the public hearing and took the following actions:

1. **Certified that the Board has reviewed and considered the environmental information in the Final Environmental Impact Report (Final EIR); certified that the Final EIR has been completed in accordance with the California Environmental Quality Act (CEQA) and the State and County CEQA guidelines and reflects the independent judgment of the Board as to the environmental consequences of the proposed Project; certified the Final EIR; adopted the Findings of Fact and Statement of Overriding Considerations prepared for the Project, and adopted the Mitigation Monitoring and Reporting Program;**

2. Indicated its intent to approve the proposed Area Plan, Advance Planning No. 2007-00019-(5), associated Zone Change No. 2014-00009-(5) and Zoning Code Amendments Advance Planning No. 2014-00009-(5), as recommended by the Regional Planning Commission (RPC) with the following additional changes recommended by the Regional Planning staff:

a. Add a provision that ensures that if a conflict exists between the Antelope Valley Area Plan (AVAP) and any new or existing Significant Ecological Area (SEA) ordinance, the provisions in the AVAP shall control;

b. Adjust the Significant Ecological Area (SEA) designation within the East and Central Economic Opportunity Areas (EOA) to the boundaries which generally align with the existing adopted SEAs and do not include any additional SEA expansion in the EOAs; also, remove the SEA designation from the Rural Land - Maximum 1 Dwelling Unit per gross acre (RL1), Rural Commercial (CR) and Light Industrial (IL) in the West EOA;

c. When any project in the West EOA proceeds with a Specific Plan, pursuant to Government Code Sections 65359 and 65450 through 65457, a plan amendment will not be required as long as the proposed development is consistent with the AVAP;

d. Within the West EOA, the SEA overlay/designation shall apply only to the portion of the parcel or lot that are indicated as SEAs in the Land Use Policy Map (Map 2.1) of the AVAP; if a portion of such a lot has an SEA overlay/designation, only that portion of the lot shall be subject to the SEA regulations, not the entire lot notwithstanding Section 22.56.215 of the County Code;

e. Delete the Community Plan requirement from the Central and East EOAs in the AVAP;

f. Make zoning consistent with the adopted Land Use Policy Map in the West EOA by changing Heavy Agriculturual - 10 Acre Minimum Required Lot Area (A 2-10) to Residential Planned Development (RPD) to allow the appropriate density in that area; and RPD zoning be allowed to convert uses to Commercial Planned Development (CPD) if the densities within the EOA remain the same;

g. Delete the policy and process outlined in the AVAP Chapter 8 Implementation calling for a review of the SEA in the Antelope Valley every two years;

h. Add a definition for "legal lot" within the AVAP, and include how any lot brought into compliance with the Subdivision Map Act after the Plan effective date will be subject to the zoning requirements in effect at the time of lot creation; define a "legal lot" as including "any lot that would otherwise currently qualify for a conditional certificate of compliance wherein the conditions imposed therein shall not include a requirement for compliance with the new land use/and or zoning designations imposed by this AVAP";

i. Delete the definition of Master-Planned development reference on page I-8 of the AVAP;

j. Change AVAP Land Use Policy 5.1 to state: "Ensure that development is consistent with the Sustainable Communities Strategy adopted in 2012, an element of the Regional Transportation Plan developed by the Southern California Association of Governments";

k. Change AVAP Land Use Policy 2.2 to state: "Limit the amount of potential development within Scenic Resource Areas, including water features, significant ridgelines, and Hillside Management Areas, through appropriate land use designations, as indicated in the AVAP Land Use Policy Map 2.1";

l. Modify AVAP policies and map to delete conflicting language that restricts growth in the EOA's; clarify the proposed Area Plan to exclude from EOAs the applicability of other proposed policies limiting development, including Policies Land Use Element (LU) 2.2 and Conservation and Open Space Element (COS) 5.2 Scenic Resource Areas, LU 2.3 Agricultural Resource Areas, LU 2.5 and COS 16.1 riparian areas, groundwater recharge basins, and vegetated areas, Policy 2.6 proximity to National Forests, LU 3.1 seismic areas, LU 3.3 fire hazard zones currently lacking proximate fire response services, LU 3.4, COS 4.5 and COS 19.1 Hillside Management Areas, LU 3.5 landslide and liquefaction areas, and LU 3.6 airport influence areas; and additionally, remove the Rural Preserve Area map designation from the EOAs;

m. Change land use designation and zoning of existing Unlimited Commercial (C-3) portions of Assessor's Parcel Number (APN) 3083-001-057 and APN 3036-024-903 from Rural Land 10 use - Maximum Dwelling Unit per 10 Gross Acres (RL10) and Heavy Agricultural - Minimum Two Acre Required Lot Area (A-2-2) zoning, to Rural Commercial (CR) and Rural Commercial Mixed Use (C-RU) zoning;

n. Change the land use designation and zoning of APN 3054-020-011 from rural Land (RL1) and Light Agricultural one-acre (A-1-1) to IL and Light Manufacturing - Development Program (M-1-DP) zoning;

o. Prohibit ground mounted utility-scale renewable energy projects in all SEA and EOA designated areas in the AVAP;

p. Exempt from the SEA Ordinance single family residences and their accessory structures and animal keeping areas and facilities located within the boundaries of the AVAP;

q. Exempt from the SEA Ordinance all previously disturbed farmland located within the boundaries of the AVAP;

r. Exempt from the SEA Ordinance minor subdivisions located within the boundaries of the AVAP;

s. Exempt from the SEA Ordinance the rebuilding and replacement of structures destroyed in a catastrophic event;

t. Instruct the Director of Planning to incorporate this AVAP as modified and adopted into the Countywide General Plan Update currently being prepared;

u. Instruct the Director of Planning to meet and work with Antelope Valley based farmers and the County Farm Bureau members to properly identify and define Agricultural Resource Areas; and

3. Instructed County Counsel to prepare the final documents and ordinance for the AVAP Update and bring back to the Board for the Board's consideration.

Ayes: 5 - Supervisor Molina, Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Attachments: Board Letter
Motion by Supervisor Antonovich
Audio
Video
Audio

VII. MISCELLANEOUS

65. Additions to the agenda which were posted more than 72 hours in advance of the meeting, as indicated on the supplemental agenda. (12-9995)

65-A. Recommendation as submitted by Supervisor Knabe: Waive the $250 fee for the use of the Board Hearing Room, excluding the cost of liability insurance, for the Retired Employees of Los Angeles County's retirement seminar, to be held on November 13, 2014, from 11:00 a.m. to 1:00 p.m.; and instruct Departments with employees in the Civic Center area to send an e-mail to their employees to advise them of the free November 13, 2014 retirement seminar and post flyers in the appropriate areas within their offices. (14-5176)

On motion of Supervisor Knabe, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Motion by Supervisor Knabe

65-B. Recommendation as submitted by Supervisors Antonovich and Ridley-Thomas: Instruct the Chief Executive Officer and the Director of Parks and Recreation to report back to the Board in writing within 30 days with a plan to produce a Countywide Comprehensive Parks and Recreation Needs Assessment, with the final report to be developed in collaboration with other Directors of appropriate County Departments and Commissions, cities, State and local agencies and non-profit organizations that will assess potential Countywide parks and recreation projects, as well as long-term operations and maintenance needs, with the report to include, but not be limited to, a list of potential projects that will meet the needs of the County as demographics change over time and a projection of the total funds required to complete the needed projects. (14-5189)

On motion of Supervisor Antonovich, seconded by Supervisor Ridley-Thomas, this item was approved.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Motion by Supervisors Antonovich and Ridley-Thomas
Report

65-C. Recommendation as submitted by Supervisor Antonovich: Establish a $10,000 reward offered in exchange for information leading to the apprehension and/or conviction of the person or persons responsible for vandalizing the veterans' memorial wall at Alhambra Park on or about November 5, 2014. (14-5184)

On motion of Supervisor Antonovich, and by Common Consent, there being no objection, this item was referred back to Supervisor Antonovich's office.

Ayes: 4 - Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe

Absent: 1 - Supervisor Molina

Attachments: Motion by Supervisor Antonovich

65-D. Recommendation as submitted by Supervisor Ridley-Thomas: Instruct the Director of Public Works to report back to the Board in writing with the estimated costs for upgrading the roof, air handlers, chiller and cooling towers, hot water boilers, electrical system, and complying with the Americans with Disabilities Act and Title 24 requirements, so that a comprehensive inventory of associated costs for occupying the building located at 1977 Saturn Street in Monterey Park (Saturn Property) can be known and evaluated by the Board; instruct County Counsel to establish a policy for Board consideration within 60 days regarding the acceptance of unsolicited real property that ensures transparency, fairness to other property owners and real estate brokers who have unlisted properties and addresses potential conflicts and other ethical improprieties; and instruct the Chief Executive Officer to take the following actions:

Disclose all parties to the proposed $38,450,000 acquisition of the Saturn Property, including the principals, brokers and County employees involved;

Complete a comprehensive analysis consistent with the Board-approved Facility Location Policy that includes a detailed analysis of all properties it evaluated prior to completing an acquisition for the Saturn Property and report back to the Board in writing;

Return to the Board for approval to consummate the acquisition of 1977 Saturn Street only after the aforementioned due diligence has been completed and reported as directed; and

Include a Facility Location Policy analysis in all future Board Letters whereby the request to initiate real property purchase or lease is being requested. (14-5186)

Arnold Sachs and Eric Preven addressed the Board.

On motion of Supervisor Knabe, and by Common Consent, there being no objection, this item was continued to November 18, 2014.

Ayes:	4 -	Supervisor Ridley-Thomas, Supervisor Yaroslavsky, Supervisor Antonovich and Supervisor Knabe
Absent:	1 -	Supervisor Molina

Attachments: Motion by Supervisor Ridley-Thomas
Video
Audio

Public Comment 68

68. Opportunity for members of the public to address the Board on items of interest that are within jurisdiction of the Board.

Andrea Campbell, Jacqueline Ayer, Saba Maskel, Jabriel Muhammad, Eric Preven, Fran Sereseres and Sheliah Ward addressed the Board.
(14-5343)

Attachments: Video
Audio

Adjournments 69

69. On motions, duly seconded and unanimously carried, the meeting was adjourned in memory of the following persons:

Supervisor Molina
Richard Durado

Supervisor Ridley-Thomas
Herbert Bridges

Supervisor Knabe
Anderson Dale Bard
Tom Blackman
Ruben Ramirez
Doug Schneider
Janet Switzer

Supervisors Antonovich and Knabe
Philip M. Crane
William R. Wise

Supervisor Antonovich
Donald Werner Clark
Edward George Dadulak Jr.
Virginia Rose Footman
Carmen C. Harris
Kenneth Edward Moore
Radul "Rudy" Radovich
Jerry L. Spain (14-5322)

IX. CLOSED SESSION MATTERS FOR NOVEMBER 12, 2014

CS-1. CONFERENCE WITH LEGAL COUNSEL - EXISTING LITIGATION
(Paragraph (1) of subdivision (d) of Government Code Section 54956.9)

Alex Rosas, et al. v. Leroy Baca, et al., United States District Court, Central District, Case No. CV12-00428 PSG (SHx)

This lawsuit concerns allegations of violence in the Los Angeles County Jails.

No reportable action was taken. (12-0821)

CS-2. CONFERENCE WITH LEGAL COUNSEL - EXISTING LITIGATION
(Paragraph (1) of Subdivision (d) of Government Code Section 54956.9)

Jason May v. County of Los Angeles, Superior Court Case No. BC 539170

This is an employment discrimination matter involving the Department of Children and Family Services.

In Open Session, this item was taken off calendar. (14-4980)

CS-3. PUBLIC EMPLOYMENT
(Government Code Section 54957)

Consideration of candidates for the position of Chief Executive Officer.

No reportable action was taken. (14-5101)

CS-4. PUBLIC EMPLOYMENT
(Government Code Section 54957)

Interview and consideration of candidates for the position of Director of Public Health.

No reportable action was taken. (14-4969)

CS-5. PUBLIC EMPLOYMENT
(Government Code Section 54957)

Interview and consideration of candidates for the position of Executive Director of the Office of Child Protection.

In Open Session, this item was continued one week to November 18, 2014. (14-4971)

CS-6. CONFERENCE WITH LABOR NEGOTIATORS
(Government Code Section 54957.6)

Agency designated representatives: William T Fujioka, Chief Executive Officer and designated staff

Employee Organization(s) for represented employees: The Coalition of County Unions, AFL-CIO; Local 721, SEIU, Union of American Physicians and Dentists; Guild For Professional Pharmacists; Peace Officers Counsel of California; Association of Public Defender Investigators; Association of Deputy District Attorneys; Los Angeles County Association of Environmental Health Specialists, Professional Peace Officers Association; and

Unrepresented employees (all).

No reportable action was taken. (13-4431)

Report of Closed Session (CSR-14)

Attachments: Audio Report of Closed Session 11/12/14

Recess 70

70. The meeting recessed at 1:12 p.m following Item Nos. 11 and 43.

The meeting was reconvened and was called to order by the Chair Pro Tem presiding at 2:15 p.m.

Present were Supervisors Gloria Molina, Mark Ridley-Thomas, Zev Yaroslavsky, and Michael D. Antonovich , Chair Pro Tem presiding. (14-5299)

Closing 71

Open Session adjourned to Closed Session at 4:30 p.m. following adjournments to:

CS-1.
Confer with Legal Counsel on existing litigation, pursuant to Paragraph (1) of subdivision (d) of Government Code Section 54956.9:

Alex Rosas, et al. v. Leroy Baca, et al., United States District Court, Central District, Case No. CV12-00428 PSG (SHx)

This lawsuit concerns allegations of violence in the Los Angeles County Jails.

CS-3.
Consider candidates for the position of Chief Executive Officer, pursuant to Government Code Section 54957

CS-4.
Interview and consider candidates for the position of Director of Public Health, pursuant to Government Code Section 54957

CS-6.
Confer with Labor Negotiators, pursuant to Government Code Section 54957.6:

Agency designated representatives: William T Fujioka, Chief Executive Officer and designated staff

Employee Organization(s) for represented employees: The Coalition of County Unions, AFL-CIO; Local 721, SEIU, Union of American Physicians and Dentists; Guild For Professional Pharmacists; Peace Officers Counsel of California; Association of Public Defender Investigators; Association of Deputy District Attorneys; Los Angeles County Association of Environmental Health Specialists, Professional Peace Officers Association; and

Unrepresented employees (all)

Closed Session convened at 4:35 p.m. Present were Supervisors Gloria Molina, Mark Ridley-Thomas, Zev Yaroslavsky, and Michael D. Antonovich, Chair Pro Tem presiding. Absent was Supervisor Don Knabe.

Closed Session adjourned at 5:28 p.m. Present were Supervisors Gloria Molina, Mark Ridley-Thomas, Zev Yaroslavsky, and Michael D. Antonovich, Chair Pro Tem presiding. Absent was Supervisor Don Knabe.

Open Session reconvened at 5:29 p.m. for the purpose of reporting actions taken in Closed Session. Present were Supervisors Mark Ridley-Thomas, Zev Yaroslavsky, and Michael D. Antonovich, Chair Pro Tem presiding. Absent were Supervisors Gloria Molina and Don Knabe.

The Board of Supervisors of the County of Los Angeles, and ex officio the governing body of all other special assessment and taxing districts, agencies and authorities for which said Board so acts, adjourned its meeting at 5:30 p.m.

The next Regular Meeting of the Board will be Wednesday, November 18, 2014 at 9:30 a.m. (14-5300)

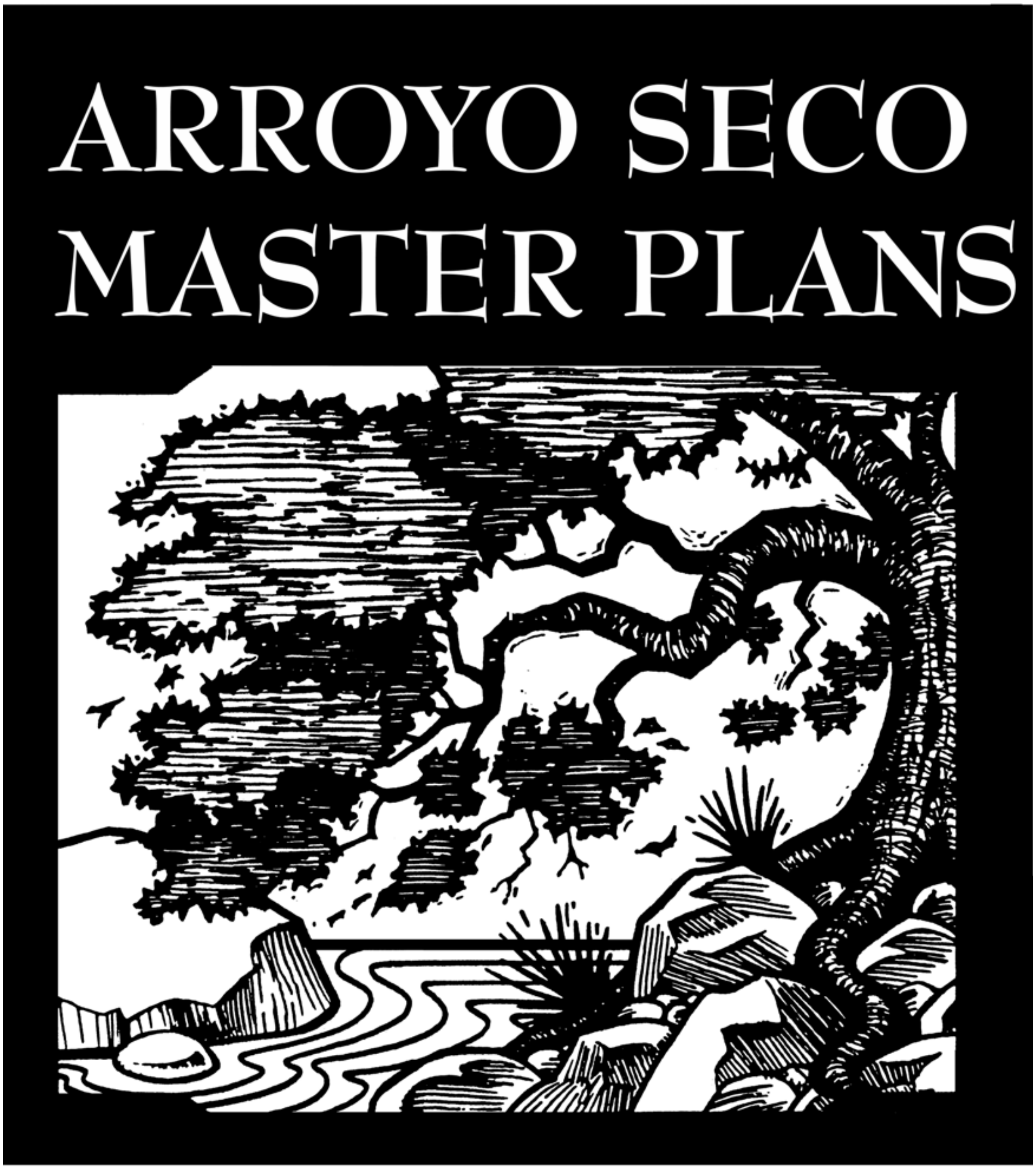
The foregoing is a fair statement of the proceedings of the regular meeting held November 12, 2014, by the Board of Supervisors of the County of Los Angeles and ex officio the governing body of all other special assessment and taxing districts, agencies and authorities for which said Board so acts.

Sachi A. Hamai, Executive Officer
Executive Officer-Clerk
of the Board of Supervisors

By ______________________

Carmen Gutierrez
Chief, Board Services Division

EXHIBIT D



Hahamongna Watershed Park Master Plan

Adopted September 29, 2003

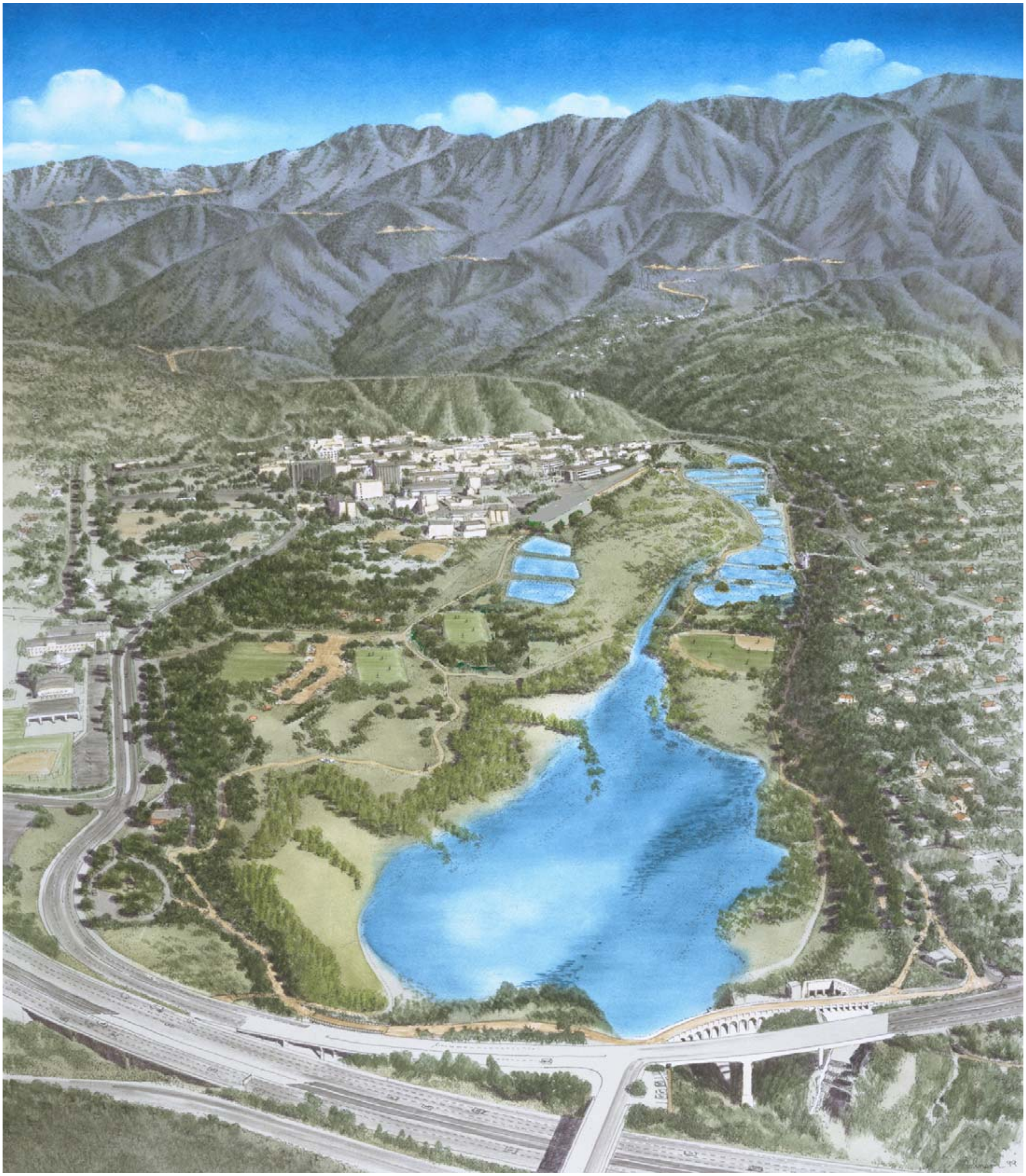
THE CITY OF PASADENA

HAHAMONGNA WATERSHED PARK MASTER PLAN

Adopted: September 29, 2003

The Arroyo Seco Master Plans consist of the following:

Hahamongna Watershed Park Master Plan
Central Arroyo Master Plan
Lower Arroyo Master Plan
Rose Bowl Use Plan
Arroyo Seco Design Guidelines



Hahamongna Watershed Park
During the winter months with storm water held
Behind Devil's Gate Dam

HAHAMONGNA WATERSHED PARK MASTER PLAN

Hahamongna Watershed Park Advisory Committee

Tom Selinske, *Chair*

Gregor Edwards	Jody Gerstner	Frank S. Osen
Vannia de la Cuba	Michael Hurley	Elizabeth Pomeroy
Joe Feinblatt	Mildred Hawkins	Bill Ukropina
Anita Fromholz	Pixie Boyden	Maria Isenberger

Past Committee Members

Denise Alvarado	Pam Garcia	Ramon Oceguera
Roy Begley	Greg Jones	Tony Santilena
Eugene Brooks	Mark Nelson	Tom Seifert, *Former Chair*
Jarratt Brunson	Omel Nieves	Dr. Ron Williams
Jeffery Commons	Phil Novelly	Katherine Luna
Mary Freeman	Henreen Nunley	John Evans

City of Pasadena
Department of Public Works
Parks and Natural Resources Division

Martin Pastucha, *Director*
Robert C. Baderian, Past A*ssistant to the City Manager*
Julie Gutierrez, *Past Director*
Kathy Woods, *Parks and Natural Resources Administrator*
Rosa Laveaga, *Arroyo Seco Park Supervisor, Project Manager*
John Cox, *Assistant Project Manager*

Pasadena Water & Power

Phyllis Currie, *General Manager*
Rufus Hightower, *Past General Manager*
Brad Boman, *Principal Civil Engineer*
Gary Takara, Civil Engineer

Raul Garibay, *Civil Engineer*

Master Plan Consultant Team

Takata Associates, *Landscape Architecture, Lead Consultant*
Philip Williams Associates, *Hydrology & Geomorphology*
Hintz & Balvin, *Community Outreach*
The Natelson Company, Inc., *Finance*
Miralles Associates, *Architecture*
Montgomery Watson, *Civil & Environmental Engineering*

Beth Thielen, *Artist*
Parsons Engineering Sciences, *Biology*
Hunt Design Associates, *Graphic Design*

Cover art by: rhandi

TABLE OF CONTENTS

Section 1. Introduction

ARROYO SECO
MASTER PLANS

SECTION 1:
INTRODUCTION

1.1 REGIONAL CONTEXT

The Arroyo Seco is a major tributary of the Los Angeles River. It flows out of the San Gabriel Mountains in the northwest corner of the City of Pasadena, forming a physical link between the San Gabriel Mountains and the Los Angeles River. Much of Pasadena's civic identity is linked to the Arroyo Seco. Numerous museums, cultural institutions, academic and research facilities, and historic sites are associated with the Arroyo Seco; and a series of regional and local parks still preserve its original natural beauty, providing the community with diverse recreational opportunities. See Exhibit 1-1, The Arroyo Seco Environment.

As the waters of the Arroyo Seco flow through the City of Pasadena, the streamcourse passes through three distinct geographical areas: Hahamongna Watershed Park (the southern portion of the upper Arroyo Seco), the Central Arroyo, and the Lower Arroyo. The City of Pasadena is currently developing Master Plans for each area of the Arroyo Seco that lies within the City limits. (See Exhibit 1-2, The Arroyo Seco in Pasadena.) The Pasadena City Council conceptually approved the Draft Lower Arroyo Master Plan (LAMP) in February of 1997. LAMP covers the Arroyo Seco from the southern boundary of the City to the Colorado Street Bridge near the 134 Ventura Freeway. The Central Arroyo Master Plan (CAMP) area extends from the Colorado Street Bridge to the 210 Freeway, just south of the Devil's Gate Dam. The planning process for the Central Arroyo started in 1999 and in January 2000 the Pasadena City Council conceptually approved CAMP. The Draft Hahamongna Watershed Park Master Plan was given conceptual approval in January 1999. The Arroyo Seco Master Plan is comprised of all three Master Plans, plus the Rose Bowl Operating Master Plan and the Arroyo Seco Design Guidelines.

Hahamongna Watershed Park (HWP) is located in Township 1 North, Range 12 West on the Pasadena, California 7.5′ USGS quadrangle map. HWP is bounded on the south by the Devil's Gate Dam area and Oak Grove Drive. Oak Grove Drive and the Jet Propulsion Laboratory (JPL) of the California Institute of Technology bound HWP to the west in the City of La Cañada-Flintridge. To the east, HWP is bounded by the residential neighborhoods of Pasadena and Altadena. The study area extends as far north as the JPL Bridge, which connects the east parking lot to the main JPL campus on the west. See Exhibit 1-3, Study Area.

Exhibit 1-1, The Arroyo Seco Environment

Source: NorthEast Trees

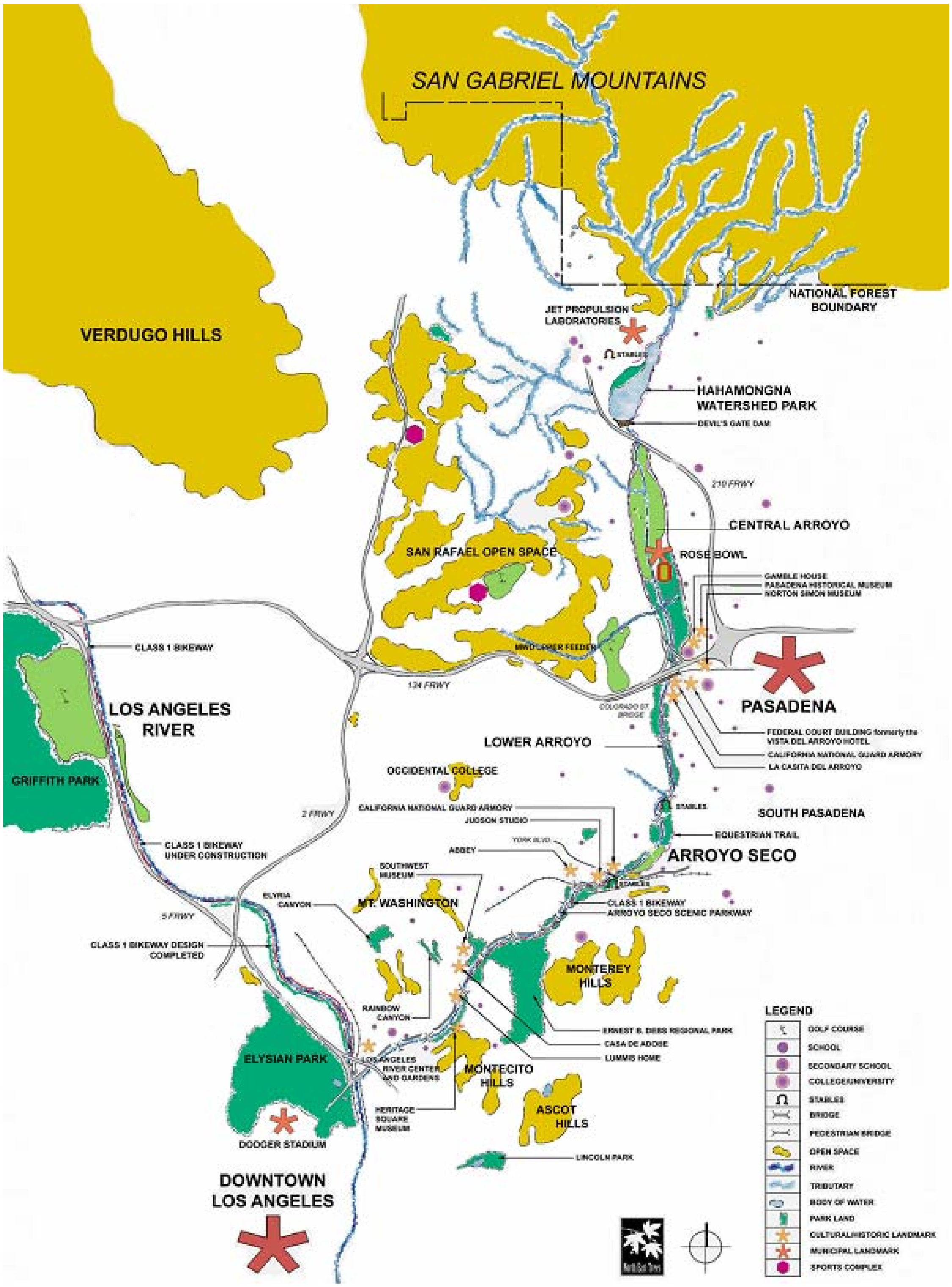
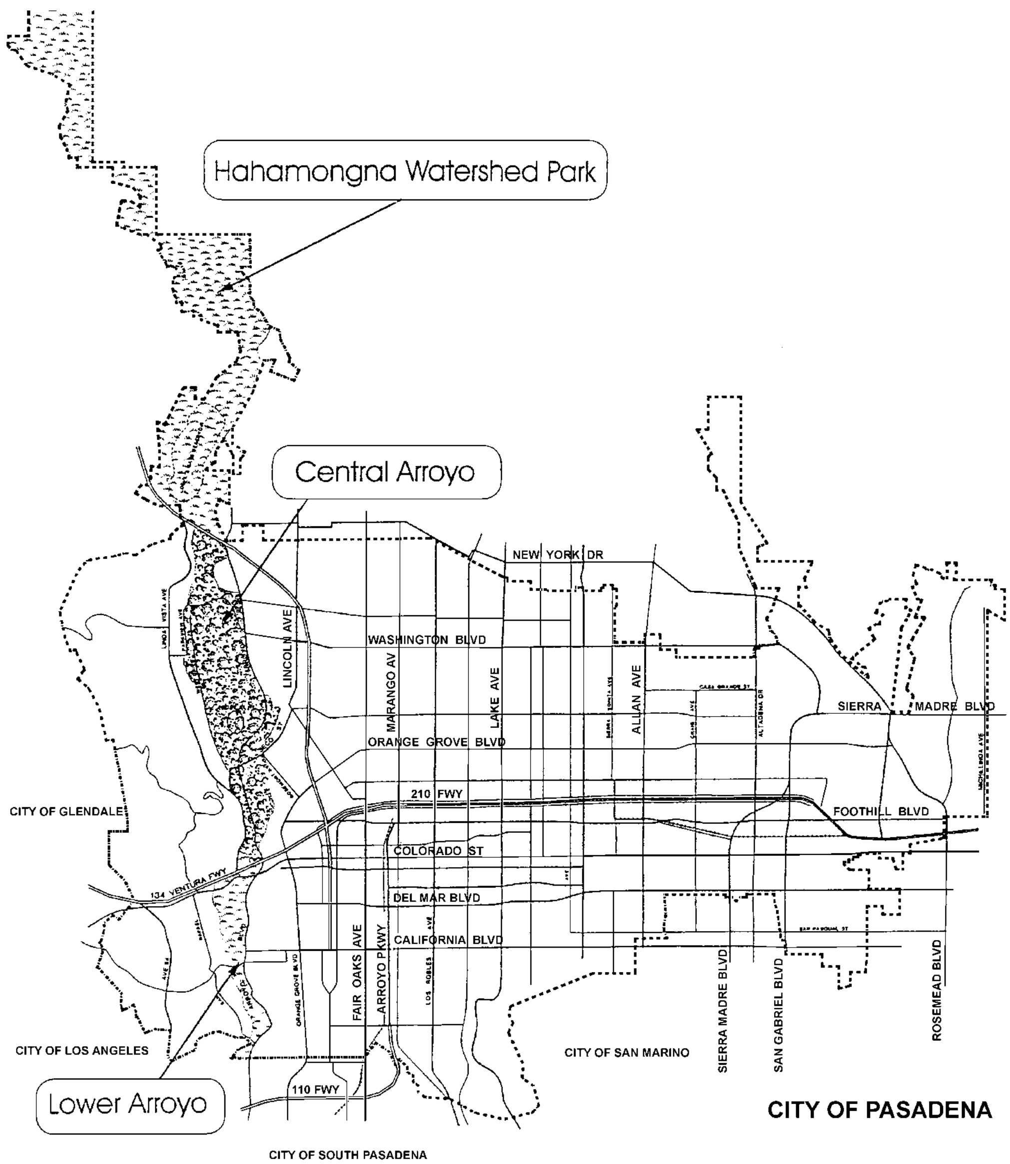


Exhibit 1-2, The Arroyo Seco in Pasadena



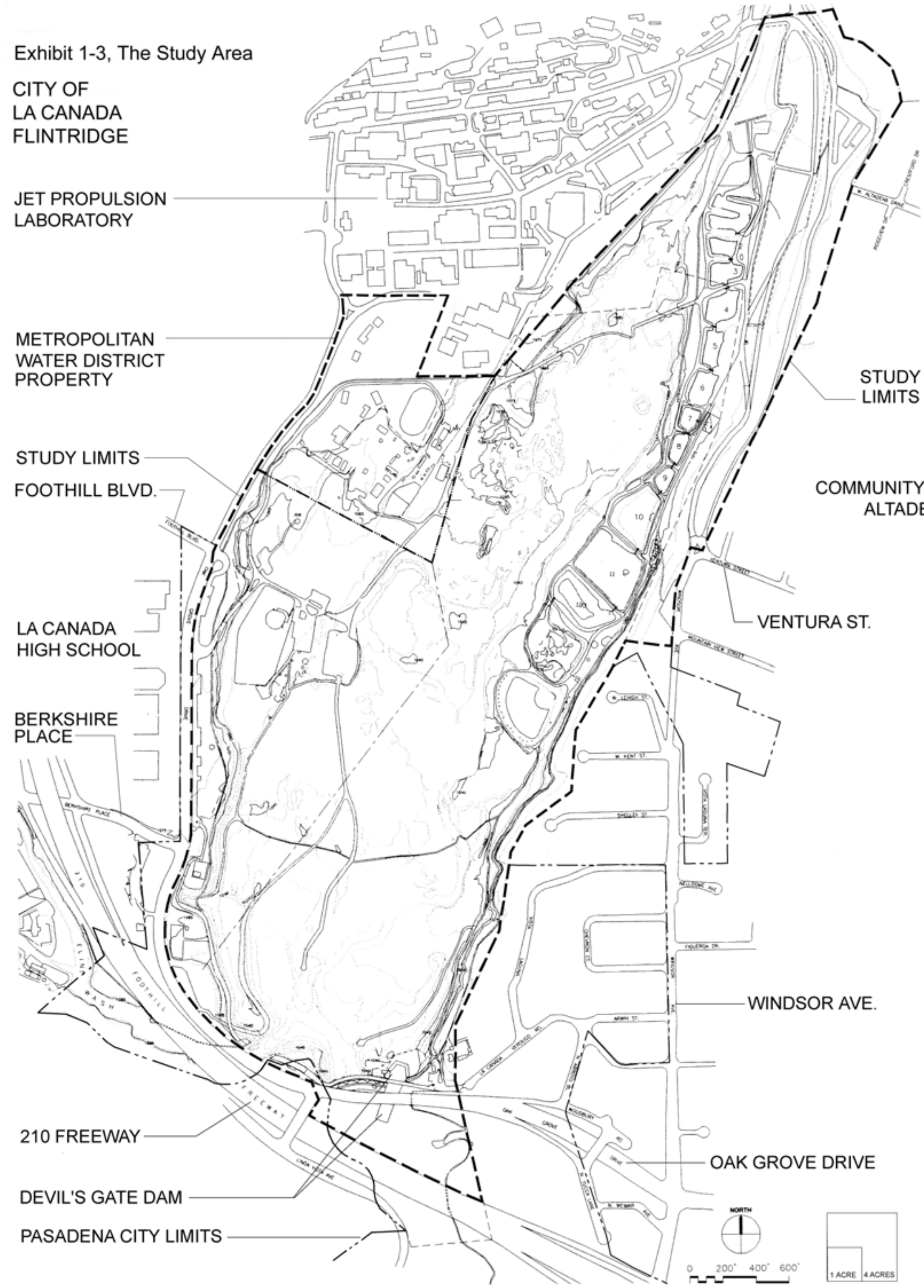


Exhibit 1-3, The Study Area
CITY OF
LA CANADA
FLINTRIDGE
JET PROPULSION
LABORATORY
METROPOLITAN
WATER DISTRICT
PROPERTY
STUDY LIMITS
FOOTHILL BLVD.
LA CANADA
HIGH SCHOOL
BERKSHIRE
PLACE
210 FREEWAY
DEVIL'S GATE DAM
PASADENA CITY LIMITS
STUDY
LIMITS
COMMUNITY OF
ALTADENA
VENTURA ST.
WINDSOR AVE.
OAK GROVE DRIVE
NORTH
0 200' 400' 600'
1 ACRE
4 ACRES

In 1920, the Devil's Gate Dam was constructed at the narrowest section of the Arroyo Seco for flood protection and as a water reservoir to recharge the Raymond Basin Aquifer. Hahamongna Watershed Park (HWP) is approximately 1,300 acres of open space extending up the Arroyo Seco Canyon from the Devil's Gate Dam. The lower watershed, the 300 acres roughly defined as the flood plain and basin behind the dam, is the focus of this Master Plan.

1.2 RELATIONSHIP TO THE GENERAL PLAN

This Master Plan has been completed in response to the policies and principles set forth in the City of Pasadena's Comprehensive General Plan. The seven guiding principles of the General Plan are as follows:

1. Growth will be targeted to serve community needs and enhance the quality of life.
2. Change will be harmonized to preserve Pasadena's historic character and environment.
3. Economic vitality will be promoted to provide jobs, services, revenues, and opportunities.
4. Pasadena will be promoted as a healthy family community.
5. Pasadena will be a city where people can circulate without cars.
6. Pasadena will be promoted as a cultural, scientific, corporate, entertainment, and educational center for the region.
7. Community participation will be a permanent part of achieving a greater city.

Pursuant to the second Guiding Principle, Objective 9, Open Space Preservation and Acquisition specifically identifies the Arroyo Seco for preservation. Policy 9.2 states "continue and complete comprehensive planning for, and implementation of, plans for the Arroyo, including restoration of the natural area of the Lower Arroyo and the development of the Hahamongna Watershed Park Plan." This Master Plan directly complies with these mandates.

1.3 PROJECT HISTORY

The Hahamongna Watershed Park Master Plan (Master Plan) report is a product of an analysis of existing conditions, a review of pertinent documents, and input from a wide variety of stakeholders and from the community through an extensive outreach program. Additional input was received from City officials and staff. Oversight of the entire project was the responsibility of the Hahamongna Watershed Park Advisory Committee (HWPAC). The following summarizes the history of the area and the project.

May 1919 The area north of what was commonly known as Devil's Gate (and today encompasses the entire study area) was annexed to the City of Pasadena by popular vote. This area was referred to as the "Arroyo Addition."

The City of Pasadena entered into a lease agreement with the City of Los Angeles for the construction of Devil's Gate Dam as well as for the maintenance of a reservoir capable of impounding waters of the Arroyo Seco for the purposes of water conservation and flood control.

1920 The County of Los Angeles completed construction of Devil's Gate Dam at the narrowest portion of the Arroyo Seco for flood control and water conservation.

Jan. 1931 "Arroyo Addition No. 2", consisting of approximately 1,000 acres in the upper Arroyo Seco watershed was annexed to the City. Now known simply as the Upper Watershed area, it extends north from the JPL Bridge.

1948 The Los Angeles County Department of Public Works (LACDPW) constructs 13.1 acres of spreading grounds and a two-acre overflow basin (No.13) on the northeast edge of the flood basin.

1960 On the eastside of the basin, 9.6 acres were leased to the Jet Propulsion Laboratory (JPL) for parking. This resulted in an asphalt lot with 1,132 parking spaces.

1968 The City of Pasadena leased the operation and maintenance of Oak Grove Park to the County of Los Angeles.

Jul. 1970 Approximately 30 acres (on the northwest side of the study area, most within the Los Angeles County easement and a portion of Oak Grove Park) was sold to the Metropolitan Water District (MWD).

1971 The County designed and implemented major improvements to Oak Grove Park including roadways, restrooms, maintenance facilities, and other infrastructure.

1978 The Division of Safe Operation of Dams (DSOD) imposed an operational restriction on Devil's Gate Dam and officially declared the dam seismically unsafe. These actions were taken in part due to the 1971 Sylmar earthquake.

May 1986 The City of Pasadena received a grant from the Santa Monica Mountains Conservancy for a study of the use of the Devil's Gate basin. A formal progress report for the Devil's Gate Multi-Use Project (DGMUP) was presented to the Pasadena City Council in March of 1988.

Jan. 1987 The Devil's Gate Multi-Use Project Advisory Committee was established to further develop and design this plan. Preliminary economic, biological, and feasibility studies were conducted by outside consultants. The Devil's Gate Project was propelled by Pasadena's Strategic Planning Process, a citizen's planning project, which identified it as one the most promising projects necessary to make Pasadena a great city in the year 2000 and beyond.

Mar. 1987 On the west side of the basin, 1.21 acres were leased to JPL for parking. This resulted in an asphalt lot with 214 spaces.

1986-91 A series of public participation workshops were held which included exhibits by environmental artists Newton & Helen Harrison.

The Devil's Gate Joint Power Planning Authority, made up of appointees representing Pasadena, La Cañada-Flintridge, Native Americans, and the Santa Monica Mountains Conservancy held a series of public meetings during an 18-month period. It also oversaw the development of the Preliminary Plan by Takata Associates, held three public workshops as part of the planning process, developed governance and funding recommendations, and obtained $1.86 million in County Parks bond money through the November 1992 election.

Dec. 1992 The Preliminary Park Plan was received and conceptually approved by the Pasadena City Council.

1993 The area was named Hahamongna Watershed Park

Oct. 1993 The Pasadena City Council established a Creation Task Force to develop the legal structure for the Hahamongna Operating Company (HOC) which would implement, manage, and operate the project. When the transfer of the operation and maintenance responsibility of the Oak Grove Park portion was returned to the City of Pasadena, 500 people attended the dedication of Hahamongna Watershed Park.

The HOC began monthly meetings starting in November of 1994. These meetings were open to the community. A 300-person mailing list was developed for meeting and event notification. During its operation, HOC participated in numerous presentations and discussions before the Pasadena City Council and Business Enterprise Committee.

Dec. 1994 All mining operations in the Hahamongna Watershed Park basin ceased. As many as eight mining operations had been in the basin and had been licensed to mine sand and gravel. They had contributed significantly to the dumping of concrete, asphalt, and other materials in the basin.

Nov. 1995 The rehabilitation of Devil's Gate Dam was initiated by the County of Los Angeles. HOC staff worked closely with the County and the contractor to minimize neighborhood impacts and begin habitat restoration in the flood basin. This project was completed in January of 1998.

Jan. 1996 Los Angeles County Department of Public Works (LACDPW) began the seismic strengthening and spillway modification to Devil's Gate Dam. This project was completed in the winter of 1998.

Aug. 1996 The Pasadena City Council disbanded the Hahamongna Operating Company Board and transferred all responsibilities of the Hahamongna Watershed Park to the Department of Public Works.

Nov. 1996 Hahamongna Watershed Park was allocated $1 million for capital improvements as a result of the 1996 Los Angeles County Park Bond Act.

Jan. 1997 The Pasadena City Council established the Hahamongna Watershed Park Advisory Committee (HWPAC) which was comprised of all members of the City's Recreation and Parks Commission with two additional members representing the Northwest Commission and two members representing the Utility Advisory Commission.

In September and October, two public hearings on Hahamongna Watershed Park planning were hosted by the HWPAC to reaffirm the Preliminary Park Plan that had been completed nearly five years previous. More than 100 people representing community members, special interest groups, and regulatory agencies attended these meetings. From these meetings the "Park Elements" for HWP were established as the new framework for the final Master Plan.

Dec. 1997 The "Park Elements" that reflected consensus towards the development of the Park's Master Plan were presented to the City Council for review.

Nov. 1998 The City Council reaffirmed its commitment to reinvestment and acquisition of parkland. The landscape architecture firm of Takata Associates was brought on board to develop the final Master Plan for Hahamongna Watershed Park.

Dec. 1998 The Pasadena City Council, with the recommendation of the Recreation and Parks Commission, approved a motion to pursue the re-purchase of the 30-acre MWD property.

1999 Responsibility for operating and maintaining the 13.1 acres of spreading grounds on the northeast edge of the flood basin was turned over to the City of Pasadena.

The City Council authorized the use of the JPL parking lot lease funds for the planning, maintenance, and operation (including security) of Hahamongna Watershed Park.

1.4 RECENT PLANNING

In January of 1997, Pasadena City Council established the Hahamongna Watershed Park Advisory Committee (HWPAC) which was given the charge of overseeing the Master Plan process. Since a number of years had passed since the approval of the Preliminary Park Plan by City Council in December 1992, and the start of the Devil's Gate Dam renovation in 1996, the HWPAC held two community workshops to solicit input on the project. Based on this public input, a list of Park Elements was drafted and adopted by the HWPAC in 1997 as a bridge between the Preliminary Park Plan and the start of the Final Park Master Plan Process. The final Master Plan reflects these elements as they have evolved.

PARK ELEMENTS of 1997

Major Themes
HWP should be a showcase for:
- Water and natural resources education and utilization
- The preservation of native plants and habitat
- Native American culture
- Passive and active recreation

Water Feature

- Water and water resources are major functions of this area that must be protected and enhanced.
- An analysis of flood potential and sediment buildup in the basin should be pursued.
- Now that Devil's Gate Dam has been rehabilitated, Pasadena should coordinate with Los Angeles County on the possible development of a water feature to maximize water conservation and habitat restoration in HWP.

Recreation

- Design children's play features to emphasize appreciation of the natural environment.
- Provide the opportunity to experience the natural outdoors by providing overnight camping, fishing, and nature study.
- West Athletic Field—upgrade this field in cooperation with youth sports leagues to promote usage.
- Johnson Field—integrate this venue into HWP by coordinating use and scheduling

Entrances

- Create an entrance at Woodbury & Arroyo/Windsor with access to the dam.
- Create secondary entrances at Foothill Boulevard and Windsor/Ventura.
- Prohibit any entrance at La Cañada-Verdugo Road or through residential neighborhoods.

Parking

- Renegotiate the leases for the Jet Propulsion Lab parking lots.
- Ensure adequate parking at multiple sites around the park and at the central parking area on the west-side Oak Grove area.
- Improve the parking area and intersection at Windsor/Ventura to promote safety and neighborhood protection.

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Structures:

- Minimize new structures and analyze costs and benefits related to maintenance and public safety.
- All facilities should emphasize the natural setting and use of natural materials.

Trails & Linkages:

- Develop a major perimeter trail around the Hahamongna basin for walkers and joggers.
- Improve equestrian trails through the park and linkages to nearby trails. Provide a linkage for bicyclists outside of the basin to connect to the San Gabriel Mountain trails.
- Trails should be inclusive where possible; multiple uses can coexist.

Signage & Nomenclature:

- Tasteful signage should be used for interpretive and educational purposes rather than facilities that are expensive to build and maintain.
- Develop a standard nomenclature for all park signs.

Design Standards for Entire Arroyo:

- Consistent design standards for all Arroyo parks and nature areas should be developed that would cover entrances, signage, circulation, architecture, native landscaping, and the use of Arroyo materials and crafts (such as rockwork and tiles) to convey the unique character and beauty of the Arroyo Seco.

1.5 THE GUIDING PRINCIPLES FOR THE ARROYO SECO

The Guiding Principles for the Arroyo Seco were developed to serve as the umbrella under which fall the specific goals and objectives for each of the Arroyo Seco Master Plans. These six Guiding Principles were developed collaboratively between members of the community, members of the Recreation and Parks Commission members of the Hahamongna Watershed Park Advisory Committee, and City staff. These Guiding Principles will also serve as a bridge between the Arroyo Seco Master Plans and the City's General Plan Update. The six principles are:

- To encourage and promote the stewardship and enjoyment of the Arroyo Seco in Pasadena.
- To balance and integrate the interrelated issues of water resources, recreation, natural resource preservation and restoration, and flood management in the Arroyo Seco.
- To provide a safe, secure and accessible Arroyo Seco for public enjoyment.
- To recognize the importance to Pasadena of the history, cultural resources and unique character of the Arroyo Seco, and to conserve and enhance these assets.
- To preserve and acquire open space in or adjacent to the Arroyo Seco.
- To recognize that the Arroyo Seco in Pasadena is comprised of distinct geographical areas that are interconnected by a number of resources and features including, but not limited to, water, habitat, geology, recreation, and culture; and that it is part of a larger watershed.

1.6 GOALS & OBJECTIVES OF THE HAHAMONGA WATERSHED PARK MASTER PLAN

The following are the goals and objectives specific to Hahamongna Watershed Park:
Goal 1: Preserve, restore, and enhance the native habitats

Objectives:

- Develop a habitat restoration plan for Hahamongna Watershed Park.
- Protect and enhance the Hahamongna Watershed Park wildlife corridor linkages to the upper watershed and the downstream reaches of the Arroyo Seco.
- Restore, enhance, and reestablish the historical native plant communities of the Arroyo Seco.
- Create wetland and aquatic habitats in HWP to increase the biodiversity.
- Locate new facilities in developed or disturbed areas so as to minimize impact to established habitats.
- Enhance the edges of the spreading basins with native trees and other appropriate plantings to blend these facilities with the riparian setting.
- Limit exterior lighting for security, safety, and operational purposes to lessen the impact on nocturnal wildlife.
- Relocate existing overhead power and communications lines to restore the natural environment and provide adequate, safe maintenance access.
- Develop dam maintenance and flood control procedures that promote preservation of native habitats.
- Repair the harmful impacts of the mining operations by regrading the highly disturbed, unnatural topography within the flood plain to allow for the successful planting of native plant communities to establish quality habitat.
- Establish a monitoring program to study runoff and sediment delivery in the flood basin to determine impacts on plant communities in HWP.
- Restore areas where erosion has occurred.

Goal 2: The Devil's Gate flood control basin will be managed to provide protection to the developed and natural downstream areas.

Objectives:

- Facilitate the dam and reservoir maintenance operations in a manner that is compatible with the proposed features of the Master Plan and will result in minimal impacts to the surrounding area.
- Maintain or improve the flood capacity behind Devil's Gate Dam.
- Develop a sediment removal plan that minimizes the impact to the basin and to the surrounding neighborhoods.
- Develop a grading plan that allows habitat restoration and recreational activities to co-exist with flood management and water conservation.
- Develop a multi-agency task force to review maintenance, sediment removal, dam operation, permit, and liability issues on a continual basis after this plan is adopted.
- Develop dam maintenance and flood control procedures that promote water conservation.
- Establish a monitoring program to study runoff and sediment delivery in the flood basin to determine impacts on flood management/water conservation capabilities.

Goal 3: Conserve and protect the water resources of the Arroyo Seco.

Objectives:

- Maximize groundwater recharge to minimize the amount of water purchased from outside sources.
- Develop a grading plan that allows habitat restoration and recreational activities to coexist with flood management and water conservation.
- Monitor water entering the basin from Flint Wash and various storm drains to ensure safe water quality.
- Develop a program to minimize and provide the means to control the inflow of trash from Flint Wash and various storm drains.
- Develop an alternative to the JPL eastside surface parking area for expanded spreading basins for groundwater recharge.

Goal 4: Provide diverse recreation opportunities for the Pasadena community.

Objectives:

- Balance the recreation needs for active, passive, and educational activities in HWP.
- Develop a grading plan that allows habitat restoration and recreational activities to co-exist with flood management and water conservation.
- Design children's play areas to emphasize learning and connections to the natural environment.
- Distribute recreation facilities to allow equal access from the surrounding neighborhoods.
- Maintain the historic recreational uses within HWP.

Goal 5: Enrich and promote the unique history and culture of Hahamongna Watershed Park.

Objectives:

- Develop HWP as a "living laboratory" for local schools and environmental education programs.
- Preserve and encourage Native American use of HWP as a cultural resource.
- Explore the possibilities of a joint partnership with the U.S. Forest Service and Native Americans in developing an interpretive center and native-plant nursery at HWP.
- Develop design guidelines to ensure aesthetic compatibility and quality construction for any improvements made in HWP.
- Develop passive viewing areas with unique vantage points.
- Create programs that inform and educate the public about the natural processes, the history and the culture of the site.
- Underground or relocate the existing above-ground electrical transmission lines.

Goal 6: Provide a safe and secure park.

Objectives:

- Provide adequate water and sewage infrastructure where needed throughout HWP.
- Develop guidelines and delegate agency responsibilities for recreation, flood management, and water conservation liabilities.

- Retain and enhance, as needed, the recently reestablished Park Ranger Program to ensure compliance with municipal laws, codes, and regulations. Secure entrances and perimeter of HWP.
- Develop an all-weather perimeter trail/road for emergency and maintenance access as well as for passive recreation.

Goal 7: Provide adequate circulation, access and parking

Objectives:

- Provide public transportation and nonmotorized access to HWP.
- Provide adequate parking throughout the park for all proposed recreation activities and facilities.
- Maintain and restore the trail links to the Central Arroyo, the surrounding neighborhoods, and the Angeles National Forest.
- Develop separate trail systems for bicycles, hikers, and equestrians wherever possible.
- Comply with ADA (Americans with Disabilities Act) standards for a “natural park.”
- Develop a signage system that provides clear directional information and informs park visitors without being intrusive.
- Improve the east entrance for better access, circulation, and traffic safety.
- Protect residential neighborhoods from the nuisances related to maintenance equipment, traffic, and noise.
- Improve and enhance regional trail connections.
- Continue to assist JPL in meeting its parking needs.

The *Arroyo Seco Master Plans* were developed by the combined efforts of the Planning and Development Department and the Department of Public Works. The implementing department for the completed *Arroyo Seco Master Plans* will be the Department of Public Works. The projects identified in the *Arroyo Seco Master Plans* are described and listed to easily translate to the City’s capital improvement program.

1.7 REPORT ORGANIZATION

The HWP Master Plan report is the product of an analysis of existing conditions: A review of previous planning documents; meetings with user groups, neighborhood groups, regulatory agencies, environmental groups and other interested groups; three community workshops; and the guidance and direction given by the Hahamongna Watershed Park Advisory Committee.

The Hahamongna Watershed Park Master Plan report consists of four sections:

Section 1 - Introduction: This first section provides an overview of the Arroyo Seco and Hahamongna Watershed Park; regional context; history; recent planning efforts; goals and objectives; and scope and content of the Master Plan report.

Section 2 - Existing Conditions, Issues, and Opportunities: This section identifies HWP's existing natural and man-made setting. A summary of the park's issues and opportunities, based upon the technical analysis and community outreach, are discussed.

Section 3 - Master Plan: This section describes the recommended Master Plan elements.

Section 4 - Implementation: This section details the phasing of specific Master Plan projects and provides a summary of environmental requirements needed to implement the Master Plan.

Secttion 2. Existing Conditions Issues & Opportunities

ARROYO SECO MASTER PLANS

SECTION 2:
EXISTING CONDITIONS, ISSUES & OPPORTUNITIES

This section of the Master Plan describes the current physical setting of Hahamongna Watershed Park (HWP) and its environment. Opportunities for improvement and issues that pertain to the various features of the park are reviewed.

Hahamongna Watershed Park in 1988. Sediment removal and mining operations are evident throughout the flood basin.

2.1 OWNERSHIP, EASEMENTS & JURISDICTION

LAND OWNERSHIP

Hahamongna Watershed Park (HWP) is located within the City of Pasadena. Other neighboring landowners within the basin include the Metropolitan Water District (MWD) and the Jet Propulsion Laboratory (JPL). The MWD property is within the master plan study area and although JPL is not a part of this park master plan, it is very much within the sphere of influence of HWP. The majority of the JPL campus is located in the City of La Cañada-Flintridge, northwest of HWP. Refer to Exhibit 2-1, Master Plan Area, for the major physical elements located within the study area.

JPL leases the two parking lots within HWP. The 30-acre MWD property was parkland purchased from the City of Pasadena in 1968. The current leaseholders on MWD property include the United States Forest Service (USFS), Los Angeles County Fire Camp 2, and the Rose Bowl Riders who sublet to the Tom Sawyer Camp. The study area also includes a small parcelof land between the mouth of Flint Wash and the dam, including an area southeast of the intersection of Linda Vista Avenue and Oak Grove Drive, which is currently within the La Cañada-Flintridge city limits (Exhibit 1-3, Study Area).

EASEMENTS

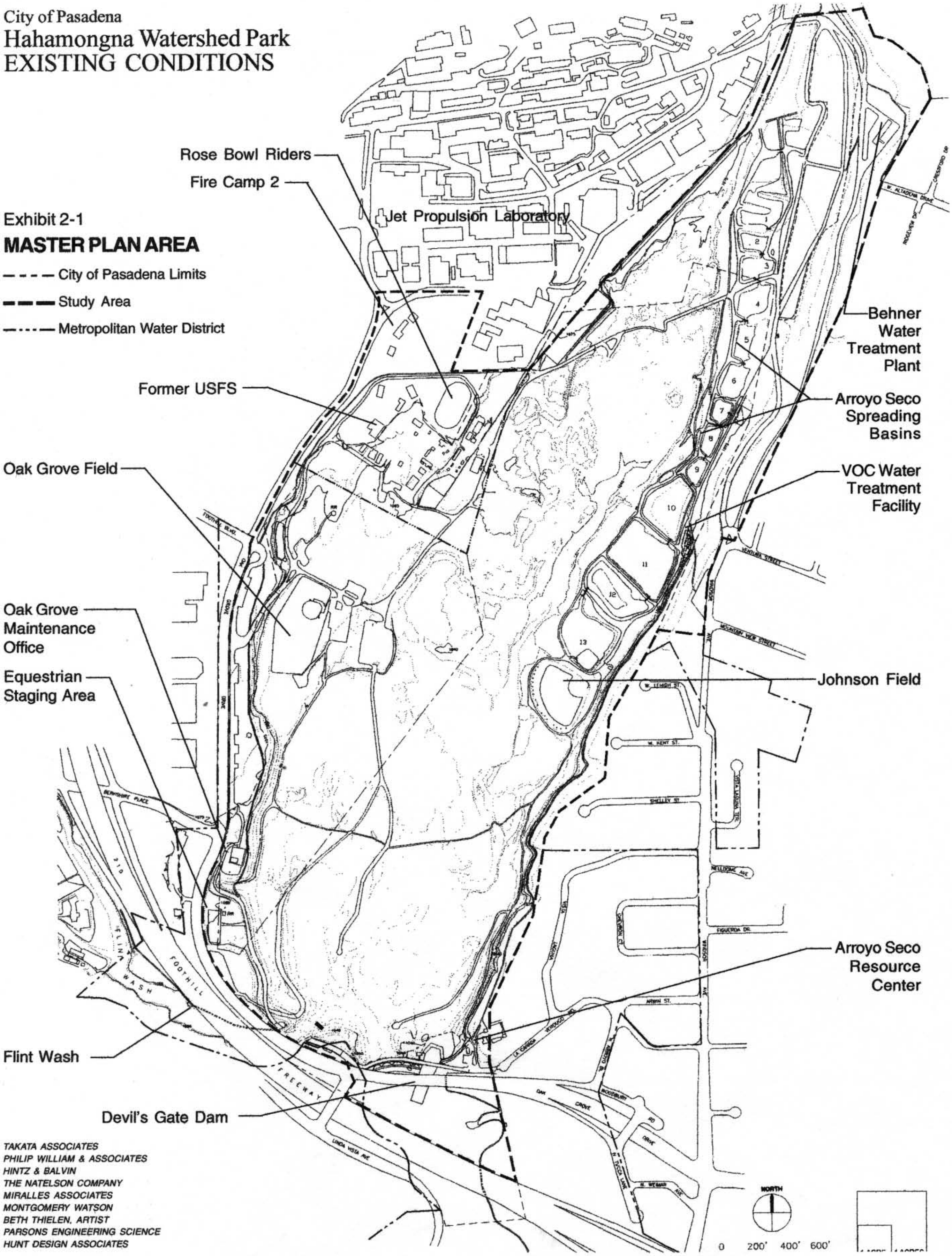
Los Angeles County Flood Control Easement

Los Angeles County Department of Public Works (LACDPW) holds an easement granting the County the right to construct and maintain Devil's Gate Dam, its spillway, bypasses, tunnels and other support facilities as may be necessary or convenient for the construction and maintenance of a reservoir capable of impounding the waters of the Arroyo Seco for purposes of storage and control; and to control such waters as may be necessary in the prevention of damage by flood. The easement applies to land below the 1075′ contour as determined from the benches of the United States Geological Survey (USGS) See Exhibit 2-5, Water Elevations later in this section.

Included in this granted easement, the City retained the right to the top of the dam as a public access way and utility corridor across the Arroyo Seco.

Gabrielino Trail Easement

The U.S. Department of Agriculture / U.S. Forest Service (USFS) has been granted an easement by the City of Pasadena for the Gabrielino Trail. The Gabrielino Trail begins at the intersection of Windsor Avenue and Ventura Street and extends north for 1.5 miles into the


City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS
Exhibit 2-1
MASTER PLAN AREA
City of Pasadena Limits
Study Area
Metropolitan Water District
Rose Bowl Riders
Fire Camp 2
Jet Propulsion Laboratory
Former USFS
Oak Grove Field
Oak Grove Maintenance Office
Equestrian Staging Area
Flint Wash
Devil's Gate Dam
Behner Water Treatment Plant
Arroyo Seco Spreading Basins
VOC Water Treatment Facility
Johnson Field
Arroyo Seco Resource Center
FOOTHILL
FREEWAY
NORTH
0 200' 400' 600'
TAKATA ASSOCIATES
PHILIP WILLIAM & ASSOCIATES
HINTZ & BALVIN
THE NATELSON COMPANY
MIRALLES ASSOCIATES
MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCE
HUNT DESIGN ASSOCIATES

Arroyo Seco Canyon and then enters USFS lands in the Angeles National Forest. Two-thirds of a mile is within the HWP study area. This section of the trail from its beginning at the intersection of Windsor and Ventura, is a multi-use, paved trail and a maintenance/ emergency roadway that follows the upper edge of the eastern slope of the basin. Bicyclists, hikers, and equestrians are all allowed access along the trail.

Utility Easements

Southern California Edison and the Southern California Gas Company hold easements for their utility lines. See Section 2.6, Utilities, for further information on these lines. The Pasadena Department of Water and Power holds easements for utility lines within the MWD property.

JURISDICTIONS

U.S. Army Corps of Engineers

The U. S. Army Corps of Engineers has jurisdiction over the area of potentially impounded waters north of the dam (below the 1040.5 elevation). North of this area and above the 1040.5 elevation, the Corps' jurisdictional area includes the intermittent, meandering stream corridors at their high-water mark. Any impact to these areas will require the filing of an Army Corps of Engineers 404 Permit (See Environmental Requirements Technical Report).

California Department of Fish and Game (CDF&G)

The CDF&G has jurisdiction over the entire Master Plan area:

- Should any project within the HWP Master Plan area change the natural flow or bed, channel or bank of any river stream or lake, a Section 1601/1603 Stream Alteration Agreement will be required. This same area of jurisdiction is shared with the Army Corps of Engineers.

- Should any project within the HWP Master Plan area impact any state-listed or endangered species or their habitat, then an MOU (Memorandum of Understanding) under the California Endangered Species Act will be required. Again, this jurisdiction is over the entire Master Plan area.

U.S. Fish and Wildlife Service (USFWS)

If federally listed sensitive species were to be found in areas of the park that are to be disturbed, Federal Endangered Species Act (FESA) Section 7 or 10 consultations with the USFWS could be required.

Following the City Council's conceptual approval of the draft Hahamongna Watershed Park Master Plan, USFWS declared approximately half of HWP critical habitat for the Southwestern Arroyo Toad, a federally listed endangered species. On February 7, 2001, approximately 182,000 acres in California were designated critical habitat for the Arroyo Toad pursuant to the Endangered Species Act of 1973, as amended. The federal ruling designated six miles in Arroyo Seco Creek, from the Long Canyon confluence downstream to the central area of the Hahamongna Basin, as Arroyo Toad critical habitat area. On October 30, 2002, the U.S. District Court for the District of Columbia eliminated the current designation of critical habitats for the Arroyo Toad. The Building Industry Legal Defense Foundation sued the U.S. Interior Department to nullify the habitat designation. Under federal law, the costs to industry and the public of designating critical habitat for an endangered species must be considered, and if they outweigh the benefit to the species, then habitat need not be designated. The U.S. Fish and Wildlife Service (USFWS) has until July 30, 2004, to redo its economic impact analysis and the Interior Department will decide by 2005 which areas of critical habitat to re-designate. See Exhibit 2-3, Terrestrial Natural Plant Communities, for the limits of the critical habitat area and Section 3 for more detailed information on this topic.

Critical habitat identifies specific areas that are essential to the conservation of a listed species with respect to areas within the geographic range occupied by the species. The City of Pasadena completed focused biological protocol surveys of the Southwestern Arroyo Toad in December 2001, and the presence of the Southwestern Arroyo Toad was not indicated. (See *Focused Herpetological Surveys Conducted in Support of the Arroyo Seco Master Plan* by AMEC, December 2001.) A minimum of three consecutive years surveying for the Arroyo Toad is needed to establish their presence. Due to the extreme drought in the winter of 2002, the USFWS advised the City to not complete a survey started in 2002, but instead extend the surveys through 2004.

California Regional Water Quality Control Board (CRWQCB)

Elements of the Park Master Plan may require a Section 401 Water Quality certification under the Clean Water Act if any project results in a discharge into a water body. The CRWQCB also has jurisdiction over the area for any construction project with grading of more than five acres; in this instance a National Pollution Discharge Elimination System (NPDES) program is required.

Either the County of Los Angeles and/or the City of Pasadena will review any alterations to storm drains, septic systems, sewer connections, power, communications systems, or fire suppression requirements.

2.2 ZONING & LAND USE

ZONING

Hahamongna Watershed Park is zoned as open space with the exception of a parcel zoned as Planned Development Districts (PD-16). This parcel, indicated in Exhibit 2-2, Zoning, is leased to JPL for its east parking area.

The adjacent land in Pasadena, Altadena, and La Cañada-Flintridge is zoned residential. All Pasadena areas are zoned RS-4, which permits four residential dwelling units per acre. The JPL parking lots are allowed under a conditional-use permit.

LAND USE

The entire basin is designated open space by the City of Pasadena's General Plan. "Open Space" is defined by the Pasadena General Plan as follows: "This category is for a variety of active and passive public recreational facilities and for City-owned open space facilities. This includes natural open spaces and areas which have been designated as environmentally and ecologically significant. This category also applies to land which is publicly owned, though in some instances public access may be restricted. Most importantly, this designation only applies to lands owned by the City."

Within the LACDPW Flood Control Easement, Oak Grove was given the designation of parkland. This area was City-dedicated parkland at the time Los Angeles County assumed control of it; and this designation remains. Permitted uses of City-dedicated parkland include active and passive recreation. Under this permit the County first developed the recreation facilities at Oak Grove. Exhibit 2-2, Zoning, illustrates dedicated parkland and waterfund land. Waterfund land is City land maintained and used by the Pasadena Department of Water and Power for water conservation purposes.

2.3 THE NATURAL ENVIRONMENT

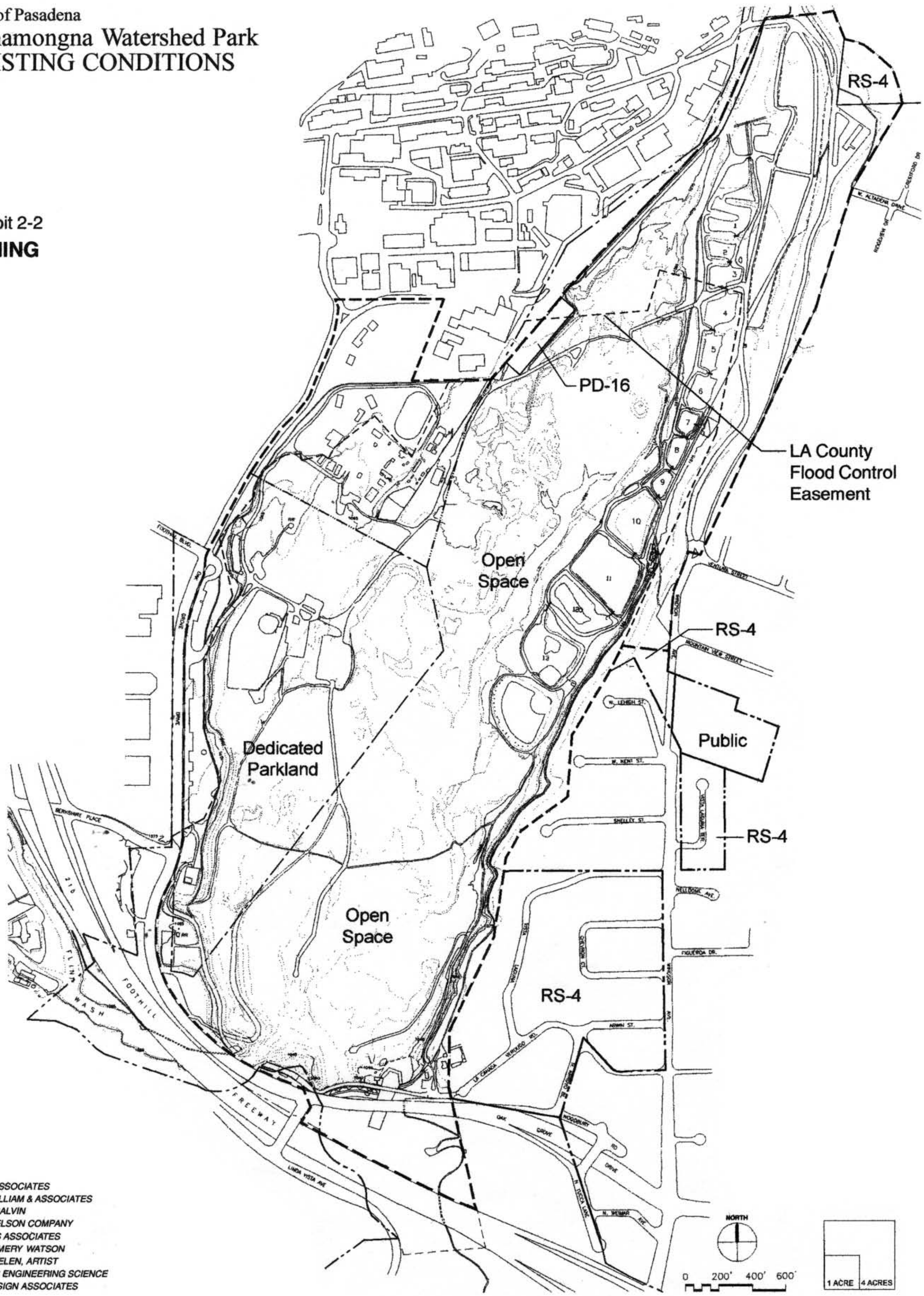
Hahamongna Watershed Park (HWP) is located on the south flank or south-facing slopes of the San Gabriel Mountains, in the Arroyo Seco drainage. The San Gabriel Mountains are part of the Transverse Ranges physiographic province of southern California. HWP is situated in what was formerly the Arroyo Seco Canyon. After the dam was constructed, sediments from mountain runoff began to accumulate behind it. This deposition raised the ground surface in the reservoir area and created a broad plain between the canyon walls. Today, this flood sediment plain gently slopes from an upstream elevation of approximately 1100 at the JPL Bridge to a downstream elevation of approximately 986 at the dam face. The former canyon walls slope steeply up from the sediment plain at its edges.

City of Pasadena

Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-2

ZONING



TAKATA ASSOCIATES
PHILIP WILLIAM & ASSOCIATES
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THE NATELSON COMPANY
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BETH THIELEN, ARTIST
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The sediment plain itself is quite irregular due to erosion and historical excavation within the reservoir. Throughout the park, shallow ridgecrests, alluvial fan slopes, and riparian areas exist along the floor of the Arroyo Seco drainage. There are a few areas that are level, or have nearly level, terrain.

HWP is located approximately at the boundary between two different precipitation regions—The San Gabriel Mountains and the San Gabriel Valley. These two regions receive an average of 27.5" and 17.6" of rain per year, respectively. Most precipitation occurs during the winter months.

The upper reaches of the Arroyo Seco watershed cover an area of approximately 21.75 square miles and include runoff from Ladybug, Cloudburst, Daisy, Cloby, Little Bear, Bear, Long, Dark, Twin, Brown, Pine, Falls, Aqua, Fern, El Prieto, and Millard Canyons. Between the JPL Bridge and Devil's Gate Dam an additional 10.15 square miles drains directly into the basin primarily through municipal storm water culverts, but also through Flint Wash which drains into the southwest corner of the basin from the City of La Cañada-Flintridge. Three large drainages within and near HWP contain ephemeral or intermittent streams with surface water flow only during extended periods of sustained rain and runoff. Streams within these three drainages originate from the upper elevations of the Arroyo Seco, Millard Canyon, and El Prieto Canyon. All streams provide at least minimal surface flow to the JPL Bridge for a portion of their length throughout the year.

THE ALLUVIAL FAN ENVIRONMENT

Erosion from the steep slopes of the San Gabriel Mountains is commonly deposited where there is a sudden reduction in streambed slope. There, the deposits form a roughly semi-circular arc referred to as an alluvial fan. HWP is situated at the opening of the Arroyo Seco canyon along the upper portion of an alluvial fan environment.

Alluvial fans are complex and potentially unstable environments, since they occur at the point between sediment supply and the beginning of extensive channel carving. Processes that have caused extensive damage on alluvial fans include lateral scour in existing channels, the formation of new channels by sudden redirection of flow at the top of the alluvial fan, and inundation by debris and sediment in the alluvial fan environment. These types of channel processes are common.

THE BIOLOGICAL ENVIRONMENT

The plant communities, vegetation, and wildlife of HWP probably would not exist in their current array without man's influence. The altered and unnatural environmental conditions currently found there are due mainly to four factors. These are: (1) the presence of Devil's Gate Dam; (2) the requirements for necessary sediment and debris removal behind the dam; (3) the landscaping practices that have over time significantly changed the appearance and composition of HWP and nearby areas, including the MWD property, from that once familiar to the Native American Gabrielinos; and (4) the encroachment of invasive nonnative plants.

Field inventory surveys of biological resources in HWP and the MWD property were conducted over a twelve-month period. Both vegetation and wildlife resources were surveyed in a floristic and faunistic manner that ensured a complete and thorough identification of all species encountered during the fieldwork. The inventories also included the identification of existing natural plant communities, and landscaped and ruderal (non-native) vegetation in the park. The inventory information about biological resources in HWP helped to define the existing setting and to lay the foundation for the habitat establishment and restoration plan presented in Section 3 of this Master Plan.

More than 300 plant species and nearly 100 animal species were observed during the inventory surveys. These numbers demonstrate a high biodiversity in HWP. See Appendix B.1 & B.2 for an inventory of existing plants and animals observed. Only plants that were actually observed were placed on the plant species inventory list. However, the animal species inventory list includes both recently observed and historical records of animals known from HWP and nearby areas with similar habitats.

The vegetation classification of plant communities in the study area was taken mainly from Holland (1986) and Sawyer and Keeler-Wolf (1995).[1] Plant nomenclature followed that of Hickman (1993), Munz (1959, 1968, and 1974), Sunset (1995), and Bailey (1949). Animal species nomenclature followed that of Jameson and Peters (1968), Burt and Grossenheider (1980), Whitaker (1980), and Ingles (1995) for mammals; Peterson (1990) National Geographic Society (1983), Stokes and Stokes (1996), Udvardy (1988), and Garrett and Dunn (1981) for birds; and Stebbins (1985), and Behler and King (1979) for reptiles.

The Existing Setting

HWP, as it exists today, represents a unique albeit somewhat unnaturally occurring set of plant and animal communities that largely would not be present in their current assemblage without Devil's Gate Dam. However, a mixture of California terrestrial natural plant communities (Holland, 1986), or vegetation series (Sawyer and Keeler-Wolf, 1995), continues to dominate the site.

Throughout the majority of the Arroyo Seco drainage in HWP, riparian scrub habitats and weedy nonnative grassland dominate the floor of the central portion of the drainage,and a portion of the MWD property. Oak woodland and other types of scrub habitats occupy large and small variable areas along the perimeter and/or side walls of the drainage. Segments of the survey sites (i.e., landscaped areas) are widely populated with introduced ornamental shrubs and trees, and exotic, ruderal weedy species of grasses and forbs (herbaceous, non-grass species). Several of these introduced species are from places other than California, and some of the plants are native to other regions and habitats of California but not to those in which HWP is located. Many of the introduced plant species generally used in landscaped settings are not from North America.

[1] See Appendix B.3 for a complete reference list of sources cited in this portion of the Master Plan.

Several terrestrial natural plant communities, that form a patchy mosaic of dominant vegetation types, occupy the survey areas. A particular plant community may fill an area forming relatively pure stands of the dominant species, or the site may contain transitional areas that possess elements of several plant communities, or vegetation series and associations, as the case may be.

The Plant Communities

At least six native terrestrial natural plant communities exist in the survey areas with characteristics common to (1) coast live oak woodland, (2) southern willow scrub, (3) mule fat scrub, (4) riversidian alluvial fan sage scrub, (5) sage scrub, and (6) southern sycamore riparian woodland. Holland (1986) describes these communities in a document prepared for the California Native Diversity Database. See Exhibit 2-3, Terrestrial Natural Plant Communities.

One nonnative, terrestrial natural plant community is also present in large and small sections of the master plan study area survey sites, i.e., ruderal vegetation. In areas of the basin that have undergone considerable disturbance by man due to periodic flood management through sediment and debris removal upstream of Devil's Gate Dam, much of the vegetation is comprised of ruderal species. The majority of this ruderal vegetation is comprised of herbaceous forbs rather than nonnative grasses. However, certain small areas are dominated by introduced, nonnative grasses and fewer forbs. Holland (1986) refers to this community as nonnative grassland. Nonnative grassland is widely scattered depending on the history of site disturbance by man (e.g., repeated fires and grading).

It should be noted that a vegetation category termed "streambed riparian vegetation" is also described below. However, this is not a true terrestrial natural plant community or vegetation series. This vegetation category is used in this report to help depict those locales along the Arroyo Seco stream channel where riparian or wetland indicator species may occur in isolated areas and/or numbers of individual species. These sections of the stream channel are sparsely covered with vegetation since it is still in a state of primary succession due to ongoing disturbance by annual flooding and scouring from seasonal rainfall runoff and sediment deposition. These species may be present in greater numbers and distribution in other major terrestrial natural communities of HWP.

Under a more recent classification system of vegetation by Sawyer and Keeler-Wolf (1995), the terrestrial natural plant communities in HWP are more complex. Using Sawyer and Keeler-Wolf's approach, at least twelve different vegetation series are known from the surveyed areas of the Arroyo Seco and canyon slopes and sidewalls along the site boundaries. The vegetation that dominates the HWP survey sites include the following

Sawyer and Keeler-Wolf series: Coast live oak, arroyo willow, black willow, red willow, mule fat, scalebroom, California sagebrush-California buckwheat, California sagebrush-black sage, chamise-black sage, sumac, California sycamore series, and California annual grassland.

Descriptions of the terrestrial natural plant communities (Holland, 1986) and/or the related vegetation series (Sawyer and Keeler-Wolf, 1995) are given below. For ease of reading this report, information about a particular vegetation series is combined with that for the respective terrestrial natural community.

Coast Live Oak Woodland

Coast live oak woodland is typically located on north-facing slopes and shaded ravines in southern California. In HWP and the MWD property, however, it occurs on the more level terrain of old terraces of alluvial fans on the west boundary of the site. There it integrates with southern willow scrub, mule fat scrub, and the ruderal vegetation in the central riparian corridor of the Arroyo Seco. On the drier, west-facing and south-facing sidewalls and slopes of the Arroyo Seco drainage to the east, coast live oak woodland patchily merges with sage scrub and ruderal communities.

The Oak Grove area, on the west side of HWP and portions of the MWD property represent an exquisite, remnant example of the sort of coast live oak woodland that used to cover much of the southern half of the state in the Coast, Transverse, and Peninsular ranges. In many Southern California foothill woodland areas, coast live oak (*Quercus agrifolia var. agrifolia*) is often codominant with toyon or Christmas berry (*Heteromeles arbutifolia*), or with southern California black walnut (*Juglans californica var. californica*) (Holland, 1986; Quinn, 1990). Sawyer and Keeler-Wolf (1995) refer to coast live oak woodland as coast live oak series.

Generally, coast live oak woodlands inhabit upland areas on slopes that are often very steep or on raised stream banks and terraces. Soils are well drained and are often sandstone or shale-derived but may also be granitic in composition. Coast live oak may be the sole or dominant tree in the canopy. These oaks reach heights as great as 100 feet (30 meters), and the canopy may be continuous, intermittent, or open. Shrubs are usually occasional or common in the understory and the terrestrial surface layer is grassy or absent (Holland, 1986; Sawyer and Keeler-Wolf, 1995).

Commonly associated shrub understory species in this plant community include black sage (*Salvia mellifera*), California blackberry (*Rubus ursinus*), California bay or laurel (*Umbellularia californica*), California redberry (*Rhamnus californica*), California sagebrush (*Artemisia californica*), chamise (*Adenostoma fasciculatum*), laurel sumac (*Malosma laurina*), western poison oak (*Toxicodendron diversilobum*), scrub oak (*Quercus berberidifolia*), toyon (*Heteromeles arbupifolia)*, Mexican elderberry (*Sambucus mexicana*), bigleaf maple (*Acer macrophyllum*), box elder (*A. negundo*), hairy ceanothus (*Ceanothus oliganthus*), Engelmann oak (*Quercus engelmannii*), bush monkeyflower (*Mimulus

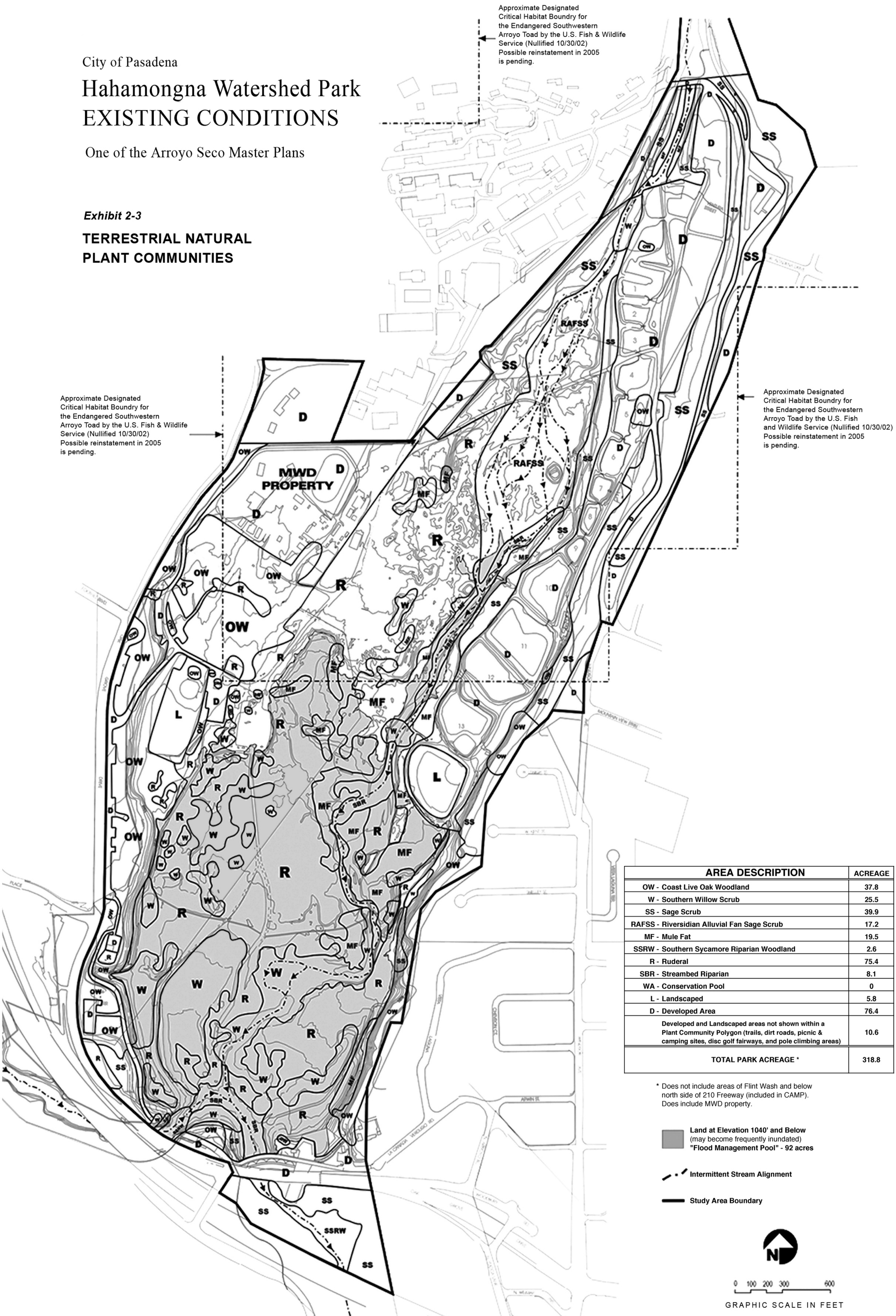
City of Pasadena

Hahamongna Watershed Park EXISTING CONDITIONS

One of the Arroyo Seco Master Plans

Exhibit 2-3

TERRESTRIAL NATURAL PLANT COMMUNITIES



AREA DESCRIPTION	ACREAGE
OW - Coast Live Oak Woodland	37.8
W - Southern Willow Scrub	25.5
SS - Sage Scrub	39.9
RAFSS - Riversidian Alluvial Fan Sage Scrub	17.2
MF - Mule Fat	19.5
SSRW - Southern Sycamore Riparian Woodland	2.6
R - Ruderal	75.4
SBR - Streambed Riparian	8.1
WA - Conservation Pool	0
L - Landscaped	5.8
D - Developed Area	76.4
Developed and Landscaped areas not shown within a Plant Community Polygon (trails, dirt roads, picnic & camping sites, disc golf fairways, and pole climbing areas)	10.6
TOTAL PARK ACREAGE *	318.8

* Does not include areas of Flint Wash and below north side of 210 Freeway (included in CAMP). Does include MWD property.

Land at Elevation 1040' and Below (may become frequently inundated) **"Flood Management Pool" - 92 acres**

Intermittent Stream Alignment

Study Area Boundary

0 100 200 300 600

GRAPHIC SCALE IN FEET

CONTOUR INTERVAL IN FEET MSL

TOPOGRAPHIC MAP PROVIDED BY TAKATA & ASSOCIATES. 1999

PREPARED BY PARSONS ENGINEERING SCIENCE, INC.

aurantiacus), and various currant or gooseberry species (*Ribes spp.)* (Holland, 1986; Sawyer and Keeler-Wolf, 1995). The herbaceous layer component is often continuous and dominated by ripgut (*Bromus diandrus*) and other introduced taxa such as common chickweed (*Stellaria media*) (Holland, 1986).

Coast Live Oak Woodland

Coast live oak woodland habitat is not considered sensitive by the State. However, southern coast live oak riparian forest, which is not present in the survey areas, is thought to be a sensitive natural community type (CNDDB, 1996a and f). Forest habitats generally connote a greater geographical distribution and density of trees compared with woodlands along with differences in edaphic and hydrographic regimes. Trees growing close enough that their canopies touch and collectively cover more than 60 percent of the ground characterize forest vegetation. Woodland canopies, in contrast, cover 30 to 60 percent of the ground (Barbour et al., 1993; Pavlik et al., 1991). Sawyer and Keeler-Wolf (1995) note that coast live oak is not listed on the national inventory of wetland plants by Reed (1988). Coast live oak woodland is valuable habitat that supports a wide variety of wildlife species.

Southern Willow Scrub

Southern willow scrub dominates the central riparian corridor of the Arroyo Seco drainage in HWP from just north of the dam, and continues upstream to the north in two large forked patterns to the west and east. On the west side of HWP, it merges with coast live oak woodland and ruderal vegetation. To the east, this terrestrial natural community integrates with the ruderal vegetation and coastal sage-chaparral scrub. At the north end of its distribution in HWP, it is replaced by mule fat scrub. According to Holland (1986), southern willow scrub is an early seral or successional type that requires repeated flooding to prevent succession to southern cottonwood-sycamore riparian forest. Sawyer and Keeler-Wolf (1995) refer to southern willow scrub as a combination of arroyo willow series, black willow series, and red willow series.

Hahamongna flood basin June 1998 and Aug 1998, willow scrub along drainage patterns in nonnative grassland

This terrestrial natural community is comprised of dense, broad-leaved, winter-deciduous riparian thickets dominated by several willow species including arroyo willow (*Salix lasiolepis*), black willow (*S. gooddingii*), red willow (*S. laevigata*), shining willow (*S. lucida ssp. lasiandra*), and narrow-leaved willow (*S. exigua*) (Holland, 1986; Sawyer and Keeler-Wolf, 1995). This riparian scrub community occupies sites with loose, sandy or fine gravelly alluvium deposited along intermittent or perennial stream channels during flood flows. Habitats within this community are usually seasonally flooded and the soils are saturated. Southern willow scrub typically occupies sites on floodplains, or on low-gradient depositions along rivers and streams (Sawyer and Keeler-Wolf, 1995). Shrubs and trees in this community may reach 33 to 100 feet (10 to 30 meters) in height, and the canopy may be continuous. Most stands often are so dense that the understory vegetation layer of shrubs is sparse (Holland, 1986). In more slightly open willow scrub sites, the ground layer of grasses and forbs may vary from sparse to abundant (Sawyer and Keeler-Wolf, 1995).

Southern willow scrub with black walnuts and western sycamores

Also associated with this riparian scrub community are scattered emergent specimens of Fremont cottonwood (*Populus fremontii ssp. fremontii*), black cottonwood (*P. balsamifera ssp. trichocarpa),* and western sycamore (*Platanus racemosa*). Other commonly associated species in southern willow scrub include mule fat (*Baccharis salicifolia*), coyote brush (*B. pilularis*), mugwort (*Artemisia douglasiana*), Mexican elderberry, and bigleaf maple.

Southern willow scrub is one of two terrestrial natural communities in the Park that are composed of vegetation that typify true wetland habitats. The other community is mule fat scrub. In a manual prepared for COE, National List of Plant Species that Occur in Wetlands: National Summary, Reed (1988), along with the collaborative efforts of many biologists, attempts to define the wetland flora of the United States and to assist in the field identification of wetlands. Plant species that occur in wetlands are those species that have shown an ability to achieve maturity and reproduce in an environment where all the soil, or portions of it, is periodically or continuously saturated. This inundation of the plant species root zone occurs during the growing season (Reed, 1988; COE, 1987).

Recently, CDFG (1997) has found the USFWS wetland definition and classification system (Cowardin et al., 1979) to be the most biologically valid of those definitions and classification systems presently used in California. The USFWS definition employs hydric soils, saturation or inundation, and vegetative criteria, and requires the presence of at least one of these criteria (rather than all three) in order to classify an area as a wetland (CDFG, 1997).

Reed (1988) considers black, red, and narrow-leaved willows to be in the obligate wetland regional indicator category (OBL) for the region of the United States that includes the state of California and the Park. OBL species occur almost always (estimated probability greater than 99 percent) under natural conditions in wetlands. Reed (1988) classifies arroyo willow, Fremont cottonwood, black cottonwood, western sycamore, mule fat, and mugwort in the facultative wetland indicator category (FACW). FACW species usually occur in wetlands (estimated probability 67-99 percent), but are occasionally found in non-wetlands (estimated probability 1-33 percent). Mexican elderberry shows a wetland condition preference under the facultative wetland indicator category (FAC). FAC species have a midrange wetland condition preference with an estimated probability of 34-66 percent occurrence of being found in wetlands or non-wetlands (Reed, 1988).

Southern willow scrub is comprised of a variety of wetland indicator species that offer a relatively wide range of preference and tolerance to fluctuating hydrologic regimes. In the Park, this community is abundant in the central riparian area of the Arroyo Seco, provides valuable cover for wildlife potentially including several rare animal species, and offers several opportunities for habitat restoration efforts as outlined in Section 3, Recommendations. Riparian and other wetland habitats, with their characteristic and unique species, are rare and declining in Southern California, and much of the state and nation, due to urban development and increased water use (Bowler, 1990; Faber, et al.; 1989; Latting, 1976).

HWP has several dominant and other less common native plant species that occupy its riparian habitats. As such, HWP contains a valuable source of wetland or riparian genetic information or gene pool for related species in other riparian habitats. These habitats also may contain isolated or disjunct populations that are geographically separated from the main population centers of a given riparian species (Latting, 1976; Faber, et al.; 1989; Conrad, 1987; Barbour and Major, 1988; Bowler, 1990). Although southern willow scrub is not considered sensitive by state regulatory agencies, it does meet at least one of three criteria needed to be defined as a wetland under the proposed acceptance by CDFG (1997) of the USFWS (1997). That criterion for a valid wetland definition is the presence of hydric vegetation (i.e., the above willow species) along the intermittent stream channel in HWP.

Wetlands and other riparian habitats are on the decline around the nation and are considered sensitive vegetation types (Faber et al., 1989) that warrant considerable regulatory agency oversight regarding their development (Federal Register, 1980 and 1982; COE, 1994; CDFG, 1997). Southern willow scrub in HWP is comprised of well-established, native wetland habitats that are important for wildlife. As such, it is worthy of applied conservation efforts during Park maintenance to the extent feasible. The Los Angeles County Department of Public Works (LACDPW) and the City are the two primary agencies responsible for the acquisition of the proper regulatory agency permits for the periodic removal of sediment and debris behind the dam. Of all the terrestrial natural communities found in HWP, southern willow scrub is the principal community that will be most affected by the ongoing maintenance requirements in HWP and yet, it offers opportunities for innovative habitat restoration planning. The present configuration of southern willow scrub along the Arroyo

Seco drainage has well-developed mature trees stands.

Southern willow scrub has established itself throughout the flood plain, from the JPL bridge to the dam in areas that have been highly disturbed by unnatural occurrences, such as dumping, mining, and flow diversion. Since 1971, when Devil's Gate dam was declared seismically unsafe to hold water, riparian corridors have established themselves in this flood-control, water conservation pool area. As a result of the rehabilitation of the dam in 1998, the holding capacity of this area is of critical concern for flood and sediment management as well as the management of water conservation; therefore, the plan proposes to create a larger conservation pool. The topography of this area has changed due to inflow of sediment as well as past mining and dumping operations

Mule Fat Scrub

Mule fat scrub often occurs as relatively pure stands and is common in areas along the riparian stream corridor of the Arroyo Seco drainage in HWP just north of the southern willow scrub stands. This community continues its distribution north, bordering the ephemeral stream channel and extends into areas of riversidian alluvial fan sage scrub, coastal sage-chaparral scrub, and nonnative grassland near the spreading basins and Johnson Field. Holland (1986) notes that mule fat scrub is an early seral community that is maintained by frequent flooding. When such flooding conditions are absent, Holland (1986) believes that mule fat scrub stands would succeed to cottonwood- or sycamore-dominated riparian forests or woodland. Sawyer and Keeler-Wolf (1995) refer to mule fat scrub as mule fat series.

Mule fat scrub is typically characterized by depauperate, tall, herbaceous riparian scrub species dominated by *Baccharis salicifolia*. Mule fat is usually the sole or dominant shrub in the canopy along with narrow-leaved willow, and the plants may attain heights of 13 feet (four meters). The canopy often is continuous and the ground layer of vegetation is sparse (Sawyer and Keeler-Wolf, 1995). This terrestrial natural community is located along intermittent stream channels with fairly coarse substrate and moderate depth to the water table (Holland, 1986). Habitats within this community are also seasonally flooded and the ground is saturated (Sawyer and Keeler-Wolf, 1995). Other commonly associated species in mule fat scrub include arroyo willow, narrow-leaved willow, hoary nettle (*Urtica dioica ssp. holosericea),* Mexican elderberry, and sedges (*Carex spp*.).

Mule fat scrub plant community adjacent to stream channel

The heavy El Niño rains of 1998 caused prolonged flooded conditions behind the dam and killed many of the Mexican elderberry specimens in the mule fat scrub stands. Mule fat individuals were also adversely affected by the high water, but they appear to have survived from re-sprouting root systems. Mule fat is a FACW species with an estimated probability of 67-99 percent of occurring in wetlands (Reed, 1988). It has a higher preference for wetland conditions than does Mexican elderberry. The die-back of Mexican elderberry, a FAC wetland indicator category species with a 34-66 percent chance of occurring in wetlands (Reed, 1988), is indicative of its midrange wetland condition preference where the sustained floodwaters were beyond tolerance levels for this species.

Riversidean Alluvial Fan Sage Scrub

Riversidian alluvial fan sage scrub is found on old and younger alluvial fan terraces along the Arroyo Seco drainage, and it borders the western edges of most of the spreading basins in HWP. The existing spreading basins are largely situated upon what were originally riversidian alluvial fan sage scrub habitats. This community developed from the flow of water and sediment deposition during flooding as the Arroyo Seco stream emptied into the HWP flood basin from the narrow canyon mouth of the Arroyo Seco north of the JPL Bridge. Today, only remnants of this community remain in HWP. Historically, without the presence of the dam, alluvial fan terraces would have spread across most of the terrain that is now parkland, and gradually merged with upland areas covered with coast live oak woodland or coastal sage-chaparral scrub. In this scenario without the dam, an ephemeral stream and channel would still be found in the basin along with riparian corridor communities of southern willow scrub and mule fat scrub beside the stream.

Holland (1986) states that this terrestrial natural community is very xeric (dry) with coarse soils and some finer soils that are slow to release stored moisture. Sawyer and Keeler-Wolf (1995) refer to riversidian alluvial fan sage scrub as scalebroom series, and note that it is located on upland sites that are rarely flooded with low-gradient deposits along ephemeral or perennial streams. Shrubs in this vegetation type are generally low in height at five feet (one and one-half meters) with the canopy continuous or intermittent, and the ground layer of vegetation variable with grasses and forbs (Sawyer and Keeler-Wolf, 1995).

Riversidian Alluvial Fan Scrub at the northern end of Hahamongna Watershed Park

Dominant species in riversidian alluvial fan sage scrub include scalebroom (*Lepidospartum squamatum*), California sagebrush, California buckwheat (*Eriogonum fasciculatum var. foliolosum),* black sage, white sage (*Salvia apiana*), brome grasses (*Bromus spp.),* western sycamore, Fremont cottonwood, southern California black walnut, brittlebush (*Encelia farinosa*), chaparral yucca (*Yucca whipplei*), chaparral mallow (*Malacothamnus fasciculatus*), hairy yerba santa (*Eriodictyon crassifolium*), laurel sumac, lemonadeberry (*Rhus integrifolia*), sugar bush (*R. ovata*) Mexican elderberry, mule fat, poison oak, birch-leaf mountain-mahogany (*Cercocarpus betuloides var. betuloides*), prickly pears (*Opuntia spp*.), deerweed (*Lotus scoparius*), bladderpod (*Isomeris arborea*), and four-wing saltbush (*Atriplex canescens*) (Holland, 1986; Sawyer and Keeler-Wolf, 1995).

Riversidian alluvial fan sage scrub is considered a sensitive habitat by California state regulatory agencies due to declining habitats lost to urban development and flood control. This sensitive terrestrial natural plant community is not previously recorded in the CNDDB (1999a and f) information for the USGS Pasadena quadrangle in which HWP is located. Therefore, this community warrants consideration for the implementation of conservation efforts to help sustain it, as much as possible, with the ongoing maintenance needs of the City and other Park environmental stakeholders. Since the riversidian alluvial fan sage scrub community in HWP is very small and is only a remnant of what used to exist there, protection is a valid endeavor.

Sage Scrub

At HWP the ranges of two bio-geographically distinct terrestrial natural plant communities overlap with characteristics common to Venturan coastal sage scrub and Riversidian coastal sage scrub (Westman, 1983; O'Leary, 1990). For convenience of description, these two terrestrial natural plant communities are combined in this report simply as “sage scrub” that also gradually merges in several places with elements of mixed chamise/ceanothus chaparral.

Sage scrub is found on slopes and sidewalls of the Arroyo Seco drainage, particularly on west-facing slopes along the east boundary of HWP. This terrestrial natural community forms patchy mosaics well removed from the drainage bottom that are dominated by southern willow scrub, mule fat scrub, riversidian alluvial fan sage scrub, and nonnative grassland. It also blends as indistinct borders with coast live oak woodland and ruderal/landscaped vegetation in developed areas of the Park. Elements of sage scrub exist in riversidian alluvial fan sage scrub in the Park, and in transitional areas of coast live oak woodland. Sage scrub probably was more widely distributed in the Park before the implementation of maintenance efforts.

Sage scrub is a mixture of fire-adapted, sclerophyllous (hard-leaved), woody chaparral species and drought-deciduous sage scrub species. This plant community apparently is post-fire successional that is found on dry, rocky, often steep, south-facing slopes and ridges with shallow or poorly differentiated soils (Holland, 1986). Often these soils are derived from rock detritus and soil accumulated at the foot of a slope (Sawyer and Keeler-Wolf, 1995). It may also be located on clay-rich soils that are slow to release stored water that favor the proliferation of California sagebrush over chamise (Holland, 1986). Generally, shrubs in sage scrub are less than six to ten feet (two to three meters) in height, although in some areas with associated emergent shrub or tree species the plants may attain heights up to 13 feet (four meters). The canopy is continuous or intermittent, and the ground layer is sparse or absent (Sawyer and Keeler-Wolf, 1995). Understory cover of forbs and grasses is often variable depending upon the fire history of a particular site. Sage scrub communities are sometimes referred to as “soft chaparral” by various botanists and plant ecologists (Mooney, 1988; Keeley and Keeley, 1988; O’Leary, 1990). Bare ground occurs frequently underneath and between shrubs. Growth season for this community generally happens following the start of winter rains with growth peaking in late winter and spring. Flowering period for most species is during spring but some species continue into summer (Holland, 1986; O’Leary, 1990). Under the Sawyer and Keeler-Wolf (1995) vegetation series classification of this sage scrub community mingling with elements of chamise/ceanothus chaparral, the Park's sage scrub community is a mixed combination of California sagebrush-California buckwheat series, California sagebrush-black sage series, chamise-black sage series, and sumac series. Distribution of dominant shrubs often forms a patchy mosaic pattern where areas may be populated by a single species or where sites may be covered by a mixed composition of different species.

Coastal sage chaparral scrub on canyon walls

Dominant species in this terrestrial natural community include California sagebrush, chamise, California buckwheat, black sage, white sage, laurel sumac, lemonadeberry, sugar bush, deerweed, chaparral yucca, bush monkeyflower, hoaryleaf ceanothus (*Ceanothus crassifolius*), other ceanothus or California-lilac species (*Ceanothus* spp.), scrub oak, birch-leaf mountain-mahogany, poison oak, holly-leaf cherry (*Prunus ilicifolia* ssp. *ilicifolia*), southern California walnut, California encelia, Mexican elderberry, toyon, Brazilian pepper (*Schinus terebinthifolius*), and Peruvian pepper (*S. molle*) (Holland, 1986; Sawyer and Keeler-Wolf, 1995).

Southern Sycamore Riparian Woodland

Southern sycamore riparian woodland is very limited in its distribution within HWP boundaries. Currently, it is found bordering the natural stream channel just south of Devil's Gate Dam and the 210 Freeway, and this woodland continues southward (prior to the concrete stream channel) towards the Central Arroyo Seco and Brookside Golf Course. Here, surface flows of water that run past the dam help sustain the hydrologic regime needed by western sycamore trees. Holland (1986) actually refers to this terrestrial natural community as southern sycamore-alder riparian woodland. For purposes of use in this report, only the name “southern sycamore riparian woodland” is used since (white) alder is largely absent but western sycamore is present in naturally occurring habitats of the Park’s southern reaches below the dam. Holland’s vegetation classification system has no “southern sycamore riparian woodland,” but this report utilizes the descriptions given to southern sycamore-alder riparian woodland. Western sycamore is frequently utilized as a landscape tree on properties in surrounding residential and other urban areas. There are other sites within HWP to the north where western sycamore trees have been used in landscape situations, but these trees do not constitute sycamore riparian woodland.

Southern sycamore-alder riparian woodland is a tall [<115 feet (35 meters)], open, broad-leaved, winter-deciduous woodland dominated by western sycamore (*Platanus racemosa*), and by white alder (*Alnus rhombifolia*) (Holland, 1986) where more perennial water flows exist. These riparian tree stands rarely form closed canopy forests and often exist as trees scattered in shrubby thickets of sclerophyllous (hard-leaved) and deciduous species. Species of vines and brambles such as western poison oak, California blackberry (Holland, 1986), and Himalayan blackberry (*Rubus discolor*) (Sawyer and Keeler-Wolf, 1995) may tend to dominate the understory layer. Other commonly associated species often include arroyo willow, black willow, red willow, California bay, coast live oak, Fremont cottonwood, mule fat, Mexican elderberry, ash (*Fraxinus* spp.) big-leaf maple, mugwort, hoary nettle, wild oats (*Avena* spp.), brome grass (*Bromus* spp.), and smilo grass (*Piptatherum miliaceum*) (Holland, 1986; Sawyer and Keeler-Wolf, 1995).

Factors that favor the formation of sycamore-alder riparian woodlands include very rocky streambeds that are subject to seasonal high-intensity flooding such as those that occur in the Arroyo Seco. It is important to note that white alder increases in abundance on more perennial streams, while western sycamore prefers more ephemeral or intermittent stream conditions. The Arroyo Seco is typically an ephemeral stream rather than a perennial stream; hence the given Spanish name “arroyo seco” meaning “dry wash.” Sawyer and Keeler-Wolf (1995) refer to southern sycamore-alder riparian woodland as two different series, i.e., white alder series and California sycamore series. White alder series inhabit soils that are intermittently flooded and saturated with fresh water, while California sycamore series prefer soils that are permanently saturated at depth.

California (western) sycamore series is found in both wetland and upland site conditions. Sycamores occur as the sole or dominant species in the canopy as widely spaced trees. In wetlands, this series inhabits soils that are permanently saturated at depth with fresh water supplies. This tree species occupies riparian corridors; braided, depositional channels of intermittent streams; gullies; springs; seeps; stream and river banks; and terraces adjacent to floodplains that are subject to high-intensity flooding. Sycamores prefer substrates that are usually composed of alluvial soils with open cobbly and rocky conditions. On upland sites, sycamores are located on slopes that are commonly rocky (Sawyer and Keeler-Wolf, 1995). Reed (1988), in his national list of wetland species, places this sycamore as a facultative wetland indicator (FACW) species, i.e., a species that has a 67-99 percent chance of occurring in wetland conditions. At the survey areas, western sycamore is more abundant while white alder is very sparse immediately downstream of dam. Scattered thickets of arroyo willow and mule fat are also present in the natural drainage channel below the dam and south into the Central Arroyo Seco prior to the concrete channel at the north end of the golf course.

The State considers southern sycamore-alder woodland to be a sensitive habitat (CNDDB, 1999a and f).

Ruderal

Ruderal vegetation dominates the central portion of the master plan study area along the drainage from west to east, and north to south within this central portion. Ruderal or weedy mustard and sunflower family members rather than grasses have dominated this community in recent years in the central riparian and graded areas of the basin. Other areas in HWP, such as coast live oak woodland and coastal sage-chaparral scrub, do have smaller, patchy mosaics of actual nonnative grassland and/or other ruderal vegetation scattered within their community boundaries. This nonnative terrestrial natural community, which has very little value to most native wildlife species, offers numerous opportunities for major habitat restoration planning efforts to help eliminate it from HWP. The eradication of ruderal vegetation species will be difficult to achieve since it is composed of introduced, invasive, and very aggressive species that are usually annual grasses and forbs. Weedy species are adapted to, and can thrive on, site disturbance conditions such as grading, clearing, burning, and even flooding that may exclude more desired native plants.

Ruderal vegetation

Ruderal vegetation (and/or nonnative grassland) may occur on fine-textured, usually clay soils that are moist or even waterlogged during the winter rainy season and become very dry during the summer and fall (Holland, 1986). Sites favored by this plant community are found on gentle slopes or on more level terrain where finer soil particles have a chance to collect favoring the growth of ruderal annual species of grasses and showy-flowered forbs or wildflowers. At the biological inventory survey sites, ruderal vegetation occurs as small to large, patchy mosaics on drainage and side slopes, and it widely covers extensive areas in the central portion of the Arroyo Seco drainage. Sites that are occupied by ruderal vegetation and/or nonnative grassland are related to the fire history and/or mechanical disturbance from grading or clearing of a particular area. Areas with frequent, repeat occurrences of fire tend to lose the dominant shrub community and allow ruderal vegetation and/or nonnative grassland to become established. Once established, this plant community is sustained by repeated fire occurrences to the exclusion of shrubby species. Ruderal vegetation and/or non-native grassland may occur on virtually any direction or aspect of level or sloping terrain where fire or conditions such as mechanical grading are present.

Nonnative, introduced, annual grass and forb species tend to dominate the understory or ground layer in this terrestrial natural community. These grasses and some forbs may reach heights as great as three feet (one meter) depending on the amount of rainfall received. They germinate with late-fall and winter rains; and grow, flower, and set seed during winter through spring months (Holland, 1986). Holland (1986) notes that with a few exceptions these weedy plant species are dead but persist as seeds through the summer and fall dry seasons. Shrub and tree species are usually absent or are very sparse, and the ground layer of vegetation is continuous or open (Sawyer and Keeler-Wolf, 1995).

Commonly observed species in ruderal vegetation and/or nonnative grassland community include slender wild oats, common wild oats, ripgut, red brome (*Bromus madritensis* ssp. *rubens*), soft chess (*B. hordeaceus*), black mustard (*Brassica nigra*), turnip or field mustard (*B. rapa*), shortpod mustard (*Hirschfeldia incana*), red-stem filaree (*Erodium cicutarium*), filaree (*E. botrys*), California poppy (*Eschscholzia californica*), gilias (*Gilia* spp.), tarweed (*Hemizonia fasciculata*), Italian ryegrass (*Lolium multiflorum*), lupines (*Lupinus* spp.), peppergrass (*Lepidium nitidum*), burclover (*Medicago polymorpha*), phacelias (*Phacelia* spp.), Mediterranean grass (*Schismus barbatus*), star-thistles (*Centaurea* spp.), and vulpias or annual fescues (*Vulpia* spp.) (Holland, 1986; Sawyer and Keeler-Wolf, 1995). During the inventory surveys, large areas of the nonnative grassland community covered with weedy annual bur-sage (*Ambrosia acanthicarpa*), horseweed (*Conyza canadensis*), and plantain (*Plantago ovata*) were observed.

Ruderal plants in the master plan study area are not only terrestrial but also are aquatic and are found immediately along the stream channel, and in and around the spreading ponds. Many of these aquatic ruderal species may be seen only when water is present and then wither and die back to surviving root systems if perennial, and/or may persist as seeds if they are annuals or perennials.

Streambed Riparian Vegetation

As noted above, an additional vegetation category termed "streambed riparian vegetation" is also described. However, it is not a true terrestrial natural plant community or vegetation series. This vegetation category is used in this report to help depict those locales along the

Arroyo Seco stream channel within HWP where riparian or wetland indicator species may occur in isolated areas and/or numbers of individual species.

These species may be present in greater numbers and distribution in other major terrestrial natural communities of HWP. Often the majority of the channel indicated as streambed riparian habitat has few plants. These sections of the stream channel are sparsely covered with vegetation since it is still in a state of primary succession due to ongoing disturbance by annual flooding and scouring from seasonal rainfall runoff. Examples of streambed riparian vegetation may include dominant or less abundant plant species found in southern willow scrub, riversidian alluvial fan sage scrub, mule fat scrub, and southern sycamore riparian woodland. Representative species from each of these terrestrial natural communities are mentioned above. Other species examples may include sedges (*Carex* spp.), rushes (*Juncus* spp.), cattails (*Typha* spp.), spikerushes (*Eleocharis* spp.), bulrushes (*Scripus* spp.), willow weed (*Polygonum lapathifolium*), and willow herbs (*Epilobium* spp.).

Landscaped Vegetation

Landscaped vegetation is largely composed of cultivated ornamental, horticultural plants that may be introduced or native tree, shrub, forb, and grass species. Landscaped plant species are usually aesthetically appealing and are moderately to extremely dependent on man for water, minerals and nutrients (from fertilizers and soil amendments), pruning and maintenance, pest and pathogen control, and for their establishment in an environmental setting. That setting often is in urban surroundings, such as near buildings, roads, parking areas, walls, developed parkland, and percolation ponds. Often landscaped plant species that are native to the part of California in which HWP is located may have existed prior to the development of the land for residential or other uses, or were planted expressly for their aesthetic value and/or ease of growing.

Many of the plant species that comprise landscaped vegetation are often drought-tolerant xerophytes that require little or no irrigation by man for their survival. Occasionally, landscaped plants escape from their intended setting and become established in the wild. Landscaped plants can become naturalized by virtue of adaptive dispersal mechanisms and strategies of their fruits, seeds, root systems, vegetative reproduction from plant parts, and animal transport. Ruderal, weedy plants are often annuals or biennials and, therefore, reproduce very rapidly and successfully in places and conditions that other native or even introduced perennial plants cannot.

In the master plan study area, the soil types and textures on the various survey sites of landscaped vegetation are characterized as urban land that historically consisted of native alluvial soils comprised of dry, dense, silty and occasionally gravelly sand, rocks and boulders. Several feet of introduced fill material of unknown origin and varying composition may cover the sites currently occupied by landscaped/ruderal vegetation.

This vegetation category was not surveyed to the extent and depth as were other native, natural terrestrial plant communities during the inventory surveys of biological resources.

However, this unnatural plant community type was mapped on the terrestrial natural community map of vegetation. The numbers and types of landscaped vegetation are too numerous and diverse to include in the scope of work for this project. Common landscape plants observed in the master plan study area included species of eucalyptus, pine, oak, acacia, western sycamore, fig, olive, pittosporum, cherry, pepper tree, maple, liquidambar, ash, juniper, cypress, pyracantha, walnut, hibiscus, oleander, privet, redwood, elm, palm, coral tree, periwinkle, lantana, ivy, plumbago, poplar, tree of heaven, agave, and many others.

SENSITIVE HABITAT AND SPECIAL STATUS SPECIES

Examination for sensitive habitats and protected or other sensitive and special status species was conducted on CNDDB (1999f) information for the USGS 7.5-minute series topographic quadrangle map for Pasadena in which the HWP survey sites are located. Supplementary information about protected and sensitive plant and animal species, and sensitive habitats was also taken from private sources (CNPS, 1994; Pasadena Audubon Society, 1994), and from other state or federal government publications (CNDDB, 1999a, b, c, d, and e; and USFWS, 1992, 1995, 1996, 1997, and 1998). The RareFind 2 computer software program, (CNDDB, 1999f) lists two sensitive natural plant communities (i.e., southern coast live oak riparian forest and southern sycamore-alder riparian woodland), six plant species, and two animal species as having the potential to occur in naturally existing habitats within the USGS Pasadena quadrangle boundaries. Today, there is no southern coast live oak riparian forest or southern sycamore-alder woodland within HWP boundaries. Southern sycamore-alder riparian woodland does exist, though, just one-third mile (one-half kilometer) north of HWP in nearby Millard Canyon. However, small areas of riversidian alluvial fan sage scrub, considered a sensitive habitat by California regulatory agencies, are present near the northern end of HWP but are not recorded in the CNDDB information for the Pasadena quadrangle.

Special status or sensitive plant species information obtained from CNDDB and CNPS records for the USGS Pasadena topographic quadrangle map include Nevin’s barberry (*Berberis nevinii*), Plummer’s mariposa lily (*Calochortus plummerae*), slender-horned spineflower (*Dodecahema leptoceras*), Los Angeles sunflower (*Helianthus nuttallii* ssp. *parishii*), southern tarplant (*Hemizonia parryi* ssp. *australis*), and Parish’s gooseberry (*Ribes divaricatum var. parishii*). None of these sensitive plant species were observed within the Park boundaries.

CNDDB and USFWS information about sensitive animal species potentially occurring in the USGS Pasadena quadrangle that contains the field survey sites and existing habitats, includes the southwestern pond turtle (*Clemmys marmorata pallida*) and the San Diego horned lizard (*Phrynosoma coronatum blainvillei*). Four other sensitive animal species, coastal western whiptail (*Cnemidophorus tigris multiscutatus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*), and loggerhead shrike (*Lanius ludovicianus*) were observed by Parsons ES at HWP during the biological resources survey period. These animal species are listed in CNDDB records (CNDDB, 1999d) for other areas in California but not specifically for the topographic quadrangle in which the field sites are located.

2.4 FLOOD MANAGEMENT

HWP is located at the foot of one of the most geologically dynamic mountains in the world; the basin receives periodic high-intensity floods that carry very high sediment loads from the San Gabriel Mountains. Los Angeles County Department of Public Works (LACDPW) owns the Devil’s Gate Dam and operates it for flood safety and sediment management. The 1919 lease agreement between LACDPW and the City of Pasadena designated an area easement for flood control, which encompasses approximately 80% of the master plan study area and roughly follows the 1075 elevation contour. Under the most extreme conditions, this area would be flooded for a short period of time.

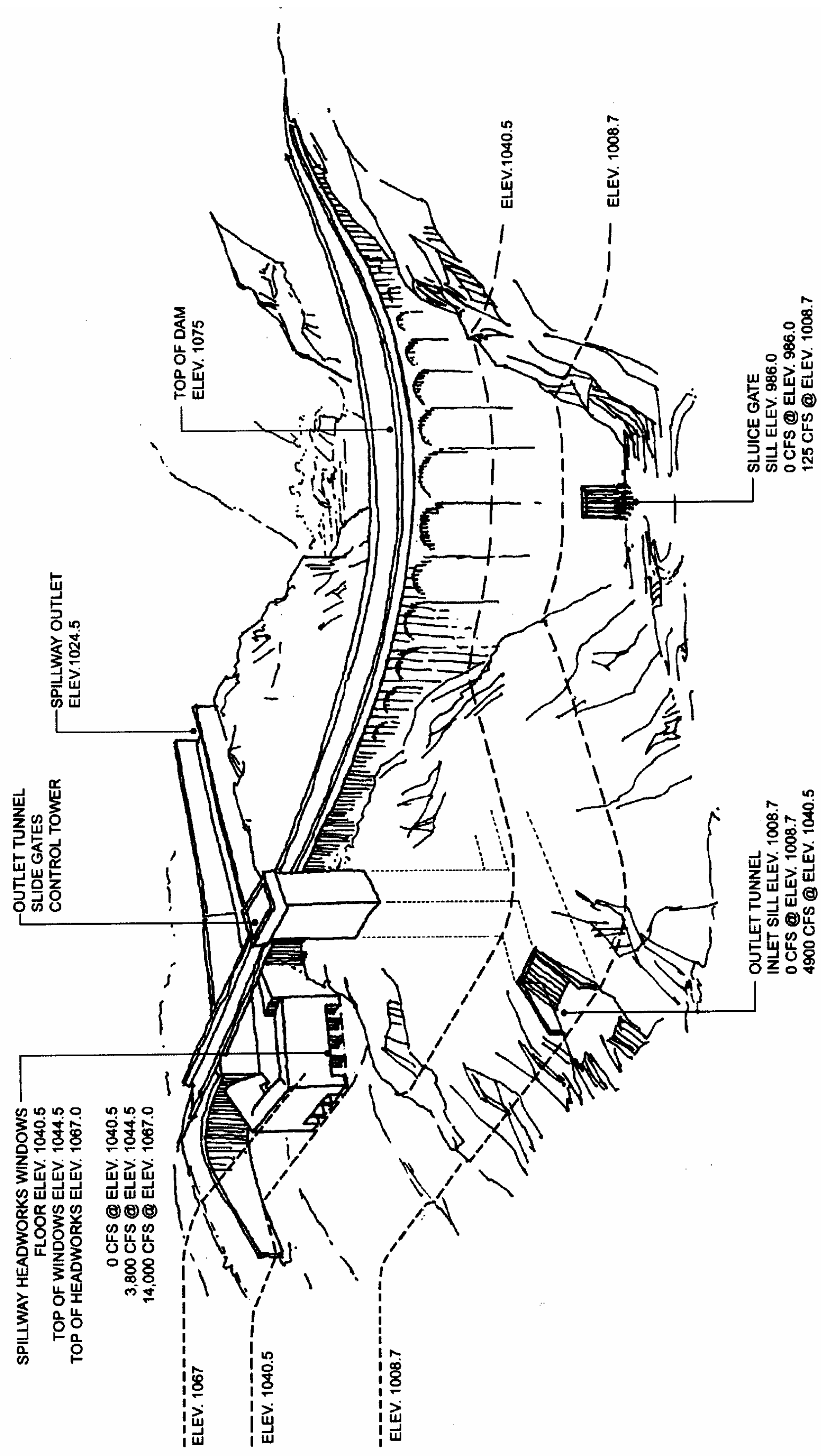
DAM OPERATIONS

The dam operation at first appears relatively simple. Under all flow and sediment transport situations, the lowest elevation outlet, the sluice gate, is kept open until water levels behind the dam rise to either the outlet tunnel or the spillway floor. See Exhibit 2-4, Operation of Devil’s Gate Dam. In this way, sediment sluicing through the dam is maximized, thereby reducing the amount of sediment accumulation and the subsequent excavation requirement in the reservoir. This method of reducing the amount of sediment accumulating behind the dam is referred to as the FAST Method—flow-assisted sediment transport method.

If the intensity and duration of the incoming storm event has more water and sediment entering the basin than can pass through the opening at the base of the dam (the sluice gate), then a pool will form behind the dam. As the water level of this pool rises above elevation 1008.7 and water begins to flow through the outlet tunnel, the sluice gate is closed. The formation of a pool and closing the sluice gate causes debris and sediment to settle out of suspension farther away from the dam, reducing the possible clogging of the sluice gate. Water with suspended sediment continues to flow through the open outlet tunnel.

Once water levels behind the dam reach elevation 1040.5, the spillway floor, the outlet tunnel gates are closed and water begins to flow through the spillway headworks openings. This method of operating the dam maximizes sediment outflow through the dam, but does nothing for water conservation. In addition, not holding water behind the dam has caused vegetation to establish itself below the 1040.5 elevation of the spillway floor. This greatly impedes sediment removal operations.

Exhibit 2-4
THE OPERATION OF DEVIL'S GATE DAM



WATER LEVELS

Critical to the understanding of the environment of the basin is the impact of the dam on flood elevations. The spillway floor elevation (1040.5), the top of the headworks (elevation 1067), and the top of the dam (elevation 1075) are mapped in Exhibit 2-5, Water Elevations.

At elevation 1040.5, accumulated waters will begin to flow through the spillway into the Central Arroyo flood-control channel. The openings of the spillway headworks are designed to limit the water flow so as not to overpower the capacity of the flood-control channel below the dam. The top of the spillway openings are at elevation 1044.5. If the storm event's intensity and duration causes water and sediment to flow into the basin faster than can exit through the spillway headworks openings, water will accumulate behind the dam—rising in elevation up the face of the spillway headworks and the dam. A capital storm event will cause water to rise up the face of the headworks and the dam to elevation 1067. The headworks acts as a control on the quantity of water released to the downstream channel. Should water continue to rise above the 1076 elevation, it will spill over the crest of the headworks and into the spillway. The top of the dam is set at elevation 1075.0, corresponding to the Los Angeles County Flood Control Easement of the basin.

As the flow into the basin equals and then lessens compared to the flow through the spillway,, the water level behind the dam descends. As the water elevation approaches the level of the floor of the spillway, the tunnel outlet is reopened. As the water level descends further, approaching the level of the outlet, the sluice gates are finally reopened and left to continue releasing all the water from behind the dam. Thus, there will be maximum capacity behind the dam for the next storm event. Since 1978, when the dam was declared seismically unsafe to hold water, the operation of the dam occurs as described.

Permanent park structures need to be located above the 1075.0 flood line or be designed to handle infrequent, short-term inundations. Trails, emergency/maintenance access, and recreation activities need to be located above elevation 1045 to avoid seasonal inundation.

The following most accurately summarizes the critical water levels and the effects on flow discharges associated with the operation of the dam:

- When water behind the dam is at elevation 1008.7 and the sluice gate (sill elevation 986.0) is fully opened, the discharge is 125cfs;

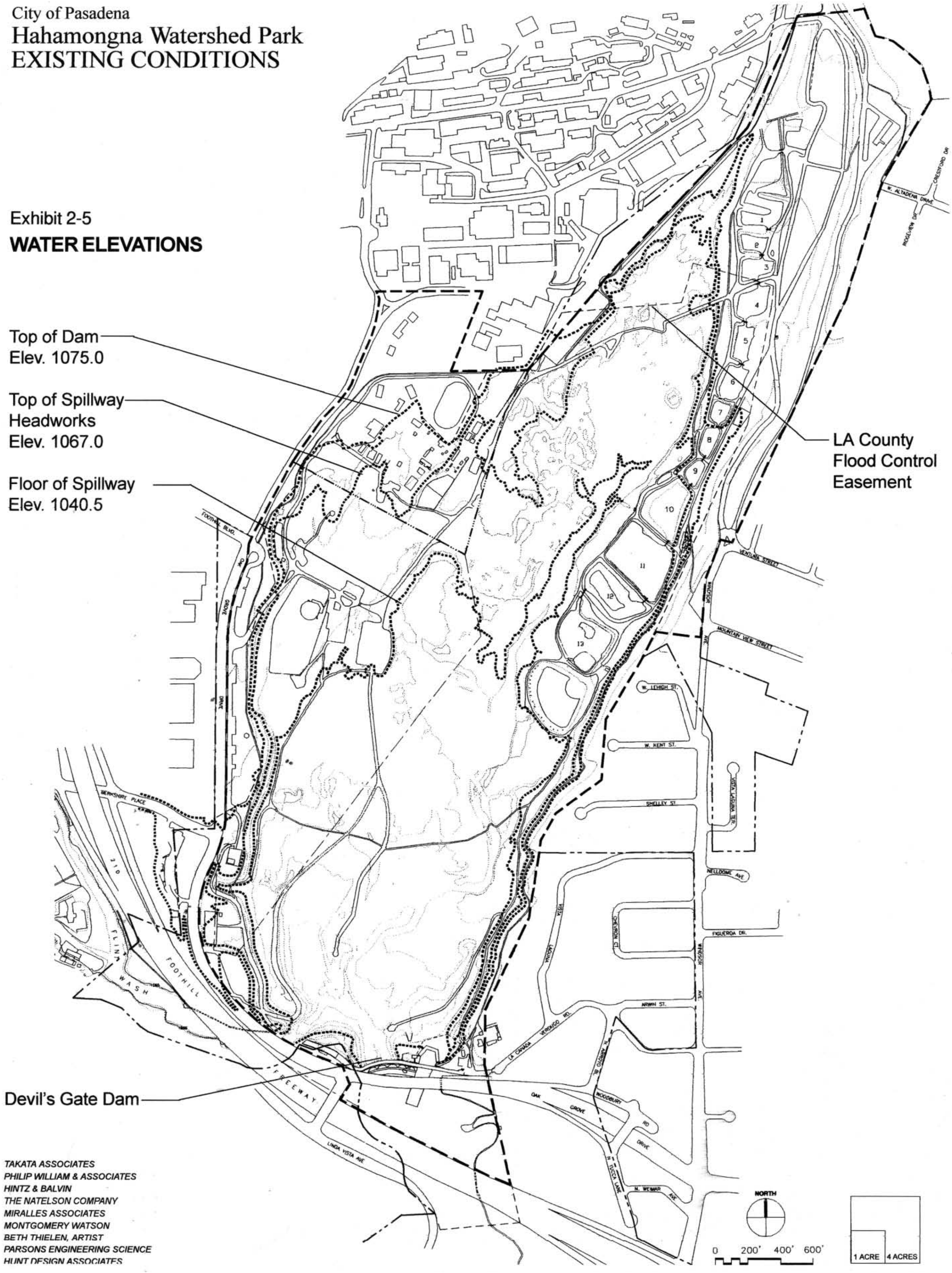
- When water level is at elevation 1040.5 and the outlet tunnel (sill elevation 1008.7) is fully opened and the sluice gate is closed, the discharge is 4,900cfs. This discharge can flow in the downstream channel at 25-30mph;

- When water level is at the top of the spillway headworks openings (elevation 1044.5) and the windows are flowing full and the outlet tunnel and sluice gate are closed, the discharge is 3,800cfs.

City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-5

WATER ELEVATIONS



TAKATA ASSOCIATES
PHILIP WILLIAM & ASSOCIATES
HINTZ & BALVIN
THE NATELSON COMPANY
MIRALLES ASSOCIATES
MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCE
HUNT DESIGN ASSOCIATES

This method of operation maximizes flood management safety at the dam, but does nothing for water conservation. In addition, by not holding water behind the dam vegetation has established itself below the 1040.5 elevation of the spillway floor, greatly impeding sediment removal operations.

FLOOD MANAGEMENT

In 1914, a devastating flood occurred in Los Angeles County, primarily the result of floodwaters originating in the San Gabriel Mountains. The flood caused over $10 million in property damage and claimed many lives. As a result, the Los Angeles County Flood Control District (LACFCD) was formed, later becoming part of the LACDPW. Their mandate was to provide flood protection for the County. To begin fulfilling this mandate, the LACFCD initiated construction of multiple dams in the San Gabriel Mountains. Devil’s Gate Dam was the first of these and was completed in 1920. Devil’s Gate Dam was built for the dual purposes of water conservation (increased yields from underground tunnels) and flood control. However, since the 1970’s, flood control has been the only purpose since the dam was deemed unsafe to hold water. In December 1999, the State Division of Safe Operation of Dams (DSOD) certified Devil’s Gate Dam to be safe to hold water once again.

When it was originally constructed, the dam created a reservoir with approximately 4,601 acre-feet of active storage capacity. Records indicate that approximately 20% of inflowing sediment passes through the dam when the FAST method is used. But even with a program of regular sediment removal over the years, sediment accumulation in the basin has gradually reduced the active storage capacity of the reservoir. In 1998, the dam was rehabilitated to meet the seismic stability capacity requirements of the State Department of Water Resources, Division of Safe Operation of Dams. Subsurface fractures were filled with concrete. A large, heavy concrete abutment was added to the base of the dam and a new spillway with headworks was constructed at a lower elevation (lowered 13.5 feet, from elevation 1054 feet to elevation 1040.5) to allow flood water to pass safely. At this new elevation, the current active storage capacity is 1424-acre feet. With a normal rainfall season, this storage capacity could be filled three times during a winter season, depending on watershed drought conditions.

Downstream of the Devil’s Gate Dam, the Arroyo Seco flows through a short canyon section of natural channel and then emerges at the Brookside Golf Course where flows enter a concrete flood channel. The design capacity of this downstream channel is approximately 11,500 cfs for 500 linear feet. Then the channel size increases to accommodate the inflow from storm drains as the Arroyo Seco Channel continues south to the confluence of the Los Angeles River Channel. Devil’s Gate Dam is operated such that downstream flows do not exceed this design capacity.

Since 1934, natural channel migration in the HWP basin has been disturbed by spatially variable sediment management activities (sediment removal and mining/dumping activities) within the reservoir. Virtually all land within the reservoir basin has been altered, removed, or overturned by earth-moving equipment (Cotton/Beland/Associates, Inc. 1988). Historical photographs and topographic maps indicate that sediment management has occurred sporadically throughout the upper, middle, and lower basin areas. Thus, it is impossible to assess what aspects of channel migration are primarily fluvial in origin versus anthropogenically influenced.

It is apparent that the gross topography of the reservoir and bank protection along the perimeter of the reservoir has set some absolute limits to channel migration. Although the thalweg, or centerline of the stream, has more commonly been situated within the central portion of the reservoir, occasionally braids have extended into the broader region. In the upper half of the reservoir (upstream of percolation pond 13), Arroyo Seco is braided and has typically been contained within a 800-foot wide corridor within the past 65 years. Variations in migration of the active braided channel appear to be strongly linked to mining and water supply management. The widest active channel area (alongside ponds 6 through 9) coincides with an abandoned gravel pit apparent in the 1934 topographic map. Conversely, some time between 1942 and 1969, construction of the percolation ponds significantly encroached upon the active channel from the east along the present-day percolation ponds 10 through 13. In addition, the mining operators' expansion of processing, storage, and dumping significantly encroached upon the active channel from the west in the same reach of the channel.

2.5 SEDIMENT DELIVERY & MANAGEMENT[2]

Flooding and sediment transport processes in the San Gabriel Mountains are extremely episodic. During some years the Hahamongna Watershed Park could experience no significant flooding or sediment delivery. During other years the basin could experience several large flood events, each of which could deliver more sediment than the long-term annual average delivery of 145,200 cubic yards (90 acre-feet). For example, based on regional data we might expect a 50-year storm (as calculated using USGS stream-gauge data) to deliver approximately 1,300 acre-feet (2,097,333 cubic yards) of sediment to the basin, equivalent to more than 14 times the long-term average annual delivery.

Sediment management records from the LACDPW for the Devil's Gate Reservoir were used to calculate long-term average annual sediment delivery to HWP. The long-term average annual sediment delivery to the basin since the construction of the dam in 1920 is approximately 145,200 cubic yards. This is the best estimate of the amount of sediment that would have to be removed annually from HWP to maintain current storage capacity behind the dam. However the current capacity of the dam with the new spillway height is 1,424 acre-feet. LACDPW has stated the minimum capacity for flood safety is 1400 acre-feet (or two debris events). Therefore, at this time, the minimum capacity has been reached and sediment must be removed or moved to above the 1040.5 elevation.

[2] Excerpted from "Flood Hazard, Sediment Management, and Water Feature Analyses, Hahamongna Watershed Park, Pasadena, CA" prepared by Philip Williams & Associates in the Technical Reports of this Master Plan.

Sediment transport modeling and limited debris flow modeling were conducted for several flood events in the Hahamongna Watershed Park. Debris flow modeling assumes extreme concentrations of sediment in floodwater entering the basin such that the physical properties of the flow (e.g., fluid density) are actually significantly different from plain water. Sediment transport modeling assumes lower concentrations of sediment such that the flow essentially behaves like plain water. Both types of flow occur at the Hahamongna Watershed Park. Modeling results also showed that much of the sediment entering the park tends to deposit in one of two locations: (1) adjacent to spreading ponds 2 through 9, or (2) adjacent to the dam. The precise limits of this debris zone are uncertain.

Debris flow from the mouth of the Arroyo Seco Canyon photographed the summer of 1969

Since the construction of the Devil's Gate Dam, LACDPW has actively excavated sediment from the reservoir area upstream of the dam. During the summer of 1994, LACDPW excavated and removed 250,000 cubic yards of sediment. A pond has existed in this area since. Around the pond and north of it where material was excavated, willows have grown. In the seven years since this sediment removal operation, some of these willows are now thirty feet tall.

After the removal of the sand and gravel operations, LACDPW proposed a complete re-grading of the flood basin, i.e., all those areas within the 1075 elevation easement with the exception of Oak Grove Park, MWD property, and the spreading basins, to improve flood capacity and management of the sediment inflow. In practice, sediment has not been removed on a regularly scheduled basis but on an as-needed, as-funded basis. Additionally, the sediment removal sites have been those with minor associated permitting issues. The amount of sediment removed over the years was less than the amount of sediment deposited in the basin. This accounts for the overall decline in active storage capacity of the reservoir.

2.6 WATER CONSERVATION

Hahamongna Watershed Park is situated over part of an unconfined groundwater aquifer known as the Monk Hill Basin. Together, the Pasadena sub-area aquifer and the Monk Hill Basin make up a larger unconfined aquifer called the Raymond Basin. The Raymond Basin aquifer is approximately 40 square miles in area and underlies much of the City of Pasadena. Average groundwater elevations in the vicinity of HWP are between 900 feet and 1,000 feet with significant seasonal fluctuations.

The first groundwater wells were drilled in the Raymond Basin in 1881. Water from these early wells was used for irrigated agriculture and for the municipal water supply. Beginning in 1891, the Pasadena Lake Vineyard Land and Water Company constructed several underground tunnels in the Hahamongna Watershed Park area that provided a significant amount of water which was sold to the City of Pasadena for the municipal water supply. In 1912, the City of Pasadena Water Department was formed that incorporated the Pasadena Lake Vineyard Land and Water Company along with the Devil’s Gate tunnel network. Between 1913 and 1919, the tunnels yielded an average of 3,400 acre-feet of water per year (flowing an average of 4.7cfs).

Devil’s Gate Dam was constructed for the joint purpose of increasing the water supply through the City’s tunnels and providing flood control. In the dry years between 1920 and 1928, the tunnels yielded an average of 2,300 acre-feet of water per year. After 1929, the water yield steadily declined until 1938 when a large flood and debris event rendered the water percolating into the tunnels nonpotable due to changes in the upper watershed. Today the water yielded by the tunnels is not being used.

The City of Pasadena actively diverts water from the Arroyo Seco and the Millard Canyon streams. The City of Pasadena has a historic right to divert up to 25cfs for the domestic water supply. The City maintains two diversion intakes upstream of the JPL Bridge. An upgrade to the intake at Millard stream was recently completed. In decades past, diverted water was routed to the Behner Treatment Plant (near the northeastern end of the Hahamongna Basin), treated, and then received directly into the municipal water supply system. During this period, Los Angeles County Department of Public Works (LACDPW) operated a series of spreading basins along the east side of the park, used to recharge the over-pumped alluvial aquifer of the Raymond Basin. These basins are called the Arroyo Seco Spreading Grounds and historically received water when flow in the Arroyo Seco exceeded the City's 25cfs diversion right. LACDPW historically would divert as much as 75cfs with the use of a breakaway dam located south of the JPL Bridge and north of the spreading basins. With the advent of more stringent water quality standards, the City's direct diversions to the municipal water supply system were discontinued. As a result, the City began diverting water into the spreading basins operated by LACDPW.

Since 1998, the City has taken over management, including the operations and maintenance of the Arroyo Seco Spreading Grounds from LACDPW and continues to use its 25cfs diversion right to route water through the spreading basins. The spreading basins utilize a total area of approximately 24 acres with a maximum water surface area of 13.1 acres. The 14 basins are identified by number in ascending order beginning with basin no.1 at the north. Total capacity of the ponds is approximately 30 acre-feet, with an estimated average percolation rate of 18cfs. This is equivalent to approximately 1.2 cfs per wetted acre. The City of Pasadena receives groundwater pumping credit equal to approximately 60% of their diversion by percolating water in this way.

Groundwater pumping and percolation in the Raymond Basin (an adjudicated groundwater basin) is overseen by the Raymond Basin Management Board (RBMB), comprising a sixteen- member board of various water purveyors including the City of Pasadena. The City of Pasadena operates the 13.1 surface acres of spreading for the Raymond Basin Management Board. The City currently obtains approximately 40% to 50% of their municipal water supply from groundwater pumping with most of the remaining municipal demand being met by water purchased from the Metropolitan Water District (MWD). One acre-foot of groundwater costs the City approximately $91 per acre-foot while MWD water costs the City approximately $431 per acre-foot.

Since groundwater is the City's most economical source of municipal water supply the City's Water and Power Department has the master planning objective of at least maintaining, and potentially expanding, the amount of groundwater recharge credit they receive from percolation in the Hahamongna Watershed Park. The City's maximum goal would be to expand percolation capacity in the park to accommodate a diversion of 32cfs. This increased diversion would include a purchased water right of 6.9cfs from the Lincoln Avenue Water Company. A more moderate goal for the City would be to expand spreading capacity to handle the 25cfs diversion right it currently owns. The City's minimum requirement is that a spreading capacity of 18cfs be maintained.

Operation of the Spreading Basins

The accumulation of fine sediment particles in the percolation ponds tends to reduce percolation rates over time. Measures are taken to prevent this such as not diverting water during high-sediment transport flood events. Furthermore, the basins are cleaned and scarified annually to remove fine sediment and restore hydraulic conductivity of the soils. To carry out maintenance, access to each of the basins is required.

Each successive basin steps down following the descending elevation toward the dam. This progression of descending steps results in a 4-foot drop in elevation from the floor of each basin. The controlling weirs between each basin allow for a maximum depth of water of 4 feet.

At the present time, spreading basin nos. 13 and 14 are not in operation. Spreading basin nos. 13 and 14 were found to not percolate well due to the thick layer of accumulated fines at the floor of each pond. Therefore, basin no. 13 was converted to an overflow basin. When excessive water is diverted through basins 1 through 12, the excess overflows into basin no. 13, which has an outlet into the Arroyo Seco channel. Spreading basin no. 14 is the current site of Johnson Field, a softball field constructed by the employees of the City of Pasadena Water & Power Department as a volunteer project.

Stream Flows

Should the combined flows of the Arroyo Seco stream and the Millard stream equal the amount allowed to be diverted, the City is not allowed to take that total amount which allows a percentage to flow in the existing riparian corridor toward the confluence of the Arroyo Seco and Millard streams. When the combined flows are greater than the City's right to divert (25cfs), then that which is not diverted flows toward the dam. When flows are small, they will percolate before reaching the dam. When flows are greater, a percentage will still percolate in its path toward the dam, but as the flow increases a greater amount will reach the dam. In the last 30 years, LACDPW has allowed these flows to pass through the dam. This practice has also allowed vegetation to establish itself along the course of the flow and below the 1040.5 elevation of the spillway floor. During high-sediment-transport flood events, water is not diverted and the flow races toward the dam. If the incoming flow to the basin is greater than what is passing through the dam, then a pool will form. As this flow reaches the pool and slows, the suspended particles of sediment will be deposited. In time, the sediment builds up and, if not removed, could cover any existing vegetation. This is currently the case behind the dam. Once vegetation is allowed to establish in this area, sediment removal operations are impeded.

Since the capacity of the basin is limited by the excessive amount of sediment currently present, LACDPW has typically allowed the pool that accumulates behind the dam to drain as quickly as possible through the dam in order to be ready for any oncoming large storm event.

Prior to the dam being declared unsafe to hold water and when LACDPW allowed water to accumulate behind the dam, it was observed to be ineffective for percolation due to the continual buildup of excessive fines in this highly sediment-laden area of the basin. For this reason LACDPW has considered plans to pump water from an accumulated pool behind the dam, via a pump back system, to the spreading basins within this basin and/or divert water to the Eaton Canyon spreading basins in east Pasadena to comply with the County's mandate for water conservation.

The streams flowing into the basin are intermittent and not perennial. Water in the streams varies depending upon the winter season. Flows can stop as early as late spring or could flow into the midsummer months but never year-round except for very minor urban runoff flows that enter the basin through storm drains.

2.7 UTILITIES

The utility infrastructure within the master plan study area includes storm drains, water mains, water wells, overhead power and communications lines, natural gas, and sewage management systems.

The following section reviews utility locations and ownership, and identifies associated issues pertaining to the utility.

STORM DRAINS

Field studies were conducted by the Pasadena Water and Power Department in May of 1996. The study identified storm drains discharging into the Hahamongna Watershed Park basin. The 23 identified storm drains originate primarily in the residential neighborhoods of Altadena and La Cañada Flintridge, and in the Jet Propulsion Laboratory. Storm water from the MWD property, and the portion of Oak Grove Drive to the west, collects as surface flow entering HWP at three locations on the southern boundary of the MWD property. There are no industrial-zoned areas draining into the basin.

Field studies undertaken as part of the Master Plan process assessed the condition of these drains. Many of the storm drains entering the basin are old and will require rehabilitation or repair to assure adequate storm runoff control. The existing configurations of a number of the storm drains have created downstream problems within the basin. Exhibit 2-6, Storm Drains, locates the outfalls of these drains. A description of each drain follows:

Altadena Storm Drain No. 1

The Altadena Drain (P-175) is a 7' square, concrete box culvert located west of the Los Angeles Flood Control District headworks and breakaway dam. It drains the foothill area of the San Gabriel Mountains south of Millard Canyon, north of Loma Alta Drive, and west of Las Flores Canyon in Altadena. Due to the length of the culvert undermining has occurred and a number of repairs have been attempted. Since the breakaway dam has been abandoned, the holes in the top of the culvert with slide gate barriers are no longer needed. Heavy runoff coming from this drain causes erosion on the downstream embankment during winter wet weather flow conditions.

Altacrest Storm Drain No. 2

The Altacrest Drain consists of two 40" diameter reinforced concrete pipes located high on the basin slope east of spreading basin no.1. One exits above the Gabrielino Trail and flows down-slope to and under the trail. The second pipe exits below the trail. The flows merge and continue down-slope to the eastern edge of the JPL parking lot. The drainage pattern follows the edge of the parking lot to its south end, crossing the access road just north of the Arroyo Well and entering spreading basin no. 5. These two lines drain the residential area north of Altadena Drive and south of Loma Alta Drive.

Mariposa Street Storm Drain No. 3

Storm drain no. 3 was not part of the 1996 study. A 30" corrugated metal pipe receives the flow from the end of Mariposa Street and carries it to the slope below the Gabrielino Trail. Flows from the residential area south of Mariposa Street enter another 30" pipe at the eastern edge of the Gabrielino Trail, crossing under and exiting down the slope to the west. Both flows join midslope and continue down to the JPL access road north of the Arroyo Well. This flow joins the flow from the Altacrest Drain, crossing the access road and entering spreading basin no. 5.

Sterling Place Storm Drain No. 4

Water collected from the residential area along the top of the slope, west and north of Sterling Place, enters a 30" corrugated metal pipe at the eastern edge of the Gabrielino Trail and exits west below the trail. The flow continues down the slope to the edge of the JPL access road, where it flows north to join the flows from the Altacrest and Mariposa drains and crosses the road to spreading basin no. 5. Storm run-off from drains 2, 3, and 4 along with surface runoff from the 9.6-acre JPL parking lot periodically floods the JPL access road at this crossing.

Ventura Street Storm Drain No. 5

This 42" concrete storm drain takes in water from Ventura Street and outlying areas. It discharges the water west of spreading basins no. 10 and no. 11 directly into the Arroyo Seco.

Lehigh Street Storm Drain No. 6

This storm drain is a 20" corrugated metal pipe that empties at the base of the slope just south of the Johnson Field restrooms alongside the access road. The outfall may need to be extended past spreading basin no. 13 to avoid erosion damage to the access road and ball field.

City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-6

STORM DRAIN OUTFALLS

*Not included in Watershed Sanitary Study, 1996

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Kent Street Storm Drain No. 7

This storm drain is a 20" steel line that conveys storm water from the residential area of Kent St. and discharges at the base of the slope directly into the Arroyo Seco.

Shelly Street Storm Drain No. 8

This storm drain is a 20" corrugated metal pipe that conveys storm water from the residential area of Shelly St. and discharges east of the dirt access road along the perimeter of the Arroyo Seco.

West Altadena Storm Drain No. 9

The West Altadena Storm Drain is a 5' diameter concrete drain located at the base of the eastside service road leading into the water conservation pool. The drainage area is north of Figueroa Drive and west of Marengo Avenue in Altadena. The outfall for this storm drain is located at approximately elevation 1008, below the height of the dam spillway floor (elevation 1040.5). When floodwater crests at the spillway, significant backflow and trash buildup in the storm drain occur.

Oak Grove No. 9A

This storm drain was not part of the 1996 study. The drain line runs along Oak Grove Drive near the dam and takes storm water from the street to the old access road of the dam. An open gutter runs down the center of the access road past the dam keeper’s house, collecting storm water runoff from La Cañada-Verdugo Road and the discharge from the drain line; it carries the flow along the downstream side of Devil’s Gate Dam and into the spillway. When La Cañada-Verdugo Road is closed (see Section 3, Recommendations), it may be necessary to collect the storm runoff in a catch basin and transport the flow via buried pipeline to the spillway.

Flint Canyon Channel Wash No. 10

A system of storm drains and channels throughout La Cañada-Flintridge enter the Flint Canyon Channel. This channel discharges into Flint Wash near the Berkshire Place over-crossing, just outside the City of Pasadena. Flint Wash enters the basin at the extreme southwest corner of HWP under the Foothill Freeway and Oak Grove Drive, just west of Devil’s Gate Dam.

Oak Drive Storm Drain No. 11 at the Equestrian Staging Area

This 18″ corrugated metal pipe discharges storm water at the southwest corner of the equestrian staging parking area. The flow then travels down a natural earthen channel to the park road, toward Flint Wash. This flow and storm water from the western roadway approach to Flint Wash enter an 18″ corrugated metal pipe, which crosses under the road and then enters the basin.

Berkshire Place Storm Drain No. 12

The Berkshire Drain is a 5' concrete drain emptying into the Oak Grove area west of the service road that runs south of the Oak Grove Maintenance Office. The drain crosses under the service road as a 30" concrete drain. It drains a portion of the Foothill Freeway, Oak Grove Drive, Berkshire Place, the adjacent church parking lot and portions of the High School. The widening and realignment of Oak Grove Drive increased the number of drain inlets and surface area runoff resulting in excessive damage to conditions downstream of the outfall. This outfall location can be extended downstream and damage repaired.

Foothill Boulevard Storm Drain No. 13 at Oak Grove Drive

The Foothill Drain is a 24" concrete drain located on the upper slope west of the Oak Grove field, just below the entry road leading to the lower Oak Grove area. The line drains areas west of Oak Grove Drive, east of Daleridge Road, south of Rupert Lane and north of Foothill Boulevard in La Cañada-Flintridge. The widening and realignment of Oak Grove Drive increased the number of drain inlets and surface area runoff, resulting in extensive erosion damage to conditions downstream of the outfall. This storm drain should be extended down-slope to prevent erosion damage and enhance the riparian corridor associated with the storm water runoff.

JPL Trunk Line No. 14

Trunk Line no. 14 is a 24" concrete drain that daylights on the western slope of the basin, south of the JPL west parking lot. It collects surface runoff from the southeast corner of the JPL campus. There are an insufficient number of drain inlets in the drainage area to transport runoff directly into basin. The west parking lot drains toward the southeast directly into HWP. This storm drain may need to be enlarged and a catch basin installed in the parking lot to mitigate the runoff. Construction of the proposed westside spreading basins (see Section 3, Recommendations) will necessitate the extension of this drain line.

JPL Trunk Line Nos. 15 - 18

The 48" concrete line collects surface runoff from the northwest side of the basin. These drains collect water from the residential areas west of JPL and inside the JPL campus. The flows are discharged towards the southeast directly into the basin.

JPL Trunk Line Nos. 19 - 23

These 24" concrete lines collect surface runoff from the northern corner of the JPL campus and surface waters from the eastern side of the JPL campus, just south of the JPL Bridge, and transport runoff directly into the basin.

WATER WELLS & MONITORING FACILITIES

The City of Pasadena owns and operates three wells in HWP: The Arroyo Well, Well 52, and the Ventura Well. Pasadena Water & Power has taken the Arroyo Well offline due to the presence of perchlorate. With the installation of new water treatment technology this well can be brought back online.

JPL has set up a series of monitoring test wells throughout the basin, on its campus, and in the western residential areas of Altadena to track contaminants in the groundwater. Exhibit 2-7, Wells, indicates the location of the many test wells in the vicinity of HWP.

WATER MAINS

There are several water lines in the basin area that either cross the basin or run parallel to it. Three water lines owned by the City of Pasadena run along the east side of the basin. The first line is a 16" steel water main that leads from the Mountain View Reservoir to the VOC Water Treatment Plant midpoint along the east access road; see Exhibit 2-8, Water Mains.

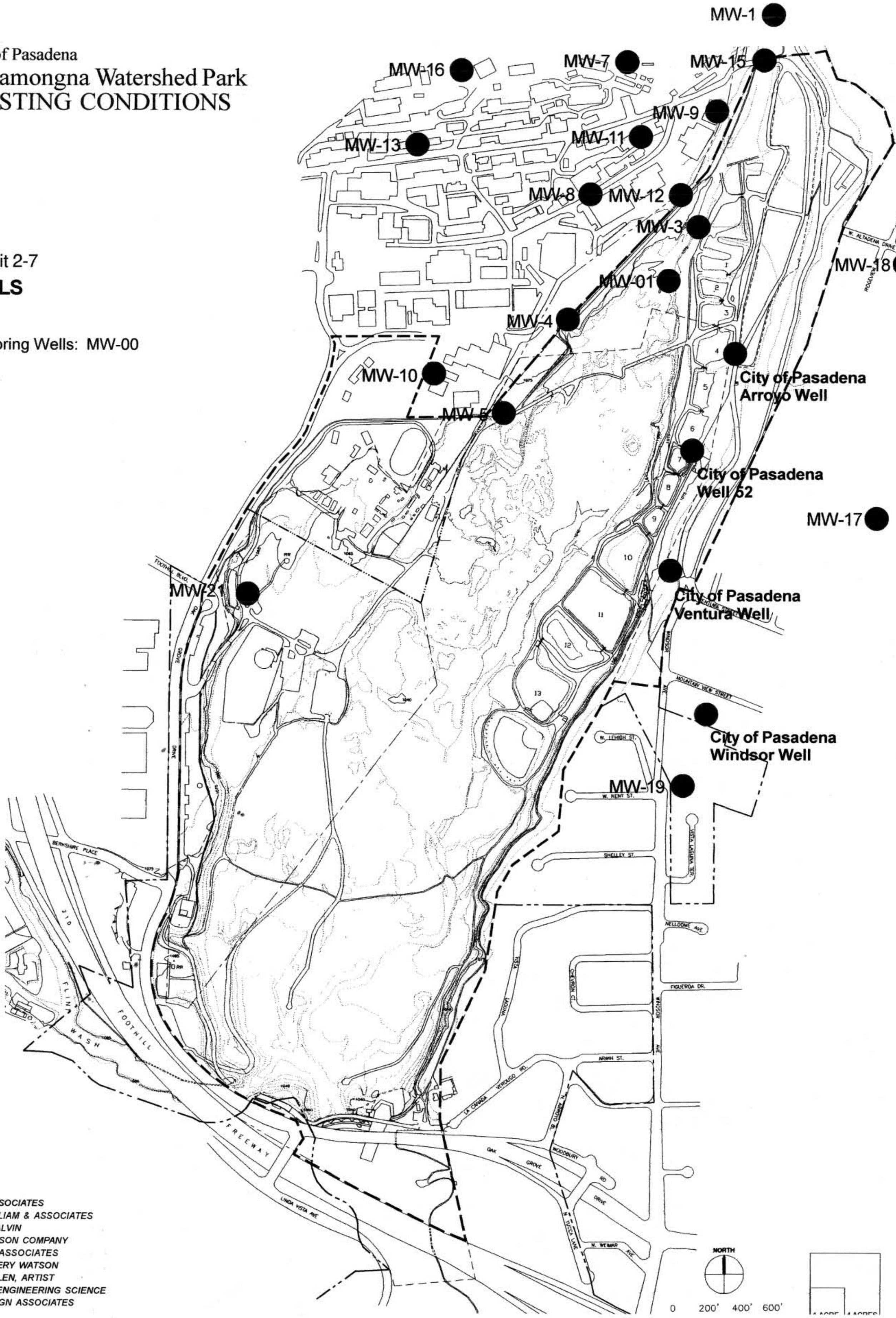
The second water line is the 30" Hume water line that brings water from the Arroyo Seco stream diversion facility to the Mountain View reservoir. From this line there are taps to divert the water where it is needed, such as the 16" steel Behner bypass line used for recharging the spreading basins, starting at spreading basin no.1.

The third water line crossing the basin area is a 12" galvanized steel standard screw end pipeline known as the Calaveras Line. This water line enters the basin from the east at Kent Street, and runs down the slope of the basin to a pressure release valve at the base of the slope. At this point the water line is split up to run along the eastside of the basin and due west towards Foothill Boulevard where the water is used in the westside of HWP and leaseholders within the MWD property. The leaseholders who use this water are the U.S. Department of Forestry, the Rose Bowl Riders, and Tom Sawyer Camp. The section of line that runs along the eastside of HWP north to the JPL Bridge supplies the existing restroom, water and irrigation systems, and a small number of 1.5" fire hydrants.

City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-7
WELLS

Monitoring Wells: MW-00



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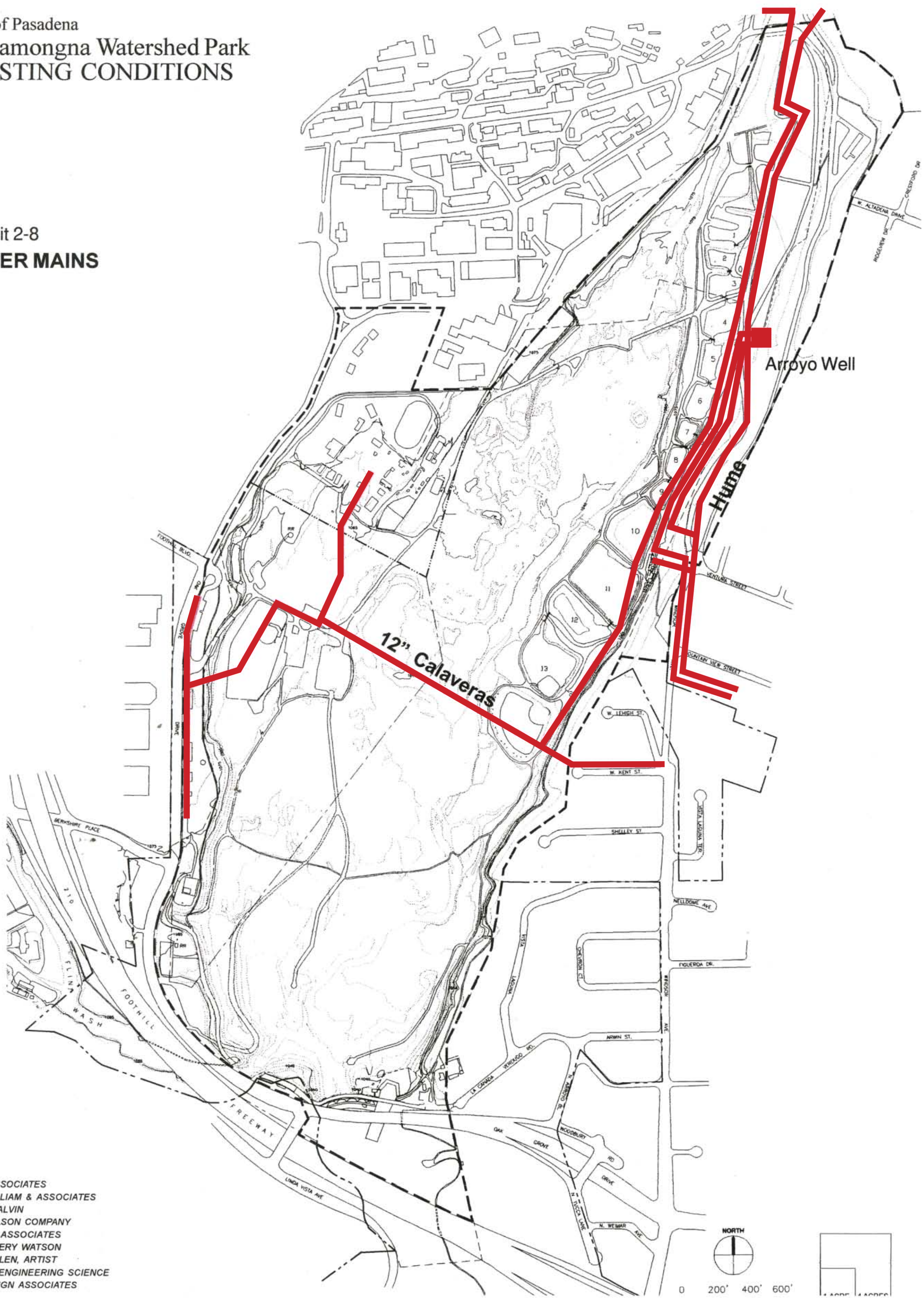
City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-8
WATER MAINS



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OVERHEAD POWER & COMMUNICATION LINES

Overhead power lines in the HWP area include Southern California Edison (SCE) and the Pasadena Water & Power Department (PWP). In some cases, the power poles in the basin are utilized by the General Telephone Company, now Verizon, and the local cable companies. The main power lines for transmission in the basin area belong to SCE. These lines follow the toe of the western slope, run the length of the basin from south to north and feed into and from JPL's main substation.

Some distribution lines in the basin belong to PWP and other distribution by SCE emanates from the JPL main substation, see Exhibit 2-9, Overhead Transmission Lines. SCE distribution to the west is at Foothill Boulevard and Berkshire Place; to the east the distribution is at Devil's Gate Dam, across the basin in line with Altadena drive and diagonally across the basin to Ventura Street. The PWP lines originate at Windsor/Ventura on the eastside of the basin and head west down the eastern slope; one line crosses the basin to the west and distributes power to the park and the MWD property and includes fiber optics to JPL. The other line heads north to the Arroyo well and south to Johnson field. The SCE north/south transmission and distribution lines, from Flint Wash to the lower Oak Grove parking area, have been inaccessible due to inundation during recent floods. PWP's power lines feed north on the Gabrielino Trail road from the intersection of Windsor Avenue and Ventura Street to the Behner Treatment Plant and JPL's east parking lot where JPL has erected lighting and communication overhead lines around the perimeter.

Along with the power lines there are communication lines which have been installed underground starting at Devil's Gate Dam. These lines travel along the east side of Oak Grove Drive to the JPL campus.

NATURAL GAS

A 12" high-pressure natural gas line, owned by the Southern California Gas Company is buried from three to eight feet deep and traverses the basin underground from Kent Street to Foothill Boulevard; see Exhibit 2-10. The gas flow for the line is bi-directional but predominately from the Pasadena side (East) to Chatsworth (West). Existing drawings indicate that the 12" line is very near the 12" galvanized Calaveras water line. Due to this close proximity it may be prudent to have this gas line evaluated for corrosion mitigation.

There is also a natural gas line leading from west end of La Cañada-Verdugo Road that supplies gas to the dam keeper's house and facilities. In Oak Grove, near the intersection of Oak Grove Drive and Berkshire Place, there is a natural gas line that runs north to south along Oak Grove Drive. This line connects to various structures requiring gas service such as the park maintenance building.

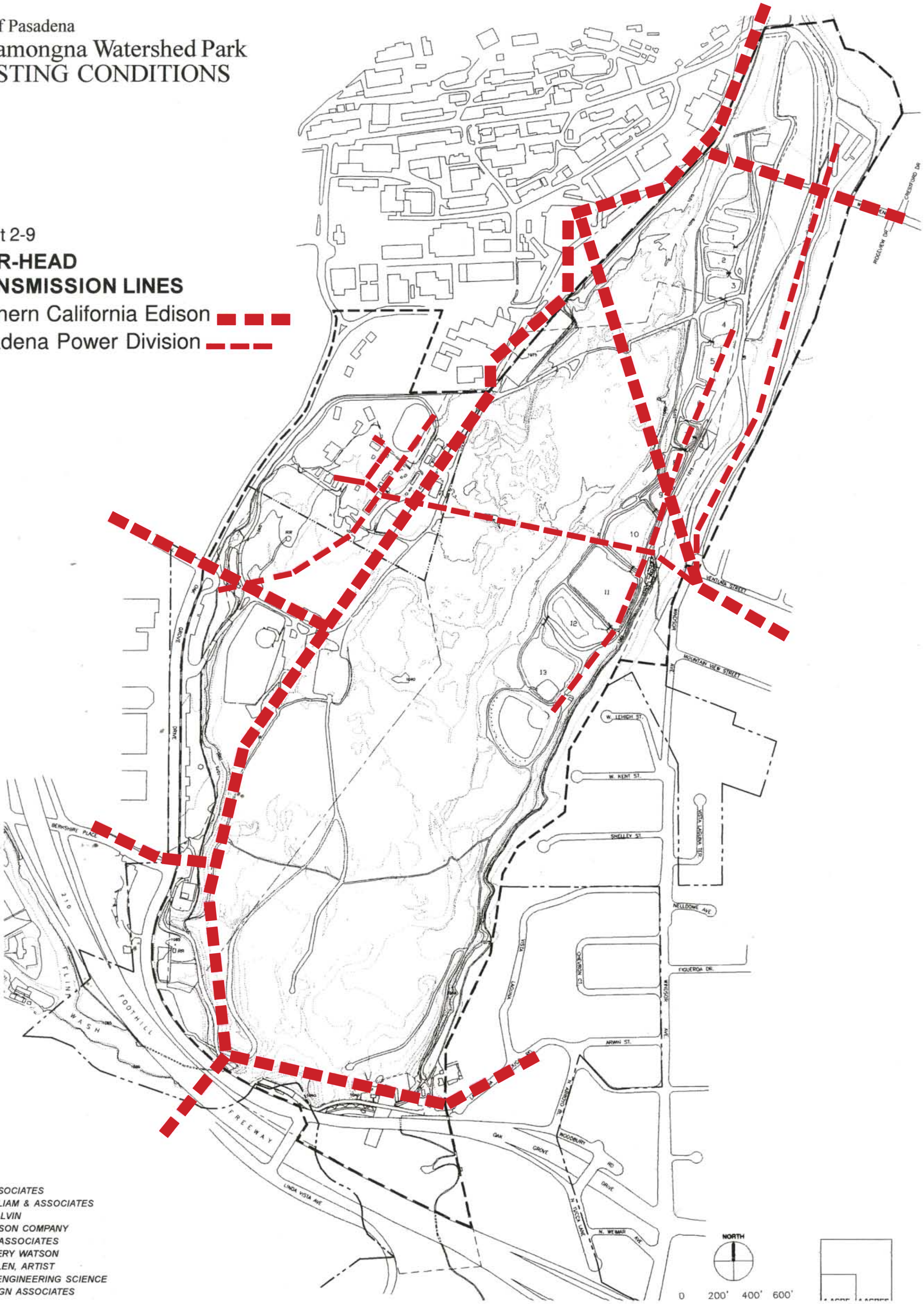
City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-9

OVER-HEAD TRANSMISSION LINES

Southern California Edison

Pasadena Power Division



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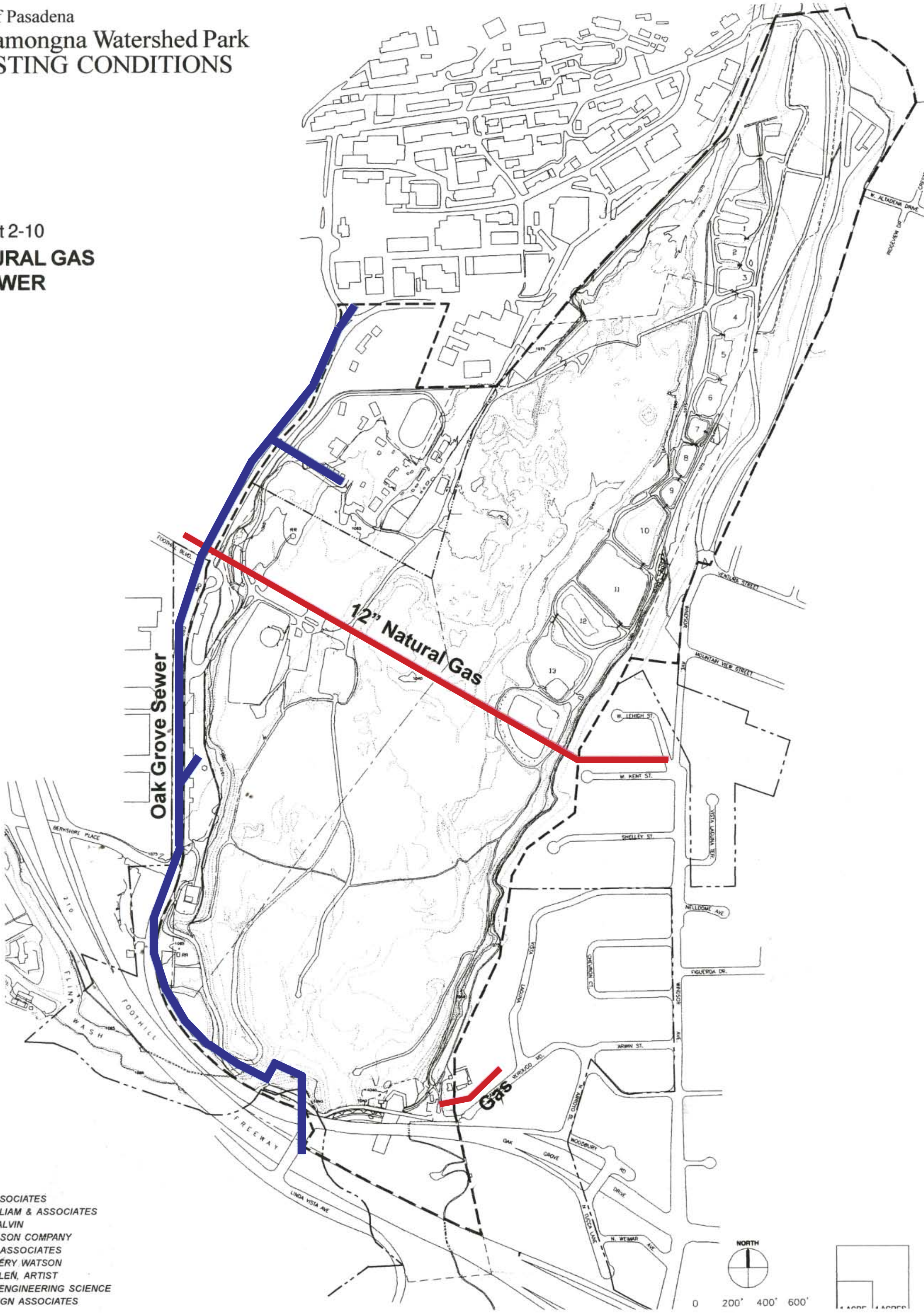
City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS

Exhibit 2-10

NATURAL GAS & SEWER



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SEWAGE MANAGEMENT SYSTEMS

The only major sewer system that runs near HWP is the Oak Grove Drive sewer main. This line starts from JPL and makes it way south toward Devil's Gate Dam along Oak Grove Drive where the line is mounted directly on the bridge crossing at Flint Wash. Just west of the dam, the line heads south, crosses the Foothill Freeway and continues south towards the Central Arroyo. The sewer has capacity for La Cañada-Flintridge as well as JPL. A recently completed sewer main was installed by the City of La Cañada-Flintridge on Foothill Boulevard which connects to the Oak Grove Drive line at this intersection. The line then continues south where it connects to the Pasadena system near the Rose Bowl, which is being repaired to be turned over to the Los Angeles County Sewer District (LACSD) system.

The upper Oak Grove restroom gravity-feeds to the main trunk line in Oak Grove Drive. The remaining three restrooms in the Oak Grove area utilize septic systems (the Equestrian Staging Area, the Oak Grove maintenance yard and the lower Oak Grove). In the area of Devil's Gate Dam, the LACDPW's facility and the Pasadena Arroyo Seco Resource Center have septic systems. On the eastside of the basin, the restroom at Johnson field has a septic system.

On the MWD property, all of the restrooms in the U.S. Forest Service area are connected by a gravity sewer system. Sewage is collected at a sewer lift station and pumped through a force main discharging into the nearby Oak Grove sewer main. In the Rose Bowl Riders and Tom Sawyer Camp areas the restrooms have septic systems.

2.8 CIRCULATION

CIRCULATION AND VEHICULAR ACCESS

The regional connections to HWP are from the Foothill Freeway (210) with access from the Berkshire Place and the Foothill Boulevard exits on the west and the Windsor Avenue exit on the east. The arterial connections which service HWP include Oak Grove Drive and Foothill Boulevard on the west and Oak Grove Drive (Woodbury Road), Windsor Avenue, and Ventura Street on the east.

Arterial traffic near HWP is heavy during the early morning due to the simultaneous arrivals of JPL commuters and La Cañada High School students. Because the high school includes grades 7 through 12, drop-off traffic is as much an issue as the need for student parking in the area. Complaints from La Cañada residents north of the high school resulted in those residential streets being closed to student parking. This, coupled with inadequate parking at the high school as well as the close proximity of the park to JPL, has created a great parking demand in the upper Oak Grove parking areas. During a recent construction project at the school, students were permitted to use the upper Oak Grove parking areas.

As part of the 1992 Preliminary Plan for HWP, a traffic impact analysis was prepared.[3] Four intersections identified by the City of Pasadena Department of Public Works were studied. They included:

- Oak Grove Drive at Foothill Boulevard
- Oak Grove Drive at Berkshire Place
- Oak Grove Drive at Linda Vista Avenue
- Oak Grove Drive (Woodbury Road) at Windsor Avenue

In 1992, all four intersections were operating at an acceptable level of service (service level D or better) during the weekday morning and evening peak hours. Only the intersection at Oak Grove and Berkshire Drive had moderate congestion (service level D) during the weekday evening peak hour.

The City of Pasadena's Department of Public Works reported that the historic vehicular traffic growth in the area was at most 1.0 percent. The 1992 Traffic Impact Study developed a baseline projection assuming a 1.06 percent growth rate that indicated that by 1998 the intersection at Oak Grove Drive and Berkshire Place would be approaching an unacceptable level of congestion if there was no development of HWP.

The West entrance currently serves as the primary park entrance to HWP. The west entrance also provides access to some of the MWD lessors (USFS and Rose Bowl Riders with Tom Sawyer Camp). The roads and trails within this property were all originally a part of the Oak Grove Park but no longer provide public access or emergency access to the northwest portion of Hahamongna Watershed Park. The Los Angeles County Fire Camp #2 leases the northeast corner of the MWD property, but access to the site is through the JPL service road bordering their facility.

The east entrance at the intersection of Windsor Avenue and Ventura Avenue provides access to the east JPL leased parking lot, City and County maintenance vehicles and occasional users of Johnson Field. The 1992 Traffic Impact Report for the Preliminary Plan identified this intersection as confusing and dangerous. It was recommended that a further investigation of the intersection was necessary particularly if facilities were developed on the east side of HWP that would attract park users unfamiliar with the intersection.

EMERGENCY AND MAINTENANCE VEHICLE ACCESS

On the west side, emergency and maintenance vehicle access is at the main entrance at Oak Grove Drive/Foothill Blvd. Limited maintenance access to Oak Grove Drive is provided by an unimproved road on the southwest portion of the park and west of Flint Wash. The road is used periodically to remove sediment from the basin for flood control purposes.

[3] Site Traffic Impact Analysis of the Proposed Devil's Gate Multi-Use Project, Barton-Ashman Associates, Inc. May 19, 1992.

On the east side emergency and maintenance vehicle access is at the Windsor Avenue and Ventura Street entrance. Limited access to the Devil's Gate Dam facility is provided at the terminus of La Cañada-Verdugo Road.

Emergency and maintenance vehicle access to the flood basin on the westside is via a north/south unimproved road, just east of the Oak Grove park area, which is accessible by its connection to the upper Oak Grove paved road at the south and in the middle, just east of the lower Oak Grove parking area. Emergency and maintenance vehicle access to the eastside of the flood basin is via a north/south road accessible at the southeast end of the Devil's Gate Dam facility and at the middle in the vicinity of the easterly JPL parking lot though the entrance at Windsor/Ventura.

Connections between the east and west sides require leaving and re-entering the park causing lost response time and inefficient maintenance routines. The lack of bridge crossings over Flint Wash and the upper portion of the site precludes an all-weather perimeter access road. The operation of heavy machinery and large trucks and unauthorized parking on La Cañada-Verdugo Road has affected the neighborhood adversely and raised the concerns of the neighbors.

BICYCLE ROUTES

An existing Class II bicycle lane on Oak Grove Drive to Berkshire Place links Foothill Blvd. to Arroyo Boulevard. This route continues south on Arroyo Boulevard providing street access to the Central and Lower Arroyo. The Gabrielino Trail provides mountain bikers access to the steeper terrain in the Angeles National Forest. Street connections to the start of the Gabrielino Trail are Windsor Drive to the south and Ventura Street from the east. Neither of these streets is within Pasadena city limits.

In 2000, the City of Pasadena completed its first Citywide Bicycle Master Plan. The primary focus of the plan was to make the city streets more "bicycle friendly." Issues pertaining to recreational bicycle riding within City parkland were not addressed with the exception of the Rose Bowl loop. At the present time, bicycles are permitted on existing paved surfaces within HWP.

TRAILS

Regional Trails

The regional trail system is illustrated in Exhibit 2-11, Regional Trail Plan. Trail connections in HWP are part of the Rim of the Valley Trail Corridor that circles the San Fernando and La Crescenta valleys. Trail connections south through the Arroyo Seco link to the Los

Angeles River Trail System thus establishing links to the Santa Monica Mountains and the

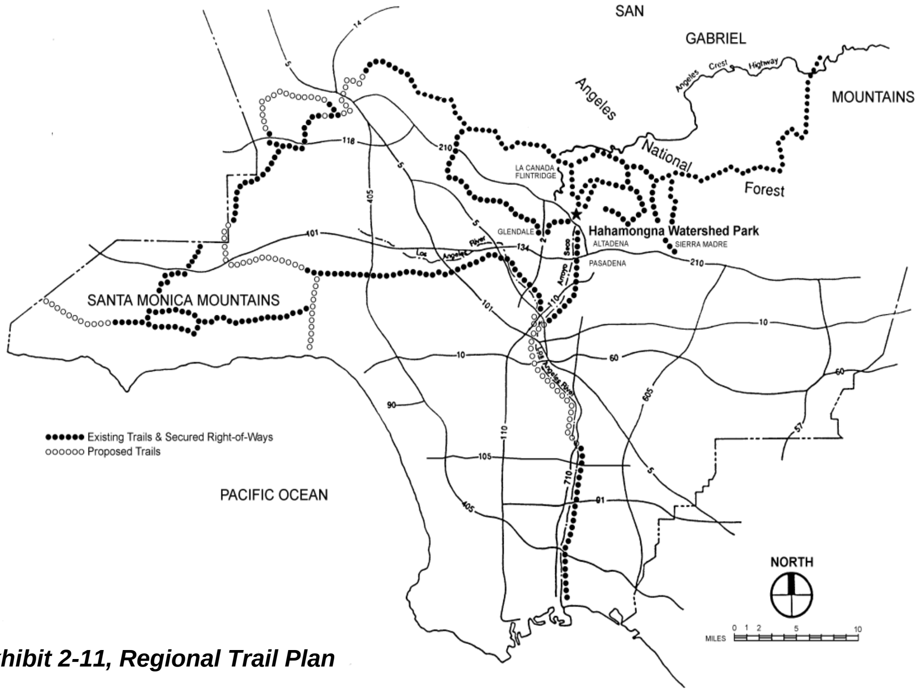


Exhibit 2-11, Regional Trail Plan

Pacific Ocean. Trail connections northward link to the network of trails in the Angeles National Forest including the Pacific Crest National Scenic Trail that extends the length of the State of California.

Hahamongna Watershed Park Trails

Exhibit 2-12 illustrates the existing trails in HWP. There are six trailhead connections to HWP that link the area with regional and local trails; they include:

- Gabrielino Trail
- Arroyo Seco Trail
- Gould Canyon Trail
- Flint Wash Trail
- Altadena Crest Trail
- Mountain View Trail

Gabrielino Trail: This regional trail begins at the intersection of Windsor Avenue and Ventura Street and connects northward to the trail system in the Angeles National Forest. The trail within HWP follows the east boundary of the park north of Ventura Street. The trail is designated by the US Forest Service as a multi-use trail for equestrians, hikers, and bicyclists.

Arroyo Seco Trail: Linking all three sections of the Arroyo Seco is the Arroyo Seco Trail. The Arroyo Seco Trail is a series of parallel trails on both sides of the arroyo. Typically the east and west trails merge in the transition from one section of the Arroyo Seco to the next. Within each section of the Arroyo Seco, the trails are given local names.

The Arroyo Seco Trail is part of the Rim of the Valley Trail Corridor. To the west through La Cañada-Flintridge, the Arroyo Seco Trail follows trails that are part of the Los Angeles County riding and hiking trails systems. The trail continues south from HWP through Central Arroyo via the east tunnel of the Devil's Gate Dam.

Connections north to the Pacific Crest Trail in the Angeles National Forest can be made using the Gabrielino Trail. The Arroyo Seco Trail within HWP is currently restricted for equestrian and hiking use only.

Gould Canyon Trail: This trail connects the La Cañada trails system through an access tunnel under Foothill Boulevard to the West Rim Trail.

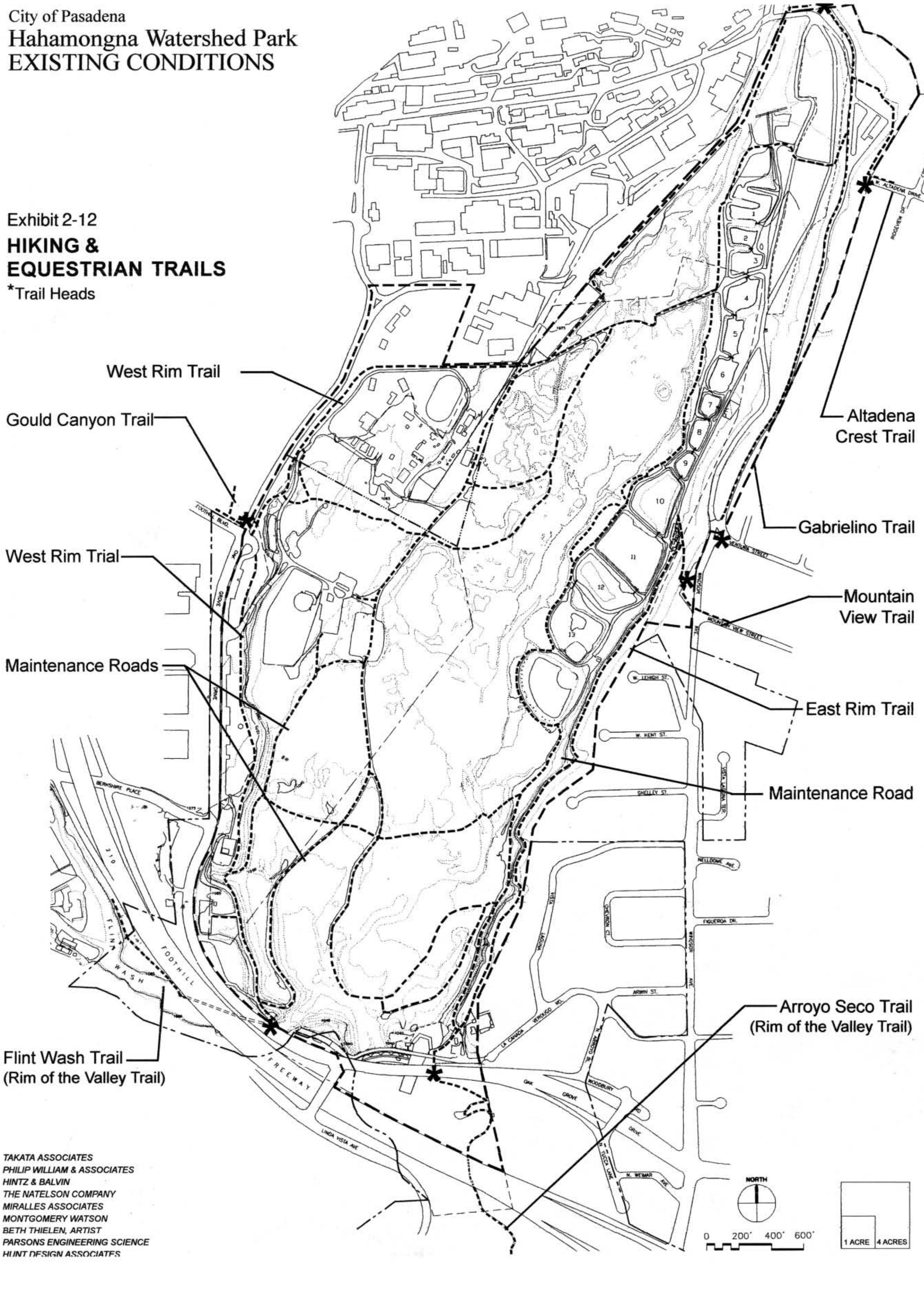
Flint Wash Trail: The Flint Wash trailhead is located in the southwest corner of HWP, starting at the confluence of Flint Wash and the HWP flood basin. The trail follows Flint Hiking & Equestrian Trails Wash under the 210 Freeway, connecting to the La Cañada trail system. This trail is part of the Rim of the Valley Trail.

Local trail access to the Altadena community is provided at the end of Altadena Drive and at the parking lot at the intersection of Windsor and Ventura. These trailhead connections lead to the Altadena Crest Trail and the Mountain View Trail.

Equestrians and hikers use a combination of trails and maintenance roads within HWP. All of these trails can be considered as part of the Arroyo Seco Trail. Internal to the park, trails exist along portions of the upper slope of the basin. The West Rim Trail leads north from the Flint Wash trailhead connection to the Equestrian Staging Area. Following the crest of the basin slope through the upper terrace picnic area, the trail continues north around the MWD property.

At the northeast corner of the MWD property, the trail connects to the Angeles National Forest along the eastern edge of the JPL campus. At the JPL Bridge, the trail slopes down to the river bed, passes under the bridge, fords the stream, and connects to the Gabrielino Trail.

From the Devil’s Gate Dam, the East Rim Trail follows the upper east crest of the basin slope northward to the VOC Water Treatment Plant. A linking trail connects the slope to the Windsor/Ventura Parking Lot and the Mountain View Trail.


City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS
Exhibit 2-12
HIKING &
EQUESTRIAN TRAILS
*Trail Heads
West Rim Trail
Gould Canyon Trail
West Rim Trial
Maintenance Roads
Flint Wash Trail
(Rim of the Valley Trail)
Altadena
Crest Trail
Gabrielino Trail
Mountain
View Trail
East Rim Trail
Maintenance Road
Arroyo Seco Trail
(Rim of the Valley Trail)
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MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCE
HUNT DESIGN ASSOCIATES
NORTH
0 200' 400' 600'
1 ACRE
4 ACRES

Segments of the maintenance roads along the bottoms of the slopes serve as trails. Trail connections running east-west in HWP are established on an ad hoc basis during the dry summer months. There is no east-west connection at Devil's Gate Dam due to the removal of the Flint Wash Bridge. No permanent all-weather east-west trails exist in HWP.

2.9 PARKING

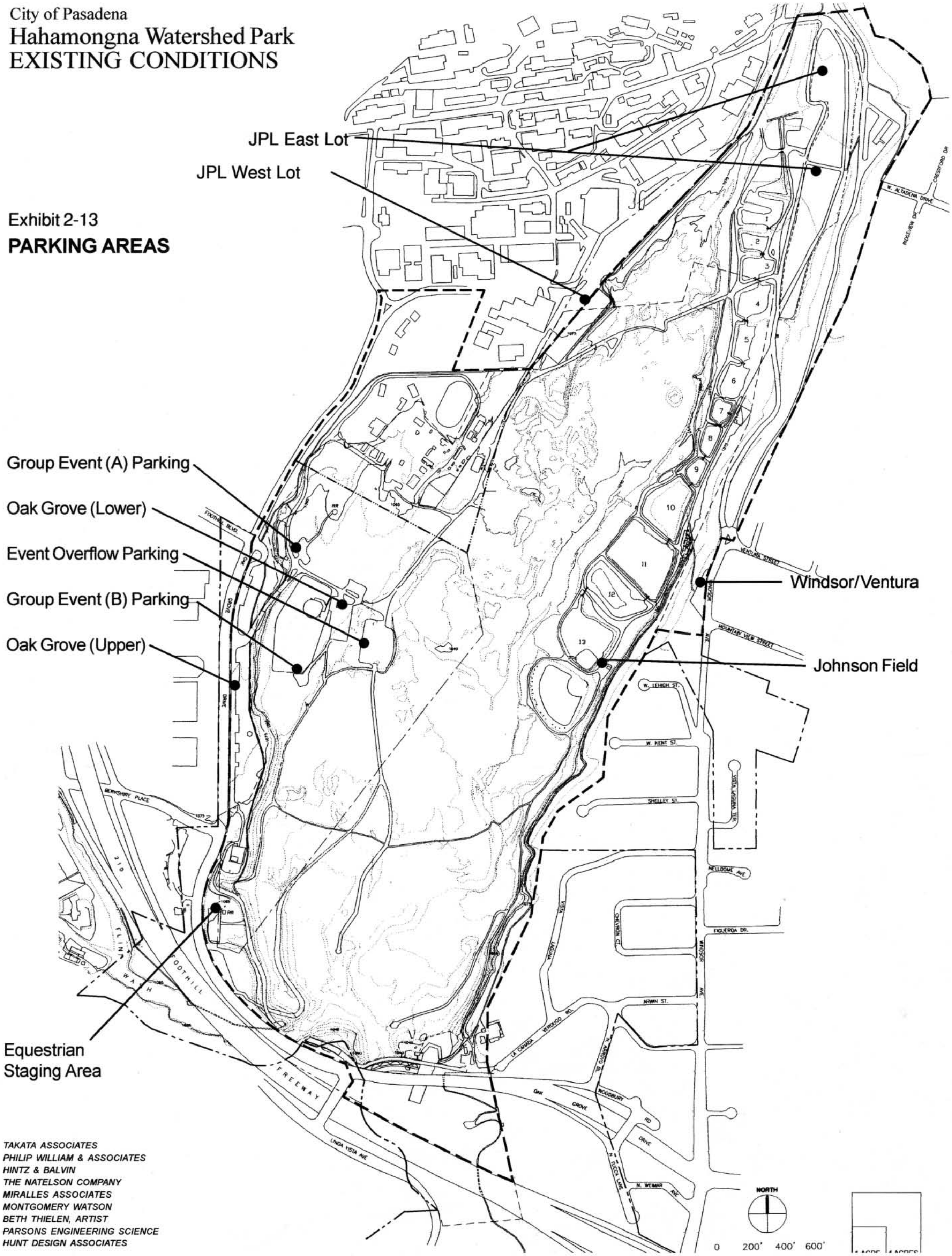
Parking for visitors presently exists at HWP in the Oak Grove area, on the east side near Johnson Field, and near the intersection of Windsor Avenue and Ventura Street.
The following table summarizes all the available parking in HWP:

SUMMARY OF EXISTING PARKING

		Park Visitor	*JPL Employee*
Westside	Oak Grove-upper	54 spaces	
	Oak Grove-lower	110 spaces	
	Equestrian Staging Area	50 spaces	
	JPL-west lot		214 spaces
	Group Event 'A'	30 spaces	
	Group Event 'B'	20 spaces	
	Event Overflow Parking	110 spaces	
Eastside	JPL-east lot		1,132 spaces
	Johnson Field	200 spaces	
	Ventura Lot	50 spaces	
Total Parking		***624 spaces***	***1,346 spaces***

Westside Parking: Visitor parking on the westside is in the Oak Grove area. Dispersed parking is provided along the access road for the upper terrace picnic areas. Below, a larger 110-space parking area services the main portion of Oak Grove (disc golf, picnic area, and multipurpose play area). Just south of the upper picnic area is the equestrian staging area parking lot. Exhibit 2-13, Parking Areas, illustrates the existing parking areas on the west side.

Eastside Parking: The park visitor parking on the eastside consists of a one-acre triangular parking lot for 50 spaces at the Windsor Avenue and Ventura Street. This parking area is primarily used by hikers and bicyclists traveling up the Gabrielino Trail to the upper watershed and the Angeles National Forest. Additionally, there is informal space dispersed along the roadside that can accommodate up to approximately 200 vehicles along the southern end of the eastside maintenance road going to Johnson Field. At the present time, there is no formal parking arrangement for visitors of Johnson Field; parking is considered "informal," meaning open dirt areas and shoulders of the road are used for parking.


City of Pasadena
Hahamongna Watershed Park
EXISTING CONDITIONS
Exhibit 2-13
PARKING AREAS
JPL East Lot
JPL West Lot
Group Event (A) Parking
Oak Grove (Lower)
Event Overflow Parking
Group Event (B) Parking
Oak Grove (Upper)
Equestrian Staging Area
Windsor/Ventura
Johnson Field
TAKATA ASSOCIATES
PHILIP WILLIAM & ASSOCIATES
HINTZ & BALVIN
THE NATELSON COMPANY
MIRALLES ASSOCIATES
MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCE
HUNT DESIGN ASSOCIATES
NORTH
0 200' 400' 600'

JPL PARKING

There are two City-owned parking lots, on the west and east sides of the park, currently leased by JPL for employee parking. The five-year lease generates $450,000 per year, which is used for the planning, maintenance, and operations of HWP. The lease will expire in 2004.

The 1.2-acre west parking lot provides 214 parking spaces. Access to the west parking lot is through JPL property. The east parking lot is 9.6 acres and provides 1,132 parking spaces. Access to the east parking lot is from the Windsor /Ventura entry. JPL has a shuttle service from the parking area to the campus.

Both parking lots are gated when not in use; however, the current lease allows shared parking of the two lots with advance communication and when not in use by JPL.

JPL is currently completing its "down-sizing" from 7,000 employees to 5,000 employees—a reduction of 20% of its work force. This process includes the closure of off-site JPL facilities and the relocation of those employees to the JPL campus. Therefore, JPL parking needs at HWP will equal or slightly increase from current conditions in the future.

2.10 EXISTING RECREATION

Existing recreation facilities are located on the west and east sides of HWP. The majority of these facilities are located in the Oak Grove area.

WESTSIDE (OAK GROVE)

The Oak Grove park facilities were developed in the early part of the 20^{th} Century by the City of Pasadena. In 1971, during the period (1968-1993) when Oak Grove was operated as a Los Angeles County regional park, the Los Angeles County Department of Parks and Recreation made extensive improvements to the park. Oak Grove has two activity levels on an upper and a lower terrace separated by a steep slope.

Upper Terrace

The upper terrace is adjacent to the internal roadway from the west entry at Foothill Boulevard south to the Flint Wash. Facilities include picnic facilities, restrooms, a maintenance building, and the equestrian staging area.

Picnic Facilities: The upper terrace is primarily devoted to individual picnic facilities under mature oak trees. Dispersed parking off the access road services the picnic areas.

Restroom: There is one restroom in the upper picnic area. The facility needs renovation and modifications to comply with disability standards (ADA).

Equestrian Staging Area: The equestrian staging area is located south of the picnic areas and the Oak Grove Maintenance Office. This area is open to the general public by permit only. Vehicle access is limited to a single lane around the maintenance office and over the Berkshire Drain. The staging area provides access to nearby trails, parking for cars and horse trailers, and a restroom. It is used for small group gatherings and by Tom Sawyer Camp as a venue for it younger campers. The restroom needs renovation and modifications to comply with disability standards (ADA).

Lower Terrace

The lower terrace is situated along the base of the western slope of the basin and extends from the MWD property to the group picnic areas south of the existing play field. The lower terrace includes facilities for passive and active recreation; the facilities include group picnicking, a play field, restrooms, and disc golf course.

Group Picnicking: Group picnic facilities are located south of the play field. The facilities include picnic benches, barbecue pits, and a drinking fountain.

Amphitheater: There is a small rustic amphitheater at the base of the slope near the group picnic area adjacent to the play field. The amphitheater is constructed with telephone pole seating and in need of renovation.

Oak Grove Field: This play field is used for baseball, large group activities for Tom Sawyer Camp, and special events such as the recent statewide Police Activities Games. The field is also used as a staging area for major disasters in coordination with the USFS and Los Angeles County Fire Department.

Restrooms: There were two restrooms on the lower terrace of Oak Grove Park. The restroom near the group picnic area was destroyed by fire and needs to be replaced. The other restroom is located to the north of the playing field in an area with four camp sinks that was formerly used for overnight group camping. The remaining restroom does not meet current disability standards (ADA) and needs rehabilitation.

Disc Golf: The 18-hole disc golf course at HWP is the nation's first disc golf course. Since its inception in early 1970, disc golf courses have been constructed all over the world. The course is quite popular and provides recreation for all ages.

The disc golf course is currently located on both the north and south ends of the lower terrace. The front nine follows the perimeter of the play field, picnic area, and parking area. The back nine is located in the oak grove of the north portion of the lower terrace. The back nine weaves in and out of the oak trees impacting the trees due to heavy use.

EASTSIDE RECREATION

Recreation facilities on the eastside of HWP are limited to Johnson Field. The field was constructed by the Department of Water and Power volunteers. It was used for informal softball games but is currently not available for public recreational usage. Facilities at this location include picnic tables, a barbecue pit, and a small restroom.

2.11 CULTURAL & ARCHAEOLOGICAL RESOURCES

ARCHAEOLOGICAL RESOURCES

In 1987, a Preliminary Assessment of the Prehistoric Cultural Resources of the Devil's Gate Reservoir [4] (HWP) was undertaken. A record search was conducted of archival materials and a physical inspection of the site was performed. The assessment reports that "no prehistoric sites were found to be located on the property."

The record search looked for existing survey reports and recorded sites within the study area and within a one-mile radius of the study area. While there were no reports or recorded sites within the study area, three sites within the one-mile radius were surveyed and reported. They are as follows:

- Survey Area L-880: Located adjacent to the study area on JPL property. This 1980 survey concluded that there were "no known or recorded resources" within the survey area.
- Survey Area L-108: Located southeast of the Devil's Gate Dam between Oak Grove Ave. and the 210 Freeway was also negative.
- Survey Area L-1659: The study area, known as the La Vina property, is located .25 miles northeast of HWP. A prehistoric quartzite flake of cultural origin was recorded.

Within the one-mile radius there are also two recorded archaeological sites:

- CA-LAn-342: Located .33 mile north of HWP, the site consists of part of a village known as the Millard Canyon site.
- CA-LAn-26: The Sheldon Reservoir site is located southeast of the Devil's Gate Dam. In 1938, the Pasadena Water Company uncovered a burial ground during the excavation of the reservoir.

[4] Environmental Baseline Study, Devil's Gate Multi-Use Project, Cotton/Beland/Associates, Inc., February 1988.

The conclusion of the assessment was that the areas should be considered as archaeologically sensitive given the proximity of the two known archaeological sites.

CULTURAL RESOURCES

The cultural resources, along with the natural environment make up the unique character of Hahamongna Watershed Park that is so appreciated today. The historical and continuing use of this environment by the community contributes significantly to the cultural heritage of the City of Pasadena as formally recognized in the City's Guiding Principles. What "has been in existence" in the Arroyo for years upon years takes many forms: natural and man-made, physical artifact, and human activity. Some have been present longer than others, but each has become a cultural resource that contributes to the heritage of the Arroyo Seco. These resources need to be enhanced and preserved.

The indigenous peoples have a long history as stewards of this landscape. Each year, following the seasons, they have collected botanical material for traditional spiritual, ceremonial, medicinal and utilitarian uses. As guardians of these natural resources, they understand how to collect in a way that does not impair the sustainability of a plant population. As custodians of their culture, individuals, families and tribal groups use sites throughout Hahamongna Watershed Park for spiritual, social, and ceremonial traditions. Although most of these events are traditionally very private, the public at times is welcomed.

A number of groups, in addition to the Native Americans, have had a historical presence in the Park and have contributed to its cultural identity. Since the early part of the 20th century, children of the region have had a memorable summer experience by attending Tom Sawyer Camp. A great number of camp attendees are second and even third generation and in many instances they return as camp counselors gaining leadership skills that serve the community.

The Oak Grove Disc Golf Course is the first disc golf course in the world. The course dates back to the early 1970's as a "Frisbee" course where play was started between two posts, throwing the Frisbee several times in turn toward a distant post. A Frisbee hitting the distant post completed that hole. In early 1976, the posts were replaced with a metal basket on a post and the tee became a small octagonal concrete pad which is unique to this course. In the early 80's, the Frisbee was replaced with a smaller thinner disc. As a result of the popularity of the Oak Gove Disc Golf Course, courses began springing up everywhere across the country and later around the world. Twice a year, the Oak Grove Course hosts a tournament. The tournament in the fall of 2001 brought contestants from as far away as Alaska, Hawaii, and even Sweden.

Hahamongna Watershed Park has a well-established equestrian community that regularly draws riders from Pasadena, Altadena, and La Cañada. Visitors bring their horses from as far away as San Diego and Santa Barbara counties to ride. HWP is the hub where many trails come together and spread out in all directions: north, south, east, and west. The equestrian groups actively work to maintain these trails that are used by many others—dog walkers, hikers, and joggers. The Pasadena Mounted Police Unit stables its horses in the area and patrols the Arroyo Seco.

Additionally, many groups take advantage of this unique environment to support their broader missions. The Audubon Society hosts a monthly tour of the park for bird watching. The Armory Center for the Arts has a continuing program entitled, “Children Investigate the Environment,” in which various City departments collaborate to teach Pasadena Unified School District youth about the area’s natural resources. The plein-air painters use the Arroyo Seco, including HWP, as an open-air studio to create their scenes on canvas. JPL, a neighbor to the park, uses the rough landscape of the flood basin to test its planet-exploring robots. Instructors with the School of Self-Reliance teach survival skills, and provide information about edible and useful plants. Many organized groups have returned time and again to participate in competitive law enforcement training events, nature hikes sponsored by the Sierra Club, scout jamborees, and company picnics.

Just below the Devil’s Gate Dam, where the canyon narrows, is a unique rock formation that resembles the profile of a horned devil. In 1858, when Judge B.S. Eaton visited Rancho San Pasqual and this particular site in the Arroyo Seco, he named the location “the Devil’s Gate.” The original concrete gravity-arch dam at Devil’s Gate was dedicated in June of 1920; it is the first dam built for the Los Angeles County’s flood control and water conservation system. From 1920 to 1965, the top of the dam was the main road between Pasadena and La Cañada.

In 1998, when the Devil’s Gate Dam was reinforced to hold water, it was also architecturally restored to its original character. For years, Los Angeles County and Pasadena City fire departments, local law enforcement agencies, and other groups have used the dam to train personnel in disaster- and accident-rescue techniques; and numerous photographers and filmmakers have used the dam and spillway as a backdrop.

In this age of environmental awareness, it is more likely that the oak woodland that gives name to Oak Grove is recognized as “natural habitat” before it is considered a cultural resource. But the Oak Grove itself is a unique setting—a cool and shady respite with the distinctive arroyo stone walls edging the slopes and trails. Since the beginning of the 20th Century, people have enjoyed the splendor of this great stand of trees, picnicking under the broad canopy, exchanging wedding vows, and celebrating birthdays.

The preservation of Oak Grove over the years is testimony to the value the community places on it. From the narrow canyon, just below Devil’s Gate Dam, to the broad flood plain with its wooded and chapparal-covered slopes and up to the prominent points with their grand vistas, this cultural resource called Hahamongna Watershed Park should be enhanced and preserved.

2.12 SUMMARY OF COMMUNITY OUTREACH

COMMUNITY OUTREACH

The Master Plan community outreach process was extensive. The process included three community meetings/workshops, site tours, numerous stakeholder meetings, and meetings with community organizations and neighborhood groups. The meetings were well attended by interested and enthusiastic participants.

The community expressed the desire that the focus of HWP should be on “keeping it natural” while balancing this concept with the objectives of water conservation, flood protection, and active recreation. The community meetings elicited ideas and reviewed two alternative concepts (see Appendix A). One alternative emphasized a natural park and the other concept emphasized active recreation, including soccer, baseball, and other field activities. Meeting attendees formed teams to discuss and suggest ways to resolve and balance these concepts.

The master plan community outreach process was extensive

The community input confirmed the inherent conflict between those that desire to keep the park natural and those who seek to develop needed active recreation facilities. It was recognized that the need for active recreation, especially fields for soccer and baseball is a communitywide issue. The community input encouraged organized sports groups to work with the City of Pasadena and the public schools to identify other venues to meet the demands. Some have mentioned the Central Arroyo as a more appropriate location.

For Hahamongna Watershed Park, the community has expressed a desire to:

- Preserve the hiking and equestrian trails;
- Provide lakes or a water feature that will bring back birds and, perhaps, put HWP on the bird flyway that runs the length of the state;
- Promote those activities that will attract wildlife and protect and enhance native species;
- Balance recreation with habitat restoration and water conservation;
- Provide additional active multi-purpose fields;

- Provide a year-round perimeter trail for hikers and equestrians;
- Provide an interpretive center and venues for environmental education and Native American culture;
- Protect and buffer adjacent neighborhoods.

SUMMATION OF THE COMMENTS FROM HAHAMONGNA WATERSHED PARK COMMUNITY MEETINGS

During the Master Plan process, three community workshops were held to solicit comments on the progress of the Master Plan. The following summation itemizes by topic both the verbal and written comments made during the workshops. In some cases similar comments, such as "keep it natural" were heard many times, but are not repeated here. As one can see, the list consists of comments from both ends of the spectrum on almost every issue. As the process proceeded, participants gravitated toward a balanced approach–not any one interest group getting everything it wanted, but instead agreeing to disagree and settling for a compromise.

Habitat

- Keep it natural;
- Watershed area should be kept as natural as possible;
- Soften all facilities (parking, buildings) with natural vegetation;
- Most of park should be natural, not full of sports fields;
- Eliminate sports fields and disc golf course;
- Keep down the development and buildings in park;
- Advocate wildlife "rehabitation;"
- Stress Native American influence on area;
- Reintroduce native plants and safeguard protected species;
- Create an Engleman Oak monument;
- Organized sports are too intense for a wetlands or nature area;
- Protect the wildlife corridor in basin;
- Develop a plant nursery for endangered plants, trees, and plants used by "gatherers" – protect the plant gene pool at Hahamongna;
- No boating on lakes in order to bring back birds and wildlife;
- No motorized boating;
- The bridge at the north end of the Park should be in wood and kept natural and rustic for hikers and horses;
- The loop perimeter trail is essential for horses and hikers so we can access all the trails, hike, watch the birds and animals and enjoy the view of this restored natural habitat.

Recreation & Sports

- Keep Disc Golf out of the floodplain to allow for year-round play;
- Make playing fields multipurpose (overlay)–baseball in summer and soccer the rest of the year;
- Eliminate baseball from Oak Grove field and designate it for soccer only;
- Establish one regulation-size soccer field at Oak Grove;
- Create more than four soccer fields; they are more important than lakes;
- Find other locations for soccer fields, not in this basin;
- Keep bicycles and horses separate;
- Allow only horses in Hahamongna basin and only allow bicycles north of Ventura;
- For equestrians, maintain perimeter trail and east-west trails, especially across JPL east parking lot & do something about blind spots on trails where collisions could occur;
- Be careful about placement of Native American activity area near equestrian staging area;
- No overnight camping except for supervised groups;
- Allow for fishing in one lake;
- Allow for practice rowing on flood conservation pool;
- Want playing fields on both eastside (Pasadena/Altadena side) and westside (La Cañada side);
- Stop trying to develop soccer fields in a natural area and instead look at school sites;
- Who pays for soccer fields and why should they get special attention;
- Sports fields mean pesticides and they are incompatible with a nature park;
- Make the disc golf ADA accessible and accessible to strollers;
- For a unique park, create unique recreational features compatible with nature.

Trails

- Connect the trail in Altadena to the rest of the system;
- Maintain trail crossings and preserve horse trail linkages at south and north end of basin;
- Develop a complete trail loop going down east and west side and connecting at the south with the restoration of the Flint Wash bridge;
- Keep trails from Hahamongna up the canyon into Angeles National Forest;
- Keep ability to use trails to get from Hahamongna Park to and from Altadena Drive side of Arroyo using trail system;
- Keep ability to get from Hahamongna Park to Flintridge Riding Academy and Club and the trail system near Flintridge riding complex;
- Keep ability to get from Hahamongna to Cherry Canyon system of trails that run from Hahamongna to La Cañada;
- Keep ability to get from Hahamongna to trails that go south to Rose Bowl;
- Hahamongna is a hub for reaching a series of trails and that hub must be respected;
- Keep Rose Bowl Riders in the Park;
- Keep Tom Sawyer Camp in Oak Grove Park;
- Develop effluent control;
- Use school facilities and not park for soccer expansion;
- Have no soccer in Hahamongna. Impact of noise to eastside residents and impact on

wildlife is the reason. Also the impact on plant life. Keep it natural!!
- Hahamongna should not be made into a stadium;
- Loop/perimeter trail for hikers and horses is essential. No bikes on trails with horses and hikers. Bikes hit horses/hikers. Keep bikes separate;
- Make the bridge at the north end of wood so it is more natural. It will be easier for horses to cross because they will not slip. Wood will also not be so hot on the feet of dogs, horses, and hikers.

Water Features

- Allow fishing in the proposed lakes;
- No fishing in proposed lakes;
- Allow practice rowing when storm water is held behind the dam;
- Keep lakes natural to attract birds and wildlife;
- Create "nature blinds" where people can observe wildlife on the water;
- Create a meandering stream into one of the lakes preferably on east side;
- Prefer a lake to a pond;
- Create islands in the lake for protected nesting of birds;
- Keep water behind dam as long as possible;
- Call lakes and ponds what they are, use simple language;
- Isolate some shoreline from human contact;
- Permanent water features (lakes) must be a part of the new Park Plan.

Noise

- Add no new fields on east side because it will increase the noise for neighbors;
- Do not add parking on east side because of noise.

Security

- Allow only supervised overnight parking for authorized groups;
- Enforce a "no bicycles on horse trails" ordinance in basin;
- Increase number of Park Rangers for security reasons;
- Develop a volunteer equestrian patrol like the one in Lower Arroyo;
- Provide year-round emergency/maintenance vehicle access and a trail loop for circulation which will require the restoration of the Flint Wash bridge;
- Create a landscaped berm at the end of La Cañada-Verdugo Road with a fence to protect eastside neighbors;
- Increase patrols on eastside to assist with security.

Enforcement

- Keep up on graffiti removal;
- Make pet owners responsible for picking up after their animals;
- Keep dogs on leash;

- No pit bulls in the Park;
- Have regular security patrols.

Circulation

- Keep main entrance on west side;
- Create a "turn around" area for horse trailers below staging area & widen the road;
- Don't bring cars in at proposed Woodbury entrance; continue to use Oak Grove Drive;
- Keep the sediment removal trucks out of eastside neighborhoods;
- Find ways to reduce traffic on North Arroyo near Woodbury Avenue;
- Improve the Windsor/Ventura entrance to eliminate traffic congestion;
- Allow resident access if you install a cul-de-sac at end of La Cañada-Verdugo Road;
- Correct point above to read "Close off area to all …Block Wall;"
- Eliminate vehicular/pedestrian access from La Cañada-Verdugo Road;
- Improve traffic circulation in and around park to eliminate congestion due to JPL & High School;
- Put traffic signal at the Windsor/Ventura intersection;
- Coordinate with the Flood Maintenance Division of L.A. County Department of Public Works regarding maintenance routes.

Parking

- Provide adequate access for the disabled to recreation areas;
- Defray costs of park operation by renting parking lots on weekends;
- Make a parking area out of Rose Bowl motel;
- Improve parking at Woodbury (Oak Grove Drive) and at Windsor/Ventura which is now a traffic hazard;
- Create weekday parking because JPL now takes it all;
- Provide adequate parking for park use;
- Assist to obtain "resident only" parking for eastside residents;
- Create a No Parking area at the end of La Cañada-Verdugo Road;
- Keep the eastside or the bluff area the "low impact" part of Hahamongna;
- Rent one of JPL's east lots for weekend parking.

Cultural Issues

- Eliminate any thought of a museum because there is not enough space to accommodate one;
- Establish an Interpretive Center with a heavy emphasis on the contribution of Native Americans and the natural environment of the basin;
- If an Interpretive Center is established, give careful thought to staffing and maintenance through adequate funds and grants;
- Keep up with graffiti removal;
- Make pet owners responsible for picking up after their animals – all animals;
- Provide gathering places for basket weavers;

- In trying to balance interests, remember that the ecosystem, although silent, is one of them;
- The City of Pasadena should be clear about what it is willing to spend for an Interpretive Center and what educational programs will be included;
- Who will fund an Interpretive Center and keep it going. It makes no sense to start one if there is not careful consideration of future funding options and responsibilities provide more workshops and educational programs related to the environment and the Native American contribution to this land;
- Create an “out-of-the-way” ceremonial center which could be used by Native Americans;
- Take care to alert Native American “gatherers” of any spraying in Hahamongna;
- Create a communications system with “gatherers” to update them on conditions;
- Create some “off the beaten track” and therefore protected areas for plants used by “gatherers;”
- Work cooperatively with other institutions such as the Southwest Museum;
- Any Interpretive Center should involve native people in the planning;
- An Interpretive Center should deal not just with past Native American traditions but should relate to their current role and the future they hope to help shape – “We are a part of yesterday but also a part of today and tomorrow;”
- Create a system of permitting for Native American “gatherers” who will protect the plants so that they can regenerate and flourish;
- Allow no art work in park other than that which reflects the natural environment/colors.

2.13 SIGNAGE AND GRAPHICS

Typically, the signs visitors encounter in a park can be categorized as either wayfinding, interpretive, or regulatory. Wayfinding signs are directional, site identification or amenity identification signs. Interpretive signs are informational.

WAYFINDING SIGNAGE & GRAPHICS

1. Park Identification Signs

The existing temporary HWP park entrance sign on the west side is effective, but institutional; it does not reflect a natural look and is not especially inviting. The typeface and layout of the sign panel does not harmonize well with the stone monument structure; a better solution would be individual letters mounted directly onto the stone.

2. Attractions

Signs that identify the park’s many activities and destinations are inconsistent and generally not well executed. Identifiers such as the Disc Golf Course sign are generic metal panels supported by individual metal posts.

3. Trail Signage

Signage identifying trails and providing information about directions and mileage is varied and inconsistent. Included are “Forest Service” type wood signs and metal in several kinds of mounting conditions.

4. Amenities Identification

Identification for restrooms, water fountains, telephones, etc. is inconsistent and the signs poorly constructed. Restroom signs may be in nonconformance with ADA (Americans with Disabilities Guidelines).

5. Safety rules and Regulations

Many existing signs in the park are the result of a need to limit or qualify visitor behavior. Many other signs have evolved to cover seemingly obvious safety issues. The unfortunate result is a preponderance of negative messages in an environment that is intended to be a carefree respite from the visitor’s daily life. The fact that many park signs are negative messages is ironic when viewed against the large amount of energy invested in enhancing this natural environment.

6. Code-Required Signage

Similar to safety rules and regulations, there is a number of these signs within the park area. Signs that are truly required need to be identified and displayed in an appropriate manner. The remainder should be eliminated or be displayed in another way.

7. Vehicle – Directionals and Parking

Signs for drivers are a diverse combination of standard road signs, “Forest Service” signs and painted metal panels. Inconsistent typography, wording, and layouts are found throughout.

8. Pedestrian – Directionals

Pedestrian signs in the park suffer from the same inconsistent ad hoc appearance as the vehicle signs. The placement of signs in HWP has occurred on an ad hoc basis with the net result that important intersections within the park are littered with signs of differing style and materials.

INTERPRETIVE SIGNAGE & GRAPHICS

Very few examples of interpretation through signage and graphics exist in the park at the present time.

2.14 ISSUES & OPPORTUNITIES

Based upon the analyses of the existing conditions and community outreach, specific issues and opportunities were identified to focus the Master Planning efforts; they include:

- Use of La Cañada-Verdugo Road for sediment removal;
- Improvements to eastside access at the Windsor/Ventura intersection;
- Oak Grove Drive traffic resulting from La Cañada High School and JPL;
- Multi-use conflicts between bicyclists, equestrians, and hikers as in the Central and Lower Arroyo;
- Disc Golf (back nine course) impact to the north Oak Grove area, that is, compaction and disturbance;
- Cultural resource opportunity to communicate the history of Native Americans, water resources, environmental education;
- Multi-use playing fields: organized sports to maximize facilities balance with habitat rehabilitation and water conservation needs;
- Water feature for recreation use and for habitat establishment;
- Habitat establishment and restoration;
- Devil's Gate Dam access for maintenance and sediment removal;
- Parking for JPL and the importance of the revenues generated from the parking lease;
- Public access to the dam area for observation point, bird watching and hiking;
- Flood Control issues: When and how the water is held, sediment and habitat removal;
- Water conservation issues include the ability to spread additional water to recharge the aquifer. Pump-back system will spread the water retained by the dam to replenish aquifer by pumping water to the spreading basins.

Section 3. Hahamongna Watershed Park Master Plan

ARROYO SECO
MASTER PLANS

SECTION 3:
HAHAMONGNA WATERSHED PARK MASTER PLAN

This section describes the Master Plan recommendations for the Hahamongna Watershed Park (HWP) as indicated and partially illustrated in Exhibit 3-1, Hahamongna Watershed Park Master Plan. The recommended Master Plan elements are firmly based upon the goals and objectives outlined in Section 1, as well as a rigorous community outreach process; an inventory and analysis of the natural and man-made environment of the HWP site; the discussion and direction from the Hahamongna Watershed Park Advisory Committee; and consultation with other public agencies that share responsibility for the area.

The Master Plan recommendations are presented and discussed as follows:

- Water Resources Management
- Conceptual Grading Plan
- Habitat Restoration Plan
- Recreation Trails
- Westside / Oak Grove Improvements
- East Side Improvements
- Circulation and Parking
- Utilities & Infrastructure
- Safety, Security & Accessibility
- Programs

3.1 WATER RESOURCES MANAGEMENT

Issues pertaining to flood management, water conservation, sediment deposition and removal, as well as habitat restoration, are inextricably related. This fact is reflected in the number of public agencies that are stakeholders in HWP and whose cooperation and commitment are essential to the success of this element of the Master Plan. The conceptual framework for water resources management is outlined below, followed by the Conceptual

Exhibit 3-1, Hahamongna Watershed Park Master Pan

Grading Plan that details the physical reshaping of the flood basin to achieve the desired balance between all the issues associated with water resources management.

FLOOD MANAGEMENT

The primary purpose of the Devil's Gate Dam is to provide flood protection to downstream communities. The dam must be able to contain an appropriate volume of water while a storm passes and then slowly release the water at a rate consistent with the capacity of the downstream flood channels. Floodwater, having risen to elevation 1040.5, can typically be accommodated by flowing out through the windows of the spillway headworks (see Section 2, Existing Conditions, for a detailed description of dam operations). Under the most extreme conditions, when the floodwater rises faster than it can flow through the windows in the spillway headworks, water will rise to the top of the dam. All areas of HWP situated below elevation 1075, the top of the dam, could become flooded. Park elements need to be designed with the following flood considerations: (1) The area that is most frequently inundated is below elevation 1040.5 (the floor of the spillway); (2) park elements sited between elevations 1040.5 and 1075 will need to be reviewed by all parties and designed for the possibility of several days of inundation.

The flood capacity below elevation 1040.5 should be as great as possible for flood management, water conservation, and sediment management. Currently, the area below this elevation covers 92 surface acres. When the water level is at spillway height (elev. 1040.5), much of the 92-acre area is covered with only a few feet of water. The conceptual grading plan, described later in this section, proposes to excavate material to create a deeper debris and sediment basin behind the dam. Excavated material will be placed both above and below the 1040.5 elevation. The material excavated will be used to raise areas identified for habitat restoration and recreation facilities to protect them from most annual inundations. The overall flood area will be reduced from 92 surface acres to 69 surface acres, so that an additional 23 acres of land will be gained for habitat restoration and recreation along with five acres of streambed riparian habitat. At the same time, the basin will have an increased holding capacity of 1,894 acre-feet of floodwaters, up from the current capacity of 1,424 acre-feet, measured at 1040 feet elevation. This would meet the County's desire to increase the capacity behind the dam for holding more storm water and for accumulating inflowing sediment.

SEDIMENT AND DEBRIS MANAGEMENT

Seasonal Flood Management / Water Conservation Pool

The flood management/water conservation pool, also referred to as the sediment and debris basin, directly behind Devil's Gate Dam, is maintained and operated by Los Angeles County Department of Public Works. LACDPW has identified 1,400 acre-feet as the *minimum* capacity needed for flood management. Therefore, the capacity below the spillway floor must be 1,400 acre-feet or greater. On average, this volume is equal to the deposition from one major debris event. The proposed grading plan creates a maximum capacity of 1,900 acre-feet. The proposed minimum capacity of 1,400 acre-feet behind the dam allows for 500 acre-feet (806,667 cubic yards) of capacity for inflowing sediment. Year after year, as stored sediment builds up toward the 500-acre-feet capacity, thereby decreasing the minimum capacity behind the dam, sediment must be removed. The difference between this maximum capacity and the minimum capacity equals 5½ years of the historical annual average inflow of 145,200 cubic yards of sediment.

Debris and sediment removal on an annual basis (approximately 3,000 cubic yards) will occur each summer to maintain the lowest opening in the dam, the sluice gate. This could allow for the continuing operation of the FAST (Flow Assisted Sediment Transport) program. This program has accounted for approximately 20% of the incoming sediment passing through the dam and not accumulating in the flood basin. See Section 2, Existing Conditions, for a detailed description of how the dam is operated.

Sediment removal operations will be needed on average every 5½ years to reestablish the full 1,900 acre-feet capacity. Given the unpredictable nature of Southern California rainfall, sediment should be removed from HWP on an "as needed" basis. This means that sediment removal could take place in consecutive years. A review of historical data indicates that it is more likely to occur within a range of three to seven years. The Master Plan recommends that procedural policies and specifications for processing and removal of sediment be cooperatively developed by the County and the City of Pasadena.

Sediment Removal Operations

The conceptual grading plan proposes to shape the basin with 3:1 slopes. The grade of the slope balances the need to maximize capacity within a smaller area with safety, stability, and ease of maintenance. Below elevation 1030, newly deposited sediment, debris and emerging vegetation will be excavated. All sediment removal within the 1030 elevation will be done to maintain flood capacity, thereby minimizing the impacts to the rest of the flood plain and allowing opportunities for habitat restoration. The Master Plan recommends that a permitting process be established that allows for this excavation on an "as needed" basis.

The deposition of sediment entering the basin can be controlled by the elevation of water held behind the dam. When inflowing, sediment-laden waters meet the slower moving water behind the dam, sediment drops out. If water is held behind the dam at elevation 1030, incoming storms will deposit sediment on the northern edge of the pool away from the lower dam openings. The deposited sediment will be below the restored habitats (situated above elevation 1030) and will minimize the amount of annual sediment removal necessary to keep the sluice gate clear.

As a storm passes, water continues to enter the basin, but it becomes less sediment-laden. When this occurs, water should be allowed to accumulate to the maximum capacity inundating the established willow and riparian habitats around the edge of the basin. This will provide those habitats with the nutrients and water regime they require. It will also allow clearer water to rise to the intake level and be pumped back to the spreading basins (see section on "Pump-Back System" on pages 3-7).

For the safe operation of the dam and downstream floodwater structures, debris needs to be prevented from passing through the dam and obstructing openings in the dam or spillway headworks. Two areas on the eastside of the flood management/water conservation pool will be raised to elevation 1045, kept clear of vegetation, and used as staging areas for equipment to remove floating debris. One is located adjacent to Johnson Field, the other midway between Johnson Field and Devil's Gate Dam.

Sediment removal operations will be staged from access roads on each side of the flood management/water conservation pool. Access to these roads will be via the proposed entrance and exit ramps to Oak Grove Drive (see Dam Access in this Section of the Master Plan) and via a permanent haul road on the west side of the Flood Management/Water Conservation Pool. The haul road will provide sediment removal trucks and maintenance equipment with direct access to the flood management/ water conservation pool and to all destinations via Oak Grove Drive and the Berkshire Place interchange on the 210 Freeway, without driving through the adjacent residential neighborhoods.

Sediment removal activities will occur every three to seven years and last for three to five months during the summer and early fall. To significantly reduce the cost, the sediment could be processed on-site. If it is processed on-site, the portable processing equipment will need to be state-of-the-art to minimize dust and noise. When all of this activity is occurring in the flood management/water conservation pool area and on the sediment removal haul roads, it will create a significant presence in the park. The Master Plan recommends installing interpretive signage and displays, along with the development of a community education and outreach program to explain the critical importance of sediment removal to flood management and to public safety.

Upper Channel Deposition Zone

The alluvial fan that has formed at the mouth of the Arroyo Seco Canyon is by definition a deposition area. The uncompacted soils of this zone support the formation of riversidian alluvial fan sage scrub. Historic photographs indicate that extensive mining occurred throughout this area, resulting in a slight depression. This area will accumulate deposition from smaller storm events and erode during high-velocity events depending on the weather. Sediment removal would eventually need to be considered in order to protect the adjacent spreading basins from flooding. Sediment removal should be event and performance based. The level of deposition should not exceed elevation 1070 in this zone of the channel.

WATER CONSERVATION

Water in Southern California is a valuable but fickle commodity. In an average rainfall year, Devil's Gate Dam with a minimum capacity of 1,400 acre-feet below the dam spillway height could fill with inflowing water 1-3 times, depending on the condition of the watershed. In a drought period the watershed could retain most of the rainfall and the dam would not fill up once. In the winter of 1992-93 the dam could have filled more than 40 times, if the water had been held. With such swings in available water, a sophisticated operating procedure needs to be developed to respond to the fluctuating supply of water within the flood basin.

Changing the existing method, area, and pattern of recharging groundwater could affect the NASA/JPL remediation activities for groundwater contaminants. Projects to improve water resource operations will require further environmental review and close coordination with NASA/JPL prior to any implementation.

Seasonal Flood Management/Water Conservation Pool

The flood basin behind the dam has been filling with sediment. With an existing capacity of 1,424 acre-feet, the basin is approaching its minimum capacity of 1,400 acre-feet. Since 1978, when the dam was declared unsafe to hold water, vegetation has been allowed to grow in the 92-acre area that is below the 1040.5 elevation. When water conservation measures are implemented, the vegetation in this area will begin to die back since it is not adapted to inundation.

To create new and higher habitat quality above the spillway elevation, to increase the capacity behind the dam, and to allow for inflowing sediment accumulation, the Master Plan recommends the creation of a seasonal pool. The pool will require the excavation of 378 acre-feet of material, to be redistributed on site. Of this total, 150 acre-feet will be placed below the 1040.5 spillway elevation and 228 acre-feet will be placed above. In addition, 243 acre-feet of material will be removed off-site to bring the capacity up to 1,900 acre-feet below spillway elevation. This deeper pool will have a reduced surface area (from 92 to 69 acres).that will be frequently inundated It will create a "flood management pool" that can better manage inflowing sediment and floating debris and a "water conservation pool" to allow the seasonal retention of floodwater to pump back to the upstream spreading basins.[1]

Pump-Back System

The infrastructure needed to pump water at selected times from the flood management/water conservation pool will be installed behind the dam. The distribution system will carry water from a new inlet, located near the dam, along the bottom of the eastern slope adjacent to the other domestic water distribution lines. The storm water will be pumped north to the highest east side basins, continuing west across the North Bridge Crossing to gravity-feed metered water to both the proposed westside basins and existing improved eastside basins.

A bridge will be constructed across the stream in the vicinity of the Altadena Drain. This will provide the means for utilities and the water distribution system to cross to the proposed westside spreading basins as well as provide the northerly crossing of the perimeter trail to be used by park visitors, maintenance and emergency vehicles.

[1] See "*Flood Hazard, Sediment Management, and Water Feature Analyses, Hahamongna Watershed Park, Pasadena, CA"* prepared by Philip Williams & Associates, Ltd. In the Technical Reports of this Master Plan, The PWA alternative suggested that with further study it might be shown that increased groundwater recharge might be achieved in Hahamongna if natural flows are restored to the Arroyo Seco channel and if ponding were allowed to occur regularly adjacent to the dam. This alternative was not considered as a proposal for the master plan because it did not meet some basic master plan goals and objectives, nor did it adequately address the operation constraints of the involved water agencies. In this alternative, storm water that would have been diverted to the spreading grounds would instead ideally percolate into the groundwater during low flows along the Arroyo Seco. However, during higher flows water would not have the time or ability to percolate in the Arroyo Seco channel due to the grade and topography of the basin floor and would therefore flow to the dam. This added storm water, which would normally be diverted to the spreading basins, would result in the reservoir filling up more rapidly and since the seasonal incoming totals already exceed the limited capacity of the reservoir, even more storm water would be lost to the ocean, again, making the PWA alternatives a less favored alternative, as proposed.

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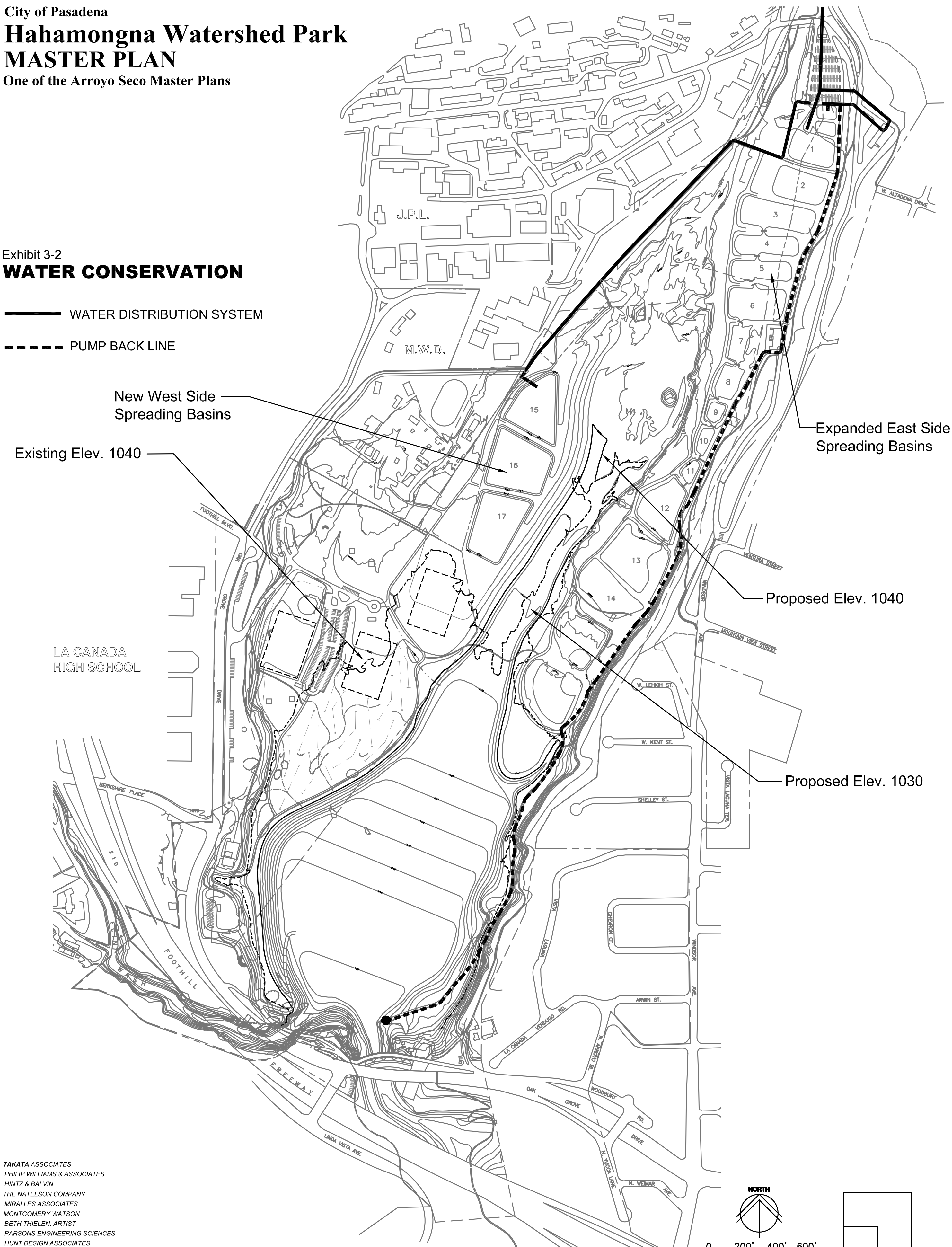
Exhibit 3-2
WATER CONSERVATION



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Spreading Operations

A primary goal of the Master Plan is to maximize the amount of water that is available to recharge the Raymond Basin Aquifer. Operation of the Arroyo Spreading Basins was recently taken over by the City of Pasadena from the County. The City is obligated to the 16-member Raymond Basin Water Board to continue operation of the 13.1 surface acres of spreading grounds. The Raymond Basin requires that any changes to the spreading area and average annual quantity of water spread be equal to or greater than currently exists/occurs. Pasadena Water and Power has estimated that 22-26 surface acres would be optimal to spread. The Master Plan dedicates a total of 26 surface acres to the spreading operation.

An additional eight acres will be created by the construction of three new spreading basins on the west side of the flood basin. On the east side, existing basins no.1 through no.4 will be expanded and two new basins constructed north of the existing basins, adding 4.9 acres to the existing13.1 surface acres of spreading. An illustrated plan of the finished configuration of spreading basins is shown in Exhibit 3-3, Spreading Basins & Northeast Parking Area. Note that this exhibit indicates the new numbering of the basins. Expansion of these basins will require the relocation of the 1,200 parking spaces in the eastside JPL parking lot.

Changing the existing method, area and pattern of recharging groundwater could affect the NASA/JPL remediation activities for groundwater contaminants. Projects to improve water resource operations will require further environmental review and close coordination with NASA/JPL prior to any implementation.

The expanded spreading acres of water will allow the Cities of Pasadena and Altadena to increase domestic consumption capacity from 40% to 60%, once groundwater contaminants have been sufficiently remediated. This proposal will also provide a significant water cost savings by minimizing the need to purchase imported water. The Pasadena Water and Power Department has estimated that the additional spreading represents approximately $500,000 per year in savings to the City.

The City’s intent is to retain as much flood water and normal run-off water as possible for spreading and habitat enhancement. In this regard, it is currently under consideration to once again fully use the water from the network of tunnels underlying the eastern and southeastern edges of the basin (this water amounts to 4-7 cu. ft. per sec.). This water is derived from flood waters being retained behind the dam that charge the tunnels.

Exhibit 3-3, Spreading Basins & Northeast Parking Area

3.2 CONCEPTUAL GRADING PLAN

The siting of all the master plan elements is ultimately determined by flood elevations as established by the reconstruction of Devil’s Gate Dam and by the impacts of periodic inundation. The conceptual grading plan was developed to achieve a balance between flood management, water conservation, habitat restoration, and recreation. It attempts to resolve some long-standing problems within the basin, such as the remnant impacts of the historic mining operations and it also suggests spatial solutions for various long-term goals.

The intent of the Conceptual Grading Plan is:

- to improve flood capacity for the County
- to improve management of sediment inflow
- to increase water spreading capacity
- to improve native habitat quantity and quality
- to protect the proposed recreation elements
- to minimize costs and environmental impacts by moving material the shortest distance possible

The Water Resources and Watershed Management Divisions of the Los Angeles County Department of Public Works assisted in the preparation and review of the proposed grading plan, illustrated in Exhibit 3-4, Conceptual Grading Plan.

SEASONAL FLOOD MANAGEMENT/WATER CONSERVATION POOL

The 1040.5 elevation of the Conceptual Grading Plan will be the designated limit of the flood management/water conservation pool operated by the County. The banks of the flood management /water conservation pool will be maintained at a 3:1, or flatter, slope between elevation 1030 and 1040.5. Below elevation 1030 the banks will be maintained at a 3:1 slope. The proposed Perimeter Trail, circling HWP, will be constructed at or above elevation 1045. This dirt roadway, used by hikers and equestrians, will act as a boundary line that separates recreational uses of HWP from areas dedicated to flood control, water conservation and habitat restoration. There are no designated recreation trails inside this loop with the exception of one trail, just north of the flood management/water conservation pool, that crosses the widened stream corridor at elevation 1027 to connect the east and west recreational areas (see Exhibit 3-8, Trail Plan). The only access to the flood control/water conservation pool will be the County sediment removal road on the west side of the pool and the two staging areas on the eastside of the pool.

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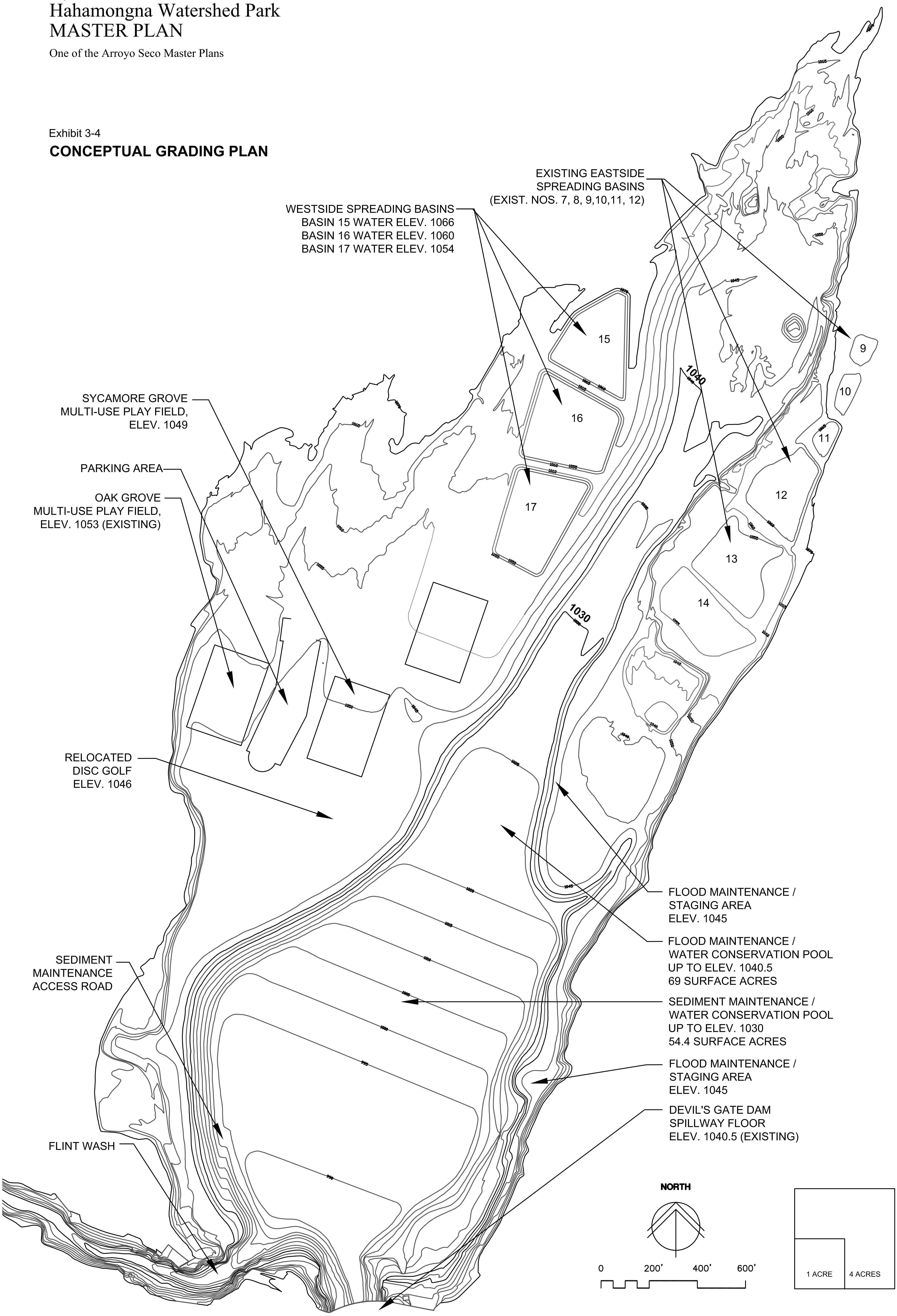
Exhibit 3-4

CONCEPTUAL GRADING PLAN



FLOOD CONTROL / WATER CONSERVATION
LOWER POOL
CONCEPTUAL BANK GRADING

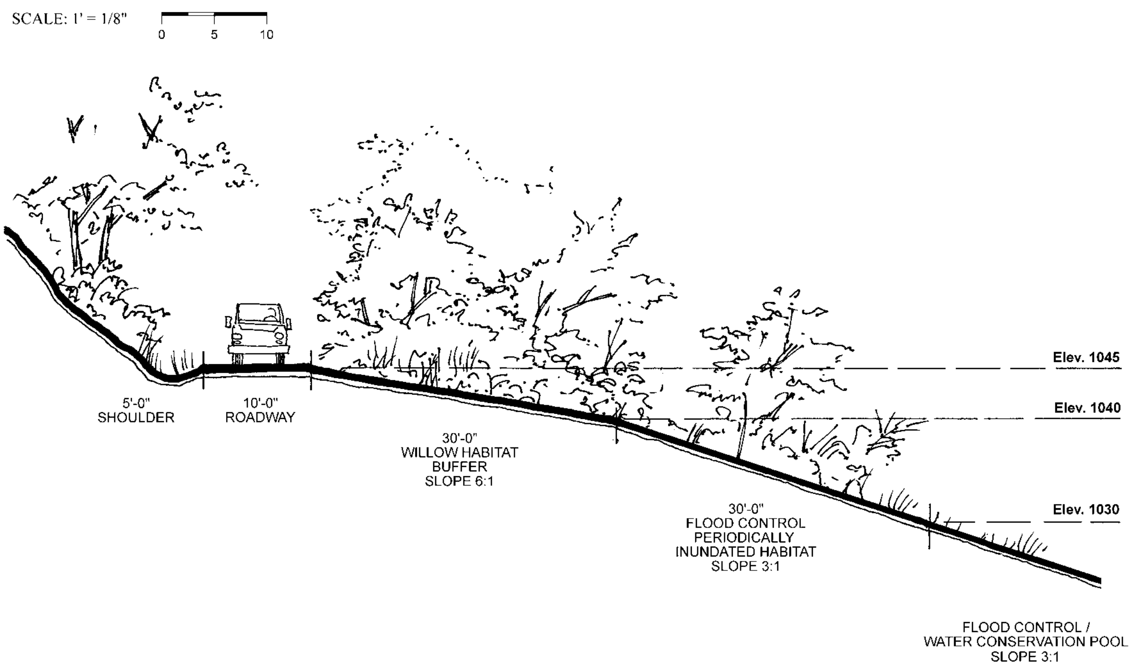


Exhibit 3-5

The banks of the flood management/water conservation pool flatten out along the upper sections of the basin allowing for a wider section of restored willow habitat.

From the Perimeter Trail (approximately elevation 1045) to elevation 1030, the southern willow scrub habitat will be reestablished around the pool. This dense, shrubby habitat will serve as a buffer between the operation of the flood management /water conservation pool and recreation uses of HWP. The health of the willow habitat will be maintained by the periodic inundation of areas between elevation 1030 to 1040.5 before the accumulated water in the flood management/water conservation pool is released or pumped back for spreading. The southern willow scrub habitat from elevation 1030 to 1045 and above will be maintained by extended periods of water holding at elevation 1030 and below. Within this area of intermittent inundation, southern willow scrub habitat may need to be reestablished, should it be impacted by sediment, based on the need for maintaining flood capacity. It is recommended that sediment removal within this area be managed through the combined consideration for habitat maintenance and flood control. This restoration project is further discussed in Section 3.3, Habitat Restoration.

STREAM CHANNEL WIDENING

Directly upstream of the flood control/water conservation pool, the riparian stream channel will be widened. Years of dumping along the western edge of the stream course narrowed its width and raised the elevation. The conceptual grading plan recommends the widening of the channel to reestablish the braided stream course and improve and expand the streambed riparian habitat. See following Section 3.3, Habitat Restoration.

As indicated on the conceptual grading plan, recreation facilities and spreading basin embankments need to be raised to elevation 1045 or higher to protect them from annual inundation. Soil excavated from the stream channel widening can be used on-site to raise the grades for the proposed new habitats and facilities. Existing trails that traverse the embankments will be abandoned to limit access to restoration areas and to maintain an area dedicated as a wildlife corridor.

OTHER PLAN ELEMENTS

The following plan elements will be significantly shaped by the Conceptual Grading Plan:

Spreading Basins

The Preliminary Plan of 1994 proposed that the edges of the existing spreading basins be recontoured and landscaped to effect a natural setting. Based on further examination of the changes in elevation along the eastside and further discussion with Pasadena Water & Power Maintenance Department, the opportunities for developing a natural landscape are limited. Basins will be shaped for maintenance and functional considerations. Landscape and habitat improvements will be made to the tops of the dikes separating the basins, along the park access road to Johnson Field, and to the edge of the Perimeter Trail adjacent to the basins. Landscaping will not be extended down the inside of the basin slopes. See Section 3.3, Habitat Restoration.

To facilitate maintenance of the existing spreading basins, the Perimeter Trail will remain along the western edge of the spreading basins. Basin maintenance operations will be staged from this side. An opening in the habitat restoration will be left on the western edge of the existing basins for basin maintenance access.

Sycamore Grove Fields & Relocated Disc Golf Course

In order to protect the proposed southern field and relocated fairways of the disc golf course from flood inundation, the grade along the western part of the basin will be raised above elevation 1045. Material excavated to increase the capacity of the flood management/water conservation pool will be used to raise the site above inundation level. The small areas of existing willows, between and around the relocated fairways, will be linked and receive less fill to create a system of drainage courses between raised areas with mulefat scrub around the edges. The drainage courses will preserve and extend the existing drainage pattern.

The northern Sycamore Grove field will be located where past mining operations excavated a large depression (at elev. 1025), well below the flood inundation level (elev. 1040.5). Earthen material excavated to widen the stream channel will be used to raise the elevation of this adjacent multipurpose field site above elevation 1055.

USE OF LANDFORM GRADING PRINCIPLES

The upper slopes of the flood management/water conservation pool, the widened edges of the stream channel, and the eastern slopes of the northern Sycamore Grove field and westside spreading basins will be graded using landform-grading principles. “Landform-grading” is an atypical form of grading that replicates the irregular shapes and gradients of natural, stable slopes.[2] The resulting landscape is more sculpted with concave and convex curves mimicking a pattern of drainage that would occur naturally. Re-vegetation of the slopes also follows a distinctly naturalistic pattern with groupings of trees and shrubs clustered in concave areas where the drainage pattern focuses runoff, and with woody and herbaceous scrub species planted on the drier convex slopes.

This method of grading seeks to minimize erosion and enhance plant sustainability, thus creating a functioning and evolving ecosystem that will sustain the wildlife that currently exists and the wildlife that one day may come to inhabit HWP. Although the contours indicated in the Conceptual Grading Plan are mechanically drawn, it is the intention of the Master Plan to create a landscape that mimics in as many ways as possible the natural undulations of the foothills using this methodology of grading.

IMPLEMENTATION OF THE GRADING PLAN

Placement of excavated material to raise an area above the frequently flooded zone will affect the existing drainage and habitat associated with the specific project. Newly restored habitats in these raised areas will require time to become established. This mitigation needs

[2] Journal of Geotechnical Engineering, “Landform Grading and Slope Evolution” Horst J. Schor and Donald H. Gray, October 1995. (See the adopted Arroyo Seco Design Guidelines, Appendix C.)

to occur before other projects in the implementation sequence are started and the excavation and placement of needed material for the next project affects additional habitat.

The material excavated from the flood management area, to be used for new raised parkland, will affect flood debris and sediment management. Therefore, all projects where material is excavated to be used as fill within the Los Angeles County Department of Public Works (LACDPW) leased Flood Easement will require its review and approval. Because of the quantities of material involved, LACDPW may choose to engineer some of the proposed projects.

Projects requiring extensive grading that affect both existing and proposed habitats will need to be reviewed and approved by the appropriate State and Federal environmental agencies prior to the engineering of the project. This review process will impact the lead-time required for these projects. Additionally, the cost and efficiency of construction will be considered in how the projects are sequenced.

3.3 HABITAT RESTORATION

Habitat establishment and restoration is proposed throughout the Hahamongna Watershed Park, as illustrated in Exhibit 3-7, Proposed Terrestrial Natural Plant Communities. For purposes of this Master Plan, “habitat establishment” is the creation of improved habitat quality[3] in areas where a particular native plant community is not present or it will involve adding area to an existing plant community where that community does not exist. “Habitat Restoration” is the improvement of the habitat quality, including increasing the plant and animal species diversity in an area where a plant community already exists. In general, all existing native plant communities that are not impacted by proposed projects including grading, removal of exotic species, or inundation, will be restored.

The areas designated on the Proposed Plant Communities map are specific plant communities where the specific species is dominant. Some areas can be small, but collectively make up a habitat of sufficiently large area to support diverse wildlife. The master plan includes a map illustrating the habitats and their associated plant communities, Exhibit 3-7A.

[3] *“Habitat Quality”* of a site can be defined in terms of a range of its assessed attributes, functions, and values. Excellent habitat generally refers to undisturbed areas that contain mostly native plants and composed of sustainable biodiversity (vegetation and wildlife). The ranking of habitat as excellent, good, fair, or poor is subjective and varies widely depending on physical condition, degree of biodiversity and species addressed. For example, biologists often generalize that riparian (streamside) habitat is of excellent quality if it provides dense cover, contains wildlife and plant species diversity, is composed of multiple strata of vegetation, is extensive in area, and contains surface water or saturated soils; the non-existence of any or some of these characteristics decreases the habitat quality.

The proposed habitats (Woodland, Upland Shrub, Alluvial, and Riparian) are broad categories based on physical conditions and associated plant communities supporting wildlife. This mosaic of contiguous plant communities is beneficial for habitat because of the diversity of native plant species and their physical structure. Open spaces as with Streambed Riparian and Riversidian Alluvial Fans Sage Scrub, combined with dense cover as with Mule Fat Scrub and Southern Willow Scrub is beneficial for a diverse wildlife.

A larger area of a particular plant community is best for certain wildlife species. The proposed relocated disc golf area has a mosaic of narrow willow scrub plant community surrounded by a band of mule fat scrub plant community. The edge between these two different plant communities is beneficial for wildlife; however, with the close human proximity on the disc golf fairways, this area will not be habitat of high quality for a diverse wildlife, but it will be better habitat than much of what is there now. The existing habitat over all has been heavily impacted by previous mining operations, resulting in an unnatural topography that is not optimum for this plant community. The area also has extensive ruderal areas, which do not support much diversity of wildlife. The USFWS, SDFG and the master plan biologist have commented on this specific area as fragmented habitat. They have suggested that the areas of willow scrub be wider; however, it is further suggested that during the specific project design phase wider bands of willow scrub plant community be created between the Perimeter Trail and the Water Conservation Pool. The area within the proposed Perimeter Trail is to have limited human activity.

The information within this section is presented in two parts. The first part is a listing of major, site-specific Habitat Establishment and Restoration Projects proposed by the Master Plan. Their listing is intended to help convey the location, intent and magnitude of the proposed habitat establishment and restoration projects. Some of these habitat projects involve the establishment and restoration of more than one plant community within the same project area and they have been organized to compliment the project area phasing (see Section 4).

The second describes the habitat establishment and restoration efforts for each plant community throughout HWP, linking the various projects previously described to proposed acreage goals for each community.

HABITAT ESTABLISHMENT AND RESTORATION PROJECTS

In addition to general improvements to the existing plant communities, eleven specific sites have been identified for restoration. A description of each project follows, and their location is identified in Exhibit 3-6, Habitat Restoration Projects.

1. Realigned Stream Corridor, Restore and Establish Habitat at

This project area includes the stream zone and banks from just south of the Altadena Storm Drain outfall north to the JPL Bridge. This portion of the stream has been channelized behind an area that used to contain an earthen breakaway dam built to divert water to the spreading basins. The Master Plan recommends discontinued use of the site as a diversion facility.

The area contains elements of degraded ruderal vegetation. In the past, the site probably was a combination of sage scrub and riversidian alluvial fan sage scrub. The higher elevations of the banks have high potential for restoration to sage scrub by using the recommended planting procedures and palette of species. Restoring the site to include riversidian alluvial fan sage scrub would be difficult because the natural dynamics needed for proper alluvial deposition of sediment are incompatible with the area's topographic constraints and its current and future uses.

Because of channelization, the stream zone has the potential for restoration of a native riparian corridor. This restoration would be a continuation of the same plant community immediately north of the JPL Bridge. Enhancing and diversifying the tree and shrub canopy overstories along the central and northern portion of the Arroyo Seco drainage in HWP is recommended. A strategy to accomplish this sort of habitat enhancement is presented in this habitat restoration plan. See information on the native plant palettes and installation methods for the southern willow scrub, mule fat scrub, and riversidian alluvial fan sage scrub communities. Increasing the native tree and shrub species diversity along the stream is possible using western sycamore, white alder, Fremont and black cottonwoods, Mexican elderberry, bigleaf maple, California bay/laurel, southern California black walnut, and several types of willow.

City of Pasadena

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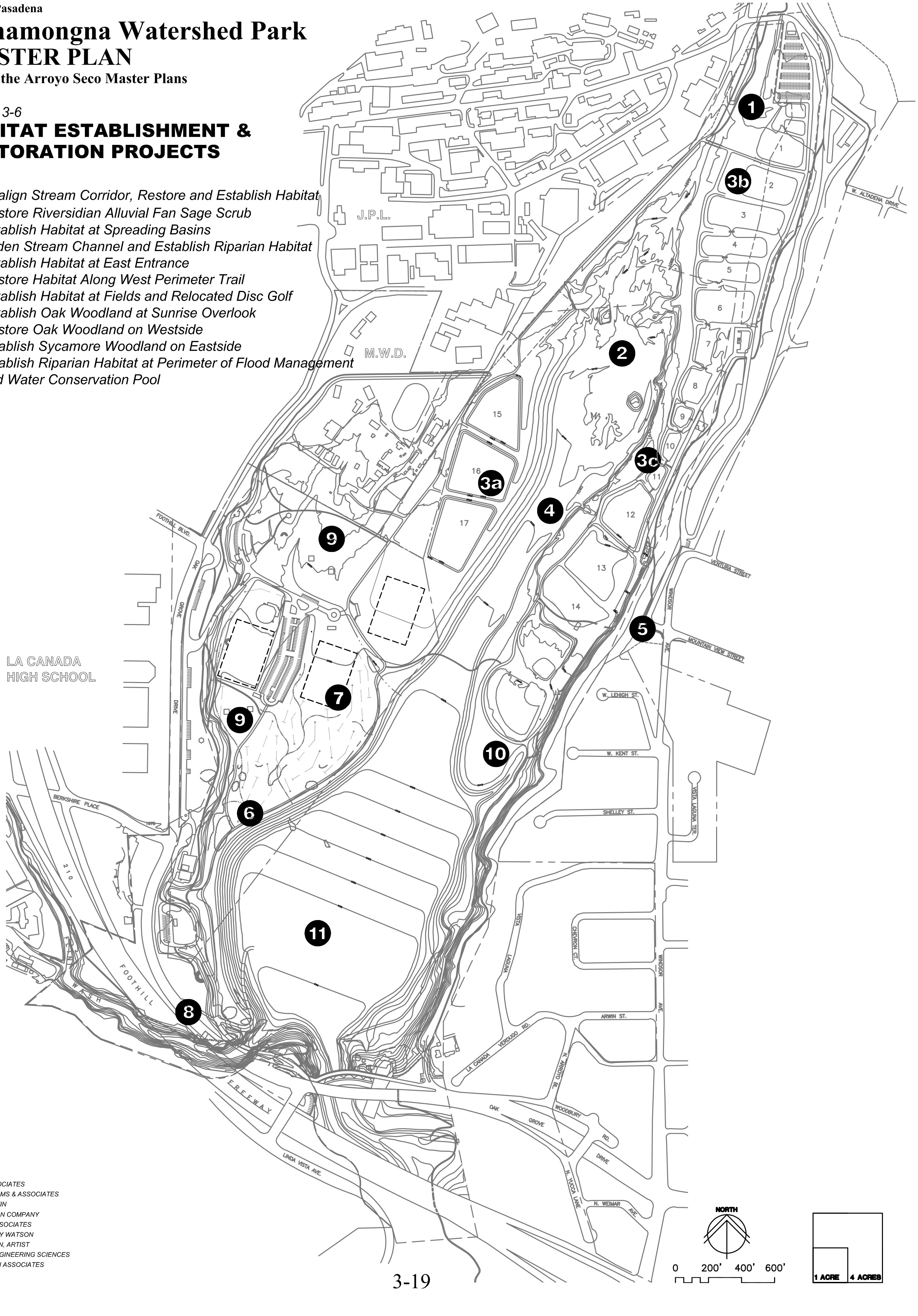
Exhibit 3-6

HABITAT ESTABLISHMENT & RESTORATION PROJECTS

1. *Realign Stream Corridor, Restore and Establish Habitat*
2. *Restore Riversidian Alluvial Fan Sage Scrub*
3. *Establish Habitat at Spreading Basins*
4. *Widen Stream Channel and Establish Riparian Habitat*
5. *Establish Habitat at East Entrance*
6. *Restore Habitat Along West Perimeter Trail*
7. *Establish Habitat at Fields and Relocated Disc Golf*
8. *Establish Oak Woodland at Sunrise Overlook*
9. *Restore Oak Woodland on Westside*
10. *Establish Sycamore Woodland on Eastside*
11. *Establish Riparian Habitat at Perimeter of Flood Management and Water Conservation Pool*



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2. Restore Riversidian Alluvial Fan Sage Scrub

Remnants of riversidian alluvial fan sage scrub are located south of the Altadena Storm Drain and the narrow mouth of the Arroyo Seco drainage as it opens into the basin. Periodic removal of sediment and debris from this area may be necessary in order to protect the spreading basins from inundation. Sediment removal in this area could mean the loss of much of the remaining riversidian alluvial fan sage scrub.

It is recommended that a compromise strategy be developed to help conserve as much as possible the sensitive riversidian alluvial fan sage scrub community. Creating several smaller cuts into the sediment deposits, parallel to the present stream flow course, would allow sediment debris removal, and would dissipate the energy from water flows into several drainage patterns. Rather than total removal of the sediment and consequential loss of much or all of the riversidian alluvial fan sage scrub, it would permit more of the alluvial fan sage scrub to remain intact. Such a strategy needs to be considered by the various parties involved with sediment management, and coordinated to develop a feasible design that would help conserve this sensitive community and yet accomplish some of the needed sediment removal.

This restoration project involves a number of smaller projects within a larger area. The larger area includes two plant communities: riversidian alluvial fan sage scrub and sage scrub, as shown on the plant community maps. The areas on either side of the stream corridor to the eastside spreading basins and to the westside JPL perimeter fencing and new westside spreading basins will be restored to these plant communities.

The current equestrian trail on the westside of the existing spreading basins traverses some of the best old alluvial fan sage scrub in the area, designated as sage scrub on the plant community maps. The proposal is to abandon the equestrian trail, relocate the trail on the spreading basins maintenance road (asphalt to be removed) and restore the existing trail with sage scrub.

Habitat restoration will also occur at the various drain outfalls along the JPL border, where exotic species need to be removed, debris and trash collected and disposed, and the riversidian alluvial fan sage scrub, sage scrub and southern willow scrub habitat restored.

Similarly, the old stream crossings (from both the east and west) have been covered over in asphalt by past mining operators. Most of this asphalt has been removed. The remaining asphalt needs to be removed and disposed, the stream allowed to take its course, and riversidian alluvial fan sage scrub and sage scrub habitat restored.

Additionally, this project establishes riversidian alluvial fan sage scrub at the southern end of this area where it transitions to a streambed riparian plant community. With the Stream

Channel Widening Project (Project 4) both the streambed riparian and the alluvial fan sage scrub plant community areas are enlarged.

3. Establish Habitat at Spreading Basins

The Master Plan calls for construction of three new spreading basins (project 3a) on the west side of the basin in what is now a low-quality habitat of nonnative annuals. Part of this area has old sediment and debris material piled up above grade, covered with a thick layer of dead plant material. The dead plant material is like a thicket or thatch that inhibits many plants, including even weedy species, from becoming established. Most of the dead plant substance appears to be weedy species and willow branches.

This area is located in what historically was sage scrub and/or riversidian alluvial fan sage scrub. The dead plant matter will be removed and taken off-site to a disposal facility or treated on-site with solarization techniques (to help kill any living weeds) and ground into a mulch for later use. The embankments along the sides of the new spreading basins will be graded using landform contouring principles and planted with sage scrub species. Such plants require less water than those in a riparian or oak woodland and will not decrease the water infiltration and groundwater recharge rates of the spreading basins.

While maintenance regimes hinder the complete restoration of plant communities adjacent to the spreading basins, it is possible to add some native tree species that will establish themselves. However, installation of high numbers of these deep-rooted trees that are sustained by groundwater is at odds with the goals of water infiltration and groundwater recharge. A compromise strategy of using carefully selected and installed native riparian plants should be pursued (projects 3a,b, c) as is currently happening around the older eastside spreading basins.

4. Widen Stream Channel and Establish Riparian Habitat

Prior to the construction of the dam, there would have been a more randomly meandering stream channel or number of channels in the large alluvial fan of the Arroyo Seco. Over time, mining and dumping practices greatly altered the stream course. A straighter, rather than meandering or braided, stream channel presently exists in HWP. The present stream channel, however, is stable due to the presence of the vegetation lining the drainage particularly in the mule fat scrub and southern willow scrub communities. Vegetation along the streambed is well established and helps direct predictable flow patterns toward the dam.

This stable vegetation and drainage course configuration will be preserved in the central portion of the basin. The western edge of the stream channel will be widened to at least double its current width. The grading for this project will be done in conjunction with restoration projects no. 3a and no. 7.

5. Establish Habitat at East Entrance

The Master Plan proposes that the existing Windsor/Ventura intersection be reconfigured for safety and other circulation improvements. This project would result in the removal and relocation of the existing 50-space parking lot located south of the intersection. This project will also allow for the enhancement of Sunset Overlook north of the intersection. The restoration site is located in what historically was sage scrub with scattered coast live oaks. Using native plants from the recommended palettes and installation methods for sage scrub and coast live oak woodland would aesthetically enhance the appearance of the area and benefit certain wildlife species.

6. Restore Habitat along Westside Perimeter Trail

The new Perimeter Trail connection between the proposed disc golf area and the Flint Wash Bridge will be constructed along the raised edge of the flood management/water conservation pool. This trail will separate the recreation facilities and the activities in Oak Grove from the flood management/water conservation pool. The Master Plan proposes that the southern willow scrub plant community be restored along the trail in conjunction with an interpretive signage component.

Much of the trail area currently exists in southern willow scrub. This area is now prone to periodic flooding such as occurred during the 1997-1998 El Niño weather pattern due to the new dam spillway elevation (1040.5). Raising the grade along the trail to be above the average high water mark would increase the chances for successful establishment and survival of recommended trees and shrubs.

7. Establish Habitat at Sycamore Grove Fields & Relocated Disc Golf

Establishment of southern sycamore woodlands in association with the new multi-use fields will be accomplished in areas where the grade is raised above elevation 1045. The small areas of existing willows will be linked and receive less fill to create a system of drainage courses between raised areas with mulefat scrub around the edges. The drainage courses will be extensions of the existing drainage pattern. Existing vegetation will be hand-cleared, leaving the willow trees that are taller than the depth of the fill. After the fill is placed, these willows will root at the higher elevation with the help of water conservation management practices. This along with other vegetation will create habitat of southern willow scrub of better quality than currently exists in the relocated disc golf area and along the eastern edge of the Perimeter Trail.

8. Establish Oak Woodland at Sunrise Overlook

Sunrise Overlook is located at the southwestern corner of HWP along Oak Grove Drive and immediately northwest of Flint Wash. This area is now covered with a temporary cover of re-vegetated forb and grass species from an earlier seed mix application, as well as some non-native species. The oak woodland to the north will be extended into this area with random plantings of coast live oak to shade and protect the proposed amphitheater. Because the site exists in what formerly was sage scrub, components of this plant community should also be used.

9. Restore Oak Woodland on Westside

The Master Plan proposes a supervised overnight camping area as well as two group picnic areas within the Oak Grove area on the west side of HWP. The existing oak woodland on the west side, including the slopes of the basin, is relatively devoid of immature oak trees and other native plants from this plant community. Once the back nine of the disc golf course is relocated, it is recommended that the plantings be diversified by utilizing native species from the plant palette and planting methods prescribed for coast live oak woodland restoration. Protection of oak and other restoration plantings at the camping and group picnic areas will be necessary.

10. Establish Sycamore Woodland on Eastside

The existing mule fat scrub area south of Johnson Field is subject to periodic inundation. During the 1997-1998 El Niño weather pattern, this area was submerged for three weeks with a detrimental effect on the native plants. It is recommended that this area be raised to elevation 1045 and restored with plants associated with the southern sycamore riparian woodland. To the east and north of this area, western sycamores, black cottonwoods, and Mexican elderberry trees have naturalized and could spread to this area if it were protected from consistent flooding. Sycamore woodland is also suggested around the perimeter of the east and west spreading basins as well as around the edges of the multipurpose play areas (see proposed plant community map).

11. Establish Riparian Habitat at Perimeter of Flood Management & Water Conservation Pool

The existing riparian southern willow scrub habitat below the 1040 elevation will degenerate and begin to die as soon as water conservation practices are implemented. These areas will be periodically inundated during the winter season. The habitat below the 1030 elevation will be completely submerged for varying lengths of time. The 1030 to 1040 elevation zone around the water conservation pool will be habitat of a quality that could benefit from inundation several times a year. Below elevation 1030, emerging vegetation, debris, and sediment will need to be periodically removed from the newly graded flood management/water conservation pool per the sediment management guidelines that will be established by the County. This project proposes a phased operation that will permit the area elevated above the floodplain (elevation 1040) and the perimeter of the water conservation pool (elevation 1030 to 1040) to become established with southern willow scrub habitat. Once these areas are established and considered habitat of high quality, the existing riparian southern willow scrub areas (below elevation 1030) will be removed in a coordinated sediment and debris removal operation.

HABITAT RESTORATION PLAN

The inventory of biological resources in HWP (see Section 2, Existing Conditions) helped to define the existing setting and lay the foundation for the habitat restoration plan. Exhibit 3-7, HWP Master Plan, Terrestrial Natural Plant Communities, illustrates the proposed spatial organization of the six identified plant communities currently present in HWP.

Inherent in the goals of the habitat plan are several criteria:

- The native species composition in the restoration efforts will be similar to the existing native plant communities found in HWP. Re-vegetation and restoration efforts are designed to promote habitat of high quality for wildlife and to also be appealing to humans and adapted to their activities. Planning and design must be biologically and ecologically conceived and sound in principle for these efforts to succeed. A sustained responsibility to maintenance of plantings and to the monitoring of their progress is required to accomplish the planned restoration efforts.

- Seed and other planting material (e.g., cuttings and container stock) will be collected from the project vicinity to the extent feasible, and/or, if necessary, will utilize plant stock material from reputable native-plant nurseries. Maintaining the integrity of the local gene pool composition of native vegetation currently found on-site and in nearby areas is a primary concern of this plan.

- Suitable planting techniques, monitoring, maintenance, and performance standards will be specified in order to maximize the opportunities for establishing viable, functional, and self-perpetuating native plant communities on restored sites.

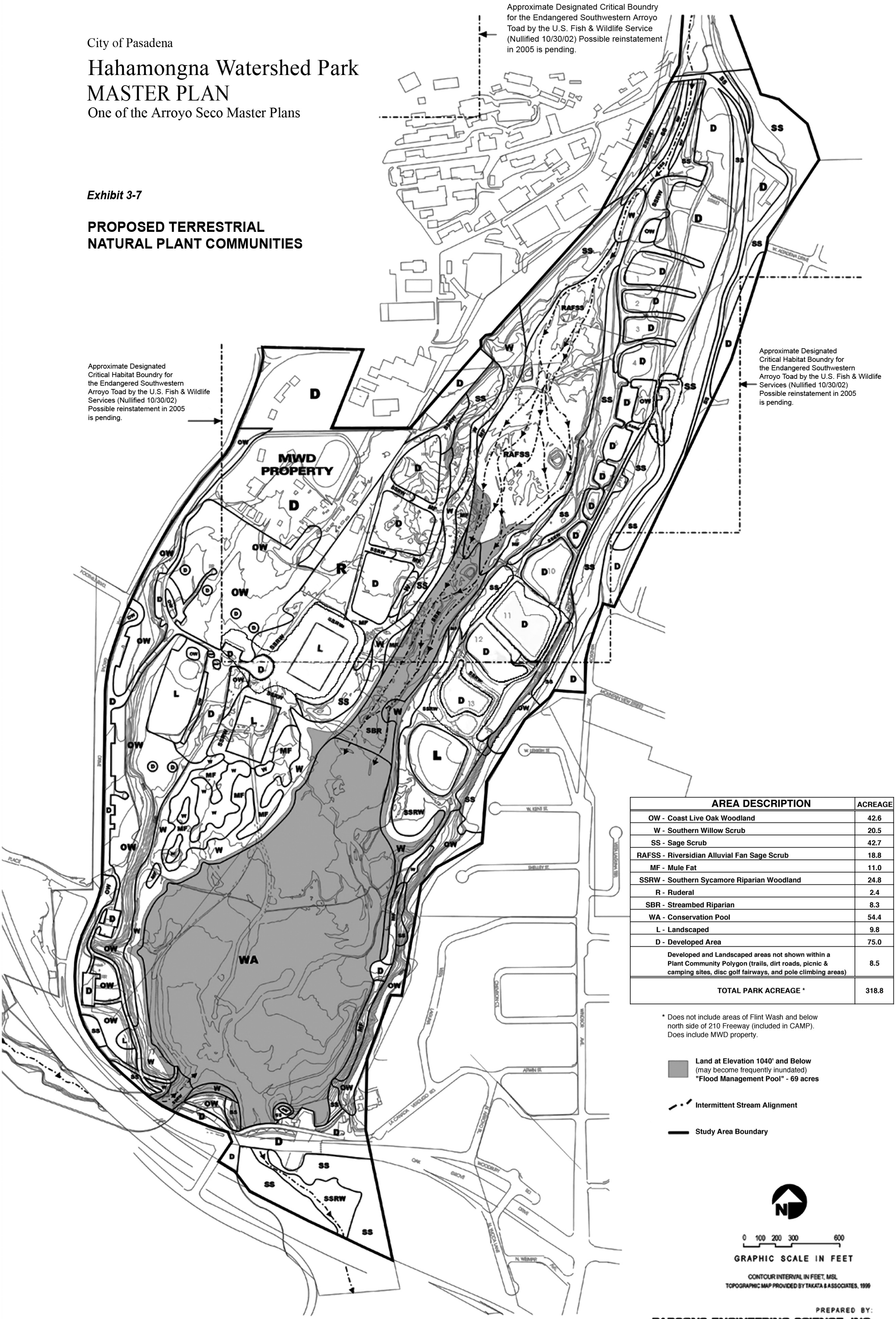
City of Pasadena

Hahamongna Watershed Park MASTER PLAN

One of the Arroyo Seco Master Plans

Exhibit 3-7

PROPOSED TERRESTRIAL NATURAL PLANT COMMUNITIES



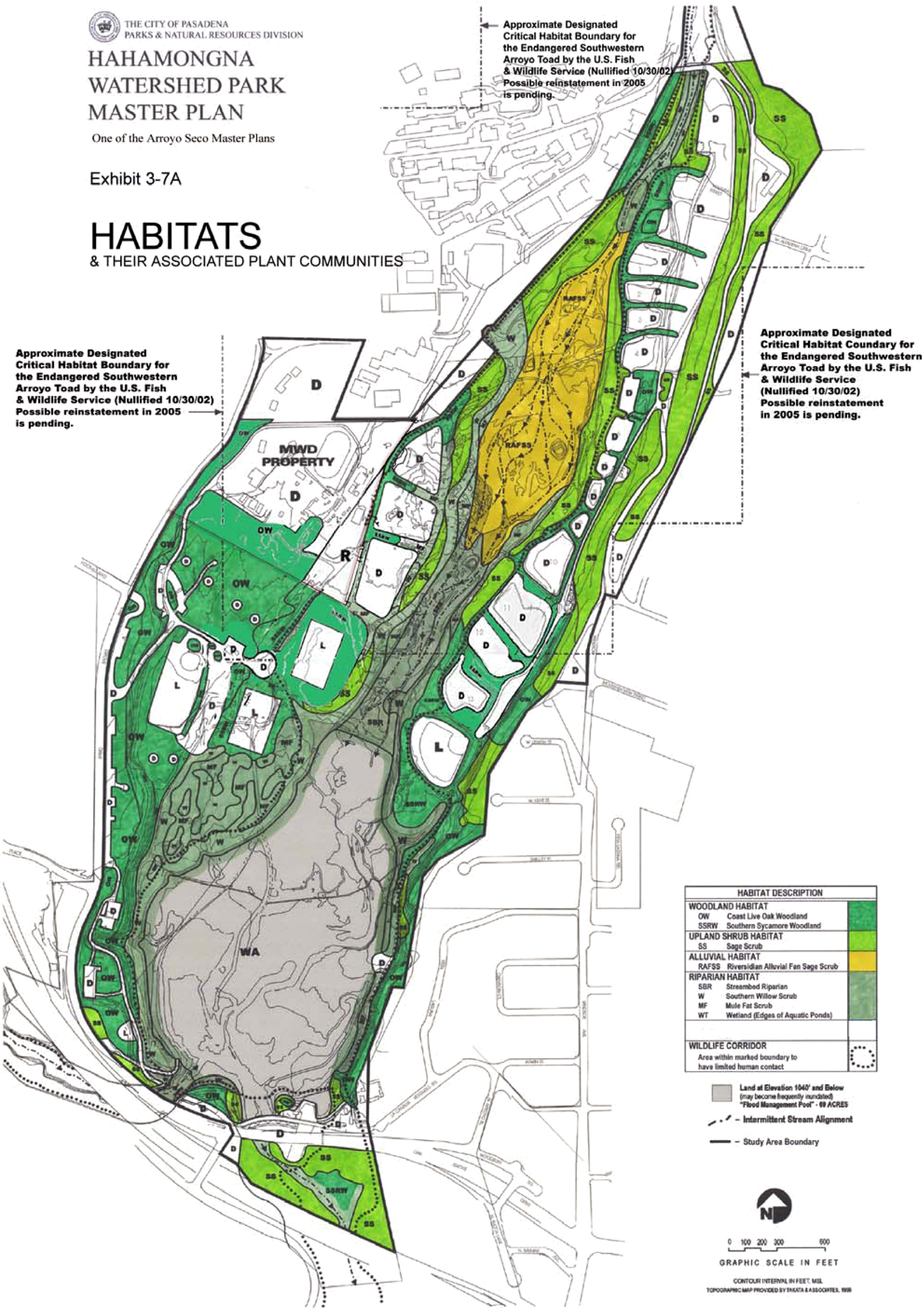
AREA DESCRIPTION	ACREAGE
OW - Coast Live Oak Woodland	42.6
W - Southern Willow Scrub	20.5
SS - Sage Scrub	42.7
RAFSS - Riversidian Alluvial Fan Sage Scrub	18.8
MF - Mule Fat	11.0
SSRW - Southern Sycamore Riparian Woodland	24.8
R - Ruderal	2.4
SBR - Streambed Riparian	8.3
WA - Conservation Pool	54.4
L - Landscaped	9.8
D - Developed Area	75.0
Developed and Landscaped areas not shown within a Plant Community Polygon (trails, dirt roads, picnic & camping sites, disc golf fairways, and pole climbing areas)	8.5
TOTAL PARK ACREAGE *	318.8

* Does not include areas of Flint Wash and below north side of 210 Freeway (included in CAMP). Does include MWD property.

Land at Elevation 1040' and Below (may become frequently inundated) **"Flood Management Pool" - 69 acres**

Intermittent Stream Alignment

Study Area Boundary



THE CITY OF PASADENA
PARKS & NATURAL RESOURCES DIVISION
HAHAMONGNA
WATERSHED PARK
MASTER PLAN
One of the Arroyo Seco Master Plans
Exhibit 3-7A
HABITATS
& THEIR ASSOCIATED PLANT COMMUNITIES
Approximate Designated Critical Habitat Boundary for the Endangered Southwestern Arroyo Toad by the U.S. Fish & Wildlife Service (Nullified 10/30/02) Possible reinstatement in 2005 is pending.
Approximate Designated Critical Habitat Boundary for the Endangered Southwestern Arroyo Toad by the U.S. Fish & Wildlife Service (Nullified 10/30/02) Possible reinstatement in 2005 is pending.
Approximate Designated Critical Habitat Coundary for the Endangered Southwestern Arroyo Toad by the U.S. Fish & Wildlife Service (Nullified 10/30/02) Possible reinstatement in 2005 is pending.
MWD PROPERTY
RAFSS
WA
HABITAT DESCRIPTION
WOODLAND HABITAT
OW Coast Live Oak Woodland
SSRW Southern Sycamore Woodland
UPLAND SHRUB HABITAT
SS Sage Scrub
ALLUVIAL HABITAT
RAFSS Riversidian Alluvial Fan Sage Scrub
RIPARIAN HABITAT
SBR Streambed Riparian
W Southern Willow Scrub
MF Mule Fat Scrub
WT Wetland (Edges of Aquatic Ponds)
WILDLIFE CORRIDOR
Area within marked boundary to have limited human contact
Land at Elevation 1040' and Below (may become frequently inundated) "Flood Management Pool" - 69 ACRES
- Intermittent Stream Alignment
- Study Area Boundary
0 100 200 300 600
GRAPHIC SCALE IN FEET
CONTOUR INTERVAL IN FEET, MSL
TOPOGRAPHIC MAP PROVIDED BY TAKATA & ASSOCIATES, 1999

All of the native plant communities are considered worthy of restoration efforts to enhance and/or increase their diversity, size, and distribution in HWP. The goal of this habitat restoration plan is to eliminate the ruderal areas within HWP, as much as possible, due to their low habitat value for wildlife and native plant diversity. Native plant species, common to virtually any or all six of the native terrestrial natural communities, will be used in the restoration efforts to potentially replace the widespread ruderal areas' weedy, invasive, and undesirable species compositions.

The types of native plant species to be used in the habitat restoration efforts have been selected to be compatible with the existing native plant communities and with current and proposed land uses in HWP. The majority of tree, shrub, forb, and grass species chosen for restoration and/or establishment purposes are mainly based on those native species already present in the various, existing on-site native plant communities. These native plant species are generally beneficial to wildlife's food and cover. They also add to the floral diversity of plants found in HWP.

Several of the plant species are of importance for their use in the spiritual, ceremonial, medicinal, and utilitarian traditions of Native Americans and in their arts and crafts. The native plants help increase educational and recreational use of the area. Many of the plants chosen provide an opportunity to study interesting, informative facts for people interested in the natural history of plants and their interrelationships with wildlife. Finally, the native plants selected for habitat restoration have various adaptive, genetic, morphological, and ecophysiological characteristics that enhance their chances of becoming a self-sustaining system and add to the biodiversity and health of the existing natural plant communities.

Since HWP exists in a dynamically fluctuating environment and has many visitors (both wildlife and humans), habitat restoration efforts will be subject to influences and impacts from many sources. The cooperation of public users and maintenance personnel will be important in helping achieve the goals of the habitat restoration plan. Protecting and restoring native plant communities located in floodplain areas are often in direct conflict with traditional flood plain management. Negotiation and cooperation are necessary among the various diverse interests and parties involved with current and proposed uses of HWP to achieve habitat restoration goals.

The following table summarizes the acreage of each natural plant community and landscaped/developed area within Hahamongna Watershed Park, both existing and proposed.

	Area Description	*Existing Acres*	*Proposed Acres*
OW	Coast Live Oak Woodland	37.8	42.6
W	Southern Willow Scrub	25.5	20.5
SS	Sage Scrub	39.9	42.9
RAFSS	Riversidian Alluvial Fan Sage Scrub	17.2	18.8
MF	Mule Fat Scrub	19.5	11.0
SSRW	Southern Sycamore Riparian Woodland	2.6	24.8
R	Ruderal	75.4	2.4
SBR	Streambed Riparian	8.1	8.3
WA	Water Conservation Pool	0.0	54.4
L	Landscaped	5.8	9.8
D	Developed	76.4	74.8
D&L	Developed and Landscaped areas not shown within a plant community polygon (such as a trail, dirt road, picnic & camping site, disc golf fairways and pole climbing area)	10.6	8.5
TOTAL STUDY ACREAGE[4]		**318.8**	**318.8**

Within HWP there are landscaped and developed areas, that have been designated on the plant community maps. The “landscaped areas” within the HWP include predominantly non-native landscaping (turf) for playing fields and native plant landscaping for ornamental purposes. The “developed areas” within HWP include predominantly roads, parking, and buildings, with native landscaping for ornamental purposes.

PLANT PALETTES OF SELECTED NATIVE SPECIES

Plant palettes for the six terrestrial natural communities in HWP are developed in this habitat restoration plan for: 1) coast live oak woodland, 2) southern willow scrub, 3) mule fat scrub, 4) riversidian alluvial fan sage scrub, 5) sage scrub, and 6) southern sycamore riparian woodland. The proposed plant palettes can be found in Appendix C, Master Plan Plant Community Palettes.

[4] Does not include the areas of Flint Wash and below the north side of the 210 freeway (included in CAMP). Both are within the Park property boundary but outside the study area. These areas total 10.7 acres. It does include the MWD property, 28 acres added + 2.4 acres already included = 30.4

The mix of native plant species that comprises the plant palettes for each respective plant community is based on the inventory surveys of biological resources conducted in HWP. The species chosen are representative of what currently exists in those communities. In some cases, others species are added to what was once known to exist there based on published historical information.

Planting guidelines are outlined in this section and fully presented in the Biological Technical Report that was prepared in support of the Master Plan process. Project descriptions in Appendix E provide a more detailed explanation of the habitat restoration projects and the enhancements suggested for each plant community.

Coast Live Oak Woodland

The collection of coast live oak acorns for planting as acorns and for propagating to create oak seedlings is described in the Biological Technical Report. A mixture of other native, container-grown trees and shrubs will also be planted in the woodland. A hydroseed/hydromulch application procedure shall be used to deliver other native shrub, forb, and grass species in the seedmix at planned oak woodland restoration sites.

An assortment of native plant species will shape the tree canopy layer. Coast live oak trees that provid acorns for the local revegetation propagation will be planted in various sizes. Other trees and/or shrubs selected for restoration efforts include big leaf maple, Engelmann oak, California bay/laurel, boxelder, toyon, laurel sumac, California coffeeberry, and Mexican elderberry. Additional native floral plantings will include chamise, hairyleaf ceanothus, bush monkeyflower, scrub oak, chaparral gooseberry or currant, California rose and blackberry, black sage, and western poison oak. All containerized specimens will be planted in natural looking combinations or groupings. All tree and shrub plantings in coast live oak woodland will be installed in natural looking groups.

The hydroseed/hydromulch mix will consist of numerous shrub, forb, and grass species that are associated with this oak woodland type. Several of the shrub species are included as container plants and in the hydroseed mixture. The hydroseed combination uses chamise, California sagebrush, bush monkeyflower, black sage, California brome (*Bromus carinatus*), golden yarrow (*Eriophyllum confertiflorum*), California everlasting (*Gnaphalium californicum*), wild pea (*Lathyrus vestitus*), deerweed, deergrass (*Muhlenbergia rigens*), and purple needlegrass (*Nassella pulchra*).

Of the 37.8 acres of coast live oak woodland in the study area, 11.6 are within the MWD property. There are 26.2 acres of coast live oak woodland within HWP that will receive habitat restoration. The following list of projects is proposed for habitat establishment and restoration of coast live oak woodland:

Westside of the Park:

- Oak Woodland Restoration (Habitat Project #9): This element, which includes the upper Oak Grove Picnic Area and the Equestrian Staging Area, has been undergoing habitat restoration for eight years. After restoration of this area and the slopes down to the Lower Oak Grove Area, including the Oak Grove Field and the west half of the overnight camping area, there will be a net increase of 1.9 acres of oak woodland.
- Oak Woodland Restoration (Habitat Project #9**):[1] The east half of the overnight area is within the critical habitat of the Arroyo Toad. This area is proposed to have an increase of 1.0 acre of oak woodland.
- Sunrise Overlook (Habitat Project #8): The Sunrise Overlook area, adjacent to the south perimeter of the Equestrian Staging Area, is proposed to have an increase of 0.9 acre of oak woodland.

Eastside of the Park:

- East Spreading Basins (Habitat Project #3b**): Adjacent to and west of the new eastside spreading basin No. 2, it is proposed to increase the existing 0.1 acre of oak woodland by 0.2 acre for a total of 0.3 acre.
- East Spreading Basins(Habitat Project #3b**): The area west of the Arroyo Well, adjacent to spreading basin 7, is proposed to have the existing 0.4-acre oak woodland increased by 0.3 acre for a total of 0.7 acre.
- East of Spreading Basin 14 and the Overflow Basin (Johnson Field)**: This area is proposed to have the existing 1.1 acres of oak woodland increased by 0.5 acre for a total of 1.6 acres. This enhances the habitat adjacent to the East Rim Trail. It will convert 0.5 acre of sage scrub to oak woodland.

Southern Willow Scrub

Dense, high-quality southern willow scrub habitat will be established around the edge of the flood management/water conservation pool. In those areas where southern willow scrub currently exists but must be removed for sediment and debris removal and maintenance purposes, the areas may be restored naturally on their own from surviving root systems. This community, compared to the others, probably endures the greatest impacts from ongoing

[1] Subsequent to the conceptual approval of the Hahamongna Watershed Park Master Plan, the U.S. Fish and Wildlife Service on February 7, 2001, designated critical habitat in HWP for the federally listed Southwestern Arroyo Toad. Those restoration projects that are wholly or partially located within designated critical habitat for the Southwestern Arroyo Toad are identified with **. On October 30, 2002, the U.S. District Court for the District of Columbia nullified all the designated critical habitats for the Arroyo Toad. The USFWS will complete a new analysis of economic impacts and consider updated field survey information to refine where the Arroyo Toad exists. The Interior Department will decide by 2005 which areas of critical habitat to redesignate.

maintenance. However, replanting with community-specific native plant species will occur in riparian areas and adjacent sites where willow scrub species can be established and survive.

The restoration plan calls for upper and lower dense canopy layers comprised of arroyo, red, black, shining, and narrow-leafed willows along with occasional groupings of Fremont and black cottonwood, western sycamore, Mexican elderberry, California bay/laurel, and big leaf maple. The scattered cottonwoods, sycamores, elderberries, bay/laurels, and maples will be established in areas located approximately 6 to 12 feet above the elevation of groundwater and/or below the low-flow channel of the Arroyo Seco stream. The arroyo, red, black, shining, and narrow-leafed willows will be planted as rooted cuttings that are a minimum of 18" in length, 2' to 12' above the elevation of the groundwater and the low-flow channel. Tree and shrub plantings will be grouped and/or scattered in natural appearing groups.

The species comprising the shrub understory layer (e.g., mule fat, coyote brush, California blackberry, California rose, and desert grape (*Vitis girdiana*) will be established at elevations 4' to 12' above the low-flow channel. The sparse herbaceous understory layer of mugwort, western ragweed, hoary nettle, meadow barley (*Hordeum brachyantherum*), Santa Barbara sedge (*Carex barbarae*), and deergrass will be hydroseeded throughout the site. Seeds of the previously mentioned coyote brush and mule fat are also included in the hydroseed mixture.

There are currently 25.5 acres of southern willow scrub in the park, of which only 7.7 acres will receive habitat restoration. When water conservation measures are implemented, the remaining 17.8 acres of existing habitat will begin to die as the area is frequently inundated. An additional 12.8 acres of new habitat will be established along with the 7.7 acres of existing habitat to be restored. The following list of the projects are proposed for habitat establishment and restoration of southern willow scrub:

Realigned Stream Corridor (Habitat Project #1): This project will keep the size of the habitat area unchanged, but will restore habitat found at the southern end of the project area.

*Westside Spreading Basins (Habitat Project #3a**):* There is currently no southern willow scrub habitat adjacent to the proposed Westside Spreading Basins. This habitat project proposes to establish 1.2 new acres of this plant community east of the spreading basins. The creation of the westside spreading basins will utilize “Landform Grading” principles to improve habitat for this and other plant communities.

*Widen Stream Channel (Habitat Project #4**):* The stream channel widening project will increase the existing 0.6 acre of southern willow scrub to 3.7 acres. This restoration project will widen the stream on its western edge for a new stream channel width total that will at least double its current width. Both the east and west embankments of the stream channel will be restored with southern willow scrub to help stabilize and control erosion of the stream banks and to provide an appropriate habitat for native fauna.

Westside Perimeter Trail (Habitat Project #6): The Westside Perimeter Trail Project will increase the existing 0.6 acre of southern willow scrub to 1.9 acres. The restoration project proposes to raise the grade on this trail with fill excavated from ruderal areas below the 1030 elevation within the proposed conservation pool. Those willows that are taller than the depth of fill will remain to root at the higher elevation with the help of water conservation management practices. This and additional habitat restoration will create a larger area of southern willow scrub of higher quality than currently exists.

Relocate Disc Golf (Habitat Project #7): The Disc Golf Relocation project will increase the existing 4.5 acres of southern willow scrub to 5.2 acres. This component proposes to raise the elevation of an area that has small pockets of existing willow scrub habitat. The areas of existing willows will be linked to create drainage courses that will receive less fill than the terraced areas of this project. The drainage courses will be extensions of the existing drainage patterns from elevation 1050 down to elevation 1030, the edge of the water conservation pool. The existing vegetation in the area will be hand-cleared to leave willow trees taller than the depth of fill. After the fill is placed, these existing willows will root at the higher elevation with the help of water conservation management practices. This and additional habitat restoration will create a larger area of southern willow scrub of higher quality than currently exists.

Flood Management/Water Conservation Pool (Habitat Project #11): This project proposes a phased operation that will permit the areas elevated above the floodplain (elevation 1040.5) and the perimeter of the water conservation pool (elevation 1040.5 to 1030) to become established with southern willow scrub habitat. The Flood Management/Water Conservation Pool Project will add 4.5 acres of southern willow scrub in this zone for a new total of 5.7 acres of southern willow scrub. These 5.7 acres represent a wide band around the perimeter of the pool that, once established, will be habitat of higher quality. The existing southern willow scrub habitat below the 1040.5 elevation and in particular below the 1030 elevation will degenerate and begin to die as soon as water conservation practices are implemented and this zone is periodically inundated during the winter season. The next phase of the project will remove the 17.8 acres of existing southern willow scrub areas (below elevation 1030) in a coordinated sediment and debris removal operation once the new willow habitat has become established.

*Storm Drain Improvements-JPL**:* This project will establish 2.0 acres of southern willow scrub at the drainage outfalls along the JPL border just north of the westside parking lot. Exotic species need to be removed and debris needs to be collected and disposed of. These particular drainage outfalls drain through existing sage scrub and some willows. Due to wet conditions caused by urban runoff, this project proposes to transition this two-acre area from a sage scrub plant community to a southern willow scrub plant community of higher quality.

Mule Fat Scrub

The mule fat scrub restoration area is designed to provide cover and foraging habitat in areas susceptible to high flows. The vegetation will be planted on the bottom and sides of the Arroyo Seco high-flow channel and on the banks of the low-flow channel and flood terraces to approximately ten feet above the bottom. Container plants and/or additional rooted cuttings of mule fat, and scattered plantings of rooted cuttings of arroyo willow will be installed in natural groupings to help stabilize the stream channel. Expansions of the existing mule fat habitat will occur to the north and south of its present distribution in HWP along the drainage bottom and low terraces.

Mexican elderberry, Fremont cottonwood, black cottonwood, western sycamore, white alder, California bay/laurel, and big leaf maple will also be installed. Installation shall occur in those sections of the mule fat community where the prolonged high water flooding behind the dam killed many elderberries during the rainy season of 1998-1999. The placement of the cottonwoods, sycamore, alder, bay/laurel, and maple trees is an effort to expand their distribution. These plants will be placed in the riparian area just north and south of the existing mule fat community in areas that are set back from the low-flow channel and that will be disturbed by sediment and debris removal maintenance. The upper canopy layer will be comprised primarily of occasional groupings of western sycamore, big leaf maple, white alder, Fremont and black cottonwoods, and California bay/laurel. These six tree species exist in limited distribution in HWP, though historically they were probably more common along the Arroyo Seco before construction of Devil's Gate Dam. Mexican elderberry, a species of high habitat value for local birds and other wildlife, will form the lower portion of the upper canopy layer. Arroyo willow will constitute the lower canopy. The shrub and herbaceous understory layers will be representative of the southern willow scrub community.

Mexican elderberries and the other six tall, upper canopy tree species will comprise approximately 60 percent of the tree plantings. Arroyo willows will constitute the remainder of the tree species. The upper canopy layer tree species will be established as container-grown plants in areas located approximately 6 to 12 feet above the elevation of groundwater and/or below the low-flow channel of the Arroyo Seco stream. The arroyo willows shall be planted as rooted cuttings that are a minimum of 18 inches in length, 2 to 12 feet above the elevation of the groundwater and the low-flow channel. The species comprising the shrub understory layer (i.e., mule fat, California rose, California blackberry, and desert grape) will be established as container plants in natural groupings at elevations 4 to 12 feet above the low-flow channel. The sparse herbaceous understory layer of mugwort, hoary nettle, western ragweed, giant wild rye, Santa Barbara sedge, and deergrass will be hydroseeded throughout the site. Mule fat will be used in the hydroseed mixture for this community.

There are currently 19.5 acres of mule fat scrub in the park, of which only 7.1 acres will receive habitat restoration. When water conservation measures are implemented, 10.7 acres of existing habitat will begin to die as the area is frequently inundated. An additional 3.9 acres of habitat will be established along with the 7.1 acres of habitat to be restored. The following list of the projects is proposed for habitat establishment and restoration of mule fat scrub:

*Stream Corridor Alignment (Habitat Project #1**):* This restoration project will increase the existing 0.9 acre of mule fat scrub habitat by 0.2 acre for a total of 1.1 acres. The project will shorten the Altadena drain and realign the stream corridor to allow for a more natural stream flow.

*Westside Spreading Basins (Habitat Project #3a**) and Stream Channel Widening (Habitat Project #4**):* There are currently 6.7 acres of mule fat scrub habitat within these two project areas. These habitat projects propose to eliminate 1.7 acres of this plant community along the upper banks of the stream and in the vicinity of the new spreading basins. The creation of the westside spreading basins and the widening of the stream channel will utilize “Landform Grading” principles to improve habitat for this and other plant communities.

Relocate Disc Golf (Habitat Project #7): There is currently no mule fat scrub habitat at this location. The Disc Golf Relocation project is proposed to establish 3.7 new acres of mule fat scrub to this area of the park. This restoration project proposes to raise the elevation of the area that has small pockets of existing willow scrub habitat to create drainage courses. Raised terraces of mule fat scrub habitat, a very resilient plant community, will serve to border the fairways. The areas of existing willows will be linked to create drainage courses that will receive less fill than the terraced areas of this project.

*Northern Sycamore Grove Field (Habitat Project No.7**):* This project will eliminate the 1.5 acres of low quality mule fat habitat present on the site in order to receive fill material . The site is a predominantly ruderal and highly disturbed habitat due to past mining operations. There will be some debris removal of broken concrete that was dumped from previous construction projects. Until this project is implemented, the site will be flooded, and when water is pumped back or allowed to pass through the dam, the flooded mule fat will die and a pool of water will remain for some time.

Flood Management/Water Conservation Pool (Habitat Project #11): When water conservation measures are implemented, an existing 10.7 acres of mule fat scrub will die as the area becomes frequently inundated. This project proposes a phased operation that will permit the areas elevated above the floodplain (elevation 1040.5) and the perimeter of the flood management/water conservation pool (elevation 1040.5 to 1030) to become established with southern willow scrub habitat. The Flood Management/ Water Conservation Pool Project will not alter an existing 1.2 acres of mule fat scrub in this zone. The next phase of the project will remove the dying 9.2 acres of existing mule fat scrub areas (below elevation 1030) in a coordinated sediment and debris removal operation.

Riversidian Alluvial Fan Sage Scrub

Another goal of the habitat restoration plan is to enhance the habitat quality of the small, existing remnant of the riversidian alluvial-fan sage-scrub community, and to eventually expand its distribution. This will be a formidable challenge due to the constraints of ongoing sediment and debris removal, and perhaps more significantly, the ability to simulate conditions that approximate the natural alluvial deposition processes inherent for development of this community.

As part of the strategy to enhance and diversify the floristic composition of riversidian alluvial fan sage scrub, several native tree species that are known from other alluvial fan sage scrub areas are included in the plant palette. Tree canopy layer species include big leaf maple, white alder, southern California black walnut, western sycamore, Fremont cottonwood, and Mexican elderberry. These species will be planted as 5- and 15-gallon container plants. The addition of the maple, alder, and sycamore is intentional to help increase the tree overstory diversity along the stream channel in this portion of the Arroyo Seco drainage. Big leaf maple, white alder, and western sycamore are common to abundant just one-half mile to the north in the Arroyo Seco north of the JPL bridge and in nearby Millard, El Prieto, and Fern canyons. Prior to the construction of the dam and maintenance practices, these tree species would have been more widely distributed in what is now within the HWP boundaries. The upper canopy layer tree species will be installed in areas located approximately 6 to 12 feet above the elevation of groundwater and/or below the low-flow channel of the Arroyo Seco stream.

The shrub understory layer will contain California sagebrush, four-wing saltbush, birchleaf mountain mahogany, brittlebush, hairy yerba santa, California buckwheat, bladderpod, scalebroom, laurel sumac, coastal prickly pear, lemonadeberry, sugar bush, white and black sages, poison oak, and chaparral yucca. These species will be planted as 1- and 5-gallon container sizes. The herbaceous understory layer will be hydroseeded and also will include several shrub species that are used as containerized plants. This layer will be composed of such species as California brome, California everlasting, deerweed, deergrass, California sagebrush, brittlebush, California buckwheat, scalebroom, and white and black sages.

There are currently 17.2 acres of riversidian alluvial fan sage scrub in the park. An additional 1.6 acres of habitat will be established for a new total of 18.8 acres of riversidian alluvial fan sage scrub habitat. Habitat establishment and restoration of this plant community is defined under Habitat Project #2**.

A number of smaller habitat restoration projects within a larger area will occur:
a) the Stream Channel Widening Project (Habitat Project #4**) will add one acre of habitat;
b) the Westside Spreading Basins Project (Habitat Project #3a**) will eliminate ruderal weedy species and add 0.2 acre of habitat to the embankments of the spreading basins;
c) the old east-to-west stream crossing has been abandoned and the asphalt roadway will be removed and disposed of, adding 0.2 acre of habitat; and
d) the various drain outfalls along the JPL border will add another 0.2 acre of riversidian alluvial fan sage scrub.

Sage Scrub

Sage scrub occupies sites on slopes along the east, south, and west perimeters of HWP. A goal of this habitat restoration plan is to enhance and increase the diversity and distribution of this scrub community in areas sited for sediment and debris removal. Another large location identified for planned restoration efforts consists of portions of the extensive non-native grassland community. In lieu of natural fire occurrence and/or controlled burning in sage scrub, it may be difficult to achieve success without the interactive, rejuvenating role and benefits of fire. It may be difficult to achieve any changes in the existing and mature status of sage scrub composition. Therefore, any areas scheduled for periodic sediment and debris removal, and/or areas of existing ruderal vegetation, will be desirable targets for sage scrub development through the restoration efforts.

As with the above terrestrial natural communities, the restoration plan calls for the use of trees, shrubs, forbs, and grasses that will be planted as container plants placed in natural-looking groups, and others that will by hydroseeded on the sites. A tree canopy layer of southern California black walnut and Mexican elderberry will utilize five- and 15-gallon container plant specimens. The shrub understory layer is diverse and uses one- and five-gallon-sized container plants. Species included on the palette for the shrub understory layer include chamise, California sagebrush, hoaryleaf ceanothus, birchleaf mountain mahogany, bush poppy, California encelia, California buckwheat, golden yarrow, toyon, goldenbush, heartleaf penstemon, Nevin's barberry (a federally and state-listed species that is commercially available), laurel sumac, bush monkeyflower, coastal prickly pear, hollyleaf cherry, lemonadeberry, sugar bush, white and black sages, scrub oak, and chaparral yucca.

The herbaceous understory layer will utilize numerous forb and grass species plus some previously mentioned containerized shrub species that will be used in the hydroseed/ hydromulch mixture. This layer will include giant wild rye, deerweed, miniature lupine, foothill needlegrass, purple needlegrass, California figwort, chamise, California sagebrush, California encelia, California buckwheat, golden yarrow, goldenbush, coastal prickly pear, and white and black sages.

There are currently 39.9 acres of sage scrub in the park of which 36.3 acres of habitat will be restored. An additional 6.6 acres of habitat will be established for new total of 42.9 acres of sage scrub habitat. The following projects are proposed for habitat establishment and restoration of sage scrub:

Stream Corridor Alignment (Habitat Project #1): This project will keep the size of the habitat area unchanged and will restore habitat within the project area.

Westside Spreading Basins (Habitat Project #3a): There is currently no sage scrub habitat in the area of the proposed westside spreading basins. This existing area is mostly a ruderal plant community. This habitat project proposes to establish 3.0 new acres of sage scrub plant community along the slope east of the spreading basins.

Eastside Spreading Basins (Habitat Project #2 and #3c): The East Spreading Basins project will increase the existing 4.9 acres of sage scrub to a total of 6.0 acres. The equestrian trail on the west side of the existing spreading basins traverses some of the best old alluvial fan sage scrub in the area, designated as sage scrub on the plant community maps. Project 3c involves spreading basins 5 through 10 on the east side. The proposal is to abandon the equestrian trail, relocate the trail on the spreading basins maintenance road (asphalt to be removed) and restore the area occupied by the existing trail with sage scrub.

Stream Channel Widening (Habitat Project #4): There is currently no sage scrub habitat at this location of the stream channel. On the western slope of the stream channel project, 2.5 acres of sage scrub habitat will be established. This project will widen the stream on its western edge for a new total stream channel width of approximately 200 feet. Both the east and west sides of the stream channel will be restored with sage scrub habitat.

Sunrise Overlook (Habitat Project #8): There are currently 1.9 acres of sage scrub habitat in this project area, much of which was established by hydroseeding when the freeway access ramp was eliminated from this location. A total of 0.9 acre of this habitat will be converted to oak woodland habitat leaving one acre of sage scrub.

Devil's Gate Dam Area: This project area currently has 13.2 acres of sage scrub. Although the acreage of habitat will remain the same, 0.2 acre of this habitat will be removed as a result of the spillway observation overlook project, but 0.2 acre will also be added as a result of habitat establishment on the slope adjacent to the dam spillway. The existing 13.0 acres remaining will receive habitat restoration.

Eastside Park: An acre of sage scrub will be eliminated due to the following projects:

a) 0.5 acre will be converted to oak woodland east of basin 14 and the overflow basin (Johnson Field);
b) 0.2 acre will be lost to the east rim trail extension project. The total remaining area in sage scrub within the Eastside Park Area will be 10.2 acres of restored habitat.

JPL Storm Drain Improvements: A total of 7.0 acres of sage scrub exists adjacent to JPL in the vicinity of the westside storm drains. This project will convert 2.0 acres of sage scrub to southern willow scrub at the drainage outfalls just north of the westside parking lot (Habitat Project #2) along JPL. These particular drainage outfalls drain through existing sage scrub and some willows. Due to wet conditions caused by urban runoff, this 2.0-acre area will be established with southern willow scrub. A total of 5.0 acres will remain in sage scrub in this area.

Southern Sycamore Riparian Woodland

Southern sycamore riparian woodland currently occupies sites downstream and south of the dam in the southern reaches of HWP near the 210/Foothill Freeway. This plant community probably was more widely distributed in the park basin prior to flood control management practices (i.e., sediment and debris removal). The southern sycamore riparian woodland restoration areas are designed to provide cover and foraging habitat in areas presently susceptible to high flows, particularly on the east side of the basin south of Johnson Field. This area is now populated with mule fat and Mexican elderberry, much of which was destroyed during the 1998-1999 El Niño winter storm events. The planned sycamore restoration area will be raised with fill material to above elevation 1040.5.

The restoration plan calls for upper and lower canopy layers comprised of occasional groupings of western sycamore, Fremont and black cottonwood, white alder, bigleaf maple, California or foothill ash (*Fraxinus dipetala*), Mexican elderberry, California bay/laurel, coast live oak, black willow, arroyo willow, red willow, and shining willow. The scattered trees will be planted in five- and 15-gallon specimens. The arroyo, red, black, shining, and narrow-leaved willows shall be planted as rooted cuttings that are a minimum of 18 inches in length. Tree and shrub plantings will be grouped and/or scattered in natural appearing groups. Artificial (drip) irrigation will need to be used for approximately five to ten years to help sustain the plantings and help them develop into mature trees.

The species comprising the shrub understory layer, i.e., mule fat, California rose (*Rosa californica*), and California blackberry, will be planted as one-gallon container plants that will also need irrigation supplied to them. The sparse herbaceous understory layer of mugwort, meadow barley (*Hordeum brachyantherum*), deergrass (*Muhlenbergia rigens*), and hoary nettle will be hydroseeded throughout the site.

There are currently 2.6 acres of southern sycamore riparian woodland habitat in the park. An additional 22.2 acres will be established for a new total of 24.8 acres of southern sycamore riparian woodland habitat. The following list of projects is proposed for habitat establishment and restoration of southern sycamore riparian woodland:

Westside	
Around proposed Southern Sycamore Grove Field (Project 7)	2.1 acres
Around proposed Northern Sycamore Grove Field (Project 7**)	4.7 acres
Adjacent to proposed Spreading Basins 15, 16 & 17 (Project 3a**)	1.4 acres
Stream Corridor Alignment (Project 1**)	1.4 acres
Eastside	
South of and around Johnson Field (Project 10)	3.8 acres
Around existing overflow basin (Project 10)	3.2 acres
Around Spreading Basins 7–14 (existing nos. 5–12, Project 3c**)	2.6 acres
Around new Spreading Basins 1 & 2 and expanded Spreading Basins 3-6 (existing nos.1–4, Project 3b**)	3.0 acres

Ruderal

The existing 75.4 acres of ruderal habitat within the study area, includes 2.4 acres within the MWD property. The 73.0 acres of ruderal habitat within HWP will be completely replaced with other plant communities, as shown in the proposed plant communities map, or eliminated within the proposed water conservation pool which will be cleared of all vegetation below elevation 1030. The ruderal areas within the designated critical habitat for the federally listed endangered Southwestern Arroyo Toad will be graded using landform grading principles.** The highly disturbed and unnatural topography will be improved and the poor quality habitat will be eliminated and instead quality habitat for the Arroyo Toad and other native flora and fauna will be restored.

Streambed Riparian

There are currently 8.1 acres of streambed riparian habitat in the park; of this total, 4.9 acres will be destroyed in the creation of the water conservation pool. This will be offset by the creation of 5.1 acres of habitat upstream of the pool for a new total of 8.3 acres of streambed riparian habitat. Following is a list of the proposed projects.

Inundated Areas (Habitat Project #11): There are two areas below the existing 1030 elevation that will be inundated frequently when water conservation procedures are implemented. This will cause the existing 4.9 acres of streambed riparian habitat in these areas to die. These two areas will be cleared, excavated and graded for the water conservation pool (Habitat Project #11).

*Stream Channel Widening (Habitat Project #4**):* The stream channel widening project will establish 5.0 additional acres of streambed riparian habitat. This restoration project will widen the stream on its western edge to approximately 200 feet. Landform grading principles will be utilized here to improve the habitat for several native plant communities and to create quality habitat for the federally listed endangered Southwestern Arroyo Toad and for other native fauna.

*Stream Corridor Alignment (Habitat Project #1**):* This restoration project will increase the existing streambed riparian habitat by 0.1 acre as a continuation of the same habitat, immediately north of the JPL bridge. The project will shorten the Altadena drain and widen the stream corridor to allow for a more natural stream alignment.

Flood Management/Water Conservation Pool

Since 1970, when the dam was declared unsafe to hold water, vegetation has been allowed to grow in the flood zone behind the dam (area below elev. 1040.5). The flood management/ water conservation pool will be constructed in an area that is predominantly ruderal habitat See Exhibit 2.3 (Existing Plant Communities).

PLANTING GUIDELINES

As habitat restoration projects are implemented, collection of native plant seed and cuttings will be carried out for each community, and/or will be acquired from reputable native plant nurseries. Seeds that are gathered and/or purchased will be used in hydroseeding/hydro-mulching applications in each community. Final specifications for the seed mix for each plant community will be developed after tests for purity and seed germination are conducted. Not all of the species depicted on the plant palettes of the six plant communities will be installed because installation depends on the availability and number of species at the time of planting. It is the goal of this habitat restoration plan, however, to plant as many of the palette species as possible in the applied restoration efforts.

A nurse crop species, plantain (*Plantago ovata*), will be included in all five natural community hydroseed/hydromulch mixtures at the rate of 40 pounds per acre. This non-native, low-growing annual forb species is an excellent nurse plant that helps shade out potential weedy species, decreases evaporation rates at the ground surface, and helps control erosion during initial revegetation plant establishment for other newly germinating native species in the seed mixes. It is also useful because it does not reseed well. Included in the hydromulch is 2,000 pounds per acre of virgin cellulose wood fiber and 150 pounds per acre of organic soil stabilizer.

Detailed recommendations for soil preparation and tillage, soil analysis and testing, soil amendments including possible fertilizer use, pre-planting weed control and removal, and pest and disease control are included in the Technical Report. Highlights from the guidelines are summarized as follows:

- Controlling the growth of weedy plant species in the planned restoration areas will be the most significant and difficult task to accomplish. Weed control must be addressed at least one year in advance of revegetation. Mechanical removal of weeds is preferred over the use of herbicides. Herbicides should never be used near aquatic and wetland areas under any circumstances due to the sensitive nature of these habitats and the potential for further spreading of harmful chemicals through water-borne transport. Soil tilling, mechanical cutting, solarization, and spot herbicide treatments should all be considered.

- Salvage and reuse of native topsoil should be part of all restoration efforts. A top soil survey should be performed to determine areas where good quality soil exists prior to the start of grading operations.

- Soil preparation will include ripping and/or disking of the soil to create a seedbed for broadcast or hydro-seeded material, or to open spaces for easier installation of containerized plant stock. Ripping and disking permit better root development by breaking up compacted soil, and help promote better aeration and water infiltration into the soil. Gravel and/or bark mulch may be used to help retain soil moisture around plantings.

- Soil analysis will be conducted to evaluate whether adverse soil conditions exist. Soil tests will be conducted after final grading of each area to be revegetated is completed. A qualified agronomy or soils testing laboratory should analyze soil samples.

- Soil amendments may be added to a particular site if the soils testing laboratory results indicate low concentrations or absence of important minerals and/or nutrients.

- Pest and disease control will be an ongoing process. Only reputable native plant nurseries and their resources will be used. Sickly plant specimens from a nursery will not be used;

and should any planted specimens become infested or infected with pests or disease after planting, those specimens will be removed to prevent spreading to healthy stock.

Local native-plant nurseries with a large variety of stocked species and knowledge of the species-specific requirements concerning light, water, soil substrate, and growth rate are recommended. Local, on-site collection of plant materials is highly desirable in order to maintain the genetic diversity of the plant communities.

The implementation schedule for the installation of plants involves seasonal timing and coordination with the anticipated late fall, winter, and early spring rainy seasons. During the implementation phase for planting native species, this strategy is critical for attaining successful restoration.

The irrigation of containerized plantings at the time of field installation, regardless of the rainy season conditions, and documentation of the site preparation and installation techniques is recommended. In brief, irrigation efforts will ensure that the selected containerized plant stocks are well watered before, during, and after field installation, at least for a predetermined period of time. This effort also helps reduce loss of plant stocks due to transplant shock. Periodic, supplemental irrigation should continue even during a normal rainy season unless planting occurs within a few days of ample rainfall. If an ample rainfall pattern continues, supplemental watering may be discontinued. Should very low rainfall or drought occur for extended periods of time following planting, irrigation of the plants may be warranted. If establishment irrigation is required, it will be accomplished in such a manner as to encourage deep root growth (i.e., periodic, deep irrigation as opposed to frequent, light irrigation that promotes development of more shallow root systems).

3.4 RECREATION TRAILS

PERIMETER TRAIL

An all-weather, permeable-surface roadway will loop around the entire basin providing hikers and equestrians an internal recreational trail with links to connecting trails in the Angeles National Forest, the Central Arroyo, and the County-maintained trails to the east and west of the park. This loop also provides internal access for emergency and maintenance vehicles. See following Exhibit 3-8, Trail Plan.

The Perimeter Trail will serve as a delineator, separating the stream and its associated restored habitats at the center of HWP from areas of concentrated recreation activity on the westside and water resources facilities on the east side. This delineation helps preserve the streambed and sloped banks as a wildlife corridor. Additionally, it will separate the sediment and debris removal activities associated with the dam from those areas of the basin available for recreation.

The trail will maintain a minimum elevation of 1045 (4.5 feet above the 1040.5 spillway floor elevation), so that it will be accessible during most storm events. Segments of the trail will need to be raised and storm drains installed at critical cross-drainage points to minimize washouts and to maintain the existing drainage patterns. For example, this type of work will be necessary at the Berkshire Drain and the relocated disc golf area.

In large part, the Perimeter Trail utilizes existing trail routes such as the maintenance road along the edge of the spreading basins and Johnson Field down to the Devil's Gate Dam. New portions of the trail will wrap around the Southern Sycamore Grove Field and the relocated disc golf area.

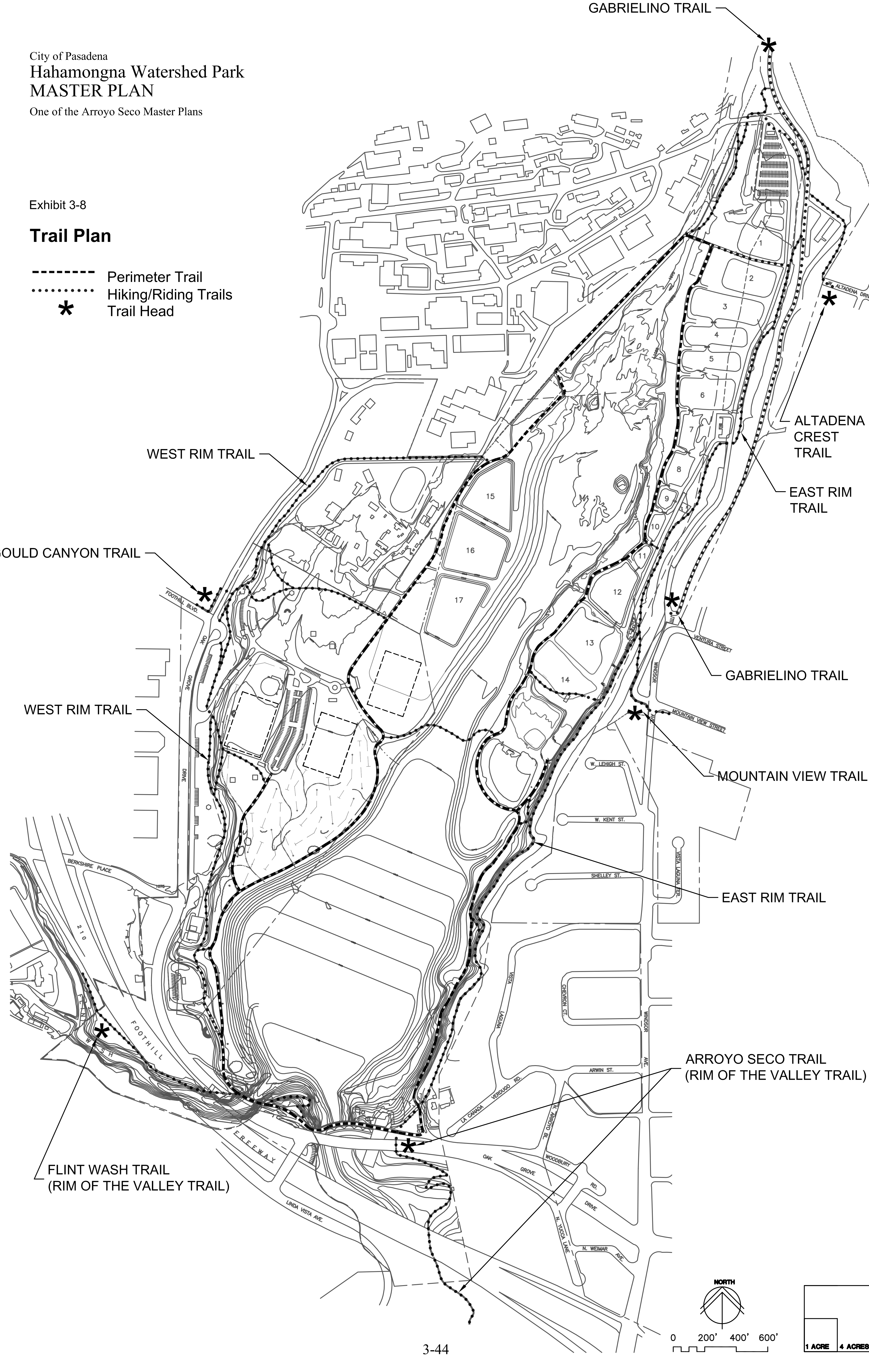
To complete the loop, the Flint Wash Bridge must be reconstructed and a new bridge built at the northern end of the basin. A prefabricated bridge with wood flooring will be installed at each location, spanning approximately 150 feet each. An existing historic abutment will be reconstructed on the east side of Flint Wash and a new abutment on the west. At the North Bridge Crossing of the Perimeter Trial, new abutments will have to be constructed.
The North Bridge Crossing will also serve as a utility crossing for the pump-back and diverted storm water distribution systems to the west side spreading basins. Appropriate signage will be posted. The recommended location of the bridge is at the northern end of the existing sloped concrete flood revetment on the east edge of the JPL campus and south of the current JPL bridge crossing.

From the Devil's Gate Dam to Flint Wash Bridge, the Perimeter Trail will be used by equestrians, bicyclists, and hikers as well as maintenance and emergency vehicles. At Devil's Gate Dam, bicyclists entering the park via the proposed east access (entry) from Oak Grove Drive will cross the dam and Flint Wash, and continue north through the west side on the paved park roadway. (See the following section on the bicycle route for more detail.) Hikers and equestrians approaching the east side of the dam on the Perimeter Trail, the East Rim Trail or from the Arroyo Seco Trail (from the Central Arroyo) will likewise cross the dam and Flint Wash together with other park users. After crossing Flint Wash, the Perimeter Trail diverges from the paved road following the edge of the flood management/water conservation pool.

City of Pasadena
Hahamongna Watershed Park
MASTER PLAN
One of the Arroyo Seco Master Plans

Exhibit 3-8

Trail Plan



A paved bicycle trail will parallel the Perimeter Trail on top of the existing sloped concrete flood revetment adjacent to the west JPL parking area to the North Bridge Crossing. Equestrians, bicyclists, and hikers as well as maintenance and emergency vehicles will use the North Bridge Crossing to connect to the eastside of the park. After crossing the bridge, the bicycle route will separate from the Perimeter Trail with a paved bicycle trail connecting to the east side paved roads. See the following section on the Bicycle Route for more detail.

On the east side, park users will share the Perimeter Trail from Devil's Gate Dam to Johnson Field with LACDPW Flood Maintenance. For short periods of time during the summer, maintenance of the dam sluice gate will require use of the trail for maintenance vehicle access to the basin. During the winter months, removal of floating debris from the flood management/water conservation pool will necessitate access to the two staging areas located adjacent to the Perimeter Trail.

HIKING AND EQUESTRIAN TRAILS

All trails in HWP will be for equestrians and hiking as shown in Exhibit 3-8, Trail Plan. All bridge surfaces will be wood to accommodate safe equestrian crossing. Trails will be made accessible throughout the year by constructing them at or above elevation 1045, out of the normal seasonal flood area.

Equestrian and hiking trails will have a minimum trail tread width and a minimum trail clearance to provide enough room for safe passage of horse and rider, and to allow hikers and equestrians room to move to the side as necessary. (See the Arroyo Seco Design Guidelines for further information on trail design standards.)

In addition to the Perimeter Trail, the following additional trail improvements are proposed as part of the Master Plan:

East Rim Trail: Improvements to the East Rim Trail include construction of a new trail from the VOC Water Treatment Plant to the Arroyo Well and the reconstruction of an old trail from the Arroyo Well to the Altadena Crest Trail. It will cross the entry access road close to the north side of the Arroyo Well, skirt the backside of the existing east JPL parking lot, and join with the Altadena Crest Trail and the Gabrielino Trail.

Trail Connections from East Rim Trail to Perimeter Trail: This project will create four trail connections along the east side linking the upper East Rim Trail to the lower Perimeter Trail. Each of the trail connections will accommodate pedestrians and equestrians. These connections will allow pedestrians and equestrians to access the East Rim Trail from the Perimeter Trail, so park users can avoid or bypass sediment/debris removal operations as necessary.

West Rim Trail: The West Rim Trail runs from Flint Wash Bridge through the upper Oak Grove area and the Metropolitan Water District (MWD) property where it converges with the Perimeter Trail south of the west side JPL parking lot. From the Gould Canyon Trail access tunnel to the Perimeter Trail, the West Rim Trail runs parallel to, but separate from. the paved inner park road used by vehicles and bicyclists.

Hikers and equestrians entering HWP from the Gould Canyon Trail access tunnel under Oak Grove Drive, and heading south on the West Rim Trail, must ride along the Park's main entry road at Foothill Boulevard. For improved safety, a portion of the trail will be moved east to a lower elevation to avoid conflicts with vehicle traffic. The new trail will connect to the existing trail just south of the "big bend" in the Park entry road.

Trail Connections from West Rim Trail to Perimeter Trail: This component replaces the existing stairs connecting the upper level of Oak Grove to the lower level. The stairs have deteriorated and are unsafe. This project element will grade a new trail linking the West Rim Trail near the upper terrace restroom to the south end of the Oak Grove Field and back up to the West Rim Trail via a reconstructed trail that once led to the Foothill Boulevard park entrance. From the lower level, a connection around the south end of Oak Grove Field ties to the trail connecting from the parking area south to the Perimeter Trail.

Dam Observation Trail: A loop will be constructed from the eastern end of the Flint Wash Bridge, along the top of an existing retaining wall to an observation point north of Devil's Gate Dam and back up to the western end of the dam. The observation point will be located on top of the west abutment of the original "Pasadena-La Cañada Bridge" (1893-1920). From the observation point, park users will have a clear view of the interior face of the dam and the water conservation pool area. This project will require cut and fill to be balanced on-site. This trail connection will be for pedestrians only and, for safety, include a railing the length of the trail.

Specific trail segments will be abandoned to allow for plant habitat restoration, improved safety, and to minimize erosion. These segments include:

- Informal trails in the sage scrub habitat adjacent to the existing spreading basins;
- Stairway connecting upper and lower terraces of Oak Grove;

- All trails below the Perimeter Trail elevation in the restored habitat and the flood management/water conservation pool areas. This includes at least five existing ad-hoc trails that cross the basin from east to west. Only one trail will remain north of the flood management/water conservation pool crossing the widened stream corridor at elevation 1027 to connect the east and west recreational areas.

BICYCLE ROUTE

Bicycle use will be allowed on any existing or proposed paved surfaces within HWP. All major facilities and attractions will be accessible by bicycle. Bicycles will *not* be allowed on any designated trail or unpaved surfaces within the park nor on the existing JPL bridge crossing. The proposed route follows the perimeter of the park on existing vehicle roads, connecting to bikeways on Foothill Boulevard and Oak Grove Drive, to the JPL campus, the Kenneth Newell Bikeway, and southward to the Central Arroyo. JPL employees who bicycle to work will be able to reach the campus via the proposed internal bicycle route. See Exhibit 3-9, Bicycle Routes.

In order to provide access to the roadway across Devil's Gate Dam and the Flint Wash Bridge, bicyclists will enter HWP using the proposed east access (entry) to the dam. The new entry slip lane from Oak Grove Drive is part of the reconfiguration of access roads to the dam for maintenance and for sediment and debris removal. The control gate will be designed to allow bicycle access.

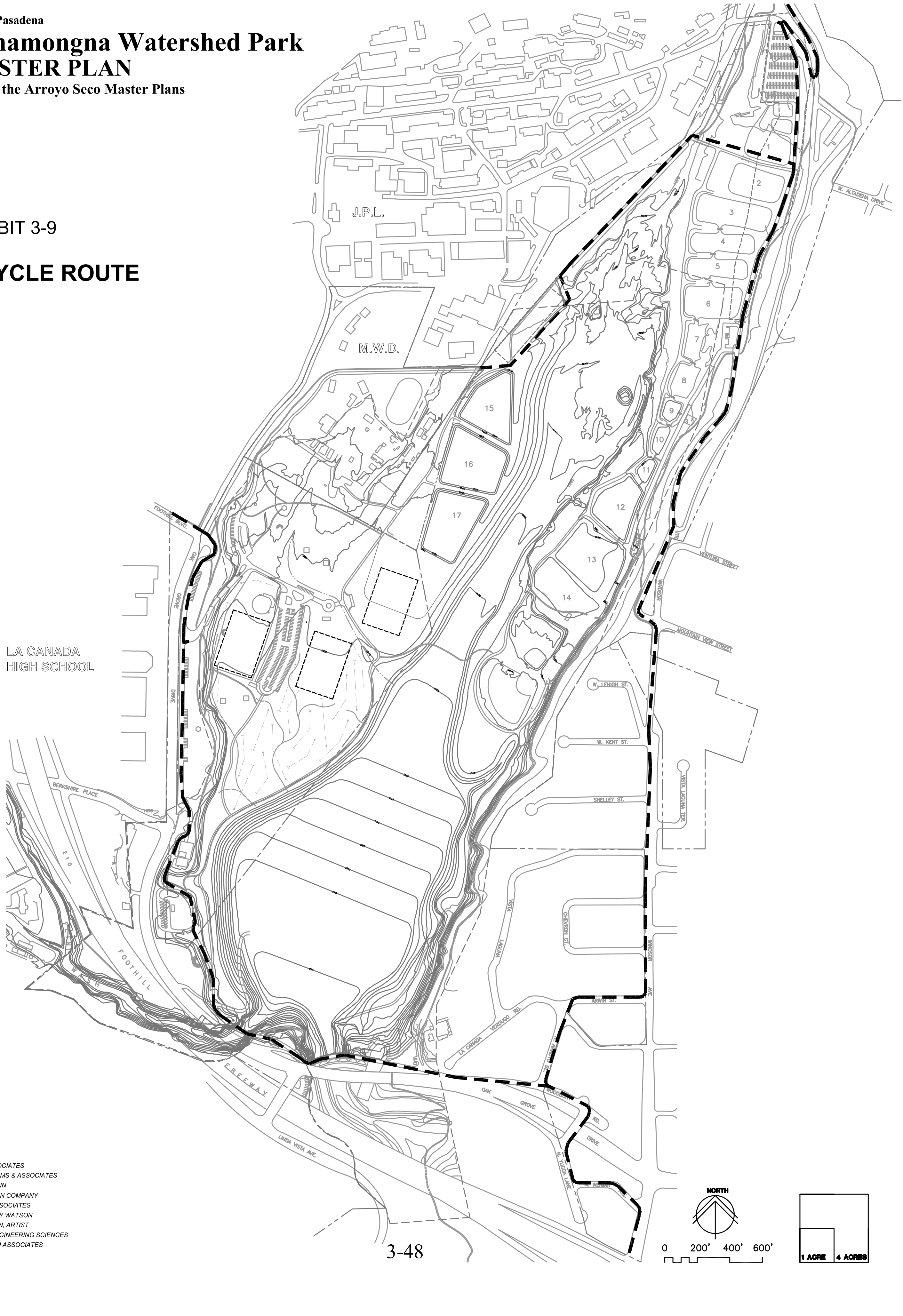
Bicycle access to the Gabrielino Trail from the east side of HWP will be via the yellow pipe gate entry at the Windsor/Ventura intersection and from the proposed new public parking at the northern quarter of the existing JPL east parking lot. These accesses will connect bicycle riders to the Gabrielino Trail via an existing paved road into the Angeles National Forest.

City of Pasadena

Hahamongna Watershed Park
MASTER PLAN
One of the Arroyo Seco Master Plans

EXHIBIT 3-9

BICYCLE ROUTE



TAKATA ASSOCIATES
PHILIP WILLIAMS & ASSOCIATES
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THE NATELSON COMPANY
MIRALLES ASSOCIATES
MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCES
HUNT DESIGN ASSOCIATES

3.5 WESTSIDE & OAK GROVE AREA IMPROVEMENTS

MULTI-USE PLAY FIELDS

The Hahamongna Watershed Park Master Plan recommends the development of multi-purpose play fields on locations where land uses have a history of disturbance. There are two new multi-purpose fields proposed and illustrated in Exhibit 3-1, HWP Master Plan, at the beginning of this section. One is proposed on the westside, adjacent to the existing Oak Grove Field; this field is proposed to be called Sycamore Grove Field. The second new field will be north of Sycamore Grove Field and east of the supervised overnight camping area. The multi-use play fields consist of turf areas suitable for organized field sports, group events, and open play. All three fields will be maintained using the best management practices outlined in the Arroyo Seco Design Guidelines and in Appendix F, "Technical Report on Athletic Fields in Hahamongna Watershed Park," so as to not have a detrimental affect on groundwater quality.

Oak Grove Field

The Oak Grove play field has already been upgraded to accommodate an overlaid youth-tournament soccer field as well as a Little League baseball field. This field configuration also allows the area to be divided into two practice fields for youth soccer. The existing mature oaks that surround Oak Grove Field will be preserved and new oaks planted. A detailed illustration of the area is shown in Exhibit 3-10, Oak Grove Improvements.

Sycamore Grove Fields 1 & 2

Two additional 2.4-acre, multi-use play fields are proposed. The southern site is currently used for temporary overflow parking just east of the existing parking lot. The northern site is located where past mining operations excavated a large depression. Both Sycamore Grove Fields will accommodate youth tournament soccer, open play, group picnics, and other group and individual activities. This field configuration allows each field to be converted into practice fields for youth soccer. This field will be surrounded by southern sycamore woodland plantings. Best management practices will be utilized for the maintenance of the athletic field turf areas to mitigate against any possible impacts to groundwater quality. Maintenance methods that consider natural solutions and the proper management of the natural resources will be given priority.

Exhibit 3-10, Oak Grove Improvements

The existing Oak Grove parking area will be expanded to accommodate the abandoned overflow parking and a new Oak Grove Field restroom constructed before the Sycamore Grove Fields are constructed.

Under existing conditions, a portion of the Southern Sycamore Grove Field site is prone to flooding, therefore the area will be raised from its current average elevation of 1040 to elevation 1050. Under existing conditions, the proposed northern Sycamore Grove field site is prone to flooding, therefore the existing large depression at elevation 1025, well below the inundation 1040.5 elevation, will be raised above elevation 1055. During disaster emergencies, the Oak Grove area will continue to be used as a staging area for fire crews and other emergency support groups.

The perimeter trail to the east and north of the Southern Sycamore Grove Field is planned to provide a strong separation between this active recreational area and the habitat restoration area of the interior basin. This portion of the trail will be ADA-accessible.

DISC GOLF COURSE

The disc golf improvements include relocation of the back nine from the north Oak Grove Area and pins 6-9 of the front nine to the area south and east of the new expanded parking lot and the Southern Sycamore Grove Field. The relocation of this portion of the disc golf course provides an opportunity for habitat restoration of the north Oak Grove area.

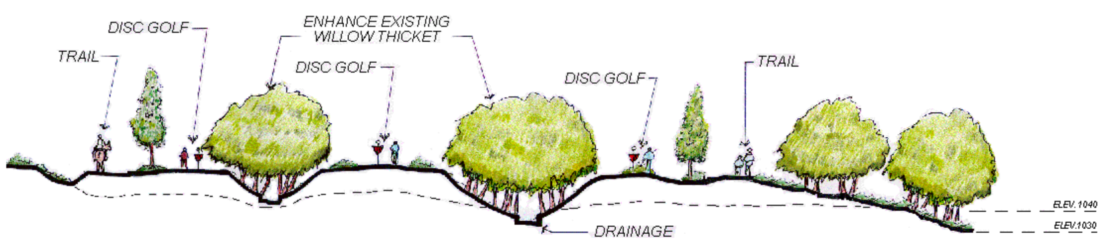


Exhibit 3-11, Conceptual cross section of raised terraces for relocated disc golf course

Portions of the new disc golf course will be raised utilizing excavated material from the water conservation pool area. The material will be placed between existing stands of willows, raising these portions to an average elevation of 1046, above the frequently inundated elevation of 1040.5. Drainage courses in this area will occur within the existing stands of native habitat.

The upper terraces will be planted to create mule fat scrub habitat along the fairways and southern willow scrub habitat as outlined in the plant restoration plan. The placement of the disc golf pins will be such to minimize conflicts with hikers and equestrians. A bench will be provided at every tee and designed in accordance with the Arroyo Seco Design Guidelines. The Master Plan recommends that the City formally recognize disc golf as a recreational use of HWP. Policies for the use of the course need to be established in a collaborative manner between the City and the disc golf community.

OUTDOOR AMPHITHEATER

The existing amphitheater located just west of the Oak Grove field will be restored, but not expanded. The telephone pole seating will be rehabilitated for ease of maintenance and to make the area safe. Seating will be designed to prevent movement of the existing unsecured poles and the area will be fine-graded and surfaced with appropriate material to make the area ADA-accessible.

WESTSIDE PICNIC AMENITIES

Both group picnic areas and smaller/individual picnic areas are planned for improvement. There are currently 52 picnic tables within the Oak Grove Area. This quantity has decreased over the past several years due to a loss of tables (breaking, etc.). It is estimated that the total number of tables will double to accommodate the use anticipated by the park improvements proposed for the Oak Grove Area.

Existing picnic tables will be moved to better positions and to also relieve the compaction on sites where they currently sit. A rotation program for the picnic tables should be considered, particularly in areas where the tables are within the drip line of an oak tree.

The upper Oak Grove Area will continue to have single picnic tables distributed throughout, while lower Oak Grove will serve as the location for two designated group picnic areas each with two shade structures. The first is south of the Oak Grove field; the second facility will be located in the overnight camp area. Each shelter will have four to six picnic tables. All group picnic areas will be provided with electrical outlets, sinks with running water and grey water drains, and group barbecues. The shade structures for the group picnic areas will be designed to fit the natural character of HWP, following the Arroyo Seco Design Guidelines. The floor of the group picnic areas will be graded level and surfaced with a permeable material such as decomposed granite blended with native soil and a binder. The group picnic areas will meet all ADA-accessibility requirements.

To support the picnic areas, the two existing restrooms, one in Upper Oak Grove and the other in the overnight camping area, will be renovated with new fixtures and ADA-accessible stalls. The abandoned restroom, which has been removed from the southwest corner of the Oak Grove play field, will be reconstructed near the southeast corner of the field, closer to the parking and to the new group picnic area. The replacement restroom will service group picnicking, multi-purpose play fields, and the disc golf course, and will include a storage area for park maintenance and field user group equipment.

SUPERVISED OVERNIGHT CAMPING

Supervised overnight camping is proposed in the northern portion of the Oak Grove area. Overnight camping will only be available to organized groups, such as the Boy Scouts and Girl Scouts, with proper supervision. The facilities for group overnight camping to be provided include group-picnic shade structures, grey-water outdoor sinks, barbecues, drinking fountains and renovated rest room. A fire ring with seating for 30 youths and an amphitheater with seating for approximately 60 youths will be created as part of this project. The amphitheater will be constructed in the same style as the existing larger amphitheater adjacent to the Oak Grove field. Access to selected campsites will be provided for the disabled. During the day the site will be available to the general public.

The existing Los Angeles County trail maintenance building and storage area will be converted to provide accommodations and administrative space for the park staff. Parking for the overnight campers and trash bin storage will be provided adjacent to the staff building and across the inner park access road. See Section 3.7, Parking & Circulation for more detail.

Selected areas of the overnight camping area will be restored to oak woodland. These areas will be identified as restoration areas and corded off. With the exception of the existing trail connecting the West Rim Trail and the Perimeter Trail via the existing restroom, equestrian trails through the oak woodland restoration areas will be removed. Hitching posts and a water trough will be provided at the southeast corner of the overnight camping area, near the vehicle turnaround between the Sycamore Grove Fields

EQUESTRIAN STAGING AREA

Improvements to the equestrian staging area include improved vehicular access for school bus and horse trailer turnaround, upgrade of the existing restroom, improved trail connections, and picnic amenities for informal gatherings.

Access improvements will be in conjunction with the Berkshire drain improvements. (See Section 3.8, Utilities & Infrastructure.) The existing single-lane access road will be raised, realigned, and widened as it passes over the Berkshire Drain to allow two-way traffic. South of Berkshire Drain, a one-way loop will allow incoming traffic to enter the parking area on the northern edge. All vehicular traffic will exit via the southeast corner of the parking area, looping back along the old entry roadway. The softer, wider turns and one-way traffic flow will provide easy access for horse trailers, school buses, and camp vans (see Exhibit 3-12, Proposed Road Improvements to Equestrian Staging Area).

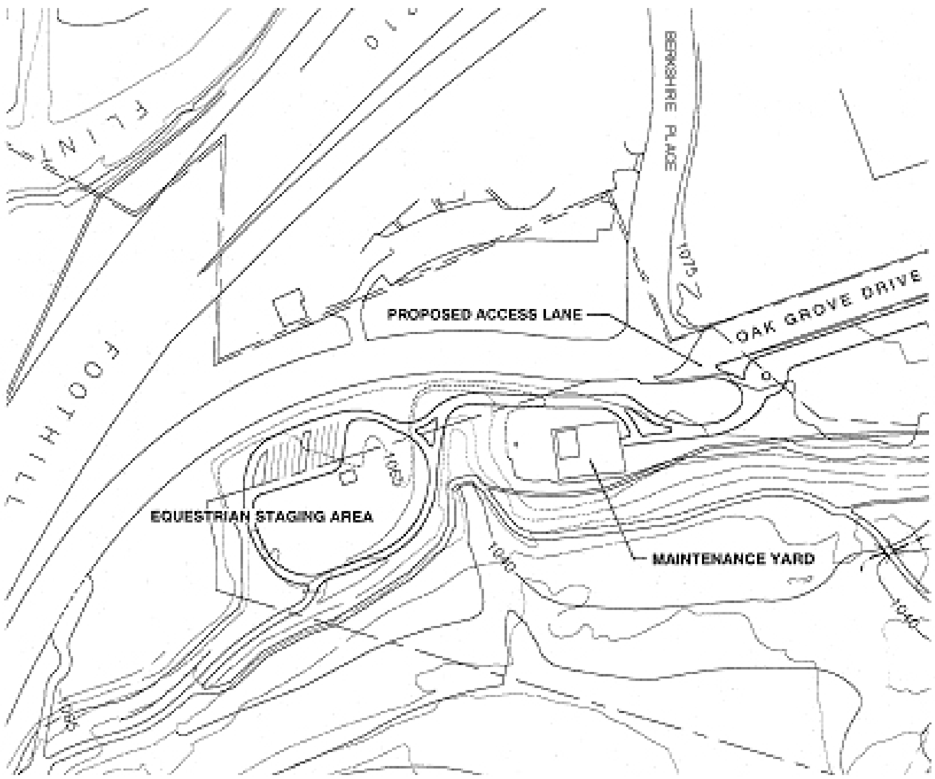


Exhibit 3-12, Proposed Road Improvements to Equestrian Staging Area

CALIFORNIA NATIVE PLANT NURSERY

A plant nursery will be established at the existing Oak Grove Maintenance Office (OGMO) to allow for the propagation of native plants indigenous to the watershed. These plants will be used for the restoration projects within HWP and other areas of the Arroyo Seco. An unused, open area adjacent to the office will be incorporated into the yard with new fencing. Improvements include propagation tables, interpretive signage, storage bins for soil and amendments, and a holding area for larger container stock. Environmental education programs and associated volunteer programs will have supervised access to the nursery.

SUNRISE OVERLOOK

On an eastward-facing knoll, south of the Equestrian Staging Area, a hollow will be carved from the hillside creating a small amphitheater above the edge of an existing retaining wall. The rising sun and the San Gabriel Mountains form the backdrop to a view of the entire HWP basin. Rounded boulders and recycled historic granite curbs from Old Town Pasadena will be used to build the stepped terraces. Oak woodland will be established around the amphitheater to provide shade, further separation from Oak Grove Drive, and a sound barrier to the 210 Freeway. An existing trail leads from the Equestrian Staging Area to the site. ADA-access will be provided by new trail ramps from both the north and south along the top of the existing retaining wall.

3.6 EAST SIDE PARK IMPROVEMENTS

SUNSET OVERLOOK

Just north of the Windsor/Ventura entrance to the park, on the crest of the west-facing canyon slope, a small picnic and interpretive area will be developed to take advantage of the broad views of the basin. The site will overlook the spreading basins and the water conservation pool to the south providing opportunities for education on water resources and habitat restoration. A small parking area, located near the intersection of Ventura and Windsor Avenues, will serve this area.

GABRIELINO TRAIL AREA

A new trailhead at the north end of the existing eastside JPL parking lot will bring park users into this area of the park, up the Gabrielino Trail and into the upper Arroyo Seco watershed area. The Gabrielino Trail area will provide a new restroom, picnic tables, public parking and interpretive signage for area recreational users. When the northern quarter of the existing JPL parking lot becomes available for public parking, then the existing parking at Windsor Avenue and Mountain View Street can be used for a new park entrance.

A new restroom will be constructed at the north end of this remodeled parking lot and serve visitors to HWP as well as those headed into the Angeles National Forest. A small storage area and a public telephone will be provided at the structure.

DEVIL'S GATE DAM AREA

Dam Keeper's Quarters and Public Restroom

The existing dam keeper's quarters located on the east side of the dam will be demolished and a new public restroom constructed to serve park visitors. A new dam keeper's quarters will be built above the public restroom with sleeping quarters, a small kitchenette, and a private restroom. This second story will afford the dam keeper a view of the basin during storm events. On the ground level, connected to the public restroom, will be a storage area (single-car garage) for materials and equipment related to the operation and maintenance of the dam.

Dam and Observation Deck

The City of Pasadena will work collaboratively with the County to enhance safety on the deck of the dam, at the observation deck south of the westside tunnel overlooking the spillway, and along the trail that lead~~s~~ down to the observation point overlooking the dam and the water conservation pool. Safety will be enhanced through the installation of ornamental fencing along the dam parapet walls and the spillway observation deck. Fencing will be similar to that installed by the City on the Colorado Street Bridge. Fencing will also be installed along the trail in order to restrict access to the flood management/water conservation pool.

3.7 CIRCULATION & PARKING

DEVIL'S GATE DAM AREA

At the present time, sediment removal trucks access the flood management/water conservation pool area through the cul-de-sac at the end of La Cañada-Verdugo Road. Use of this residential street for sediment removal has been highly disruptive to the neighborhood. The Master Plan proposes to close La Cañada-Verdugo Road and reroute truck traffic via a slip lane from Oak Grove Drive. The new East Access (entry) to the dam would be gated and provide one-way access to the dam area. The entry gate would be configured to accommodate bicyclists.

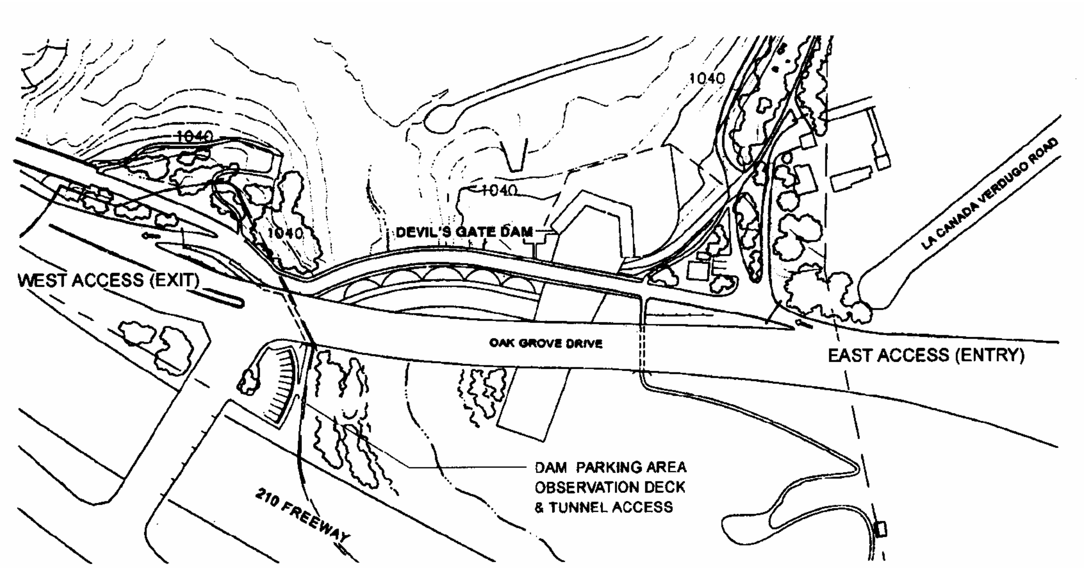


Exhibit 3-13, Slip Lane Entry and Exit to Dam

The new West Access (exit) from the dame area will allow exiting maintenance vehicles and equipment to cross the top of the dam and exit back onto Oak Grove Drive via another one-way slip lane. Exiting vehicles will be required to turn right on Oak Grove Drive and continue on to the Berkshire Place entrance to the 210 Freeway. This route across the top of the dam is part of both the Perimeter Trail and the bike route. Appropriate signage and attention to safety regulations during periods of sediment and debris removal will be necessary to maintain safe multi-modal access for all park visitors.

The East Access (entry) from Oak Grove Drive will require the removal of the existing dam keeper's quarters to raise the road bed and smooth the transition to the east-side haul road used for sediment and debris removal. A new public restroom and dam keeper's quarters will be constructed near the east end of the dam along with three parking spaces.

The existing pipe gate at the end of the cul-de-sac on La Cañada-Verdugo Road will be removed and the street curb restored, eliminating all vehicle access from this residential street. A landscaped berm will be created along the edge of the cul-de-sac to further buffer the adjacent residential neighborhood from park activities. Storm drains and perimeter fencing will be modified as needed.

New Dam Parking Area

A small landscaped parking area is proposed at Oak Grove Drive and Linda Vista Drive for park visitors who wish to visit the Devil's Gate Dam area. This scenic overview is the only public-accessible location with a view of the south side of the dam. From this point the rock formation for which “Devil’s Gate” is named, is visible, as is the floodwater cascading from the spillway onto the narrow canyon floor. Access to HWP and the top of the dam from this proposed parking area is accommodated through an existing pedestrian tunnel under Oak Grove Drive that leads to the dam. Visitors will be able to access the tunnel via a new ADA-accessible ramp. The chain-link fencing on the existing retaining wall at the entrance to the tunnel will be replaced with ornamental iron safety fencing, similar to that recommended for the dam’s parapet walls. A gate will be installed at the southern opening of the tunnel to provide a secured access at this location during the night when the Park is closed.

WESTSIDE/OAK GROVE AREA

Park Entrances

The main, west park entrance will remain at Oak Grove Drive and Foothill Boulevard. A new park entrance sign and lighting will be installed and the landscaping improved. This entrance will remain open to accommodate the tenants of the MWD property. The need for a traffic control gate or entry kiosk for security and dissemination of information will be assessed.

In order to provide safer and efficient access for park visitors during peak traffic hours (during arrivals and departures from La Cañada High School and JPL), a one-way access lane from Oak Grove Drive, north of the Berkshire Place intersection, is proposed to allow entry during park events and morning/afternoon high school student drop-off/pick-up. This project is indicated on Exhibit 3-1, HWP Master Plan under Oak Grove Drive Improvements. The access lane will be ingress only and will have a security gate and appropriate signage installed. See Exhibit 3-12, Proposed Road Improvements to the Equestrian Staging Area. The Foothill Boulevard entrance will continue to be both ingress and egress. Due to public safety concerns, a portion of this project has been temporarily implemented.

Circulation and Parking Improvements

The main parking lot located on the lower terrace near the existing Oak Grove Field will be expanded. This expansion replaces the overflow parking area which is being converted to the Southern Sycamore Grove Field, therefore, the project will not increase the amount of parking in the area, but will consolidate the two existing lots. Due to current parking demand, this paved parking area needs to be expanded before the Southern Sycamore Grove Field is constructed. The access road will be extended and a turnaround constructed to accommodate fire and emergency vehicles. This project is indicated on Exhibit 3-1, HWP Master Plan, under Oak Grove Area improvements as Expanded Parking Area.

The existing parking area on the east side of the inner park access road and the north side of the overnight camping area will be upgraded to accommodate parking for buses and a drop-off area for vehicles or a bus. A small parking area, adjacent to the park ranger station, will be constructed with a new trash enclosure in the storage yard area currently used by the County Department of Parks and Recreation. This parking area will have a natural, permeable surface.

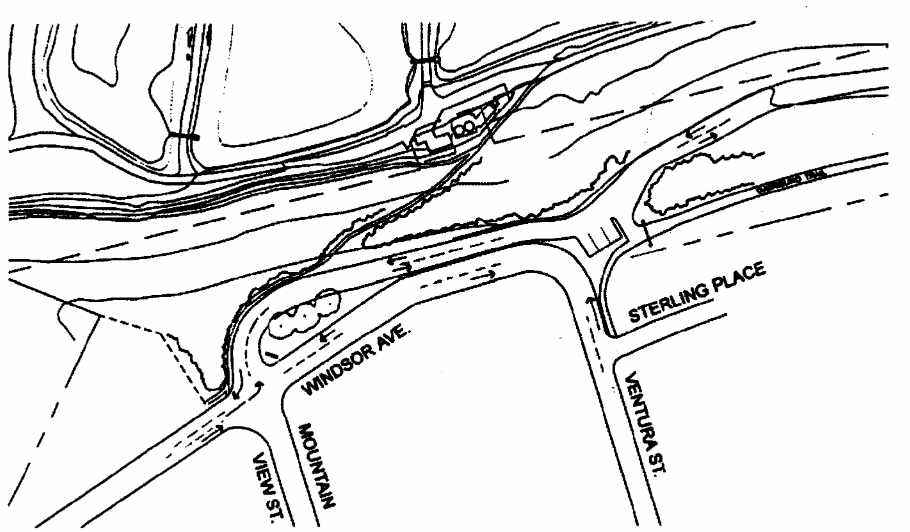
Improvements to the parking area at the equestrian staging area will include widening of the access road, realignment, and resurfacing. See Exhibit 3-12, Proposed Road Improvements to the Equestrian Staging Area. The existing access road will be widened from the upper Oak Grove turnaround and then raised to allow incoming traffic to drive over the new drainpipe that will be needed for the Berkshire drain upgrade. All vehicular traffic will enter the parking area on the northern edge and will exit via the southeast corner of the parking area, looping back along the old entry roadway. Pavement will be eliminated where possible from the existing roadway between the Berkshire drain and the Flint Wash Bridge. The softer, wider turns and one-way traffic flow will provide easy access for horse trailers, school buses, and camp vans. Ten pull-through parking spaces will be provided. These spaces will be used by no more than two buses, with the remainder of the spaces being designated for horse trailers and cars.

EASTSIDE PARK AREA

Park Entrance

In order to provide a safer entrance for park visitors and JPL employees, a new park entrance is proposed at Windsor Avenue and Mountain View Street. See Exhibit 3-14, Proposed Park Entry. The existing parking lot on Windsor Ave. would be demolished and park visitor parking made available in the Gabrielino Trail Area in what is now the north end of the existing JPL east parking lot. All eastside traffic will enter and exit HWP at a four-way intersection at Mountain View Street and Windsor Avenue. A designated left-hand turn lane will accommodate the stacking of rush-hour traffic into the new entrance without stopping through-traffic. If the County implements any improvements to the Windsor Avenue and Ventura Street intersection prior to the implementation of this proposed project, the intersection will be evaluated for traffic volume safety and whether any further improvements will be necessary.

Exhibit 3-14, Proposed Park Entry at Windsor and Mountain View



The proposed improvements will require the construction of a new retaining wall along the west edge of the park access road and at the end of Ventura Street. After construction is finished the entrance area will be relandscaped with native plants from the oak woodland and sage scrub palettes. A small parking area will be located near Sunset Overlook.

Circulation and Parking Improvements

Eastside Parking: Park visitor parking in the northeast section of HWP (Gabrielino Trail Area) will consist of the northern portion of the existing JPL east lot (approximately 25% of the existing JPL parking lot). The remainder of the existing JPL lot will be used for the reconfiguration of the eastside spreading basins. This parking area will be for HWP park users and people connecting to trails in the Angeles National Forest and the upper watershed.

EMERGENCY & MAINTENANCE VEHICLE ACCESS

Emergency and maintenance vehicle access to the interior of the park is by a proposed all-weather perimeter road/trail, see Exhibit 3-1, HWP Master Plan. Hikers and equestrians will also have use of this unimproved road for recreation. In order to complete the loop road, two bridges will need to be constructed—one bridge at Flint Wash and the other at the north end of the park. Emergency and maintenance vehicles will access the loop road through a system of locked gates at strategic locations throughout the park.

3.8 UTILITIES & INFRASTRUCTURE

Following is a conceptual discussion of the impact to existing utilities and infrastructure along with the recommendations for new utilities that would be required to service the Master Plan proposals.

STORM DRAINS

The Master Plan does not have a direct impact on the existing storm drain systems that enter the park. However, discharge from the storm drains does have an impact on the park environment. Field studies undertaken as part of the Master Plan process assessed these drains. The 24 storm drains entering the park are shown in Exhibit 2-6, Storm Drains (See Section 2.7, Utilities). Modifications to certain storm drain outfalls are proposed to rectify erosion and habitat damage caused by increased runoff from urban development and to improve performance of the drain. Those drains include the Altadena Drain, Altacrest Drain, Berkshire Drain and Foothill/Oak Grove Drain. Modifications will be needed to JPL Trunk Line #14 because the existing outfall location is within the proposed Westside Spreading Basins. Additionally, there are recommended overall storm drain modifications that apply to all 24 existing storm drains. Other minor modifications to existing and new storm drains needed within HWP will be assessed during project implementation.

Overall Storm Drain Modifications

Storm water entering the flood management/water conservation pool from Flint Wash, from storm water runoff of adjacent lands, and from all storm drain outfalls will need to comply with state-mandated water quality standards including monitoring and cleanup of pollution from runoff. Runoff pollutants include horticultural fertilizers and pesticides, pathogens from animal manure (dogs and horses), hazardous substances in municipal waste including trash, oil, and grease from motorized vehicles. Remediation may occur at an outfall location in the Park, at the pollutant source, or at the inlet to the storm drain depending on the particular type of pollutant. Water quality becomes important because any water held behind the dam and pumped back for percolation in the spreading basins is a source of drinking water. A fiscally workable and scientifically proven solution to some of these pollution problems requires further investigation. Best management practices will be utilized to ensure TMDL’s (Total Maximum Daily Loads) of pollutants are reduced and that natural/biological alternatives are considered first. Examples of such are bio-swales and the use of riparian systems that can function as biological filters and scrubbers for urban runoff contaminants.

Altadena Drain Improvements

The Altadena drain extends into the stream channel north of the existing spreading basins. Its extended concrete box structure was utilized as part of an earthen breakaway dam, which would divert water to the eastside spreading basins. This site is no longer used as a diversion facility due to the environmental impacts from the breakaway dam and this diversion method. In order to widen the stream corridor, allowing for a more natural stream alignment (see habitat restoration project no. 1), the drain will be shortened and the embankment armored to prevent erosion from the runoff generated by this drain. The stream corridor will then be restored to a riparian habitat, similar to and as a continuation of the same plant community, immediately north of the JPL Bridge. This riparian habitat also exists due to urban runoff for a short stretch of the stream course south of the drain.

Extension of Altacrest Drain

The discharge from the 40″ reinforced concrete pipe (RCP) adjacent to the Gabrielino Trail and east of the JPL east parking lot (just south of the existing equestrian trail) will continue downslope in an extended enlarged single RCP. This underground drain line will run between the enlarged existing ponds and empty directly into the stream corridor. There would be an inlet to receive runoff from the eastside park road and the remaining northerly quarter of the existing parking lot.

Repair at Berkshire Drain

The increased volume of runoff resulting from the widening of Oak Grove Drive and Berkshire Place has caused severe scouring of the downstream drainage swale within the park. The park road will be raised four feet and a new transition structure built with a new enlarged pipe running under the road and down the slope and exiting into the basin below the Perimeter Trail. The eroded areas on the upper slope will be filled and restored with oak woodland habitat. The area where the drain line crosses under the Perimeter Trail will be restored with southern willow scrub habitat. From the new outfall to the water conservation pool, the drainage swale will be stabilized with riparian willow habitat to prevent future erosion. The widening of the park road during this project will allow two lanes of traffic to pass safely to and from the Equestrian Staging Area.

Repair at Foothill Drain

Increased runoff from the widening of Oak Grove Drive, Foothill Boulevard west of the park entrance, and urban development of a portion of the La Cañada-Flintridge area has caused severe erosion within the park on the slope above the existing Oak Grove play field. This project would extend the existing 24″ concrete drain down the slope, make a turn south parallel to the play field and discharge into the existing drainage swale. The existing swale that flows south along the toe of the oak grove slope needs to be improved. The new pipe would be covered over and the slope restored with oak woodland habitat.

WATER MAINS

There are several water lines in the basin area that either cross the basin or run parallel to it. Improvements identified in the Master Plan will require a connection to the existing potable water distribution system. These include new restrooms, campsite sinks, drinking fountains, and the overnight-staff building. The Calaveras water line serves the Park effectively and will be used as the main supply for further improvements.

The existing domestic water distribution system will need to be evaluated as part of park improvements and for fire suppression needs. Fire hydrants at appropriate locations will need to be installed as improvements are made. Any utility relocation or new utilities that cross the basin floor are expected to be attached to the proposed North Bridge Crossing.

OVERHEAD POWER AND COMMUNICATION LINES

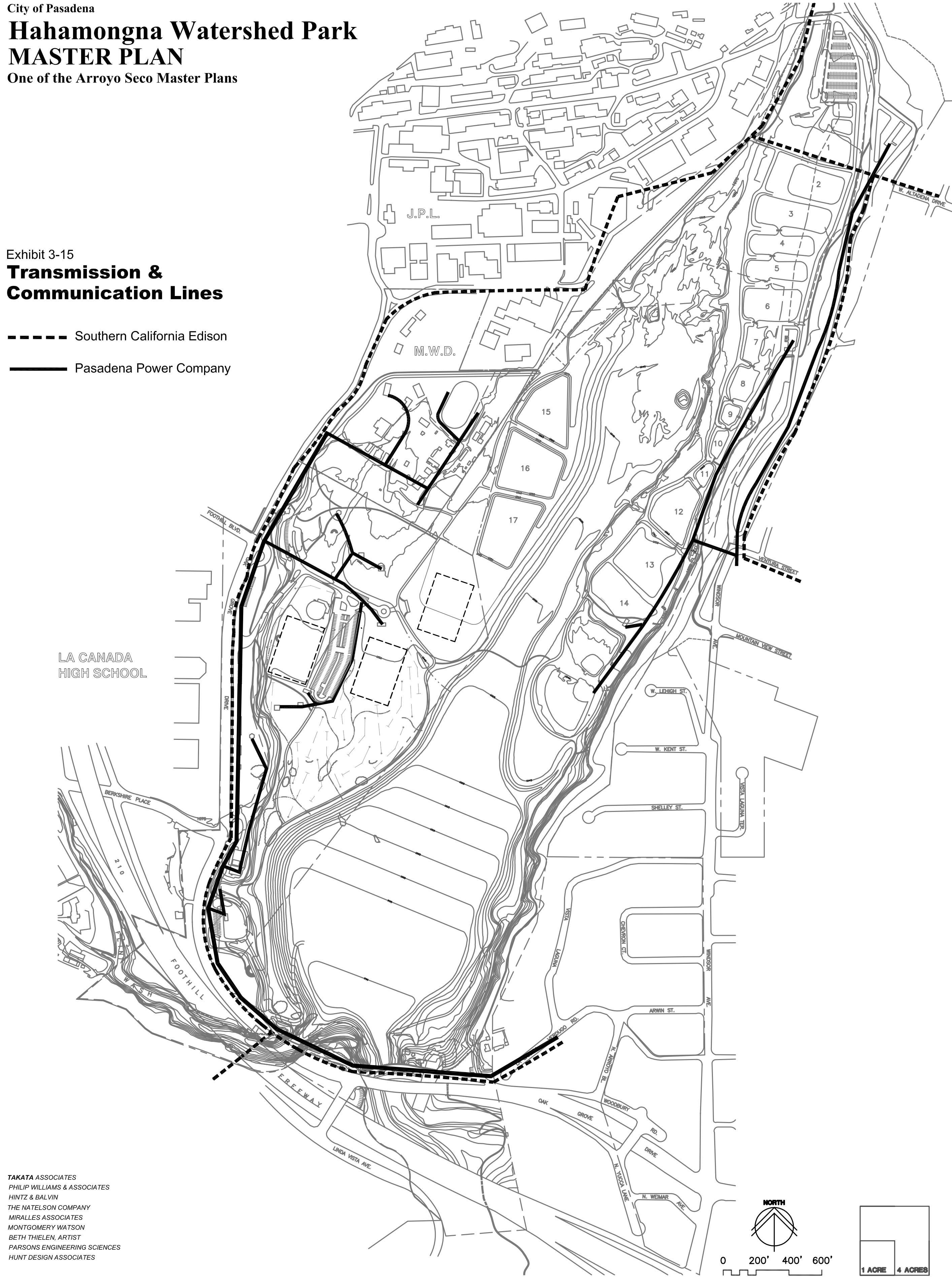
Relocation of the power and communication lines is recommended. However, significant costs would be incurred and additional easements would need to be negotiated with the two electrical service providers as well as communication entities. Additional power and telephone lines are planned at the new restroom areas. Some upgrading of existing facilities may also be necessary at Johnson Field, the Oak Grove Maintenance Office, and the Equestrian Staging Area. It is recommended that new utility services be placed underground when inside the HWP boundary. There will be new electrical service to the pump-back facilities near the Devil’s Gate Dam. Any relocated utilities or new utilities that cross the basin floor are expected to be either attached to the proposed North Bridge Crossing or within the adjacent overhead utility easement. Any utility relocation will be based on the Master Plan, its Environmental Impact Report (EIR), and a proposed utility design and cost estimate, all of which will be needed prior to permitting and easement negotiations.

Underground Pasadena’s Eastside Overhead Power and Communication Lines

This project would occur in two phases. The first phase would be to underground these overhead distribution lines from the VOC Water Treatment Plant to the Arroyo Well. The second would be to underground the existing Pasadena Water and Power overhead distribution lines from the VOC Water Treatment Plant to Johnson field (see Exhibit 3-15, Transmission & Communication Lines).

Exhibit 3-15

Transmission & Communication Lines



TAKATA ASSOCIATES
PHILIP WILLIAMS & ASSOCIATES
HINTZ & BALVIN
THE NATELSON COMPANY
MIRALLES ASSOCIATES
MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCES
HUNT DESIGN ASSOCIATES

Relocate the Existing Southern California Edison (SCE) Power Line in the Hahamongna Basin

This project will minimize the number of overhead basin crossings as well as remove this line from the sensitive Riversidian Alluvial Fan Sage Scrub habitat, which restricts the maintenance of this utility. This overhead distribution line that runs diagonally across the basin from the JPL sub-station to the Windsor/Ventura intersection would be relocated. The new alignment would run north to the east/west distribution lines, adjacent to the North Bridge, crossing the basin with the existing lines, then running south to Ventura Street along the Gabrielino Trail, reconnecting to the distribution system at the Windsor/Ventura intersection.

Relocate the Existing Pasadena Power and Communication Line

This project would relocate the existing Pasadena power and communication lines that traverse the basin from the VOC Water Treatment Plant to the MWD property and northern portions of the Oak Grove area. This utility will be relocated due to the undesirable aesthetics of these poles, the erosion of the pole bases, and their inaccessibility for maintenance in the project identified as the "Widen Stream Channel and Establish Riparian Habitat Project." The communication portion of this line would be relocated to a new line that would run to JPL from the Windsor/Ventura intersection north along the Gabrielino Trail.

The power portion of this line will be relocated to the Pasadena grid that crosses the Devil's Gate Dam to feed facilities in the westside portion of the park. This alignment would go from the dam to Foothill Boulevard (preferably underground) and provide a new feed to OGMO, the equestrian staging area restroom, the new restroom near the Oak Grove field, the group picnic shelters south of the Oak Grove field, the park ranger station, the existing restroom in the overnight area, and the group picnic shelters in the overnight camping area.

Relocate the SCE North/South Transmission and South Distribution Line

These lines currently follow the toe of the western slope of the park, run the length of the basin from south to north, and feed into and from JPL's main substation. The base of 11 of the 21 power poles will be frequently inundated during heavy storm events, when water conservation measures are implemented, making it impossible to access these poles. The poles either need to be relocated to an alignment in Oak Grove Drive or be raised to an appropriate height in their current location after the westside perimeter trail, relocated disc golf, and improved parking lot areas are raised above the seasonally inundated elevation of 1040.5 (spillway elevation). It is the preference of this Master Plan to have the poles relocated to Oak Grove Drive. Prior to implementing the proposed grading of the Flood

Management Water Conservation Pool, an analysis of alternative improvements or relocation of this utility will be completed for review and approval. This will guarantee the safety and stability of this critical utility. A mutual agreement between SCE and the City of Pasadena (and potentially other agencies such as JPL, MWD and the City of La Cañada-Flintridge) needs to be worked out.

NATURAL GAS

City records indicate that the 12″ high-pressure natural gas line that crosses the basin runs parallel to the 12″ Calaveras water line. See Exhibits 2-8, Water Mains, and Exhibit 2-10, Natural Gas & Sewer, in Section 2, Existing Conditions. Due to their close proximity to each other, it would be prudent to have the condition of this gas line and the adjacent water line evaluated. Additionally, the depth of coverage will need to be reviewed when the streambed is widened to determine if it is adequate.

In the Oak Grove area near the intersection of the Oak Grove Drive and Berkshire, there is a natural gas line that runs north-south along the Oak Grove Drive. This line currently connects to various structures requiring gas service such as the park maintenance facility. It will also be used to service the overnight camping staff building. The gas line in La Cañada-Verdugo Road that services the Arroyo Seco Resource Center will be extended to the new dam keeper's quarters on top of the new public restroom at the east end of dam.

SEWER SYSTEMS

Conforming to California EPA Water Quality Standards, all existing septic systems in HWP will be abandoned and new sewer collection and delivery systems constructed. The existing septic tanks will be pumped out, cleaned, back-filled with sand and abandoned in place. Before back-filling, the bottoms of the tanks will be broken through so that no seeping water will be allowed to stand in the abandoned tanks. Permits for the abandonment will be needed.

New sewer systems that include lift stations with force mains to the existing gravity sewer systems outside the Park are proposed; three on the westside and three on the eastside. At these six points of connection outside the Park, capacity will have to be studied and permits obtained with resulting associated fees.

The following is a summary of proposed projects that impact the sewage system:

Existing Restroom upgrades

The two existing restrooms in Oak Grove (on the upper terrace and in the overnight camping area) are already approved to be upgraded with new fixtures and partitions under the City's Capital Improvement Program. The new partitions will be designed to accommodate ADA-access. The upper restroom is currently connected to the Oak Grove Drive gravity sewer main and does not need upgrading. The overnight camping area restroom will be connected to a new lift station and force main.

New Restroom at Oak Grove Field (replacement facility)

The abandoned restroom at the southwest corner of the existing Oak Grove field will be reconstructed at the end of the new parking lot near the southeast corner of the existing field. The new replacement restroom will have one urinal and two stalls for men and three stalls for women as well as storage space (20' x 30' minimum) and will meet current ADA-accessibility standards. The restroom will have a sewage lift station and a force main to the gravity sewer main on Oak Grove Drive. Security lighting will be installed at this restroom.

Upgrade Restroom at Park Ranger Station (Overnight Camping Area)

The existing building used by Los Angeles County Trails maintenance personnel will be converted to a park ranger station to supervise the overnight group camping area. The remodel will include adding a bathroom and kitchenette. A sewage lift station will be located between the existing lower restroom and this converted park building with gravity lines from each and a sewage lift station with force main to the gravity sewer main at Oak Grove Drive.

Upgrade and Improve Restroom at Equestrian Staging Area

During the initial implementation phases of the Master Plan, this restroom will be renovated to meet ADA-accessibility standards and improve its physical appearance. Later, the restroom will be reconstructed to accommodate one urinal and two stalls for men and three stalls for women. This project will be combined with the sewer improvements needed at the Oak Grove Maintenance Office. A gravity feed will lead to a sewage lift station and a force main at a central location next to the Berkshire drain. Sewage will then be pumped up to the gravity sewer main in Oak Grove Drive.

Upgrade Oak Grove Maintenance Office (OGMO) Sewer

The restroom facilities at the OGMO are adequate and do not need upgrading. The office is currently on a septic system that will be abandoned. A gravity sewer will connect to the proposed sewage lift station near the Berkshire drain and sewage will be pumped up to the gravity sewer main in Oak Grove Drive.

New Dam Keeper's Quarters with Public Restroom (replacement facility)

On the eastside of the dam, the existing dam keeper's quarters would be demolished and rebuilt as a public restroom to serve park visitors at the dam. The restroom will have one urinal and one stall for men, two stalls for women, and will meet current ADA-accessibility standards. On the ground level, connected to the public restroom would be a storage area (single car garage) for materials and equipment related to the operation and maintenance of the dam. Dam keeper's quarters will be built above the public restroom with sleeping quarters, a small kitchenette and a private restroom. The second story will afford the dam keeper a view of the basin during storm events. The former dam keeper's house (the current Arroyo Seco Resource Center) will gravity feed to a sewage lift station adjacent to this facility, then a force main will connect to the City system servicing the houses on La Canada-Verdugo Road.

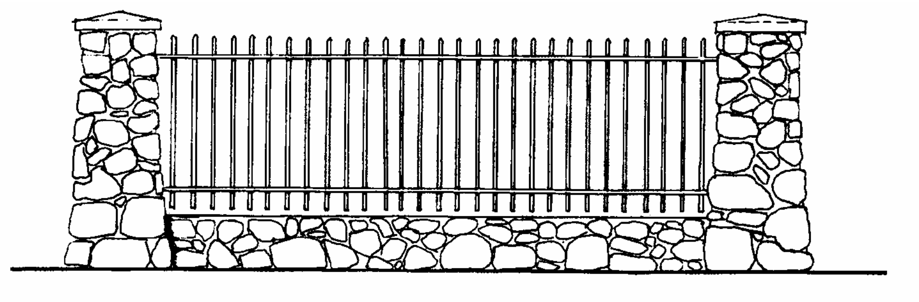
New Restroom at the Gabrielino Trailhead Area

When the specific need is identified, a new restroom will be constructed at the north end of the proposed public parking lot (currently the existing JPL east parking lot) and serve park visitors using HWP as well as visitors headed into the Angeles National Forest. It will have one urinal and one stall for men and two stalls for women and meet current ADA-accessibility standards. A public telephone will be located at the structure. This restroom may need a sewage lift station with a force main to the JPL gravity lines across the JPL bridge.

3.9 SAFETY, SECURITY & ACCESSIBILITY

For security and public safety, HWP will be closed at sundown. The park will be patrolled by the Pasadena Police Department. With the completion of the perimeter trail, the County and City personnel will be able to patrol the perimeter of the water/conservation pool during periods when rapidly flowing floodwater is entering the basin.

The existing chain link fencing along the perimeter will be upgraded to decorative iron and Arroyo stone reflecting the historic heritage of the Arroyo Seco in Pasadena. Additionally, the City will work with the Los Angeles County Department of Public Works to install fencing along the parapet wall of Devil's Gate Dam and along the scenic overlook south of the dam. The quality of work and design should resemble that installed on the Colorado Street Bridge.



Decorative iron and Arroyo stone fencing for the perimeter edge

Security gates will be constructed at vehicular entries and at the tunnel leading from the new dam parking lot under Oak Grove Drive. All new fences and gates will conform to the Arroyo Seco Design Guidelines.

Lighting will be provided on built structures and at major park entrances only. Many of the mammals that inhabit the basin are nocturnal. With the evening closure of the park, priority is given to these residents. All new lighting will conform to the Arroyo Seco Design Guidelines.

Public telephones will be provided where possible in association with the improved restrooms and recreation amenities.

ACCESSIBILITY

All new construction will meet current ADA-accessibility standards. Developed state and national standards for natural park areas will be used where applicable.

The majority of the bicycle route will be ADA-accessible. Some new picnic site amenities, the new multi-use play fields, and portions of the disc golf area will be ADA-accessible where feasible.

3.10 PROGRAMS

ENVIRONMENTAL EDUCATION ELEMENT

In many of the Stakeholder and Community Meetings, people from varied professions and backgrounds expressed the desire for an Interpretive Center somewhere in the Arroyo. Here, children and adults alike could come to study birds, wildlife, and plants. Some participants, such as the Native Americans, saw an Interpretive Center as a place where they could display and share their cultural heritage. Representatives of the Pasadena Unified School District and area science teachers see such a center as an opportunity to create a "living laboratory" where children could study wildlife and learn about the environment. From Native Americans to artists to science teachers, there is widespread support for an Interpretive Center which would be dedicated to ancient and modern indigenous cultures of the area together with the study of the environment and the opportunity to experience nature first-hand.

An Interpretive Center could be the main vehicle to communicate the importance of the Arroyo Seco, its history, and its environmental, cultural, and water resources. These resources will also be explained through environmental education programs and through interpretive signage in selected areas of HWP.

The environmental and cultural education programs at an Interpretive Center would support the habitat restoration of the park. The ability to plan the restoration effort in part to reflect plantings that are part of Native American culture provides opportunities for Native Americans to share their story. Plants gathered for ceremonies, medicine, basket weaving, musical instruments, and other native arts and crafts are part of the habitat restoration plan. Plant materials for the restoration projects can be grown at the California native plant nursery in partnership with interested groups.

To get this effort off the ground, the City of Pasadena should further explore possible locations for an Interpretive Center and involve interested members of the Community including but not limited to:

- Native American Community
- Armory Center for the Arts
- Pasadena Arts Commission
- Pasadena Unified School District
- John Muir High School Science Department
- Project Seed, Caltech
- St. Francis High School Science Department
- Local Conservancies
- Environmental Organizations

The following organizations are currently using the Arroyo and HWP for their programs. As current stakeholders, continued support for their programs may result in expanded opportunities for park users.

- The Armory Center for the Arts, Children Investigate the Environment Program
- Kidspace (soon to be located in Brookside Park)
- Jet Propulsion Laboratory (JPL), The Planetary Society
- Tom Sawyer Camps
- The Sequoia School
- The Audubon Society

The following programs are possible resources or potential users for HWP

- The Bay Institute Watershed Education Program
- The Center for Eco-literacy
- Pasadena Libraries
- City of Pasadena Cultural Affairs Division Gallery Space
- Pasadena Unified School District
  - Gifted and Talented Program and Community learning Centers
  - Wilson Middle School
  - Washington School
- The California Arts Council-Artist in Residency Program
- California Institute of Technology, Division of Geological and Planetary Sciences

An Interpretive Center could support the educational component and could offer the following:

- Programs relating to the Arroyo Seco environment

- Programs led by working artists, focusing on the traditions, arts and crafts of Native Americans. The intention would be to show to those interested, the plants used and gathering techniques that do not impair the sustainability of a plant population; and

- A communications program established to inform and update the public on habitat restoration, water quality, flood management, sediment removal, and water conservation issues and activities.

Programs offered at an Interpretive Center and educational information at interpretive sites throughout the park would stress the importance of a sustainable ecosystem. Specific topics would include the geology and hydrology of the San Gabriel Mountains and the Raymond

Basin Aquifer; the importance of a healthy watershed; how a watershed can be managed; management of flood water, debris and sediment; how to restore and preserve native plant habitat; why biological diversity is important to a sustainable ecosystem; which native plants, plant communities, and wildlife exist in the park; the importance of the Arroyo Seco as a wildlife corridor to a sustainable ecosystem; and which plants are used by the Native Americans in their traditions, arts and crafts.

INTERPRETIVE CENTER

The concept of an Interpretive Center will require further study since a likely location in the Arroyo Seco is not known at this juncture. At such time as a location becomes probable, it is recommended that the planning for such an undertaking becomes a joint effort between the City of Pasadena and organizations that would take an active role in this facility. An Interpretive Center could provide visitors opportunities to learn about the Arroyo Seco environment, water resources and conservation, flood management, and the NativeAmerican culture.

It is recommended that such a remodeled or newly constructed facility contain at a minimum the following features:

- A large flexible space dedicated to exhibits and demonstrations
- Classroom space for instruction
- Auditorium/conference space for up to 200 people
- Multipurpose covered patio for large groups
- Work area to prepare or repair exhibits
- Entrance lobby and gift shop
- Administrative offices
- Storage area and janitorial/sanitary facilities
- Expanded nursery facilities for plant propagation
- Large kitchen for group service
- Maintenance and storage yard

Section 4. Implementation of the Master Plan

ARROYO SECO
MASTER PLANS

SECTION 4:

IMPLEMENTATION OF THE MASTER PLAN

4.1 IMPLEMENTATION PLAN

The following is a list of the projects that are proposed in the Hahamongna Watershed Park Master Plan. The project planning for a new park is complex. Projects are listed sequentially within each area grouping, like stepping stones. Serious consideration was given to the order in which a project is listed within a group; the initiation of one leading to the ability to begin the next.

The projects listed first are suggested improvements to existing park facilities and features. This includes habitat restoration projects. Any improvements to park infrastructure will be made as necessary.

There is a considerable amount of grading and earthmoving associated with some of the projects in the HWP Master Plan area. Placement of excavated material to raise an area above the frequently flooded zone will affect the existing drainage as well as habitat associated with the specific project; therefore, newly restored habitats in these raised areas will require time to become established. This type of mitigation needs to occur before other projects in the implementation sequence begin and prior to the excavation and placement of needed material for the next project which may affect additional habitat.

The material excavated from the flood management area to increase capacity and to be used for newly raised parkland, will affect debris and sediment management. Therefore, all projects where material is excavated to be used as fill within the County's leased Flood Easement will require the County's review and approval. Because of the quantities of material involved, the County may choose to engineer some of the proposed projects within its easement.

Projects requiring extensive grading that affect the existing and proposed habitats, and the sequence of these projects, will need to be reviewed and approved by the appropriate state and federal environmental agencies prior to the engineering of the projects. Therefore, the cost and efficiency of construction has been considered in how the following projects are sequenced.

CITY OF PASADENA
PARKS & NATURAL RESOUCES DIVISION

Hahamongna Watershed Park
MASTER PLAN

One of the Arroyo Seco Master Plans

Exhibit 4-1

Project Implementation Areas

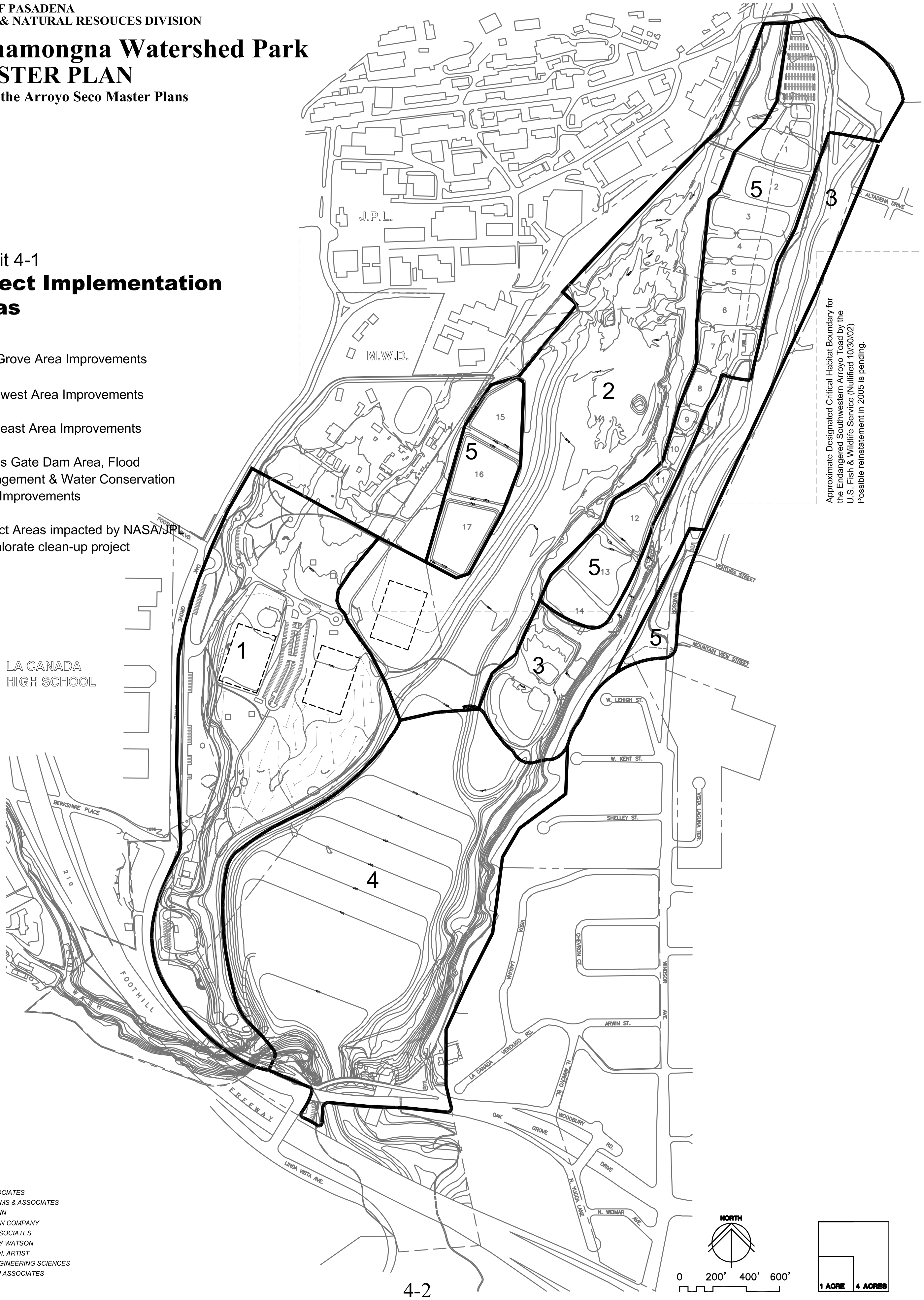
1: Oak Grove Area Improvements

2: Northwest Area Improvements

3: Northeast Area Improvements

4: Devil's Gate Dam Area, Flood Management & Water Conservation Pool Improvements

5: Project Areas impacted by NASA/JPL perchlorate clean-up project



TAKATA *ASSOCIATES*
PHILIP WILLIAMS & ASSOCIATES
HINTZ & BALVIN
THE NATELSON COMPANY
MIRALLES ASSOCIATES
MONTGOMERY WATSON
BETH THIELEN, ARTIST
PARSONS ENGINEERING SCIENCES
HUNT DESIGN ASSOCIATES

A: PRE-MASTER PLAN IMPROVEMENTS

- Upgrade the two existing restrooms in the Oak Grove Area, including Title 24 and ADA requirements.
- Upgrade existing Oak Grove Area picnic amenities and implement conservation of oak woodland.
- Remove asphalt from between and along the western edge of the existing spreading basins on the eastside of Hahamongna Watershed Park.

AREA 1: OAK GROVE AREA IMPROVEMENTS

Group 1A

- Construct turnaround and the expanded parking area to replace the overflow parking; install landscaping and irrigation.
- Construct gravity sewer lines and lift station with force main for improved water quality at the Oak Grove Field. Underground power and communication lines.
- Construct Oak Grove Field restroom replacement and two group-picnic shade structures.
- Construct the Foothill Drain improvements including improvements to the existing drainage swale.
- Construct two trail connections from the West Rim Trail to Oak Grove Field and the Perimeter Trail.
- Construct the West Rim Trail improvements and the realignment around the Foothill Boulevard park entrance.
- Implement the Oak Woodland Restoration Project including establishment of oak woodland on the slopes between the upper and lower Oak Grove areas.
- Improve the Outdoor Amphitheater at Oak Grove Field and provide picnic amenities when specific need and locations are identified.

Group 1B

- Construct haul road and construction equipment entry at Oak Grove Drive for sediment removal access.
- Grade the west approach to the Flint Wash Bridge and the amphitheater at Sunrise Overlook.
- Grade the east approach to the Flint Wash Bridge and the southeast portion of the Perimeter Trail to create a uniform grade to the basin for flood management equipment and erosion control.
- Construct the Flint Wash Bridge, including abutments, retaining walls and approaches.
- Construct Sunrise Overlook and establish coast live oak woodland in this area.

Group 1C

- Raise the grade above the flood plain for the Southern Sycamore Grove Field and the relocated Disc Golf Area.
- Construct the Southern Sycamore Grove Field and the Perimeter Trail, including the improved storm drainage and crossings.
- Implement the Southern Sycamore Grove Field and Disc Golf Habitat Establishment and Restoration Project.
- Relocate SCE transmission, distribution and communication lines to Oak Grove Drive or improve the existing SCE facilities to insure safety, stability, and operation.
- Relocate to Oak Grove Drive the Pasadena Power lines that cross sensitive habitat in the basin from the Windsor/Ventura intersection to the Oak Grove Area and MWD property.

Group 1D

- Construct the Berkshire Drain improvements and restore the coast live oak woodland.
- Raise the grade above the flood plain for the Perimeter Trail from Flint Wash to relocated Disc Golf Area.
- Implement the Perimeter Trail Habitat Establishment and Restoration Project on the west side, including stabilizing the riparian stream corridor below the Berkshire Drain.
- In the Oak Grove Area, construct the overall storm drain modification improvements.
- Realign and widen the access road to the Equestrian Staging Area; improve the parking area and picnic amenities.
- Upgrade the existing restroom in the equestrian staging area, construct a gravity sewer to a lift station with a force main for improved water quality, and underground the power to the restroom and the lift station.
- Upgrade the Oak Grove Maintenance Office with a gravity sewer to the lift station for improved water quality, and establish the Native Plant Nursery.

Group 1E

- Construct the park access improvements on the west side, including the park entrance at Foothill Boulevard and the Oak Grove Drive improvements, and an “enter-only” park access lane at Berkshire Avenue.
- Construct decorative perimeter fencing along Oak Grove Drive, from Flint Wash to the MWD property.
- Complete the Disc Golf Area improvements, relocating the disc golf course out of the Overnight Camping Area.
- Construct the Supervised Overnight Camping Area improvements, including day-use picnic amenities.
- Construct improvements to the existing parking areas and to an existing building for the Park Ranger Station.

- Construct gravity sewers from the Park Ranger Station and the Overnight Camping restroom to a lift station with force main located in the Overnight Camping vehicle pull-through, drop-off area. Underground the power in the overnight Camping Area.
- Implement the Oak Woodland Restoration and Habitat Establishment Project in the western half of the Overnight Camping Area.

Group 1F

Proposed improvements are within the Designated Critical Habitat for the Endangered Southwestern Arroyo Toad. This Designated Critical Habitat, established February 7, 2001, was nullified October 30, 2002. Refer to section 4.3 Environmental Requirements, U.S. Fish and Wildlife Service for details.

- Complete the Supervised Overnight Camping Area improvements, including day-use picnic amenities.
- Construct two group-picnic shade structures *(one in the eastern half and one in the western half of the Overnight Camping Area)*
- Implement the Oak Woodland Restoration and Habitat Establishment Project in the eastern half of the Overnight Camping Area.

AREA 2: NORTHWEST AREA IMPROVEMENTS

Proposed improvements are within the Designated Critical Habitat for the Endangered Southwestern Arroyo Toad. This Designated Critical Habitat, established February 7, 2001, was nullified October 30, 2002. Refer to section 4.3 Environmental Requirements, U.S. Fish and Wildlife Service for details.

Group 2A

- Construct the Stream Channel Widening Project, using Land Form Grading principles, and restore and establish streambed riparian habitat.
- Fill and grade the eastern edge of the Overnight Camping Area for proper drainage.
- Construct the overall storm drain modification improvements in this area.
- Fill, grade, and construct the northern Sycamore Grove Field
- Implement the Habitat Establishment Projects from the west side Perimeter Trail, around the northern Sycamore Grove Field, to the stream corridor including the graded slopes.
- Implement the Riversidian Alluvial Fan Sage Scrub Habitat Establishment and Restoration Project.

Group 2B

- Construct the Stream Corridor Realignment Habitat Project and restore and establish the streambed riparian, sage scrub, and southern sycamore riparian woodland habitats.
- Improve and realign the Altadena Drain outfall, and stabilize the streambed corridor.
- Construct the North Bridge Crossing completing the Perimeter Trail.

- Construct the northwest segment of the bicycle route to the North Bridge Crossing.
- Relocate the SCE diagonal cross basin distribution line out of sensitive habitat to a west-to-east alignment at the new bridge to insure safety, stability, and operation.
- Complete the Riversidian Alluvial Fan Sage Scrub Habitat Establishment and Restoration project, including relocation of the equestrian trail and restoration of the sage scrub habitat.

AREA 3: NORTHEAST AREA IMPROVEMENTS

Some of the proposed improvements are within, or are dependent on, listed projects that are within the Designated Critical Habitat for the Endangered Southwestern Arroyo Toad. This Designated Critical Habitat, established February 7, 2001, was nullified October 30, 2002.

Group 3A

- Underground the eastside overhead power and communication lines from the Arroyo Well to Johnson Field.
- Construct the water conservation distribution system and the pump-back system from the Arroyo Well to Johnson Field and improve the domestic water distribution system.
- Construct the overall storm drain modification improvements on the eastside.
- Extend the East Rim Trail by reconstructing the trail from the Arroyo Well north to the Altacrest Trail.

Group 3B

- Construct the completing segment of the East Rim Trail from the VOC Treatment Plant north to the Arroyo Well.
- Construct the trail connections from the East Rim Trail to the Perimeter Trail.
- Construct Sunset Overlook, including interpretive signage and park amenities as needed.
- Implement the East Entrance Habitat Establishment project at the Sunset Overlook area.

AREA 4: DEVIL’S GATE DAM AREA, FLOOD MANAGEMENT, AND WATER CONSERVATION POOL IMPROVEMENTS

Group 4A

- At Oak Grove Drive and Linda Vista Avenue, construct the new parking area, walks, and landscaping to the spillway overlook and the west side dam access tunnel.
- Construct ornamental fencing for public safety at Devil’s Gate Dam and the Spillway Overlook Observation Deck.
- Fill and grade the existing entry to Devil’s Gate Dam and construct new East Access (Entry) to the Dam from Oak Grove Drive.
- Construct West Access (Exit) from Dam to Oak Grove Drive and restore and establish habitat in this area.

- In the Devil's Gate Dam area, construct the overall storm drain modification improvements.
- Construct a gravity sewer from the Arroyo Seco Resource Center (existing dam keeper's house) and the new Dam Keeper's Quarters and public restroom to a lift station with force main to City sewers for improved water quality.
- Close access to the dam area from La Cañada-Verdugo Road at the cul-de-sac and establish habitat in this area.
- Construct the new Dam Keeper's Quarters and public restroom; landscape and provide picnic amenities at this location and at the park area between the dam and the Flint Wash Bridge when specific need and locations are identified.
- Construct the Dam Observation Trail, with safety railing, to the Water Conservation Pool Overlook.

Group 4B

- Raise the grade to above the flood plane and implement the Sycamore Woodland Habitat Project in the area south of Johnson Field.
- Grade the eastside of the flood management pool and construct sediment and debris management staging areas.
- Complete the sediment removal access haul road. Remove sediment below elevation 1040.5 (spillway floor) to increase capacity to 1,900 acre-feet in the flood management and water conservation pool area.
- Remove all vegetation below elevation 1030 in the water conservation pool area except where the widened stream corridor enters. Complete the Flood Management and Water Conservation Pool Habitat Project above elevation 1030.

AREA 5: WATER RESOURCE AND ASSOCIATED IMPROVEMENTS

Proposed improvements could impact or are dependent on listed projects that could impact the NASA/JPL remediation activities for groundwater contaminants and will require further environmental review and coordination with NASA/JPL.
Proposed improvements are within the Designated Critical Habitat for the Endangered Southwestern Arroyo Road. This Designated Critical Habitat, established February 7, 2001, was nullified October 30, 2002.

Group 5A

- Remove the southern ¾ of the east JPL parking lot.
- Relocate and improve water conservation distribution system (diverted and pumped-back storm water).
- Construct the Eastside Spreading Basins Project including expanded spreading basins 1 through 4, two new basins, and relocated sludge ponds 1 and 2.
- Complete the pump-back system from the dam area to the spreading basins.

- Construct the overall storm drain modification improvements, including the Altacrest Drain improvements and drainage improvements in the Interpretive Area.
- Implement the Habitat Establishment Project at the eastside spreading basins from the remaining northern parking lot south to Johnson Field.
- Convert the northern ¼ of the east JPL parking lot to public parking and restore and establish habitat in this area.
- Construct a sewer lift station and force main across the JPL bridge to JPL’s sewer system and underground the power to the site for the new public restroom.
- Construct a new public restroom at the north end of the east lot; install eastside picnic amenities on the west side of the Stream Corridor Alignment Habitat Project and at the new public restroom. These improvements will be made when specific need and locations are identified.

Group 5B
- Construct the Westside Spreading Basins and implement the Habitat Establishment from the westside Perimeter Trail and around the spreading basins.
- Extend the water conservation distribution system (diverted and pumped-back storm water) across the North Bridge Crossing and south to the Westside Spreading Basins.
- Construct the New Park Entrance for the Northeast Area when the specific need is identified.
- Implement the East Entrance Habitat Establishment project.

4.2 WATER RESOURCES COMMISSION

Interagency coordination will be necessary to effectively oversee the management of the Water Resources Element of the HWP Master Plan. The Master Plan proposes that as part of the ongoing management of the basin a joint agency commission be established. Representatives from the County, Pasadena Water & Power, Pasadena Department of Public Works, and the Raymond Basin Management Board would meet as needed to review and resolve in a timely manner pertinent water conservation and quality issues.

4.3 ENVIRONMENTAL REQUIREMENTS

IDENTIFICATION OF AGENCIES AND ISSUES

During the Master Plan process, 25 public and private agencies were identified from which permits or approvals will be sought for the Hahamongna Watershed Park. The primary permits that will need to be sought are summarized below for the Master Plan.

SPECIFIC PERMITS AND APPROVALS FROM PUBLIC AGENCIES

Los Angeles County Department of Public Works

Permits and approvals will be required for Hahamongna Watershed Park from several County Public Works divisions, including the Water Resources Division, Flood Maintenance Division, Land Development Division, Design Division, and Programs Development Division. These include facilities review and permits for encroachment or construction within the County flood control easement to modify ground surface or construct park facilities. To initiate review, the County will need topographic maps, plans, and specifications that show proposed facilities overlain on maps showing flood easement and other County facilities (roads, lands, etc.).

It is anticipated that a request for permit assistance will be made with the Watershed Management and Construction Divisions of County Public Works, and a meeting with the relevant divisions be set up to identify all approvals needed. A description of the project will be provided before the meeting to assist in identifying the appropriate groups within the County.

U.S. Army Corps of Engineers, Los Angeles District

Some of the proposed projects will need a Clean Water Act Section 404 permit for filling or dredging in waters of the U.S., including wetlands, as applicable to bridge construction or other stream channel modification. Engineer Form 4345 initiates the review process. An Individual Permit may be issued as either ENG Form 1721, the standard permit, or as a Letter of Permission (LOP). The standard permit is processed through the typical review procedures, which include public notice, opportunity for a public hearing and receipt of comments. It is issued following a case-by-case evaluation of a specific activity. Most applications involving public notices are completed within four months, and many within 60 days. If work is minor or routine with minimum impact, and objections are unlikely, then it may qualify for a LOP. A LOP can be issued more quickly and public notice is not required. The District Engineer will notify the applicant if a LOP is appropriate.

Information required includes identification of the applicant, description of the activity (in writing and drawings—vicinity map, plan view, elevation or cross-section), names and addresses of property owners adjoining the water body, location of the site, and other approvals being sought or obtained.

The Corps will also need to review a jurisdictional wetland delineation for the park. The delineation will need to be completed for the Corps to evaluate wetland effects of proposed activities in the Park and to complete the 404 permit process. A delineation was begun by the Corps, but at this writing (March 2002) it remains in draft form.

Corps permits will be required, at minimum, for the new northern perimeter bridge and reconstruction of the Flint Wash Bridge, construction or removal of pipelines across waterways, and construction within designated wetlands. The Environmental Impact Report (EIR) for the project is required to identify these specific impact areas, impact significance, and mitigation measures.

If significant potential impacts on jurisdictional wetlands are identified for proposed facilities or activities, mitigation will be required. These measures would include habitat enhancement or mitigation/habitat replacement at a ratio to be determined (often 3 to 1). The Corps has been asking applicants to justify proposed mitigation ratios by submitting a quantitative and qualitative functional analysis to demonstrate that the proposed mitigation will compensate for the lost functions of the area affected (habitat functions, biogeochemical functions, and hydrological functions). The EIR will include this analysis.

U.S. Forest Service

Any proposed park facilities or activities on USFS land will require easements and/or Special Use Permits (per 36 CFR 251.54). Portions of the USFS Gabrielino Trail and Lower Brown Mountain Road lie within Pasadena City limits. The USFS Ranger Station adjacent to the project area is on land owned by the Metropolitan Water District.

The USFS will have vacated its facilities on the MWD property and will not be affected by relocation of the power supply serving this property. Prior to implementation of this project, PW&P and PPW will coordinate with MWD and the other tenants on the property so as to not interrupt the service.

The additional visitors to the park could increase traffic and impact areas served by the USFS. Additional visitors also increase the potential for fires on USFS land.

Beneficial effects of the park include provision of a perimeter road around the park, which improves access to greater areas of the park. Availability of water from the flood management water conservation pool for fire fighting is a second potential benefit. The conservation pool would need to be a minimum of 18 inches deep for a snorkel intake, and three to four feet deep for a bucket-type intake (helicopter mounted) for fire suppression supply (D. Feser, USFS, pers. comm. 1999). Beneficial and adverse impacts will be discussed together with mitigation measures in the Master Plan EIR. USFS compliance with the National Environmental Policy Act (NEPA), the federal counterpart of CEQA, would be incorporated into NEPA compliance associated with other federal approvals for the project through the Corps of Engineers' 404 process.

U.S. Fish and Wildlife Service

If federally listed sensitive species are found in areas of the park that would be disturbed, Federal Endangered Species Act (FESA) Section 7 or 10 consultations with the U.S. Fish and Wildlife Service (USFWS) could be required. The need for these approvals was evaluated during the course of the Master Plan biological inventory. Subsequent to the conceptual approval of the Hahamongna Watershed Park master Plan (HWPMP), the U.S. Fish and Wildlife Service on February 7, 2001, designated critical habitat for the federally listed Southwestern Arroyo Toad. This included six miles of Arroyo Seco Creek from the Long Canyon confluence downstream to the upper end of Devil's Gate Reservoir. Those restoration projects and/or areas that are wholly or partially located within this designated critical habitat for the Southwestern Arroyo Toad are identified in the Habitat Restoration Section of this Master Plan.

On October 30, 2002, the U.S. District Court for the District of Columbia nullified all the designated critical habitats for the Arroyo Toad. Under federal law, the costs to industry and the public of designating critical habitat for an endangered species must be considered, and if they outweigh the benefit to the species, then habitat need not be designated. The USFWS will complete a new analysis of economic impacts and consider updated field survey information to refine where the Arroyo Toad exists. In the fall of 2003, they will propose new designated critical habitats for review and make a recommendation to the Interior Department by July 30, 2004. The Interior Department will decide by 2005 which areas of critical habitat to redesignate. FESA consultation will be required through the SFWS should critical habitat be designated within the park.

The USFWS will, however, coordinate with the Corps on 404 permits (discussed above) to determine whether the proposed project would significantly impact delineated jurisdictional wetlands or the designated critical habitat area, and identify acceptable mitigation measures.

California Department of Fish and Game, Region 5

California Endangered Species Act (CESA) Memorandum of Understanding (MOU, formerly a Section 2081 Permit) will be required if the project has the potential to impact state-listed endangered or threatened species or their habitat. From the discussion under USFWS above, it is unlikely that this will be required.

A Section 1601/1603 Stream Alteration Agreement between the City and the CDFG will be required for modification of stream channels within the park. The agreement is needed for a project which will divert, obstruct, or change the natural flow or bed, channel or bank or any river, stream or lake. Information on the proposed action is provided on Form FG-2023, which describes the proposed action, its location, impacts, and mitigations. The completed form and supporting information are submitted with a copy of the final certified CEQA document (EIR in this case) and copies of any other permits already obtained and as they become available, including 404, Regional Board, USFWS consultations, County/City Public Works and other approvals.

Project elements that may require 1601 agreements include reconstruction of the Flint Wash Bridge; the new northern perimeter trail bridge; and construction or removal of pipelines that cross waterways, as their construction would change the stream channel and banks and, depending on construction method identified during detailed design, involve temporary stream diversion. If the design for the new bridge does not require impacting the stream course or banks, a CDFG agreement may not be needed for this project.

Diversion of natural inflows greater than 25 cubic feet per second to new spreading basins on the west side of the basin will also require an agreement. Modifications to existing spreading basins may also be included.

These impacts will be identified in detail in the project EIR together with acceptable mitigation measures.

California Regional Water Quality Control Board, Los Angeles Region

The project will require a National Pollution Discharge Elimination System (NPDES) stormwater discharge permit for construction areas larger than five acres. Grading proposed for the Park area as a whole will exceed five acres, although no single element will reach this figure. If simultaneous grading in the park involves less than five acres, a permit will not be required.

In addition, a Clean Water Act (CWA) section 401 Water Quality Certification could be required as part of the Corps of Engineers section 404 permit process. All projects which may result in discharge into a water body, such as the construction of the Flint Wash and perimeter trail bridges and storm drain modifications, must request State certification that the project will not violate State and Federal water quality standards. Based on the information provided in the application, the Regional Board may grant a 402 waiver, a certification, a denial, or Waste Discharge Requirements. The 401 application is submitted with a copy of the 404 application and a final EIR. The Regional Board has 60 days to respond.

Similarly, if site dewatering is required during construction, a temporary NPDES permit is required from the Regional Board. The supporting information includes the location of the proposed discharge, anticipated discharge water quality, and anticipated discharge volume, as well as the expected duration of the discharge. Current plans do not indicate a need for dewatering for foundations of proposed facilities.

The Regional Board would also issue Waste Discharge Requirements should reclaimed water be used to irrigate the park in the future.

South Coast Air Quality Management District (AQMD)

Permits to Construct and Operate will be required for applicable units (internal combustion engines, etc.). At present, all pump motors needed for sewage lift stations are proposed to be electric. In addition, a Fugitive Dust Control Plan and compliance with AQMD Rule 403 will be required.

City of Pasadena Planning and Development Department

The project will require a Conditional Use Permit (CUP) from the City, although it is a City-sponsored project. Master Plan elements requiring a CUP in an Open Space Zone include restrooms, soccer fields, and power line relocation. Other potential elements triggering a CUP are construction of fences more than six feet high and new night lighting. It is recommended that one master CUP be obtained for all park elements. Conditions for times and types of uses of the site would be identified in the CUP. A public-notice period including a public hearing is part of the CUP process.

Conformance with the City's new tree protection ordinance will be required if the project involves removal or disturbance of oaks or construction activities within the trees' drip line. Supporting information includes tree location, configuration, health, and proposed project activities. Potential impacts could include construction of new water distribution pipelines to new outdoor sinks, water fountains and restrooms, and new power poles and power distribution to the USFS on the west side of the park.

ADDITIONAL APPROVALS FOR PROPOSED MASTER PLAN UTILITIES MODIFICATIONS

Storm Drain Modifications

The City will need to obtain a permit from the Los Angeles County Department of Public Works for modifications to County storm drains that enter the park. The County will need detailed information on the proposed locations, sizes and materials of the modified drains; how the existing and proposed drains would change drainage characteristics of the park; and evaluate operation and maintenance requirements**.**

Power Relocation

Relocation of power lines will require coordination with Southern California Edison (SCE) and the Pasadena Water and Power Department involving a written description of the existing line, the need for relocation, the site of the relocated line, and the proposed new corridor. SCE has indicated that relocation costs would be borne by the City. Impacts of relocation will be identified in the project EIR. Impacts of relocation on USFS land will be evaluated by that agency, as described above.

Septic Systems to Sewer

Connection of existing restrooms and new restrooms to the County Sanitation Districts of Los Angeles system, via the Oak Grove sewer, will require permission from that agency. The City will need to complete an application for sewer and treatment plant capacity, including the location of the discharge, anticipated water quality, and amount of flow. The County will also need to approve the engineering design of the connections. Per City of Pasadena Health Department practice, the septic tanks would be decommissioned by pumping out sludge and water and filling with sand or dirt (M. Lim, pers. comm. 1999).

New restrooms located in the floodplain will also be evaluated for protection from flooding to avoid water pollution.

Expand or modify telephone systems

Provision of additional telephone service to the park will require a written request to the current service provider, SBC (formerly Pacific Bell). Now Verizon (formerly General Telephone) has utility easements that may be encroached upon; if so, permits for construction of park facilities would need to be formally requested.

Fire department of review of water system for fire suppression

The City of Pasadena Fire Department will review project plans and specifications to ensure that sufficient fire suppression flow, hydrants, and emergency access are provided.

SCHEDULE FOR APPROVALS AND PERMITS

The agencies identified have, by statute, 180 days to complete permit processing. While certain permit application materials indicate shorter periods, for planning purposes it is prudent to assume the longer time frame.

As indicated for individual agencies above, the permit review process begins with submittal of an application accompanied either by a completed EIR, or engineering design drawings, or both. Therefore, the permit applications are submitted with these documents as soon as they are available to begin a prescribed process.

Ideally, the permit process begins long before these documents are completed. The appropriate agencies are identified and contacted early in the project. The agencies' issues are considered and incorporated into the planning process, mitigation can be developed and agreed upon, and the project can be modified to minimize impacts and mitigation requirements. In this way, by the time the application is submitted it is merely a formality, because the agency is familiar with the project and can process the review expeditiously. The time-consuming, iterative requests for additional information to support the application and multiple additional agency contacts are minimized.

Appendix A

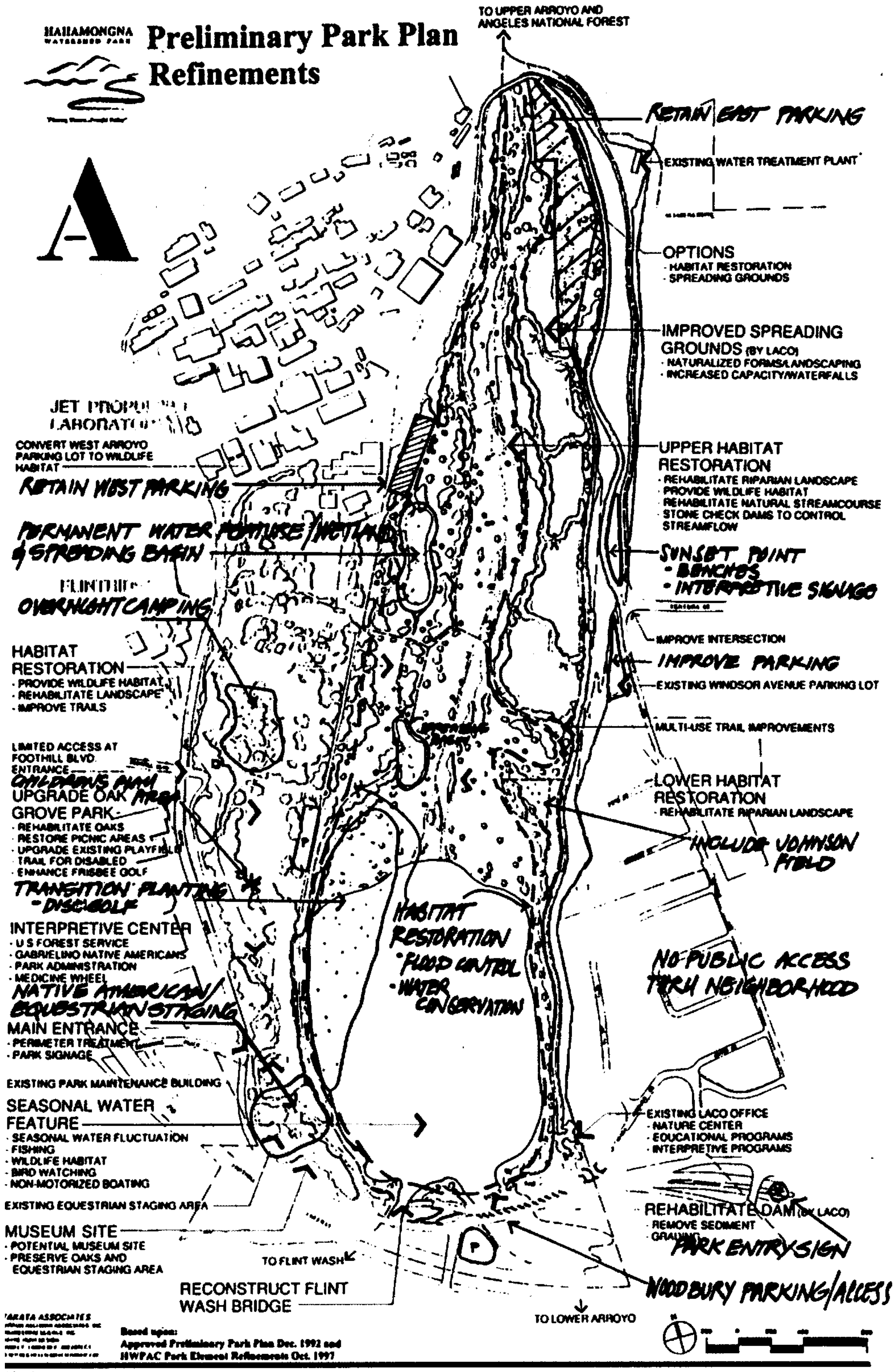
ARROYO SECO
MASTER PLANS

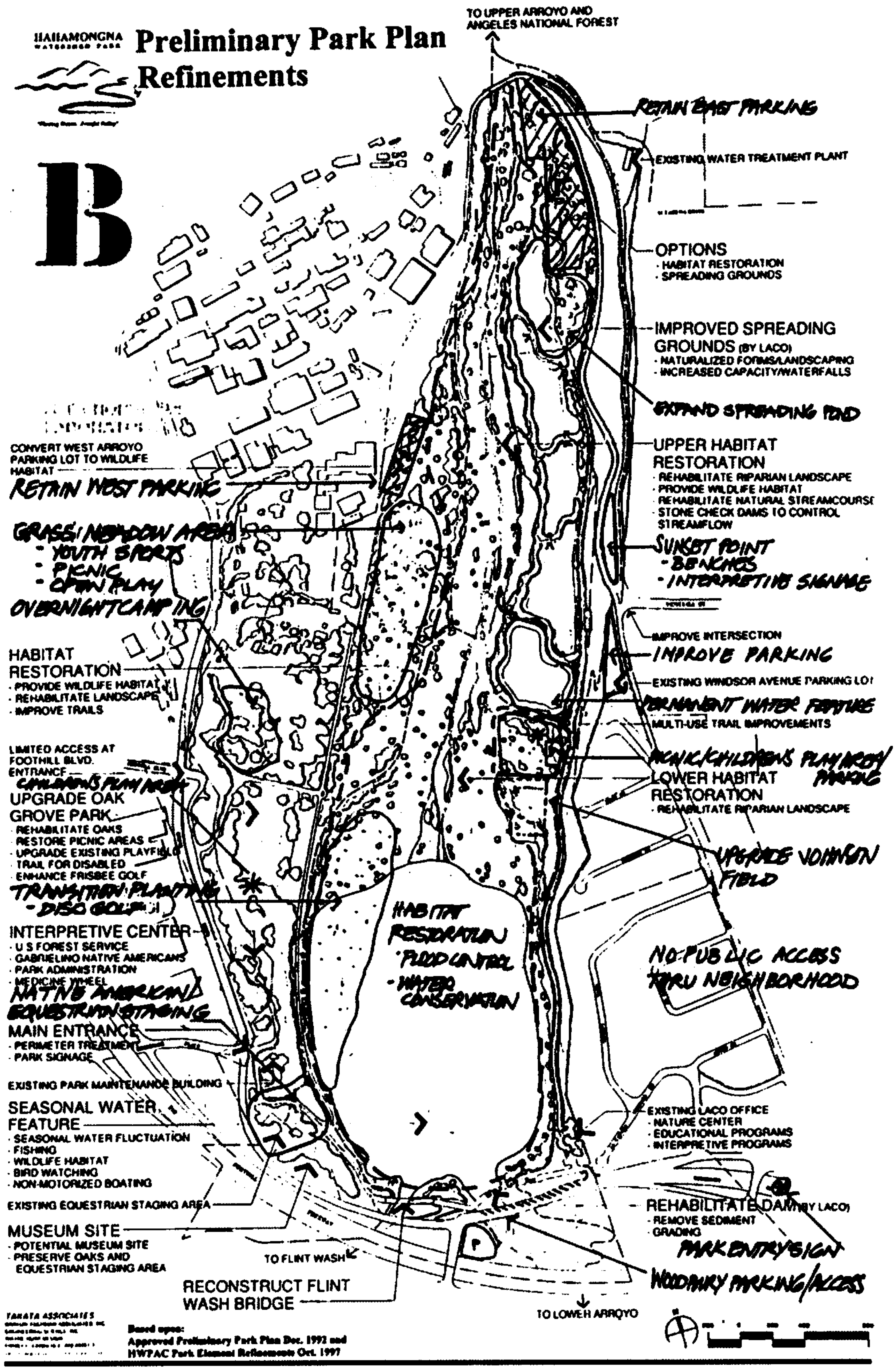
APPENDIX A:
MASTER PLAN CONCEPTS AND ALTERNATIVES

During the Master Plan process, a number of concepts and alternatives were considered for a variety of situations within the park. This Appendix reviews those concepts and presents the several alternatives to various components of the plan prior to its adoption by City Council.

A.1 MASTER PLAN CONCEPTS

In order to achieve a balance between habitat restoration, water conservation, and active recreation, two alternative concepts were reviewed during the second community workshop. One alternative (A) emphasized a natural park and the other (B) emphasized active recreation by including open lawn areas for soccer. These two plans are presented on the following pages.


HAHAMONGNA WATERSHED PARK
Preliminary Park Plan Refinements
A
TO UPPER ARROYO AND ANGELES NATIONAL FOREST
RETAIN EAST PARKING
EXISTING WATER TREATMENT PLANT
OPTIONS
- HABITAT RESTORATION
- SPREADING GROUNDS
IMPROVED SPREADING GROUNDS (BY LACO)
- NATURALIZED FORMS/LANDSCAPING
- INCREASED CAPACITY/WATERFALLS
UPPER HABITAT RESTORATION
- REHABILITATE RIPARIAN LANDSCAPE
- PROVIDE WILDLIFE HABITAT
- REHABILITATE NATURAL STREAMCOURSE
- STONE CHECK DAMS TO CONTROL STREAMFLOW
SUNSET POINT
• BENCHES
• INTERPRETIVE SIGNAGE
IMPROVE INTERSECTION
IMPROVE PARKING
EXISTING WINDSOR AVENUE PARKING LOT
MULTI-USE TRAIL IMPROVEMENTS
LOWER HABITAT RESTORATION
- REHABILITATE RIPARIAN LANDSCAPE
INCLUDE JOHNSON FIELD
NO PUBLIC ACCESS THRU NEIGHBORHOOD
EXISTING LACO OFFICE
- NATURE CENTER
- EDUCATIONAL PROGRAMS
- INTERPRETIVE PROGRAMS
REHABILITATE DAM (BY LACO)
- REMOVE SEDIMENT
- GRADING
PARK ENTRY SIGN
WOODBURY PARKING/ACCESS
TO LOWER ARROYO
JET PROPULSION LABORATORY
CONVERT WEST ARROYO PARKING LOT TO WILDLIFE HABITAT
RETAIN WEST PARKING
PERMANENT WATER FEATURE/WETLAND & SPREADING BASIN
OVERNIGHT CAMPING
HABITAT RESTORATION
- PROVIDE WILDLIFE HABITAT
- REHABILITATE LANDSCAPE
- IMPROVE TRAILS
LIMITED ACCESS AT FOOTHILL BLVD. ENTRANCE
CHILDREN'S PLAY AREA
UPGRADE OAK GROVE PARK
- REHABILITATE OAKS
- RESTORE PICNIC AREAS
- UPGRADE EXISTING PLAYFIELD
- TRAIL FOR DISABLED
- ENHANCE FRISBEE GOLF
TRANSITION PLANTING
- DISC GOLF
HABITAT RESTORATION
• FLOOD CONTROL
• WATER CONSERVATION
INTERPRETIVE CENTER
- U S FOREST SERVICE
- GABRIELINO NATIVE AMERICANS
- PARK ADMINISTRATION
- MEDICINE WHEEL
NATIVE AMERICAN/EQUESTRIAN STAGING
MAIN ENTRANCE
- PERIMETER TREATMENT
- PARK SIGNAGE
EXISTING PARK MAINTENANCE BUILDING
SEASONAL WATER FEATURE
- SEASONAL WATER FLUCTUATION
- FISHING
- WILDLIFE HABITAT
- BIRD WATCHING
- NON-MOTORIZED BOATING
EXISTING EQUESTRIAN STAGING AREA
MUSEUM SITE
- POTENTIAL MUSEUM SITE
- PRESERVE OAKS AND EQUESTRIAN STAGING AREA
TO FLINT WASH
RECONSTRUCT FLINT WASH BRIDGE
TAKATA ASSOCIATES
Based upon:
Approved Preliminary Park Plan Dec. 1992 and
HWPAC Park Element Refinements Oct. 1997


HAHAMONGNA WATERSHED PARK
Preliminary Park Plan Refinements
B
TO UPPER ARROYO AND ANGELES NATIONAL FOREST
RETAIN EAST PARKING
EXISTING WATER TREATMENT PLANT
OPTIONS
- HABITAT RESTORATION
- SPREADING GROUNDS
IMPROVED SPREADING GROUNDS (BY LACO)
- NATURALIZED FORMS/LANDSCAPING
- INCREASED CAPACITY/WATERFALLS
EXPAND SPREADING POND
UPPER HABITAT RESTORATION
- REHABILITATE RIPARIAN LANDSCAPE
- PROVIDE WILDLIFE HABITAT
- REHABILITATE NATURAL STREAMCOURSE
- STONE CHECK DAMS TO CONTROL STREAMFLOW
SUNSET POINT
- BENCHES
- INTERPRETIVE SIGNAGE
IMPROVE INTERSECTION
IMPROVE PARKING
EXISTING WINDSOR AVENUE PARKING LOT
PERMANENT WATER FEATURE
MULTI-USE TRAIL IMPROVEMENTS
PICNIC/CHILDREN'S PLAY AREA/PARKING
LOWER HABITAT RESTORATION
- REHABILITATE RIPARIAN LANDSCAPE
UPGRADE JOHNSON FIELD
NO PUBLIC ACCESS THRU NEIGHBORHOOD
CONVERT WEST ARROYO PARKING LOT TO WILDLIFE HABITAT
RETAIN WEST PARKING
GRASS/MEADOW AREA
- YOUTH SPORTS
- PICNIC
- OPEN PLAY
OVERNIGHT CAMPING
HABITAT RESTORATION
- PROVIDE WILDLIFE HABITAT
- REHABILITATE LANDSCAPE
- IMPROVE TRAILS
LIMITED ACCESS AT FOOTHILL BLVD. ENTRANCE
CHILDREN'S PLAY AREA
UPGRADE OAK GROVE PARK
- REHABILITATE OAKS
- RESTORE PICNIC AREAS
- UPGRADE EXISTING PLAYFIELD
- TRAIL FOR DISABLED
- ENHANCE FRISBEE GOLF
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- DISC GOLF
HABITAT RESTORATION
- FLOOD CONTROL
- WATER CONSERVATION
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- PARK ADMINISTRATION
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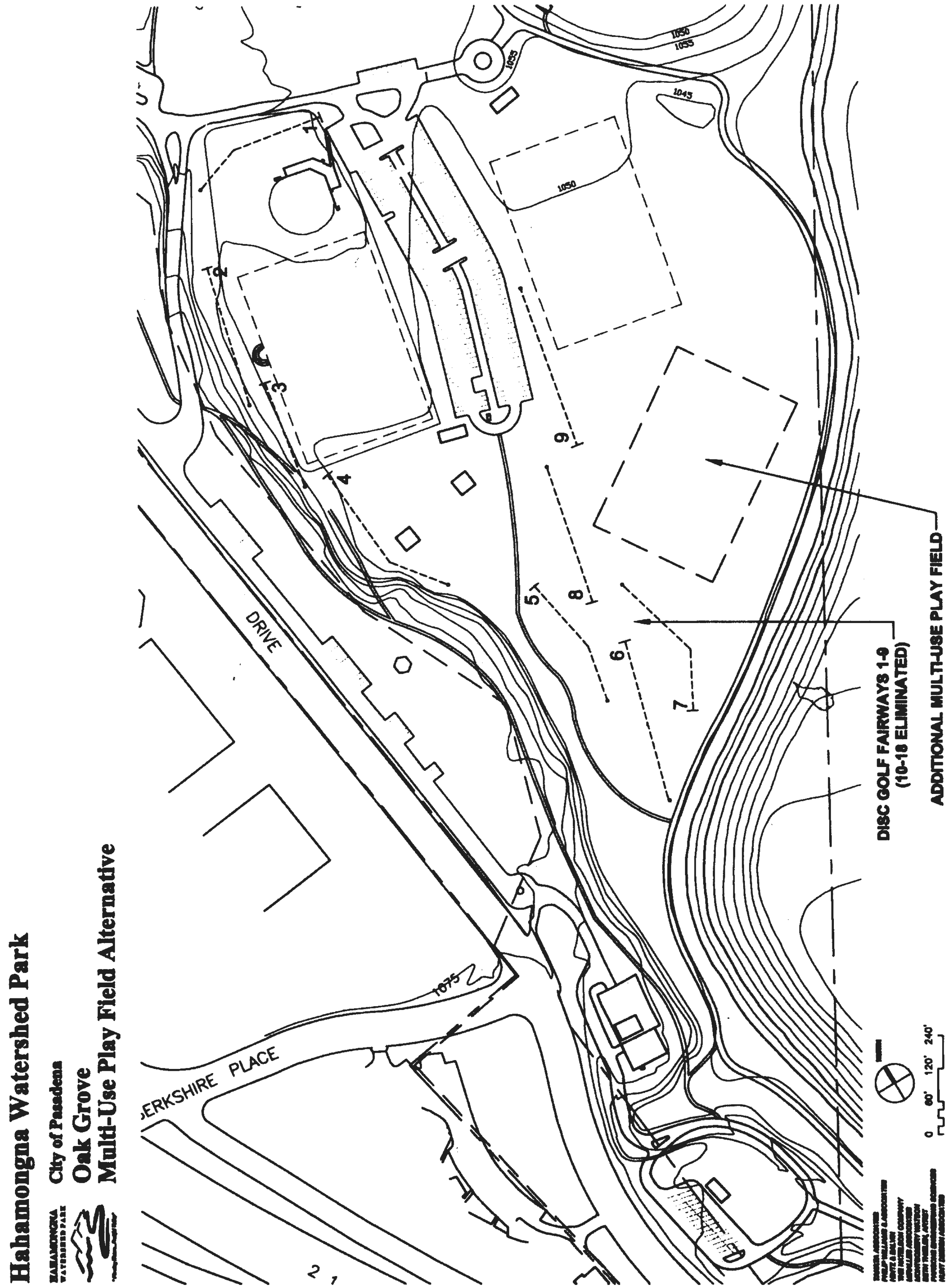
PARK ENTRY/SIGN
WOODBURY PARKING/ACCESS
TO LOWER ARROYO
TAKATA ASSOCIATES
Based upon:
Approved Preliminary Park Plan Dec. 1993 and
HWPAC Park Element Refinements Oct. 1997

A.2 DISC GOLF ALTERNATIVE

In February 2000, the Hahamongna Watershed Park Master Plan was conceptually approved by the Pasadena City Council. The Council also requested the evaluation of an alternative, which would take the relocated disc golf course proposal and consider a multipurpose athletic field on that site instead. This alternative is presented on the following page.

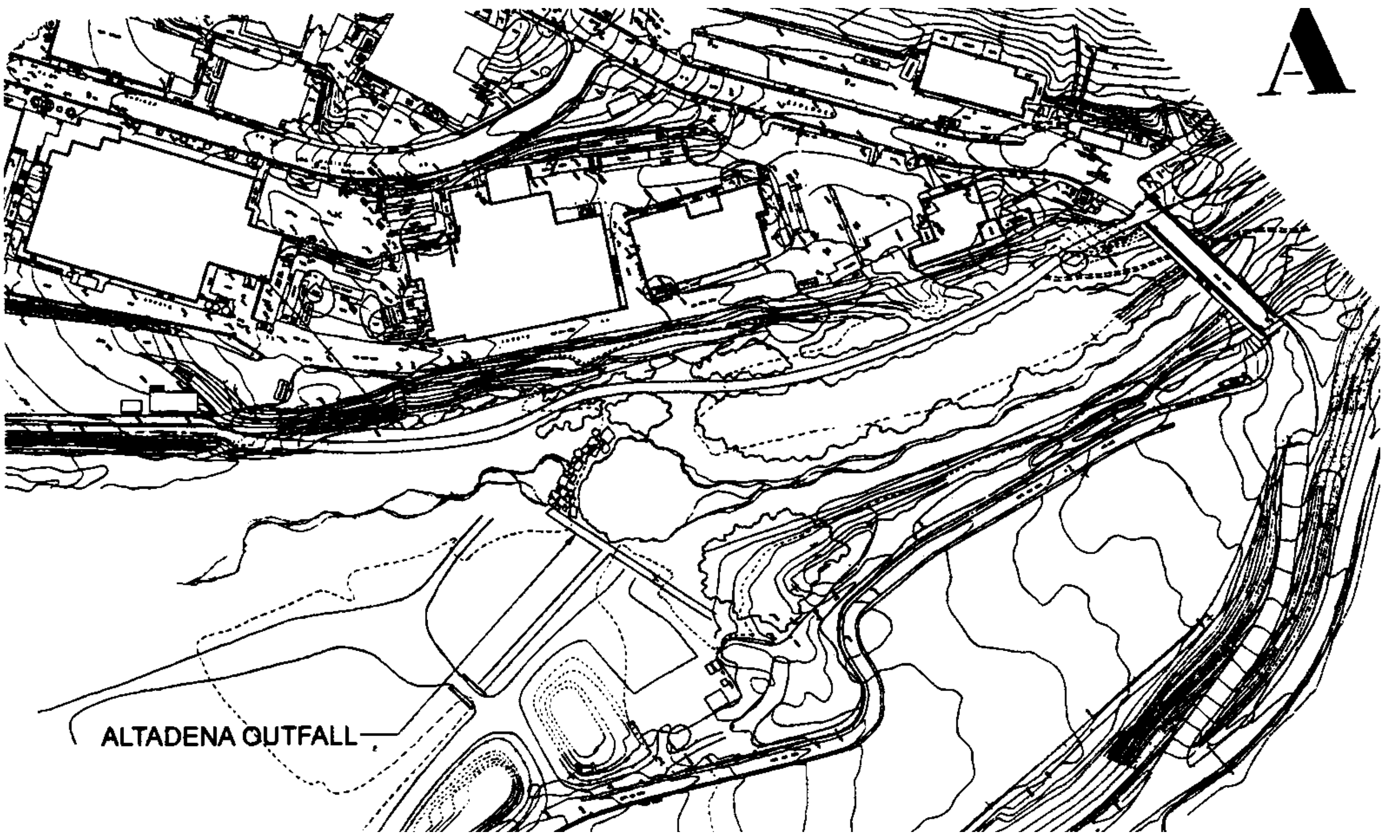

Hahamongna Watershed Park
City of Pasadena
Oak Grove
Multi-Use Play Field Alternative
DISC GOLF FAIRWAYS 1-9
(10-18 ELIMINATED)
ADDITIONAL MULTI-USE PLAY FIELD
DRIVE
ERKSHIRE PLACE
1050
1055
1045
1075

A.3 PARKING STRUCTURE ALTERNATIVES

*** The Parking Structure was not approved as part of the Council adopted plan.**

A.4 NORTH BRIDGE CROSSING OF THE PERIMETER TRAIL

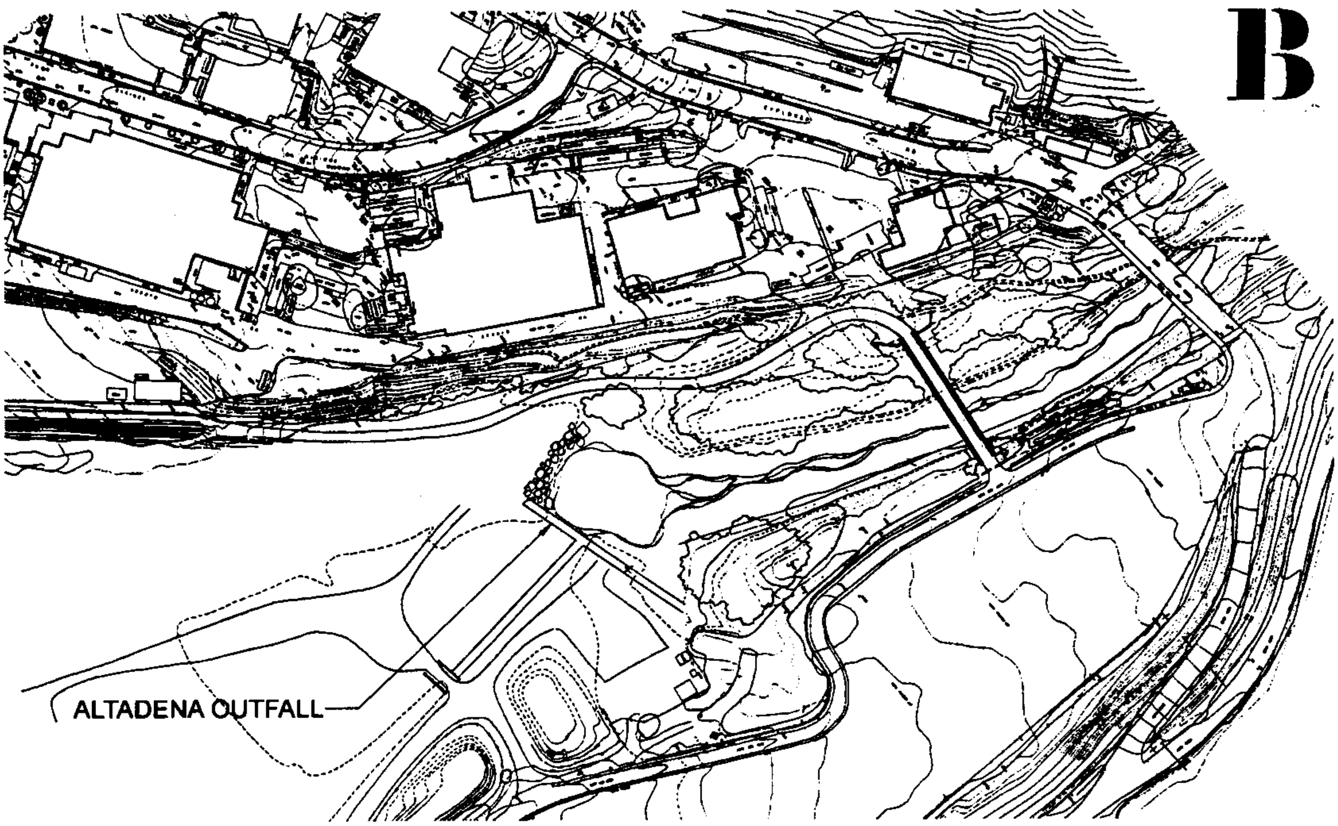
Three locations were considered as possible sites for the all-weather crossing of the northern basin: The existing JPL Bridge (A), the old bridge site (B), and the recommended site south of the Altadena Drain (C).



Existing JPL Bridge Alternative

Use of the existing JPL Bridge would require the widening of the existing trail from the embankment north to the bridge. The trail adjacent to the bridge would require fill to reduce the grade leading up to the bridge. The gap between the bridge and the JPL perimeter fence would have to be widened to allow for a vehicle-turning radius. This would require cutting the concrete railing of the bridge.

Pro
Makes use of existing infrastructure by connection to the JPL Bridge
Least-expense option
Con
Potential impact to restoration areas
Internal loop requires two more locked gates
Equestrians would use JPL Bridge during winter floods
Could disturb sensitive EPA Monitoring Area
Affects JPL security needs—fenced and gated roads & parking



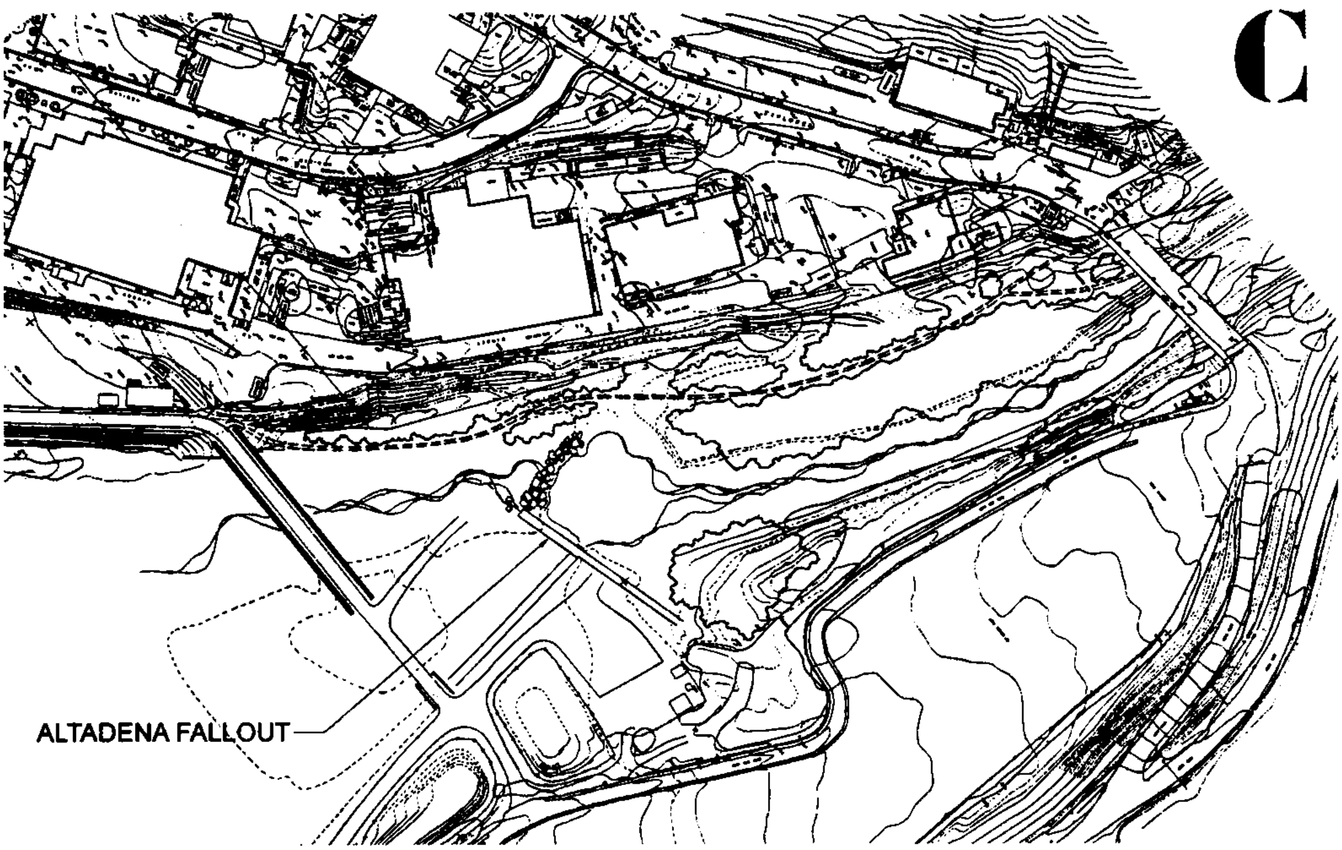
Old Road Alternative

The historic crossing prior to the construction of the JPL Bridge was approximately 300• to the south. The abandoned bridge abutments are still visible. This location would require new construction and the widening of the existing trail from the west embankment north to the old abutments.

Pro
Makes use of available infrastructure by using existing footings
Equestrians would have winter crossing

Allows for complete internal loop
Avoids Altadena Storm Drain

Con
Requires new bridge span
Potential impact to restoration areas
Cost equal to Plan C—Grading road approaches with required habitat mitigation
Could disturb sensitive EPA Monitoring Area



South of the Altadena Drain – This alternative was selected and incorporated into the adopted plan.

The recommended alternative crossing was for a location south of the Altadena Drain. The proposed span would cross the channel from the northern end of the embankment to the top of the existing spreading basin maintenance road. This alternative would require construction of a new bridge.

Pro
Avoids sensitive habitat

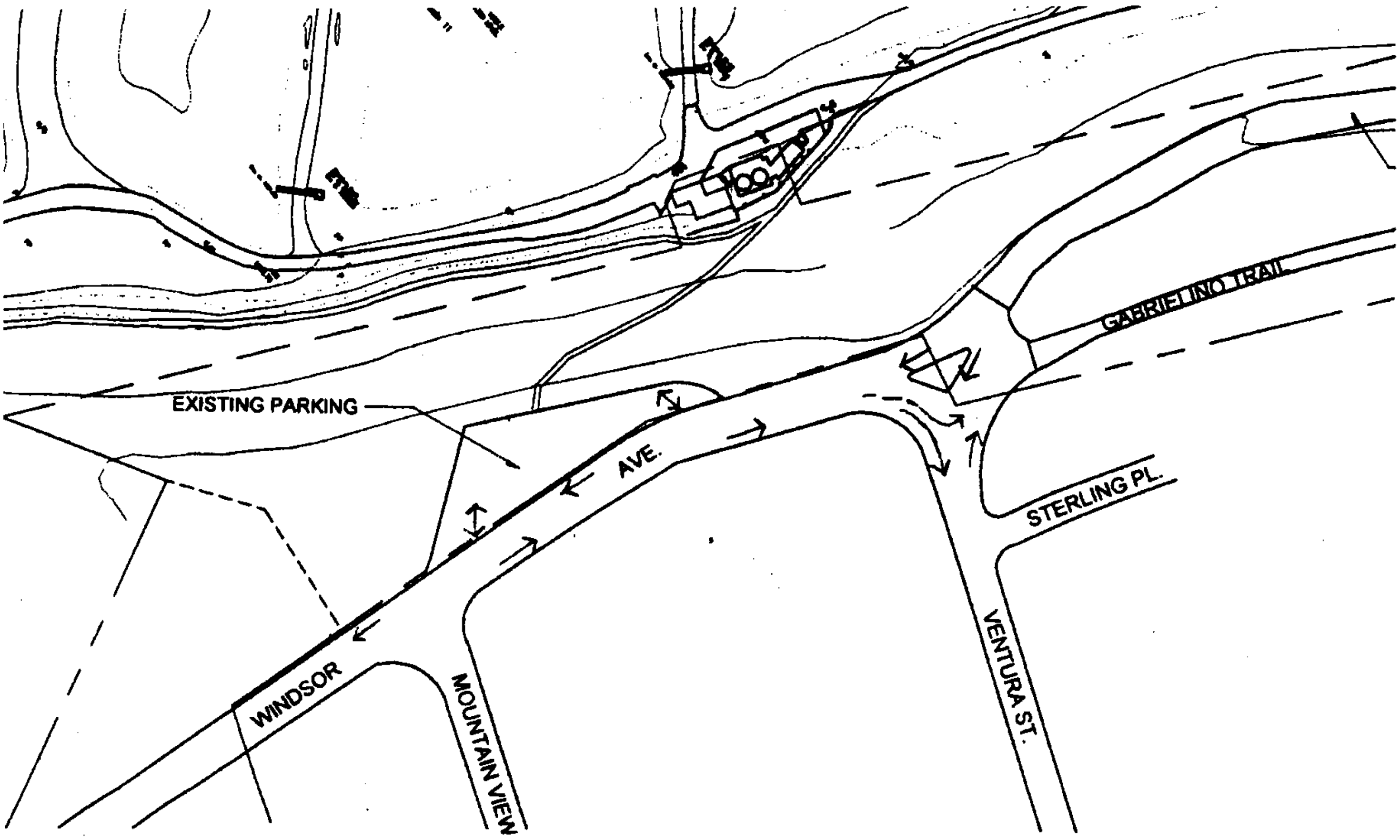
Allows for complete internal loop
Provides equestrians and other park users with winter crossing
Overhead electric power distribution line could be relocated using a bridge conduit crossing
Cost equal to Plan C—Grading road approaches with required habitat mitigation

Con
Close to Altadena Storm Drain
Longer bridge span

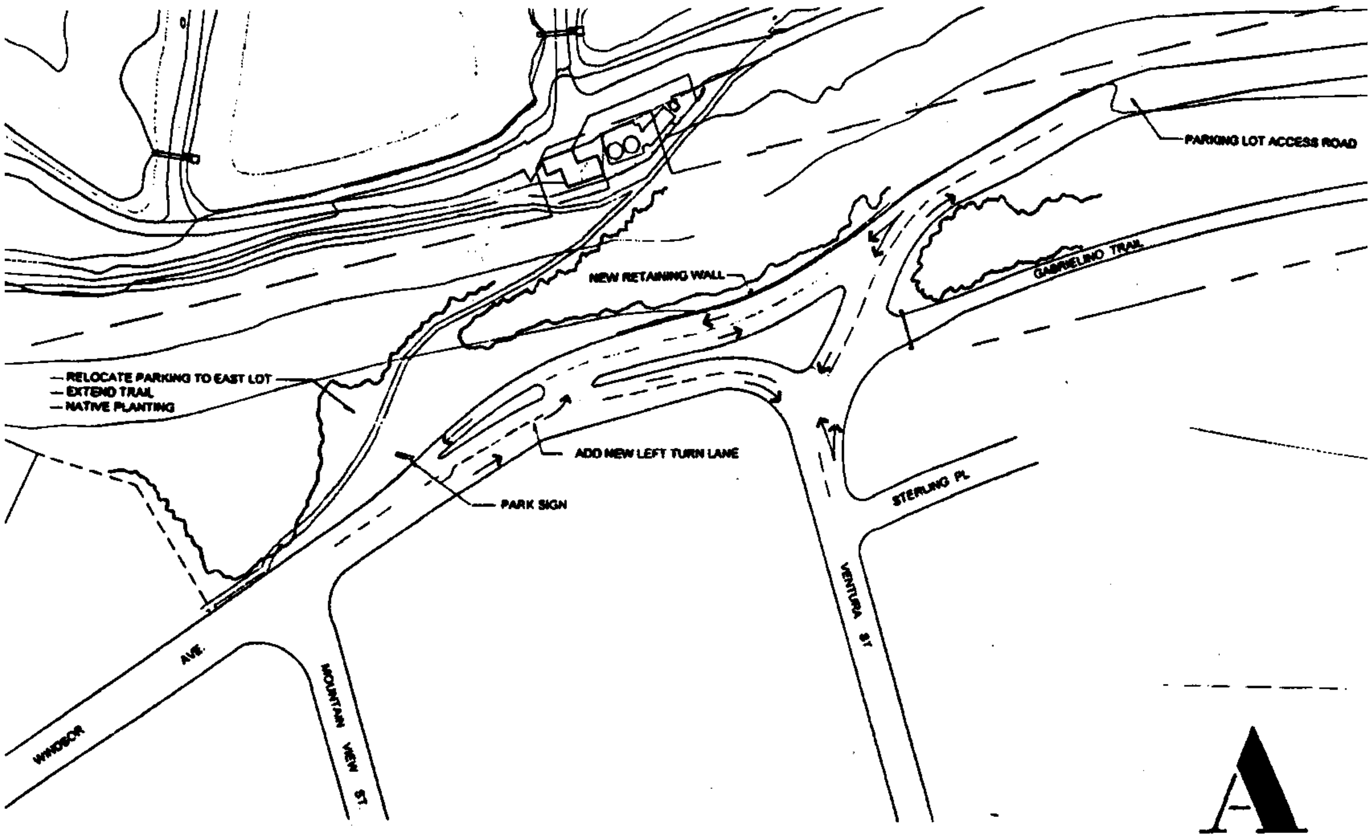
A.5 WINDSOR / VENTURA ENTRANCE

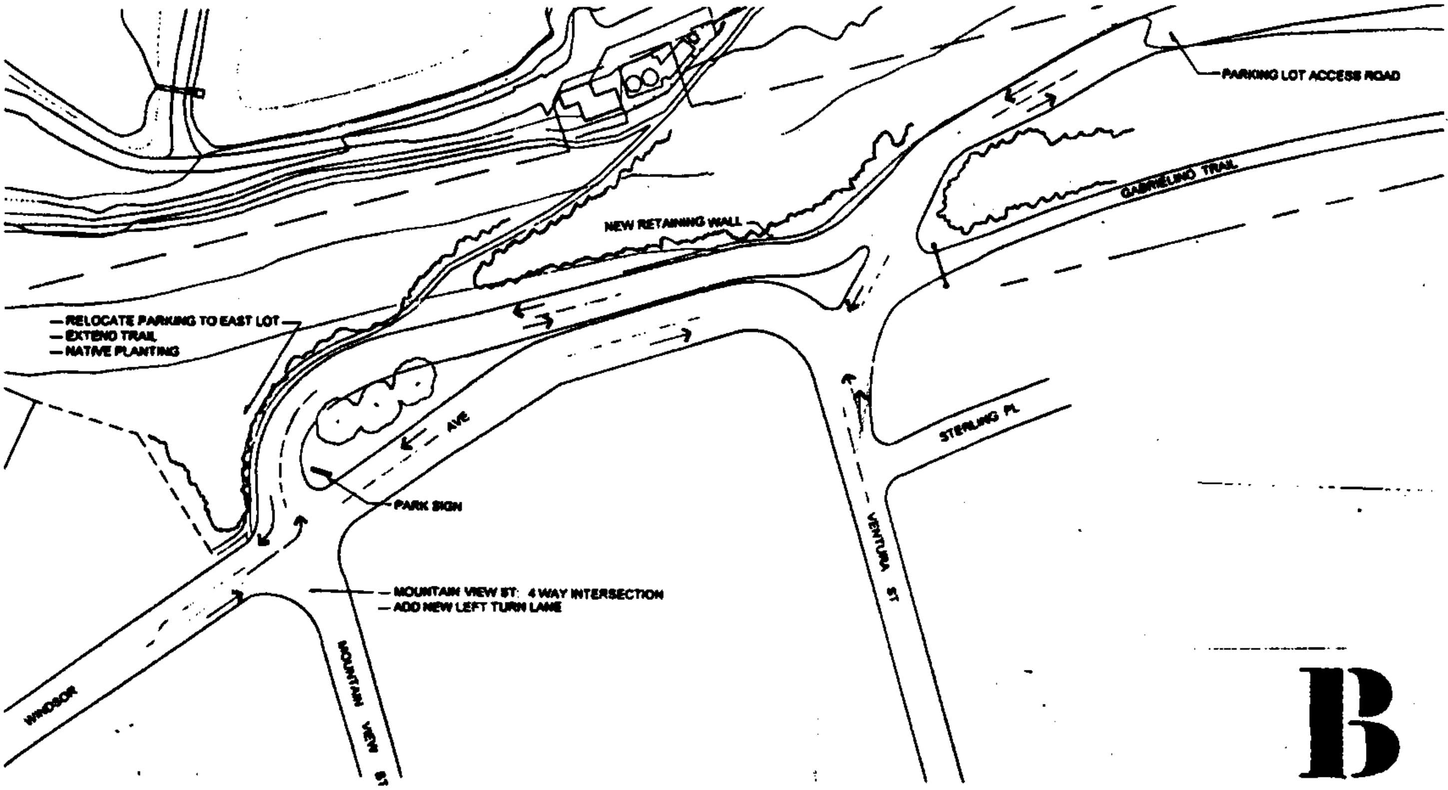
Two alternatives were considered to improve traffic flow and park user safety at the intersection of Windsor Road and Ventura Drive. Traffic impacts will be reviewed as part of the EIR process.

Existing Conditions



Left Hand Slip Lane Alternative



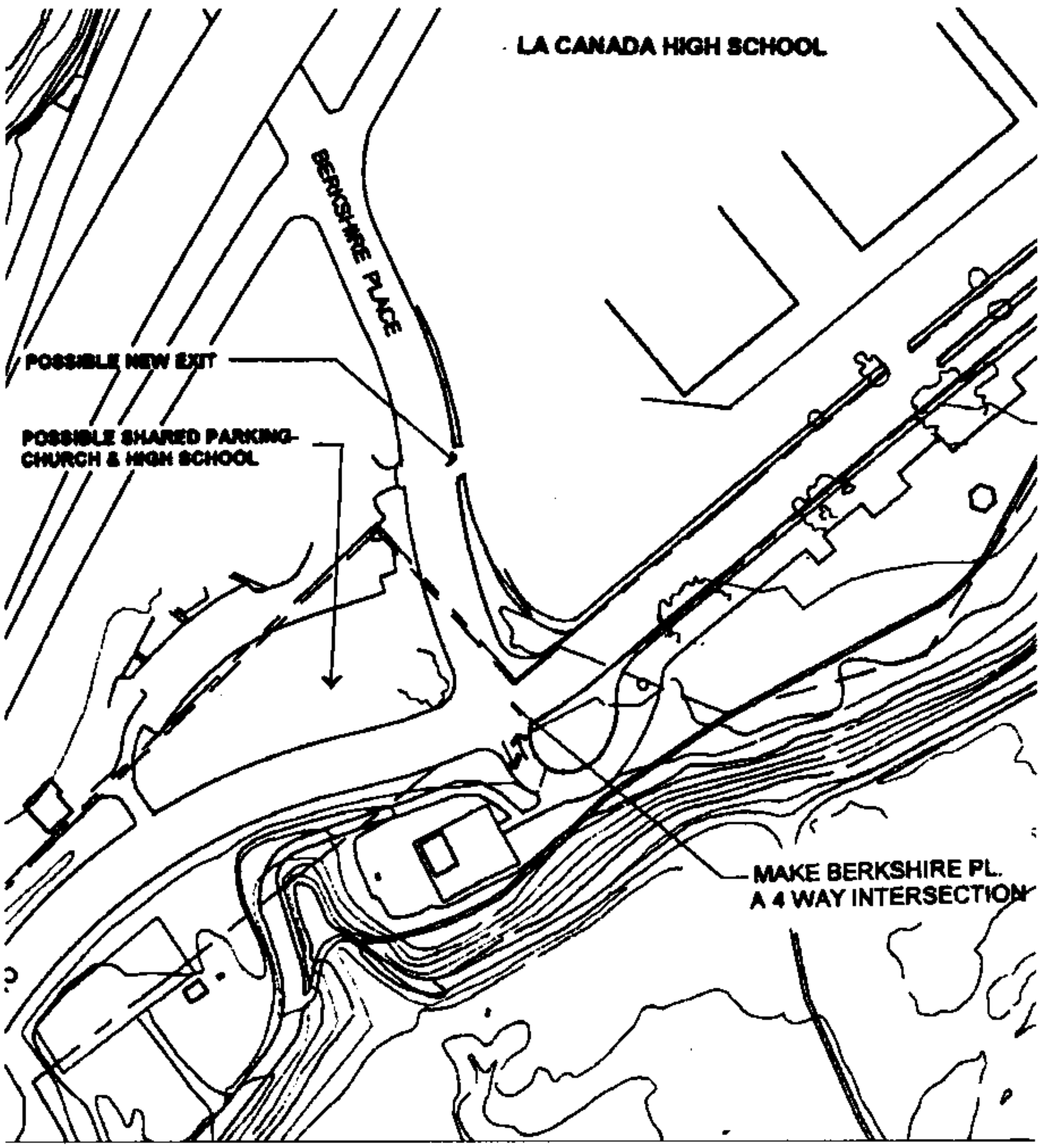


Mountain View Intersection Alternative B—This alternative was selected as part of the adopted plan and will be implemented when and if conditions warrant.

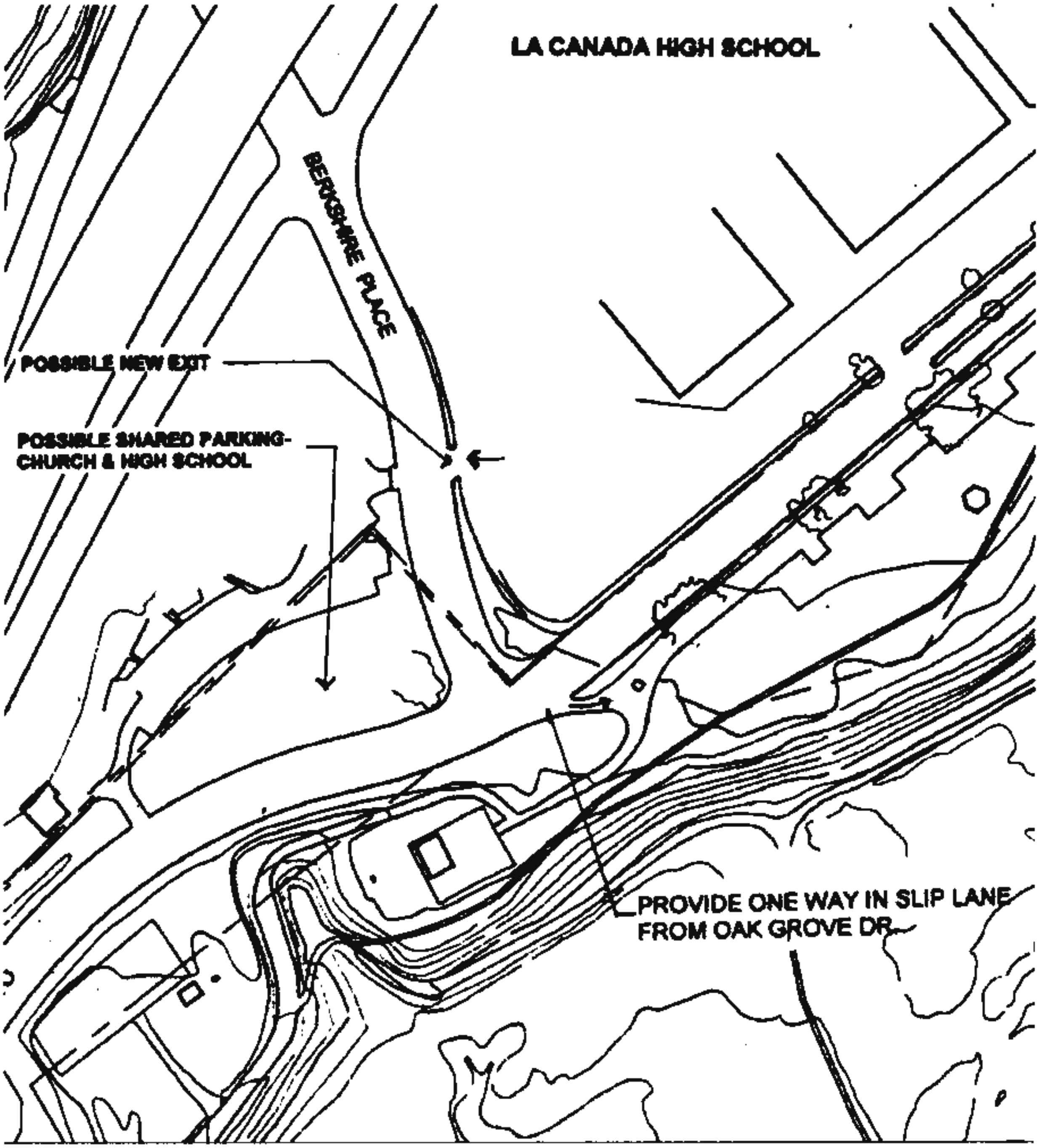
A.6 BERKSHIRE ENTRANCE

Two alternatives were considered to improve the traffic flow and park user safety at the intersection of Berkshire Place and Oak Grove Drive.

Four-Way Intersection Alternative



Entry Slip Lane Alternative
ADOPTED



A.7 DAM KEEPER'S QUARTERS

An alternative to constructing the proposed public restroom as a two-story structure at the eastern end of the Devil's Gate Dam was considered. This alternative would remodel the existing single family home currently being used as the Arroyo Resource Center. A dam keeper's quarters above the public restroom was included in the Council adopted plan.

Appendix B

ARROYO SECO
MASTER PLANS

APPENDIX B.1: BIOLOGICAL INVENTORIES
VASCULAR PLANT SPECIES OBSERVED AT HAHAMONGNA WATERSHED PARK

Scientific Name[1]	Common Name[2]
DIVISION LYCOPHYTA	
SELAGINELLACEAE	**SPIKE-MOSS FAMILY**
Selaginella bigelovii	spike-moss
DIVISION PTEROPHYTA	
PTERIDACEAE	**BRAKE FAMILY**
Pellaea andromedifolia	coffee fern
POLYPODIACEAE	**POLYPODY FAMILY**
Polypodium californicum	California polypody
DIVISION CONIFEROPHYTA	**CONE-BEARING PLANTS**
CUPRESSACEAE	**CYPRESS FAMILY**
*Calocedrus decurrens**	incense cedar
*Cupressus arizonica**	Arizona cypress
Juniperus sp.*	ornamental juniper
PINACEAE	**PINE FAMILY**
*Cedrus deodara**	deodar cedar
Picea sp.*	spruce
*Pinus canariensis**	Canary Island pine
*Pinus halepensis**	Aleppo pine
*Pinus radiata**	Monterey pine
Pinus spp.*	multiple pine species
TAXODIACEAE	**BALD CYPRESS FAMILY**
*Sequoia sempervirens**	redwood
DIVISION ANTHOPHYTA	**FLOWERING PLANTS**
CLASS DICOTYLEDONES	**DICOTS**
ACERACEAE	**MAPLE FAMILY**
Acer macrophyllum	big-leaf maple
Acer negundo	box elder
*Acer saccharinum**	silver maple
AIZOACEAE	**FIG-MARIGOLD FAMILY**
*Carpobrotus chilensis**	ice plant, sea fig
*Carpobrotus edulis**	ice plant
AMARANTHACEAE	**AMARANTH FAMILY**
*Amaranthus albus**	tumbleweed
Amaranthus blitoides	pigweed , amaranth
ANACARDIACEAE	**SUMAC FAMILY**
Malosma laurina	laurel sumac
Rhus integrifolia	lemonadeberry
Rhus ovata	sugar bush
*Schinus molle**	Peruvian pepper tree, California pepper tree
*Schinus terebinthifolius**	Brazilian pepper tree

Scientific Name[1]	Common Name[2]
Toxicodendron diversilobum	western poison oak
APIACEAE	**CARROT FAMILY**
*Conium maculatum**	poison hemlock
Daucus pusillus	rattlesnake weed
*Foeniculum vulgare**	fennel
Tauschia arguta	tauschia
APOCYNACEAE	**DOGBANE FAMILY**
*Nerium oleander**	oleander
*Vinca major**	periwinkle
ARALIACEAE	**GINSENG FAMILY**
*Hedera canariensis**	Algerian ivy
ASCLEPIADACEAE	**MILKWEED FAMILY**
Asclepias fascicularis	narrow-leaf milkweed
ASTERACEAE	**SUNFLOWER FAMILY**
Achillea millefolium	yarrow
Acourtia microcephala	acourtia
*Ageratina adenophora**	sticky eupatorium
Ambrosia acanthicarpa	annual bur-sage
Ambrosia psilostachya	western ragweed
*Anthemis cotula**	mayweed, stinkweed, dog-fennel
Artemisia californica	California sagebrush
Artemisia douglasiana	mugwort
Artemisia dracunculus	tarragon
Baccharis pilularis	chaparral broom, coyote broom
Baccharis salicifolius	mule fat, seep-willow, water-wally
Bidens frondosa	sticktight
*Bidens pilosa**	common beggar's tick, Spanish-needles
Brickellia californica	California brickellbush
*Centaurea melitensis**	tocalote
*Centaurea solstitialis**	yellow star-thistle
Chaenactis glabriuscula	yellow pincushion
*Chamomilla suaveolens**	pineapple weed
Cirsium occidentale var. *californicum*	California thistle
*Cirsium vulgare**	bull thistle, red thistle
*Conyza bonariensis**	horseweed
Conyza canadensis	horseweed
*Cotula australis**	brass-buttons
Encelia californica	California bush sunflower
Encelia farinosa	brittlebush, incienso
Ericameria pinifolia	pine goldenbush, haplopappus
Eriophyllum confertiflorum	golden-yarrow
Filago californica	herba impia, California filago
*Gazania rigens**	gazania daisy
Gnaphalium bicolor	cudweed, everlasting
Gnaphalium californicum	cudweed, everlasting
Gnaphalium canescens ssp. *microcephalum*	cudweed, everlasting
Hazardia squarrosa	saw-toothed goldenbush
Helianthus annuus	annual sunflower, common sunflower
Hemizonia fasciculata	tarplant, tarweed
Heterotheca grandiflora	telegraph weed

Scientific Name[1]	**Common Name**[2]
Heterotheca villosa	goldenaster
*Hypochaeris glabra**	smooth cat's-ear
Isocoma menziesii var. *menziesii*	goldenbush
*Lactuca serriola**	prickly lettuce
Lepidospartum squamatum	scale broom
Lessingia filaginifolia	California-aster
Madia gracilis	tarweed, gumweed
Malacothrix saxatilis	cliff-aster
Microseris sp.	microseris
*Picris echioides**	bristly ox-tongue
Rafinesquia californica	California chicory
Senecio flaccidus var. *douglasii*	groundsel, ragwort, butterweed, bush senecio
*Senecio mikanioides**	German ivy
*Sonchus asper**	prickly sow thistle
*Sonchus oleraceus**	common sow thistle
Stephanomeria cichoriacea	stephanomeria, Tejon milk-aster
Stephanomeria virgata	stephanomeria, wand chicory
*Taraxacum officinale**	dandelion
*Xanthium spinosum**	spiny cocklebur
BETULACEAE	**BIRCH FAMILY**
Alnus rhombifolia	white alder
BIGNONIACEAE	**BIGNONIA FAMILY**
*Catalpa speciosa**	western catalpa
BORAGINACEAE	**BORAGE FAMILY**
Cryptantha intermedia	cryptantha
Pectocarya penicillata	comb-bur
BRASSICACEAE	**MUSTARD FAMILY**
Arabis sp.	rock cress
*Brassica nigra**	black mustard
*Brassica rapa**	turnip, field mustard
*Capsella bursa-pastoris**	shepherd's purse
Cardamine oligosperma	bitter-cress, toothwort
*Cardaria draba**	heart-podded hoary cress
Descurainia pinnata	tansy mustard
*Hirschfeldia incana**	short-pod mustard
Lepidium lasiocarpum	peppergrass, pepperwort
Lepidium nitidum	peppergrass, pepperwort
*Lobularia maritima**	sweet alyssum
*Raphanus sativus**	radish
Rorippa nasturtium-aquaticum	water cress
*Sisymbrium altissimum**	tumble mustard, Jim Hill mustard
*Sisymbrium irio**	London rocket
*Sisymbrium orientale**	hedge mustard
Thysanocarpus laciniatus	lacepod, fringepod
BUXACEAE	**BOXWOOD FAMILY**
*Buxus sempervirens**	common boxwood, English boxwood
CACTACEAE	**CACTUS FAMILY**
*Opuntia ficus-indica**	Indian-fig
Opuntia littoralis	coast prickly pear
*Opuntia ramosissima**	pencil cactus, diamond cholla

Scientific Name[1]	Common Name[2]
CAPPARACEAE	**CAPER FAMILY**
Isomeris arborea	bladderpod
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**
Lonicera subspicata	chaparral honeysuckle, wild honeysuckle
Sambucus mexicana	blue elderberry, Mexican elderberry
Symphoricarpos mollis	creeping snowberry, trip vine
CARYOPHYLLACEAE	**PINK FAMILY**
*Cerastium glomeratum**	mouse-ear chickweed
*Polycarpon tetraphyllum**	four-leaved allseed, polycarp
*Silene gallica**	common catchfly, campion
Silene laciniata ssp. *major*	catchfly, firewheel catchfly, Indian pink, campion
Spergularia sp.	spurrey
*Stellaria media**	common chickweed
CHENOPODIACEAE	**GOOSEFOOT FAMILY**
*Atriplex canescens**	four-wing saltbush
*Chenopodium album**	pigweed, lamb's quarters, goosefoot
*Chenopodium ambrosioides**	Mexican tea
*Chenopodium botrys**	Jerusalem oak
*Chenopodium murale**	goosefoot, nettle-leaved goosefoot
*Salsola tragus**	Russian thistle, tumbleweed
CISTACEAE	**ROCK-ROSE FAMILY**
Helianthemum scoparium	peak rush-rose, wild rock-rose
CONVOLVULACEAE	**MORNING-GLORY FAMILY**
Calystegia macrostegia	wild morning-glory
CRASSULACEAE	**STONECROP FAMILY**
Crassula connata	pygmy-weed
*Crassula argentea**	jade plant
Dudleya lanceolata	lance-leaved liveforever
CUCURBITACEAE	**GOURD FAMILY**
Cucurbita foetidissima	calabazilla, wild gourd, stinking melon
Marah macrocarpus	wild cucumber, man-root
CUSCUTACEAE	**DODDER FAMILY**
Cuscuta californica	dodder, witch's hair
Cuscuta sp.	dodder, witch's hair
EUPHORBIACEAE	**SPURGE FAMILY**
Chamaesyce albomarginata	rattlesnake weed
*Chamaesyce maculata**	spotted spurge
Chamaesyce serpyllifolia	thyme-leafed spurge
Eremocarpus setigerus	turkey mullein, dove weed
*Ricinus communis**	castor bean
FABACEAE	**LEGUME or PEA FAMILY**
*Acacia baileyana**	Cootamundra wattle, acacia
*Acacia dealbata**	silver wattle, acacia
Acacia decurrens	green wattle, acacia
*Acacia longifolia**	Sydney golden wattle, acacia
*Albizia lophantha**	plume acacia, plume albizia
*Ceratonia siliqua**	carob, St. John's bread
*Cytisus striatus**	broom
*Erythrina humeana**	natal coral tree
*Genista monspessulana**	broom

Scientific Name[1]	**Common Name**[2]
Lathyrus vestitus var. *alefeldii*	wild pea, wild sweet pea
Lotus heermannii var. *heermannii*	lotus
Lotus scoparius	deerweed
Lupinus bicolor	miniature lupine, dove lupine
Lupinus concinnus	bajada lupine
Lupinus hirsutissimus	stinging lupine
Lupinus longifolius	bush lupine
Lupinus truncatus	collar lupine
*Medicago polymorpha**	California burclover
*Melilotus indica**	sourclover
*Spartium junceum**	Spanish broom
Trifolium sp.*	clover
*Vicia villosa**	hairy vetch, winter vetch
FAGACEAE	**OAK FAMILY**
Quercus agrifolia var. *agrifolia*	coast live oak, encina
Quercus berberidifolia	scrub oak
*Quercus chrysolepis**	canyon oak
Quercus engelmannii	Engelmann oak, mesa oak
GERANIACEAE	**GERANIUM FAMILY**
*Erodium cicutarium**	red stem filaree, storksbill
*Erodium moschatum**	white stem filaree, storksbill
*Geranium molle**	geranium, cransebill
*Pelargonium x hortorum**	common geranium, garden geranium
GROSSULARIACEAE	**GOOSEBERRY FAMILY**
Ribes aureum	golden currant
Ribes malvaceum	chaparral currant
HAMAMELIDACEAE	**WITCH-HAZEL FAMILY**
*Liquidambar styraciflua**	American sweet gum
HYDROPHYLLACEAE	**WATERLEAF FAMILY**
Emmananthe penduliflora	whispering bells
Eriodictyon crassifolium	yerba santa
Eucrypta chrysanthemifolia	eucrypta
Nemophila menziesii var. *menziesii*	baby blue eyes, nemophila
Phacelia cicutaria	catepillar phacelia
Phacelia distans	fern-leaf phacelia
Phacelia minor	wild Canterbury bell
Phacelia ramosissima	branching phacelia
JUGLANDACEAE	**WALNUT FAMILY**
Juglans californica var. *californica*	southern California black walnut
LAMIACEAE	**MINT FAMILY**
Lamium amplexicaule	dead nettle
*Marrubium vulgare**	horehound
Salvia apiana	white sage
Salvia columbariae	chia
Salvia mellifera	black sage
Stachys ajugoides var. *ajugoides*	hedge nettle
LAURACEAE	**LAUREL FAMILY**
Umbellularia californica	California bay, California laurel
LOASACEAE	**LOASA FAMILY**
Mentzelia micrantha	blazing star

Scientific Name[1]	**Common Name[2]**
LYTHRACEAE	**LOOSESTRIFE FAMILY**
Ammannia coccinea	ammannia
MALVACEAE	**MALLOW FAMILY**
Malacothamnus fasciculatus	chaparral mallow
*Malva neglecta**	common mallow, cheeses
*Malva parviflora**	cheeseweed, little mallow
MORACEAE	**MULBERRY FAMILY**
*Ficus carica**	edible fig
MYOPORACEAE	**MYOPORUM FAMILY**
*Myoporum laetum**	myoporum
MYRTACEAE	**MYRTLE FAMILY**
*Eucalyptus camaldulensis**	red gum, river red gum
*Eucalyptus cornuta**	yate tree
*Eucalyptus ficifolia**	red-flowering gum
*Eucalyptus globulus**	blue gum, Tasmanian blue gum
*Eucalyptus leucoxylon**	white ironbark
*Eucalyptus rudis**	flooded gum
*Eucalyptus sideroxylon**	red ironbark
Eucalyptus spp.*	multiple eucalyptus species
NYCTAGINACEAE	**FOUR O'CLOCK FAMILY**
*Bougainvillea spectabilis**	bougainvillea
Mirabilis californica	wishbone plant, wishbone bush
OLEACEAE	**OLIVE FAMILY**
Fraxinus velutina	velvet ash, Arizona ash
Fraxinus sp.*	ash
*Ligustrum japonicum**	Japanese privet
*Olea europaea**	olive, European olive
ONAGRACEAE	**EVENING PRIMROSE FAMILY**
Camissonia bistorta	California sun cup, southern sun cup, camissonia
Camissonia californica	sun cup, camissonia
Camissonia micrantha	small-flowered evening primrose, camissonia
Clarkia purpurea	purple clarkia
Clarkia unguiculata	clarkia
Epilobium canum ssp. *canum*	California fuschia, zauschneria
Epilobium ciliatum ssp. *ciliatum*	willow herb
Oenothera elata ssp. *hookeri*	Hooker's evening primrose
OXALIDACEAE	**OXALIS FAMILY**
*Oxalis corniculata**	oxalis
*Oxalis pes-caprae**	Bermuda buttercup
PAPAVERACEAE	**POPPY FAMILY**
Dendromecon rigida	bush poppy
Eschscholzia californica	California poppy
*Romneya coulteri**	matilija poppy
PASSIFLORACEAE	**PASSION FLOWER FAMILY**
*Passiflora caerulea**	blue crown passion flower
PITTOSPORACEAE	**PITTOSPORUM FAMILY**
*Pittosporum tobirum**	tobira, Japanese pittosporum
*Pittosporum undulatum**	Victorian box
PLANTAGINACEAE	**PLANTAIN FAMILY**
Plantago erecta	California plantain

Scientific Name[1]	Common Name[2]
*Plantago lanceolata**	English plantain
*Plantago major**	common plantain
PLANTANACEAE	**SYCAMORE FAMILY**
Platanus racemosa	western sycamore
PLUMBAGINACEAE	**PLUMBAGO or LEADWORT FAMILY**
*Plumbago auriculata**	cape plumbago
PODOCARPACEAE	**PODOCARPUS FAMILY**
*Podocarpus macrophyllus**	yew pine
POLEMONIACEAE	**PHLOX FAMILY**
Gilia capitata	gilia, blue-headed gilia
Gilia sp.	gilia
Leptodactylon californicum	prickly phlox
Navarretia sp.	navarretia
POLYGONACEAE	**BUCKWHEAT FAMILY**
Eriogonum elongatum var. *elongatum*	buckwheat, wand buckwheat
Eriogonum fasciculatum var. *foliolosum*	California buckwheat
Eriogonum gracile var. *gracile*	slender buckwheat
*Polygonum arenastrum**	common knotweed, doorweed
Polygonum lapathifolium	willow weed
*Rumex crispus**	curly dock
PORTULACACEAE	**PURSLANE FAMILY**
Calyptridium monandrum	pussypaws
*Portulaca oleracea**	common purslane
PRIMULACEAE	**PRIMROSE FAMILY**
*Anagallis arvensis**	scarlet pimpernel
RANUNCULACEAE	**BUTTERCUP FAMILY**
Delphinium cardinale	scarlet larkspur, cardinal larkspur
RHAMNACEAE	**BUCKTHORN FAMILY**
Ceanothus crassifolius	hoaryleaf ceanothus
Ceanothus leucodermis	chaparral whitethorn
Ceanothus megacarpus	bigpod ceanothus
Ceanothus oliganthus	hairy ceanothus
Rhamnus californica	California coffeeberry
Rhamnus crocea	spiny redberry
Rhamnus ilicifolia	holly-leaf redberry
ROSACEAE	**ROSE FAMILY**
Adenostoma fasciculatum	chamise
Cercocarpus betuloides var. *betuloides*	birch-leaf mountain-mahogany
*Cotoneaster pannosa**	cotoneaster
Heteromeles arbutifolia	toyon, Christmas berry
Prunus cerasifera var. *atropurpurea**	purple-leaf plum
Prunus ilicifolia ssp. *ilicifolia*	holly-leaf cherry, islay
Prunus ilicifolia ssp. *lyonii**	Catalina cherry
*Pyracantha angustifolia**	firethorn, pyracantha
Rosa californica	California rose, wild rose
Rosa spp.*	cultivated roses
*Rubus discolor**	Himalayan blackberry
Rubus ursinus	California blackberry
RUBIACEAE	**MADDER FAMILY**
Galium angustifolium	narrow-leaved bedstraw, shrubby bedstraw

Scientific Name[1]	**Common Name**[2]
Galium aparine	goose grass, bedstraw, cleavers
SALICACEAE	**WILLOW FAMILY**
Populus balsamifera ssp. *trichocarpa*	black cottonwood
Populus fremontii ssp. *fremontii*	Fremont cottonwood, alamo
*Populus nigra**	Lombardy poplar
Salix exigua	narrow-leaved willow, sandbar willow
Salix gooddingii	Goodding's black willow, black willow
Salix laevigata	red willow
Salix lasiolepis	arroyo willow
Salix lucida ssp. *lasiandra*	shining willow
SCROPHULARIACEAE	**FIGWORT FAMILY**
Keckiella cordifolia	heart-leaf penstemon
Mimulus aurantiacus	sticky monkeyflower, orange bush-monkeyflower
Mimulus cardinalis	scarlet monkeyflower
Penstemon spectabilis	showy penstemon, beardtongue
Scrophularia californica	California figwort
*Verbascum blattaria**	moth mullein
*Verbascum thapsus**	mullein, great mullein
Veronica americana	American brooklime, speedwell
*Veronica persica**	Persian speedwell
SIMAROUBACEAE	**QUASSIA or SIMAROUBA FAMILY**
*Ailanthus altissima**	tree of heaven
SOLANACEAE	**NIGHTSHADE FAMILY**
Datura wrightii	jimson weed
*Nicotiana glauca**	tree tobacco
Solanum douglasii	white nightshade
Solanum xanti	purple nightshade
TAMARICACEAE	**TAMARISK FAMILY**
Tamarix sp.*	tamarisk, salt cedar
ULMACEAE	**ELM FAMILY**
*Ulmus parvifolia**	Chinese elm, evergreen elm
*Ulmus pumila**	Siberian elm
URTICACEAE	**NETTLE FAMILY**
Urtica dioica ssp. *holosericea*	hoary nettle
VERBENACEAE	**VERVAIN FAMILY**
*Lantana montevidensis**	lantana
Verbena lasiostachys	vervain
VISCACEAE	**MISTLETOE FAMILY**
Phoradendron macrophyllum	bigleaf mistletoe
ZYGOPHYLLACEAE	**CALTROP FAMILY**
*Tribulus terrestris**	puncture vine, caltrop
CLASS MONOCOTYLEDONES	**MONOCOTS**
ARECACEAE	**PALM FAMILY**
*Washingtonia robusta**	Mexican fan palm
COMMELINACEAE	**SPIDERWORT FAMILY**
*Tradescantia fluminensis**	wandering Jew, spiderwort
CYPERACEAE	**SEDGE FAMILY**
Carex sp.	sedge
Cyperus esculentus	nutsedge, galingale

Scientific Name[1]	**Common Name[2]**
Cyperus sp.	nutsedge, galingale
Eleocharis acicularis	spikerush
IRIDACEAE	**IRIS FAMILY**
Sisyrinchium bellum	blue-eyed grass
JUNCACEAE	**RUSH FAMILY**
Juncus sp.	rush
LEMNACEAE	**DUCKWEED FAMILY**
Lemna sp.	duckweed
LILIACEAE	**LILY FAMILY**
*Agave americana**	agave, century plant
Aloe sp.*	aloe
Calochortus sp.	mariposa lily
*Yucca gloriosa**	soft-tipped yucca
Yucca whipplei	chaparral yucca, our Lord's candle, Spanish bayonet
POACEAE	**GRASS FAMILY**
Agrostis exarata	bent grass
*Arundo donax**	giant reed
*Avena barbata**	slender wild oat
*Avena fatua**	wild oat
*Bromus diandrus**	ripgut
*Bromus hordeaceus**	soft chess
Bromus madritensis ssp. *rubens**	red brome, foxtail chess
*Bromus tectorum**	cheatgrass, downy brome
*Cynodon dactylon**	Bermuda grass
*Digitaria sanguinalis**	crab grass
*Echinochloa crus-galli**	barnyard grass
Hordeum marinum ssp. *gussoneanum**	Mediterranean barley
Hordeum murinum ssp. *leporinum**	foxtail barley
*Lamarckia aurea**	goldentop
Leptochloa uninervia	sprangletop
Leymus condensatus	giant wild rye
*Lolium multiflorum**	Italian ryegrass
Melica imperfecta	melic, oniongrass
Nassella cernua	nodding needlegrass
*Paspalum dilatatum**	dallis grass
*Pennisetum setaceum**	fountain grass
*Piptatherum miliaceum**	smilo grass
*Poa annua**	annual bluegrass
Poa secunda ssp. *secunda*	one-sided bluegrass
*Polypogon monspeliensis**	annual beard grass, rabbit's foot
*Schismus barbatus**	Mediterranean grass
Setaria gracilis	bristle grass
*Sorghum halapense**	Johnson grass
Vulpia microstachys	vulpia, fescue
*Vulpia myuros**	vulpia, fescue
TYPHACEAE	**CATTAIL FAMILY**
Typha latifolia	broad-leaved cattail

*Indicates species that are **Introduced or Not Native** to California and/or the area of California in which Hahamongna Watershed Park is located.

1 Scientific nomenclature follows that of Hickman (1993), Munz (1959, 1968, and 1974), Bailey (1949) Sunset (1995), and Muns (1986).

2 Common names may vary by author and/or regionally in their usage.

This is not intended as an exhaustive listing of the vegetation occurring on the site or surrounding area; some species, particularly annual herbs or very uncommon species may not have been detected during the field surveys.

APPENDIX B.2: BIOLOGICAL INVENTORIES

TERRESTRIAL VERTEBRATE ANIMALS OF HAHAMONGNA WATERSHED PARK AND NEARBY AREAS WITH SIMILAR HABITATS

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
CLASS AMPHIBIA	**AMPHIBIANS**		
FAMILY PLETHODONTIDAE	**LUNGLESS SALAMANDERS**		
Batrachoseps nigriventris	black-bellied (California) slender salamander		X
Batrachoseps pacificus major	garden slender salamander		X
Aneides lugubris	arboreal salamander		X
FAMILY BUFONIDAE	**TRUE TOADS**		
Bufo boreas halophilus	California toad		X
FAMILY HYLIDAE	**TREE FROGS**		
Pseudacris regilla	Pacific tree frog or chorus frog		X
		X	
CLASS REPTILIA	**REPTILES**		
FAMILY TESTUDINIDAE	**WATER and BOX TURTLES, and TORTOISES**		
Clemmys marmorata pallida	southwestern pond turtle	X[3]	X
FAMILY IGUANIDAE	**IGUANIDS**		
Sceloporus occidentalis biseriatus	western or Great Basin fence lizard	X	X
Uta stansburiana	side-blotched lizard	X	X
Phrynosoma coronatum blainvillei	San Diego horned lizard		X
FAMILY SCINCIDAE	**SKINKS**		
Eumeces skiltonianus skiltonianus	western skink		X
FAMILY TEIIDAE	**WHIPTAILS**		
Cnemidophorus tigris multiscutatus	coastal western whiptail	X	X
FAMILY ANGUIDAE	**ALLIGATOR LIZARDS**		
Elgaria multicarinatus webbi	San Diego alligator lizard	X	X
FAMILY ANNIELLIDAE	**CALIFORNIA LEGLESS LIZARDS**		
Anniella pulchra pulchra	silvery legless lizard		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
FAMILY LEPTOTYPHLOPIDAE	**SLENDER BLIND SNAKES**		
Leptotyphlops humilis humilis	western blind snake		X
FAMILY COLUBRIDAE	**COLUBRIDS**		
Diadophis punctatus modestus	San Bernardino ringnecke snake		X
Masticophis flagellum piceus	coast coachwhip, red racer		X
Masticophis lateralis lateralis	chaparral whipsnake, California striped racer	X	X
Salvadora hexalepis virgultea	coast patch-nosed snake		X
Pituophis melanoleucus annectens	San Diego gopher snake	X	X
Lampropeltis getulus californiae	California kingsnake		X
Lampropeltis zonata	California mountain kingsnake		X
Hypsiglena torquata	night snake		X
Thamnophis hammondi hammondi	two-striped garter snake		X
Tantilla planiceps	western black-headed snake		X
FAMILY VIPERIDAE	**PIT VIPERS, RATTLESNAKES**		
Crotalus viridis helleri	southern pacific rattlesnake	X	X
CLASS AVES	**BIRDS**		
FAMILY PHALACROCORACIDAE	**CORMORANTS**		
Phalacrocorax auritis	double-crested cormorant		X
FAMILY ARDEIDAE	**BITTERNS, HERONS, and EGRETS**		
Ardea herodias	great blue heron	X	X
Ardea alba	great egret	X	X
Egretta thula	snowy egret		X
Butorides virescens	green heron		X
Nycticorax nycticorax	black-crowned night heron		X
FAMILY ANATIDAE	**DUCKS, GEESE, and SWANS**		
Branta canadensis	Canada goose		X
Anas crecca	green-winged teal		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
Anas platyrhynchos	mallard	X	X
Anas acuta	northern pintail		X
Anas cyanoptera	cinnamon teal	X	X
Anas strepera	gadwall		X
Anas americana	American wigeon	X	X
Aythya valisineria	canvasback		X
Aythya americana	redhead		X
Aythya collaris	ring-necked duck	X	X
Aythya affinis	lesser scaup		X
Bucelphala albeola	bufflehead		X
Oxyura jamaicensis	ruddy duck	X	X
FAMILY CATHARTIDAE	**VULTURES and CONDORS**		
Cathartes aura	turkey vulture	X	X
FAMILY ACCIPITRIDAE	**KITES, HARRIERS, HAWKS, and EAGLES**		
Pandion haliaetus	osprey		X
Elanus leucurus	white-tailed kite		X
Circus cyaneus	northern harrier		X
Accipiter striatus	sharp-shinned hawk	X	X
Accipiter cooperii	Cooper's hawk	X	X
Buteo lineatus	red-shouldered hawk	X	X
Buteo jamaicensis	red-tailed hawk	X	X
Aquila chrysaetos	golden eagle		X
FAMILY FALCONIDAE	**FALCONS**		
Falco sparverius	American kestrel	X	X
Falco columbarius	merlin		X
Falco mexicanus	prairie falcon		X
FAMILY PHASIANIDAE	**TURKEYS, PHEASANTS, GROUSE, and QUAIL**		
Callipepla californica	California quail	X	X
Oreortyx pictus	mountain quail		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
FAMILY RALLIDAE	**RAILS, SORAS, and COOTS**		
Porzana carolina	sora		X
Fulica americana	American coot	X	X
FAMILY RECURVIROSTRIDAE	**STILTS and AVOCETS**		
Himantopus mexicanus	black-necked stilt		X
Recurvirostra americana	American avocet		X
FAMILY CHARADRIIDAE	**PLOVERS and SANDPIPERS**		
Charadrius vociferus	killdeer	X	X
Tringa melanoleuca	greater yellowlegs	X	X
Actitis macularia	spotted sandpiper		X
Calidris mauri	western sandpiper		X
Calidris minutilla	least sandpiper		X
Gallinago gallinago	common snipe		X
FAMILY LARIDAE	**SKUAS, GULLS, TERNS, and SKIMMERS**		
Larus delawarensis	ring-billed gull		X
Larus californicus	California gull	X	X
FAMILY COLUMBIDAE	**PIGEONS and DOVES**		
Columba livia	rock dove	X	X
Columba fasciata	band-tailed pigeon	X	X
Streptopeilia chinensis	spotted dove	X	X
Zenaida macroura	mourning dove	X	X
FAMILY CUCULIDAE	**CUCKOOS, ROADRUNNERS, and ANIS**		
Geococcyx californianus	greater roadrunner		X
FAMILY TYTONIDAE	**BARN OWLS**		
Tyto alba	barn owl		X
FAMILY STRIGIDAE	**TRUE OWLS**		
Otus kennicottii	western screech owl		X
Bubo virginianus	great horned owl	X	X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
Glaucidium gnoma	northern pygmy owl		X
FAMILY CAPRIMULGIDAE	**POORWILL**		
Phalaenoptilus nuttallii	common poorwill		X
FAMILY APODIDAE	**SWIFTS**		
Chaetura vauxi	Vaux’s swift		X
Aeronautes saxatalis	white-throated swift	X	X
FAMILY TROCHILIDAE	**HUMMINGBIRDS**		
Archilochus alexandri	black-chinned hummingbird		X
Calypte anna	Anna's hummingbird	X	X
Calypte costae	Costa’s hummingbird		X
Selasphorus sasin	Allen's hummingbird	X	X
FAMILY ALCEDINIDAE	**KINGFISHERS**		
Ceryle alcyon	belted kingfisher	X	X
FAMILY PICIDAE	**WOODPECKERS**		
Melanerpes lewis	LewisÒs woodpecker		X
Melanerpes formicivorus	acorn woodpecker	X	X
Sphyrapicus nuchalis	red-naped sapsucker		X
Sphyrapicus ruber	red-breasted sapsucker	X	X
Picoides nuttallii	Nuttall's woodpecker	X	X
Picoides pubescens	downy woodpecker	X	X
Picoides villosus	hairy woodpecker		X
Picoides albolarvatus	white-headed woodpecker		X
Colaptes auratus	northern (red-shafted) flicker	X	X
FAMILY TYRANNIDAE	**TYRANT FLYCATCHERS and KINGBIRDS**		
Contopus borealis	olive-sided flycatcher		X
Contopus sordidulus	western wood peewee	X	X
Empidonax traillii	willow flycatcher		X
Empidonax difficilis	Pacific-slope flycatcher	X	X
Empidonax wrightii	gray flycatcher		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
Sayornis nigricans	black phoebe	X	X
Sayornis phoebe	eastern phoebe		X
Sayornis saya	Say's phoebe	X	X
Myiarchus cinerascens	ash-throated flycatcher		X
Tyrannus vociferans	Cassin's kingbird		X
Tyrannus verticalis	western kingbird	X	X
FAMILY ALAUDIDAE	**LARKS**		
Eremophila alpestris	horned lark		X
FAMILY HIRUNDINIDAE	**SWALLOWS**		
Progne subis	purple martin		X
Tachycineta bicolor	tree swallow		X
Tachycineta thalassina	violet-green swallow		X
Stelgidopteryx serripennis	northern rough winged swallow		X
Hirundo pyrrhonota	cliff swallow	X	X
Hirundo rustica	barn swallow	X	X
FAMILY CORVIDAE	**CROWS and JAYS**		
Cyanocitta stelleri	Steller’s jay		X
Amphelocoma californica	western scrub jay	X	X
Corvus brachyrhynchos	American crow	X	X
Corvus corax	common raven	X	X
FAMILY PARIDAE	**CHICKADEES and TITMICE**		
Parus gambeli	mountain chickadee		X
Parus inornatus	plain titmouse	X	X
FAMILY AEGITHALIDAE	**BUSHTITS**		
Psaltriparus minimus	bushtit	X	X
FAMILY SITTIDAE	**NUTHATCHES**		
Sitta canadensis	red-breasted nuthatch	X	X
Sitta carolinensis	white-breasted nuthatch		X
Sitta pygmaea	pygmy nuthatch		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
FAMILY CERTHIIDAE	**CREEPERS**		
Certhia americana	brown creeper		X
FAMILY TROGLODYTIDAE	**WRENS**		
Campylorhynchus brunneicapillus	cactus wren		X
Salpinctes obsoletus	rock wren	X	X
Catherpes mexicanus	canyon wren		X
Thryomanes bewickii	Bewick's wren	X	X
Troglogytes aedon	house wren	X	X
Cistothorus palustris	marsh wren		X
FAMILY CINCLIDAE	**DIPPERS**		
Cinclus mexicanus	American dipper		X
FAMILY MUSCICAPIDAE	**KINGLETS, GNATCATCHERS, and THRUSHES**		
Regulus satrapa	golden-crowned kinglet		X
Regulus calendula	ruby-crowned kinglet	X	X
Polioptila caerulea	blue-gray gnatcatcher	X	X
Sialia mexicana	western bluebird		X
Myadestes townsendi	Townsend’s solitaire		X
Catharus ustulatus	Swainson’s thrush		X
Catharus guttatus	hermit thrush	X	X
Turdus migratorius	American robin	X	X
Ixoreus naevius	varied thrush		X
Chamaea fasciata	wrentit	X	X
FAMILY MIMIDAE	**MOCKINGBIRDS and THRASHER**		
Mimus polyglottos	northern mockingbird	X	X
Toxostoma redivivum	California thrasher	X	X
FAMILY MOTACILLIDAE	**PIPITS**		
Anthus rubescens	American pipit		X
FAMILY BOMBYCILLIDAE	**WAXWINGS**		
Bombycilla cedrorum	cedar waxwing	X	X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
FAMILY PTILOGONATIDAE	**SILKY FLYCATCHERS**		
Phainopepla nitens	phainopepla	X	X
FAMILY LANIIDAE	**SHRIKES**		
Lanius ludovicianus	loggerhead shrike	X	X
FAMILY STURNIDAE	**STARLINGS**		
Sturnus vulgaris	European starling	X	X
FAMILY VIREONIDAE	**VIREOS**		
Vireo bellii pusillus	least Bells' vireo		X
Vireo solitarius	solitary vireo		X
Vireo huttoni	Hutton's vireo	X	X
Vireo gilvus	warbling vireo		X
FAMILY EMBERIZIDAE	**WARBLERS, BLACKBIRDS, and SPARROWS**		
Subfamily Parulinae	**Warblers**		
Vermivora celata	orange-crowned warbler	X	X
Vermivora ruficapilla	Nashville warbler		X
Dendroica petechia	yellow warbler		X
Dendroica coronata	yellow-rumped (Audubon's) warbler	X	X
Dendroica nigrescens	black-throated gray warbler		X
Dendroica townsendi	Townsend's warbler		X
Oporornis tolmiei	MacGillivray's warbler		X
Geothlypis trichas	common yellowthroat		X
Wilsonia pusilla	WilsonÒs warbler		X
Icteria virens	yellow-breasted chat		X
Piranga ludoviciana	western tanager		X
Cardinalis cardinalis	northern cardinal		X
Pheucticus melanocephalus	black-headed grosbeak		X
Guiraca caerulea	blue grosbeak		X
Passerina amoena	Lazuli bunting		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
Subfamily Emberizinae	**Towhees, Sparrows, and Juncos**		
Pipilo chlorurus	green-tailed towhee		X
Pipilo maculatus	spotted towhee	X	X
Pipilo crissalis	California towhee	X	X
Aimophila ruficeps canescens	southern California rufous-crowned sparrow		X
Spizella passerina	chipping sparrow		X
Spizella atrogularis	black-chinned sparrow		X
Chondestes grammacus	lark sparrow		X
Amphispiza belli	sage sparrow		X
Passerculus sandwichensis	savannah sparrow	X	X
Ammodramus savannarum	grasshopper sparrow		X
Passerella iliaca	fox sparrow		X
Melospiza melodia	song sparrow	X	X
Melospiza lincolnii	Lincoln’s sparrow	X	X
Zonotrichia atricapilla	golden-crowned sparrow	X	X
Zonotrichia leucophrys	white-crowned sparrow	X	X
Junco hyemalis	dark-eyed (Oregon, slate-colored) junco	X	X
Subfamily Icterinae	**Blackbirds and Orioles**		
Agelaius phoeniceus	red-winged blackbird		X
Sturnella neglecta	western meadowlark		X
Xanthocephalus xanthocephalus	yellow-headed blackbird		X
Euphagus cyanocephalus	Brewer's blackbird	X	X
Quiscalus mexicanus	great-tailed grackle		X
Molothrus ater	brown headed cowbird	X	X
Icterus cucullatus	hooded oriole		X
Icterus bullockii	Bullock's (northern) oriole	X	X
FAMILY FRINGILLIDAE	**FINCHES**		
Carpodacus purpureus	purple finch		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
Carpodacus mexicanus	house finch	X	X
Carduelis pinis	pine siskin		X
Carduelis psaltria	lesser goldfinch	X	X
Carduelis lawrencei	Lawrence's goldfinch		X
Carduelis tristis	American goldfinch	X	X
FAMILY PASSERIDAE	**WEAVER FINCHES**		
Passer domesticus	house sparrow	X	X
MAMMALIA	**MAMMALS**		
FAMILY DIDELPHIIDAE	**OPOSSUMS**		
Didelphis virginiensis virginiensis	Virginia opossum	X	X
FAMILY SORICIDAE	**SHREWs**		
Sorex ornatus ornatus	ornate shrew		X
FAMILY TALPIDAE	**MOLES**		
Scapanus latimanus occultus	broad-handed mole, California mole		X
FAMILY PHYLLOSTOMIDAE	**LEAF-NOSED BATS**		
Macrotus californicus	California leaf-nosed bat		X
FAMILY VESPERTILIONIDAE	**PLAIN-NOSED BATS**		
Myotis yumanensis sociabilis	Yuma myotis		X
Myotis evotis evotis	long-eared myotis		X
Myotis volans interior	long-legged myotis		X
Myotis californicus californicus	California myotis		X
Pipistrellus hesperus hesperus	western pipistrel		X
Eptesicus fuscus bernardinus	big brown bat		X
Lasiurus cinereus cinereus	hoary bat		X
Lasiurus borealis teliotis	red bat		X
Corynorhinus townsendi pallescens	pale (western) big-eared bat		X
Antrozous pallidus pacificus	pallid bat		X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
FAMILY MOLOSSIDAE	**FREE-TAILED BATS**		
Tadarida brasiliensis mexicana	guano bat, Mexican free-tailed bat		X
Tadarida molossa	big free-tailed bat		X
Eumops perotis californicus	western mastiff bat, greater mastiff bat		X
FAMILY URSIDAE	**BEAR FAMILY**		
Ursus americanus	black bear, cinnamon bear		X
FAMILY PROCYONIDAE	**RACCOONS, RINGTAILS, and COATIS**		
Bassariscus astutus octavus	ringtail		X
Procyon lotor psora	raccoon	X	X
FAMILY MUSTELIDAE	**WEASELS, SKUNKS, BADGERS, OTTERS, etc.**		
Mustela frenata latirostra	long-tailed weasel		X
Taxidea taxus jeffersonii	American badger		X
Spilogale gracilis	spotted skunk		X
Mephitis mephitis holzneri	striped skunk	X	X
FAMILY CANIDAE	**DOGS, WOLVES, and FOXES**		
Canis latrans ochropus	coyote	X	X
Canis familiaris	domestic dog	X	X
Urocyon cinereoargenteus californicus	gray fox	X	X
FAMILY FELIDAE	**CATS**		
Felis concolor californica	mountain lion, cougar, puma, catamount		X
Lynx rufus californicus	bobcat		X
Felis catus	feral cat	X	X
FAMILY SCIURIDAE	**SQUIRRELS**		
Spermophilus beecheyi beecheyi	California ground squirrel	X	X
Sciurus griseus anthonyi	California gray squirrel, western gray squirrel		X
Sciurus niger	eastern fox squirrel	X	X
FAMILY GEOMYIDAE	**POCKET GOPHERS**		
Thomomys bottae bottae	valley pocket gopher, Botta's pocket gopher	X	X

Recent Observations and Historical Records

Scientific Name[1]	Common Name[2]	Recent Observation	Historical Record
FAMILY ARVICOLIDAE	**VOLES**		
Microtus californicus sanctdiegii	California vole	X	X
FAMILY HETEROMYIDAE	**POCKET MICE, KANGAROO MICE, and KANGAROO RATS**		
Chaetodipus californicus	California pocket mouse		X
Dipodomys agilis agilis	Pacific kangaroo rat		X
FAMILY CRICETIDAE	**MICE, RATS, LEMMINGS, and VOLES**		
Reithrodontomys megalotis longicauda	western harvest mouse	X	X
Peromyscus californicus insignis	California mouse, parasitic mouse		X
Peromyscus maniculatus gambelii	deer mouse	X	X
Peromyscus boylei rowleyi	brush mouse		X
Neotoma lepida intermedia	San Diego desert woodrat		X
Neotoma fuscipes macrotis	dusky-footed woodrat	X	X
FAMILY MURIDAE	**MOUSE**		
Mus musculus	house mouse		X
FAMILY LEPORIDAE	**HARES and RABBITS**		
Sylvilagus audubonii sanctidiegi	desert cottontail, Audubon's cottontail	X	X
Sylvilagus bachmani cinerascens	brush rabbit	X	X
FAMILY CERVIDAE	**DEER**		
Odocoileus hemionus californicus	mule deer	X	X

[1] Scientific nomenclature follows that of:
- Stebbins (1985), and (Behler and King, 1979) for amphibians and reptiles;
- Peterson (1990), National Geographic Society (1983), Stokes and Stokes (1996), and Udvardy (1988) for birds; and,
- Jameson and Peeters (1988), Burt and Grossenheider (1980), Whitaker (1980), and Ingles (1965) for mammals.

[2] Commons names may vary by author and/or regionally in their usage.

[3] A dead southwestern pond turtle's intact carapace and plastron was found by John Cox of the City of Pasadena. This specimen apparently had been washed down into Hahamongna Watershed Park from farther up the Arroyo Seco drainage during the 1998 El Niño rains and floods.

This is not intended as an exhaustive listing of wildlife occurring on the site or surrounding area; some species, particularly for birds (i.e., winter migratory and/or summer visitor bird species) may not have been detected during the field surveys.

B.3 REFERENCES

Anderson, B.W, and R.D. Ohmart, 1982. *Revegetation for Wildlife Enhancement Along the Lower Colorado River*. United States Department of the Interior (USDI), Bureau of Reclamation, Lower Colorado Region, Office of Environment, Boulder City, Nevada. Contract No. 7-07-30-V0009. 215 pages.

Anderson, B.W, 1988. Deep Tillage Aids Tree Establishment in Riparian Revegetation Projects in Arid Southwest. *Restoration and Management Notes* 6(2):84-87.

Bailey, L.H., 1949. *Manual of Cultivated Plants*. MacMillan Publishing Company, New York, New York. 1,116 pages.

Bainbridge, D.A., N. Sorensen, and R.A. Virginia, 1993. Revegetating Desert Plant Communities. *In* T.D. Landis (technical coordinator), *Proceedings, Western Forest Nursery Association, September 14-18, 1992*. USDA Forest Service, General Technical Report RM-221. Pages 21-26.

Barbour, M.G. and J. Major (editors), 1988. *Terrestrial Vegetation of California.* California Native Plant Society (CNPS), Special Publication No. 9, Sacramento, California. 1,036 pages + Supplement.

Barbour, M.G., B.M. Pavlik, F. Drysdale, and S. Lindstrom, 1993. *California's Changing Landscapes: Diversity and Conservation of California Vegetation*. Published by the California Native Plant Society, Sacramento, California. 244 pages.

Behler, J.L. and F.W. King, 1979. *The Audubon Society Field Guide to North American Reptiles and Amphibians*. Alfred A. Knopf, Inc., New York, New York. 719 pages.

Bowler, P.A., 1990. Riparian Woodland: an Endangered Habitat in Southern California. *In* A.A. Schoenherr (editor), *Endangered Plant Communities of Southern California*. Southern California Botanists Special Publication No. 3. Pages 80-97.

Bradshaw, A.D., and M.J. Chadwick, 1980. *The Restoration of Land*. University of California Press, Berkeley and Los Angeles, California. 317 pages.

Burt, W.H. and R.P. Grossenheider, 1980. *A Field Guide to the Mammals*. Houghton Mifflin Company, Boston, Massachusetts. 289 pages.

CDFG (California Department of Fish and Game), 1997. *1997 Fish and Game Code,* Section 1600-1607, and policies pertaining to wetland definition. Law/Tech Publishing Company, Limited, San Clemente, California. 527 pages.

CNDDB (California Natural Diversity Data Base), 1999a. *List of California Terrestrial Natural Communities Recognized by the Natural Diversity Data Base*. CDFG, Natural Heritage Division, NDDB (Natural Diversity Data Base), Sacramento, California. January. 65 pages.

CNDDB, 1999b. *State and Federally Listed Endangered, Threatened, and Rare Plants of California*. CDFG, Habitat Conservation Division, Wildlife and Habitat Data Analysis Branch, NDDB, Sacramento, California. April. 15 pages.

CNDDB, 1999c. *Special Plants List*. CDFG, NDDB, Biannual publication, Sacramento, California. June. 119 pages.

CNDDB, 1999d. *Special Animals*. CDFG, Wildlife and Habitat Data Analysis Branch, NDDB, Sacramento, California. June. 42 pages plus appendices.

CNDDB, 1999e. *State and Federally Listed Endangered and Threatened Animals of California*. CDFG, Natural Heritage Division, NDDB, Sacramento, California. July. 12 pages.

CNDDB, 1999f. *RareFind 2*, computer software program. United States Geological Survey (USGS) 7.5-minute Series Topographic Quadrangle Map of Pasadena, California. CDFG, Natural Heritage Division, NDDB, Sacramento, California. July 1999 subscription update.

CNPS (California Native Plant Society), 1994. *California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California*. Special Publication No. 1, Fifth Edition. Edited by M.W. Skinner and B.M. Pavlik, California Native Plant Society, Sacramento, California. 338 pages.

City of Pasadena, 1996. *Draft Master Plan for the Lower Arroyo Seco, City of Pasadena*. Prepared by the City of Pasadena Department of Recreation and Parks, and the City of Pasadena Department of Public Works and Transportation. 65 pages plus appendices.

COE (US Army Corps of Engineers), 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1. Environmental Laboratory, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. 169 pages.

COE, 1994. Regulatory Program of the U.S. Army Corps of Engineers, Section 401 and Section 404 of the Clean Water Act of 1972 and 1994 (as amended). The Code of Federal Regulations, January 24, 1994).

Conrad, C.E., 1987. *Common Shrubs of Chaparral and Associated Ecosystems of Southern California*. General Technical Report PSW-99, Pacific Southwest Forest and Range Experiment Station, USDA Forest Service, Berkeley, California. 86 pages.

Cotton/Beland Associates, Inc., 1988. *Devil's Gate Multi-Use Project*, *Environmental Assessment Baseline Studies*. Prepared for the City of Pasadena Water and Power Department.

Cowardin, L.M., V. Carter, F. Golet, and E.T. LaRoe, 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service report, FWS/OBS 79/31. 103 pages.

Cox, J., 1999. Employee with City of Pasadena Public Works and Transportation Department, Parks and Natural Resources Division. Personal communication with Jim Eckert, Parsons ES biologist, July.

Faber, P.A., E. Keller, A. Sands, and B.M. Massey, 1989. *The Ecology of Riparian Habitats of the Southern California Coastal Region: a Community Profile*. Prepared for the U.S. Fish and Wildlife Service, Biological Report 85(7.27), Washington, D.C. 152 pages.

Federal Register, 1980. "40 CFR Part 230: Section 404(b) (1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material," Volume 45, Number 249, pages 85352-85353, U.S. Government Printing Office, Washington, D.C.

Federal Register, 1982. "Title 33: Navigation and Navigable Waters; Chapter II, Regulatory Programs of the Corps of Engineers," Volume 47, Number 138, page 31810, U.S. Government Printing Office, Washington, D.C.

Garrett, K. and J. Dunn, 1981. *Birds of Southern California: Status and Distribution*. Los Angeles Audubon Society, Los Angeles, California.

Griffin, J.R., 1988. Oak Woodland. *In* M.G. Barbour and J. Major (editors), *Terrestrial Vegetation of California*. California Native Plant Society (CNPS), Special Publication No. 9, Sacramento, California. Pages 383-415.

Hanes, T.L.,1988. California Chaparral. *In* M.G. Barbour and J. Major (editors), *Terrestrial Vegetation of California*. California Native Plant Society (CNPS), Special Publication No. 9, Sacramento, California. Pages 417-469.

Hickman, J.C. (editor), 1993. *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley and Los Angeles, California. 1,400 pages.

Holland, R.F., 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California*. Nongame Heritage Program. California Department of Fish and Game, Sacramento, California. 156 pages.

Ingles, L.G., 1965. *Mammals of the Pacific States*. Stanford University Press, Stanford, California. 506 pages.

Jameson, E.W. and H.J. Peeters, 1988. *California Mammals*. University of California Press, Berkeley and Los Angeles, California. 403 pages.

Keeley, J.E. and S.C. Keeley, 1988. Chaparral. *In* M.G. Barbour and W.D. Billings (editors), *North American Terrestrial Vegetation*. Cambridge University Press, Cambridge, England. Pages 165-207.

Koebig & Koebig, Inc., 1974. *Phase Two Master Improvement Plan: Upper Arroyo Seco*. 32 pages plus appendices.

Koler, J.A., 1993. *A Survey of the Mammals and Birds of the Lower Arroyo Seco Park, Pasadena, California*. Master of Science thesis, California State University, Los Angeles. 56 pages.

LACDPW (Los Angeles County Department of Public Works, Hydraulic/Water Conservation Division), 1995. *Final Negative Declaration for the Devil's Gate Dam Rehabilitation Project,* State Clearinghouse # 94121010. Alhambra, California.

Latting, J. (editor), 1976. S*ymposium Proceedings: Plant Communities of Southern California*. California Native Plant Society, Special Publication No. 2, Berkeley, California. 164 pages.

Linhart, Y.B., 1995. Restoration, Revegetation, and the Importance of Genetic and Evolutionary Perspectives. *In* B.A. Roundy, E.D. McArthur, J.S. Haley, and D.K. Mann (compilers), *Proceedings: Wildland Shrub and Arid Land Restoration Symposium*. General Technical Report INT-GTR-315. Pages 271-287.

McCreary, D.D., 1990. Native Oaks--The Next Generation. *Fremontia* 19(3):44-47.

McCreary, D.D., 1991. Artificially Regenerating Native Oaks in California. *Oak's 'n Folks Newsletter*: December. Integrated Hardwood Range Management Program, University of California, Berkeley, California. Pages 3-4.

Miller, R.M., 1985. Overview: Mycorrhizae. *Restoration and Management Notes* 3(1):14-20.

Mooney, H.A., 1988. Southern Coastal Scrub. *In* M.G. Barbour and J. Major (editors), *Terrestrial Vegetation of California*. California Native Plant Society (CNPS), Special Publication No. 9, Sacramento, California. Pages 471-489.

Mueller-Dombois, D. and H. Ellenberg, 1974. *Aims and Methods of Vegetation Ecology*. John Wiley & Sons, Inc., New York, New York. 547 pages.

Muns, B., 1984. *Flora of Lower Eaton Canyon, San Gabriel Mountains: a Checklist of the Vascular Plants*. Arcadia, California. 24 pages.

Muns, B., 1986. *Flora of the Arroyo Seco, San Gabriel Mountains*. Arcadia, California. 8 pages.

Munz, P.A., 1959. *A California Flora*. In collaboration with D.D. Keck. University of California Press, Berkeley and Los Angeles, California. 1,681 pages.

Munz, P.A., 1968. *Supplement to a California Flora*. University of California Press, Berkeley and Los Angeles, California. 224 pages.

Munz, P.A., 1974. *A Flora of Southern California*. University of California Press, Berkeley and Los Angeles, California. 1,081 pages.

National Geographic Society, 1983. *A Field Guide to the Birds of North America*. National Geographic Society, Washington, D.C. 464 pages.

O'Leary, J.F., 1990. Californian Coastal Sage Scrub: General Characteristics and Considerations for Biological Conservation. *In* A.A. Schoenherr (editor), *Endangered Plant Communities of Southern California*. Southern California Botanists Special Publication No. 3. Pages 24-41.

Pasadena Audubon Society, 1994. Birds of Devil's Gate Basin, Hahamongna Oak Grove and Lower Arroyo Seco. Pasadena, California. 2 pages.

Pavlik, B.M., P.C. Muick, S.G. Johnson, and M. Popper, 1991. *Oaks of California*. Published by Cachuma Press and the California Oak Foundation, Los Olivos and Oakland, California. 184 pages.

Peterson, R.T., 1990. *A Field Guide to Western Birds*. Houghton Mifflin Company, Boston, Massachusetts. 432 pages.

Phillips, E.A., 1959. *Methods of Vegetation Study*. Holt, Rinehart, and Winston, Inc., New York, New York. 107 pages.

Pillsbury, N.H., J. Verner, and W.D. Tietje (technical coordinators), 1997. *Proceedings of a Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues*; March 19-22, 1996; San Luis Obispo, California. General Technical Report PSW-GTR-160. Pacific Southwest Research Station, UDSA Forest Service, Albany, California. 738 pages.

Plumb, T.R., and M.D. De Lasaux, 1997. An Evaluation of Coast Live Oak Regeneration Techniques. *In* N.H. Pillsbury, J. Verner, and W.D. Tietje (technical coordinators), *Proceedings of a Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues*; March 19-22, 1996; San Luis Obispo, California. General Technical Report PSW-GTR-160. Pacific Southwest Research Station, UDSA Forest Service, Albany, California. Pages 231-250.

Quinn, R.D., 1990. The Status of Walnut Forests and Woodlands (*Juglans californica*) in Southern California. *In* A.A. Schoenherr (editor), *Endangered Plant Communities of Southern California*. Southern California Botanists Special Publication No. 3. Pages 42-54.

Raymond Basin Management Board, 1999. *Watermaster Service in the Raymond Basin: July 1, 1998-June 30, 1999*. Raymond Basin Management Board, La Cañada-Flintridge, California. 63 pages.

Reed, P.B., Jr., 1988. *National List of Plant Species That Occur in Wetlands: National Summary.* U.S. Fish and Wildlife Service Biological Report 88 (24), Washington, D.C. 244 pages.

Roundy, B.A., E.D. McArthur, J.S. Haley, and D.K. Mann (compilers), 1995. *Proceedings: Wildland Shrub and Arid Land Restoration Symposium*. General Technical Report INT-GTR-315. 384 pages.

Rundel, P.W., 1995. Adaptive Significance of Some Morphological and Physiological Characteristics in Mediterranean Plants: Facts and Fallacies. *In* J. Roy, J. Aronson, and F. di Castri (editors), *Time Scales of Biological Responses to Water Constraints.* SPB Academic Publishing, Amsterdam, The Netherlands. Pages 119-139.

Sawyer, J.O. and T. Keeler-Wolf, 1995. *A Manual of California Vegetation*. California Native Plant Society, Sacramento, California. 471 pages.

Schaller, F.W., and P. Sutton (editors), 1978. *Reclamation of Drastically Disturbed Lands*. Published by the American Society of Agronomy, Inc., the Crop Science Society of America, Inc., and the Soil Science Society of America, Inc., Madison, Wisconsin. 742 pages.

Schiechtl, H., 1980. *Bioengineering for Land Reclamation and Conservation.* The University of Alberta Press, Edmonton, Alberta, Canada. 404 pages.

Schoenherr, A.A., 1992. *A Natural History of California*. University of California Press, Berkeley and Los Angeles, California. 772 pages.

Society for Ecological Restoration (SERCAL), 1992. *Revegetation/Restoration Planning: The Basics*. Proceedings for workshop held November 13, 1992, Sacramento, California. Sponsored by SERCAL, California Chapter.

St. John, T.V., 1988. Soil Disturbance and the Mineral Nutrition of Native Plants. *In* J.P. Rieger and B.K. Williams (editors), *Proceedings of the Second Native Plant Revegetation Symposium, San Diego, California*. Published by the Society for Ecological Restoration and Management, Madison, Wisconsin. Pages 34-39.

St. John, T.V., 1993. The Importance of Mycorrhizal Fungi and Other Beneficial Microorganisms in Biodiversity Projects. *In* T.D. Landis (technical coordinator), *Proceedings, Western Forest Nursery Association*, *September 14-18, 1992*. USDA Forest Service, General Technical Report RM-221. Pages 99-105.

St. John, T.V., 1996. Specifically-modified land imprinter inoculates soil with mycorrhizal fungi in California. *Restoration and Management Notes* 14:84-85.

Stebbins, R.C., 1985. *A Field Guide to Western Reptiles and Amphibians*. Houghton Mifflin Company, Boston, Massachusetts. 336 pages.

Stokes, D. and L. Stokes, 1996. *Stokes Field Guide to Birds: Western Region*. Little, Brown and Company, Boston, Massachusetts. 519 pages.

Sunset, 1995. *Sunset Western Garden Book*. By the editors of Sunset Books and Sunset Magazine. Sunset Books, Inc., Menlo Park, California. 624 pages.

Takata Associates, 1992. *Devil's Gate Park, Draft Staff Report for Devil's Gate Joint Powers Planning Authority*. South Pasadena, California.

TOPO!, 1997. *TOPO! Interactive Maps on CD-ROM, Los Angeles, Santa Barbara, and Surrounding Recreational Areas*. Wildflower Productions, San Francisco, California. USGS 7.5 minute series topographic quadrangle map of Pasadena, California.

Udvardy, M.D.F., 1977. *The Audubon Society Field Guide to North American Birds: Western Region*. Alfred A. Knopf, New York, New York. 854 pages.

USDA Forest Service (United States Department of Agriculture Forest Service), 1979a. *User Guide to Vegetation, Mining and Reclamation in the West.* Surface Environment and Mining Program (SEAM), USDA Forest Service General Technical Report INT-64. Intermountain Forest and Range Experiment Station, Ogden, Utah. 85 pages.

USDA Forest Service, 1979b. *User Guide to Soils, Mining and Reclamation in the West.* Surface Environment and Mining Program (SEAM), USDA Forest Service General Technical Report INT-68. Intermountain Forest and Range Experiment Station, Ogden, Utah. 80 pages.

USDA Forest Service, 1995. *Negative Declaration and Finding of No Significant Impact for El Prieto Canyon Pipeline Replacement Project*. Prepared for USDA Forest Service, Angeles National Forest, by CM Engineering Associates, Inc., San Bernardino, California. 18 pages plus appendices.

USFWS (United States Fish and Wildlife Service), 1992. *Endangered and Threatened Wildlife and Plants, Review of Plant Taxa for Listing as Endangered or Threatened Species, Notice of Review*. 50 CFR Part 17. U.S. Government Printing Office, Washington, D.C.

USFWS, 1995. *Endangered and Threatened Wildlife and Plants*. 50 CFR 17.11 Chapter 1 (10-1-95 Edition). U.S. Government Printing Office, Washington, D.C. Pages 94-147.

USFWS, 1996. *U.S. Fish and Wildlife Service Issues Revised List of "Candidates" for Endangered* (and Threatened*) Species List*. News release from USFWS, February 27, 1996, Washington, D.C.

USFWS, 1997. *Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates or Proposed for Listing as Endangered or Threatened, Annual Notice of Findings on Recycled Petitions, and Annual Description of Progress on Listing Actions.* 50 CFR Part 17. U.S. Government Printing Office, Washington, D.C.

USFWS, 1998. *Endangered and Threatened Wildlife and Plants*. 50 CFR 17.11 (November 1998). U.S. Government Printing Office, Washington, D.C.

USGS (United States Geological Survey), 1966. 7.5-Minute Series Topographic Quadrangle Map of Pasadena, California (photorevised 1981). Reston, Virginia, and Denver, Colorado.

Westman, W.E., 1983. Xeric Mediterranean-type Shrubland Associations of Alta and Baja California and the Community/Continuum Debate. *Vegetatio* 52:3-19.

Whitaker, J.O., Jr., 1980. *The Audubon Society Field Guide to North American Mammals*. Alfred A. Knopf, Inc., New York, New York. 745 pages

Appendix C

ARROYO SECO
MASTER PLANS

APPENDIX C: PLANT PALETTTES FOR TERRESTRIAL NATURAL PLANT COMMUNITIES

Table C-1. Coast Live Oak Woodland Plant Palette

Scientific Name[1]	Common Name[1]	Occurrence	Minimum Density	Distribution[2]	Spacing[3] (feet)	Container Size (gal.)	lb./acre[4]
Canopy Layer							
Acer macrophyllum	Bigleaf maple	Occasional	25/acre	Groups: 2-3	20	5, 15	
Quercus agrifolia	Coast live oak	Dominant	100/acre	Groups: 3-6	20	1, 5, 15	
Quercus engelmannii	Engelmann oak	Occasional	15/acre	Groups: 2-3	20	5, 15	
Umbellularia californica	California bay/laurel	Occasional	15/acre	Groups: 2-3	20	5, 15	
Shrub Understory Layer							
Acer negundo	Boxelder	Occasional	20/acre	Groups: 2-4	4	5, 15	
Adenostoma fasciculatum	Chamise	Occasional	20/acre	Groups: 3-6	4	1, 5	2
Artemisia californica	California sagebrush	Occasional	30/acre	Groups: 3-6	4	1, 5	2
Ceanothus oliganthus	Hairyleaf ceanothus	Occasional	20/acre	Groups: 2-4	4	1, 5	
Heteromeles arbutifolia	Toyon	Subdominant	50/acre	Groups: 4-6	6	5, 15	
Malosma laurina	Laurel sumac	Occasional	20/acre	Groups: 6-8	6	5, 15	
Mimulus aurantiacus	Bush monkeyflower	Occasional	30/acre	Groups: 3-6	3	1	1
Quercus berberidifolia	Scrub oak	Subdominant	50/acre	Groups: 4-6	6	1, 5	
Rhamnus californica	California coffeeberry	Subdominant	50/acre	Groups: 4-6	6	5, 15	
Ribes malvaceum	Chaparral gooseberry	Occasional	25/acre	Groups: 2-4	4	1	
Rosa californica	California rose	Occasional	25/acre	Groups: 6-8	3	1	
Rubus ursinus	California blackberry	Occasional	25/acre	Groups: 4-8	4	1	
Salvia mellifera	Black sage	Occasional	30/acre	Groups: 4-8	4	1, 5	2
Sambucus mexicana	Mexican elderberry	Occasional	15/acre	Groups: 2-3	15	5, 15	
Toxicodendron diversilobum	Western poison oak	Occasional	10/acre	Groups: 2-3	15	1	
Herbaceous Understory Layer							
Bromus carinatus	California brome	Occasional					4
Eriophyllum confertiflorum	Golden yarrow	Occasional					3
Gnaphalium californicum	California everlasting	Occasional					1
Lathyrus vestitus	Wild pea	Occasional					6
Lotus scoparius	Deerweed	Occasional					6
Muhlenbergia rigens	Deergrass	Occasional					4
Nassella pulchra	Purple needlegrass	Occasional					4

1 Plant species may be substituted with the concurrence of the project biologist/restoration specialist.
2 Scattered distribution indicates that plantings should be distributed throughout the terrestrial natural community.
3 Refers to distance between plants of the same species; category applies only to species planted in groups.
4 Final specifications for the seed mix will be developed after tests for purity and seed germination of seed collected for each species.

Table C-2. Southern Willow Scrub Plant Palette

Scientific Name[1]	Common Name[1]	Occurrence	Minimum Density	Distribution[2]	Spacing[3] (feet)	Container Size (gal.)	lb./acre[4]
Upper Canopy Layer							
Acer macrophyllum	Bigleaf maple	Occasional	15/acre	Groups: 1-3	20	5, 15	
Platanus racemosa	Western sycamore	Occasional	20/acre	Groups: 2-4	20	5, 15	
Populus balsamifera ssp. *trichocarpa*	Black cottonwood	Occasional	20/acre	Groups: 2-4	20	5, 15	
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Occasional	25/acre	Groups: 3-4	20	5, 15	
Sambucus mexicana	Mexican elderberry	Occasional	25/acre	Groups: 3-4	15	5, 15	
Salix gooddingii	Black willow	Subdominant	50/acre	Groups: 5-10	10		
Umbellularia californica	California bay/laurel	Occasional	15/acre	Groups: 1-3	20	5, 15	
Lower Canopy Layer							
Salix exigua	Narrow-leaved willow	Occasional	25/acre	Groups: 3-4	6		
Salix laevigata	Red willow	Subdominant	50/acre	Groups: 5-10	10		
Salix lasiolepis	Arroyo willow	Dominant	250/acre	Scattered			
Salix lucida ssp. *lasiandra*	Shining willow	Occasional	25/acre	Groups: 3-4	8		
Shrub Understory Layer							
Baccharis pilularis	Coyote brush	Occasional	50/acre	Groups: 3-4	6	1	1
Baccharis salicifolia	Mule fat	Dominant	200/acre	Groups: 5-15	4	1	1
Rosa californica	California rose	Dominant	150/acre	Groups: 5-10	3	1	
Rubus ursinus	California blackberry	Subdominant	100/acre	Groups: 4-8	4	1	
Vitis girdiana	Desert grape	Subdominant	100/acre	Groups: 4-8	4	1	
Herbaceous Understory Layer							
Ambrosia psilostachya	Western ragweed	Occasional					10
Artemisia douglasiana	Mugwort	Occasional					10
Carex barbarae	Santa Barbara sedge	Occasional					5
Hordeum brachyantherum	Meadow barley	Occasional					15
Muhlenbergia rigens	Deergrass	Occasional					8
Urtica dioica ssp. *holosericea*	Hoary nettle	Occasional					5

1 Plant species may be substituted with the concurrence of the project biologist/restoration specialist.
2 Scattered distribution indicates that plantings should be distributed throughout the terrestrial natural community.
3 Refers to distance between plants of the same species; category applies only to species planted in groups.
4 Final specifications for the seed mix will be developed after tests for purity and seed germination of seed collected for each species.

Table C-3. Mule Fat Scrub Plant Palette

Scientific Name[1]	Common Name[1]	Occurrence	Minimum Density	Distribution[2]	Spacing[3] (feet)	Container Size (gal.)	lb./acre[4]
Upper Canopy Layer							
Acer macrophyllum	Bigleaf maple	Occasional	20/acre	Groups: 1-3	20	5, 15	
Alnus rhombifolia	White alder	Occasional	25/acre	Groups: 2-4	20	5, 15	
Platanus racemosa	Western sycamore	Occasional	25/acre	Groups: 2-4	20	5, 15	
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Occasional	25/acre	Groups: 3-4	20	5, 15	
Populus balsamifera ssp. *trichocarpa*	Black cottonwood	Occasional	20/acre	Groups: 2-4	20	5, 15	
Sambucus mexicana	Mexican elderberry	Subdominant	50/acre	Groups: 3-4	15	5, 15	
Umbellularia californica	California bay/laurel	Occasional	20/acre	Groups: 1-3	20	5, 15	
Lower Canopy Layer							
Salix lasiolepis	Arroyo willow	Dominant	250/acre	Scattered			
Shrub Understory Layer							
Baccharis salicifolia	Mule fat	Dominant	200/acre	Groups: 5-15	4	1	1
Rosa californica	California rose	Dominant	200/acre	Groups: 5-10	3	1	
Rubus ursinus	California blackberry	Subdominant	100/acre	Groups:4-8	4	1	
Vitis girdiana	Desert grape	Subdominant	100/acre	Groups:4-8	4	1	
Herbaceous Understory Layer							
Ambrosia psilostachya	Western ragweed	Occasional					10
Artemisia douglasiana	Mugwort	Occasional					10
Carex barbarae	Santa Barbara sedge	Occasional					5
Leymus condensatus	Giant wild rye	Occasional					20
Muhlenbergia rigens	Deergrass	Occasional					8
Urtica dioica ssp. *holosericea*	Hoary nettle	Occasional					5

1 Plant species may be substituted with the concurrence of the project biologist/restoration specialist.
2 Scattered distribution indicates that plantings should be distributed throughout the terrestrial natural community.
3 Refers to distance between plants of the same species; category applies only to species planted in groups.
4 Final specifications for the seed mix will be developed after tests for purity and seed germination of seed collected for each species.

Table C-4. Riversidian Alluvial Fan Sage Scrub Plant Palette

Scientific Name[1]	Common Name[1]	Occurrence	Minimum Density	Distribution[2]	Spacing[3] (feet)	Container Size (gal.)	lb./acre[4]
Canopy Layer							
Acer macrophyllum	Bigleaf maple	Occasional	10/acre	Groups: 1-2	20	5, 15	
Alnus rhombifolia	White alder	Occasional	10/acre	Groups: 1-2	20	5, 15	
Juglans californica var. *californica*	Southern California black walnut	Occasional	10/acre	Groups: 1-2	20	5, 15	
Plantanus racemosa	Western sycamore	Occasional	15/acre	Groups: 2-3	20	5, 15	
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Occasional	15/acre	Groups: 2-3	20	5, 15	
Sambucus mexicana	Mexican elderberry	Occasional	10/acre	Groups: 1-2	15	5, 15	
Shrub Understory Layer							
Artemisia californica	California sagebrush	Subdominant	30/acre	Groups: 2-4	4	1, 5	2
Atriplex canescens	Four-wing saltbush	Occasional	20/acre	Groups: 2-4	4	1, 5	
Cercocarpus betuloides	Birchleaf mountain-mahogany	Occasional	20/acre	Groups: 2-4	4	1, 5	
Encelia farinosa	Brittlebush	Occasional	20/acre	Groups: 2-4	4	1, 5	2
Eriodictyon crassifolium	Hairy yerba santa	Occasional	20/acre	Groups: 2-4	4	1, 5	
Eriogonum fasciculatum	California buckwheat	Subdominant	30/acre	Groups: 2-4	4	1, 5	3
Isomeris arborea	Bladderpod	Occasional	10/acre	Groups: 1-2	4	1, 5	
Lepidospartum squamatum	Scalebroom	Dominant	50/acre	Groups: 2-4	6	1, 5	1
Malosma laurina	Laurel sumac	Occasional	20/acre	Groups: 2-4	6	1, 5	
Opuntia littoralis	Coastal prickly pear	Occasional	20/acre	Groups: 1-2	4	1	
Rhus integrifolia	Lemonadeberry	Occasional	20/acre	Groups: 2-4	6	1, 5	
Rhus ovata	Sugar bush	Occasional	20/acre	Groups: 2-4	6	1, 5	
Salvia apiana	White sage	Occasional	20/acre	Groups: 2-4	4	1, 5	2
Salvia mellifera	Black sage	Subdominant	30/acre	Groups: 2-4	4	1, 5	2
Toxicodendron diversilobum	Western poison oak	Occasional	10/acre	Groups: 1-2	10	1	
Yucca whipplei	Chaparral yucca	Occasional	20/acre	Groups: 2-4	4	1	
Herbaceous Understory Layer							
Bromus carinatus	California brome	Occasional					4
Gnaphalium californicum	California everlasting	Occasional					1
Lotus scoparius	Deerweed	Occasional					6
Muhlenbergia rigens	Deergrass	Occasional					5

1 Plant species may be substituted with the concurrence of the project biologist/restoration specialist.
2 Scattered distribution indicates that plantings should be distributed throughout the terrestrial natural community.
3 Refers to distance between plants of the same species; category applies only to species planted in groups.
4 Final specifications for the seed mix will be developed after tests for purity and seed germination of seed collected for each species.

Table C-5. Coastal Sage-Chaparral Scrub Plant Palette

Scientific Name[1]	Common Name[1]	Occurrence	Minimum Density	Distribution[2]	Spacing[3] (feet)	Container Size (gal.)	lb./acre[4]
Canopy Layer							
Juglans californica var. *californica*	Southern California black walnut	Subdominant	30/acre	Groups: 1-2	20	5, 15	
Sambucus mexicana	Mexican elderberry	Subdominant	30/acre	Groups: 1-2	15	5, 15	
Shrub Understory Layer							
Adenostoma fasciculatum	Chamise	Dominant	150/acre	Groups: 2-4	4	1, 5	2
Artemisia californica	California sagebrush	Dominant	150/acre	Groups: 2-4	4	1, 5	2
Ceanothus crassifolius	Hoaryleaf ceanothus	Occasional	20/acre	Groups: 2-4	4	1, 5	
Cercocarpus betuloides	Birchleaf mountain-mahogany	Occasional	30/acre	Groups: 2-4	4	1, 5	
Dendromecon rigida	Bush poppy	Occasional	20/acre	Groups: 2-4	4	1, 5	
Encelia californica	California encelia	Subdominant	75/acre	Groups: 2-4	4	1, 5	2
Eriogonum fasciculatum	California buckwheat	Subdominant	75/acre	Groups: 2-4	4	1, 5	8
Eriophyllum confertiflorum	Golden yarrow	Occasional	40/acre	Groups: 2-4	4	1, 5	2
Heteromeles arbutifolia	Toyon	Subdominant	50/acre	Groups: 2-4	4	1, 5	
Isocoma menziesii var. *menziesii*	Goldenbush	Occasional	20/acre	Groups: 2-4	4	1, 5	2
Keckiella cordifolia	Heartleaf penstemon	Occasional	20/acre	Groups: 2-4	4	1, 5	
Mahonia nevinii	Nevin's barberry	Occasional	20/acre	Groups: 2-4	4	1, 5	
Malosma laurina	Laurel sumac	Occasional	30/acre	Groups: 2-4	6	1, 5	
Mimulus aurantiacus	Bush monkeyflower	Occasional	50/acre	Groups: 2-4	6	1, 5	1
Opuntia littoralis	Coastal prickly pear	Occasional	30/acre	Groups: 1-2	4	1	
Prunus ilicifolia ssp. *ilicifolia*	Hollyleaf cherry	Occasional	30/acre	Groups: 2-4	6	1, 5	
Rhus integrifolia	Lemonadeberry	Occasional	30/acre	Groups: 2-4	6	1, 5	
Rhus ovata	Sugar bush	Occasional	30/acre	Groups: 2-4	6	1, 5	
Salvia apiana	White sage	Occasional	30/acre	Groups: 2-4	4	1, 5	2
Salvia mellifera	Black sage	Subdominant	50/acre	Groups: 2-4	4	1, 5	2
Quercus berberidifolia	Scrub oak	Occasional	30/acre	Groups: 2-4	6	1, 5	
Yucca whipplei	Chaparral yucca	Occasional	30/acre	Groups: 2-4	4	1	

Coastal Sage-Chaparral Scrub Plant Palette, cont.

Herbaceous Understory Layer							
Leymus condensatus	Giant wild rye	Occasional					6
Lotus scoparius	Deerweed	Occasional					8
Lupinus bicolor	Miniature lupine	Occasional					5
Nassella lepida	foothill needlegrass	Occasional					3
Nassella pulchra	Purple needlegrass	Occasional					3
Scrophularia californica	California figwort	Occasional					3

[1] Plant species may be substituted with the concurrence of the project biologist/restoration specialist.
[2] Scattered distribution indicates that plantings should be distributed throughout the terrestrial natural community.
[3] Refers to distance between plants of the same species; category applies only to species planted in groups.
[4] Final specifications for the seed mix will be developed after tests for purity and seed germination of seed collected for each species.

Table C-6. Southern Sycamore Riparian Woodland Plant Palette

Scientific Name[1]	Common Name[1]	Occurrence	Minimum Density	Distribution[2]	Spacing[3] (feet)	Container Size (gal.)	lb./acre[4]
Upper Canopy Layer							
Acer macrophyllum	Bigleaf maple	Occasional	10/acre	Groups: 1-3	20	5, 15	
Alnus rhombifolia	White alder	Occasional	15/acre	Groups: 1-3	20	5, 15	
Fraxinus dipetala	California ash	Occasional	10/acre	Groups: 1-3	20	5, 15	
Platanus racemosa	Western sycamore	Occasional	30/acre	Groups: 2-4	20	5, 15	
Populus balsamifera ssp. *trichocarpa*	Black cottonwood	Occasional	10/acre	Groups: 2-4	20	5, 15	
Populus fremontii ssp. *fremontii*	Fremont cottonwood	Occasional	10/acre	Groups: 3-4	20	5, 15	
Quercus agrifolia	Coast live oak	Occasional	10/acre	Groups: 1-3	20	5, 15	
Sambucus mexicana	Mexican elderberry	Occasional	15/acre	Groups: 3-4	15	5, 15	
Salix gooddingii	Black willow	Subdominant	10/acre	Groups: 2-4	10		
Umbellularia californica	California bay/laurel	Occasional	10/acre	Groups: 1-3	20	5, 15	
Lower Canopy Layer							
Salix laevigata	Red willow	Subdominant	15/acre	Groups: 5-10	10		
Salix lasiolepis	Arroyo willow	Dominant	25/acre	Scattered			
Salix lucida ssp. *lasiandra*	Shining willow	Occasional	15/acre	Groups: 3-4	8		
Shrub Understory Layer							
Baccharis salicifolia	Mule fat	Dominant	25/acre	Groups: 5-10	4	1	1
Rosa californica	California rose	Dominant	30/acre	Groups: 5-10	3	1	
Rubus ursinus	California blackberry	Subdominant	25/acre	Groups: 4-8	4	1	
Herbaceous Understory Layer							
Artemisia douglasiana	Mugwort	Occasional					10
Hordeum brachyantherum	Meadow barley	Occasional					15
Muhlenbergia rigens	Deergrass	Occasional					8
Urtica dioica ssp. *holosericea*	Hoary nettle	Occasional					5

1 Plant species may be substituted with the concurrence of the project biologist/restoration specialist.
2 Scattered distribution indicates that plantings should be distributed throughout the terrestrial natural community.
3 Refers to distance between plants of the same species; category applies only to species planted in groups.
4 Final specifications for the seed mix will be developed after tests for purity and seed germination of seed collected for each species.

Appendix D

ARROYO SECO
MASTER PLANS

APPENDIX D:

WATER DATA: NEEDS & COSTS

The benefits from projects described in Section 3.1 Water Resources Management

DIRECT BENEFITS:

- Pasadena Water & Power
- Lincoln Avenue Water Company

INDIRECT BENEFITS:

- Help maintain safe yield of the Raymond Basin
- Help maintain groundwater levels
- Reduce dependency on imported water
- Increase the amount of water that can be pumped back from the Water Conservation Pool

PERMANENT LAKE FEATURES EVAPORATION WATER NEEDS*:
Evaporation from Aquatic and Wetland Habitats; each lake has a 0.3-acre island

East Lake	=	3.6 Acres	=	156,816 ft^2
West Lake	=	4.8 Acres	=	209,088 ft^2

Evaporation Rate	0.15 in/day	0.375 ft/month
Rainfall in Basin	22 in/year	– 0.153 ft/month
		0.222 ft/month

East Lake 156,816 ft^2 × 0.222 ft/month = 34,813 ft^3/month = 348 billing units/month
West Lake 209,088 ft^2 × 0.222 ft/month = 46,418 ft^3/month = 464 billing units/month

Average rate for domestic water is $1.54/billing unit

348 billing units/month × $1.54/billing unit = $536/month = $6,432/year for East Lake

464 billing units/month × $1.54/billing unit = $715/month = $8,580/year for West Lake

TOURNAMENT YOUTH SOCCER FIELD IRRIGATION NEEDS:
A soccer field is 245 ft × 380 ft = 93,100 ft^2 = 2.14 acres

Watering needs are 52.5 in/year = 4.375 ft/year = 0.365 ft/month

93,100 ft^2 × 0.365 ft/month = 33,931.5 ft^3/month = 340 billing units/month

340 billing units/month × $1.54/billing units = $524/month = $6,288/year/field

Source: Pasadena Water & Power, September 2003.

The lakes were not approved as part of the Council adopted plan.

Appendix E:
SUMMARY OF PROPOSED PROJECTS

Prepared by
City of Pasadena Parks and Natural Resources Division

DEVIL'S GATE DAM AREA

New Parking Area

A small landscaped parking area will be constructed at the intersection of Linda Vista and Oak Grove Drive with an overlook to the Devil's Gate Dam spillway. An existing tunnel under Oak Grove Drive will allow pedestrian access to the western end of the dam. The parking area will be landscaped and located on the upper terrace; ADA accessible trail/ramp(s) will take visitors from the parking area to the lower observation area and the tunnel under Oak Grove Drive giving access to the dam area. An existing retaining wall along the observation area will need to have the existing chain link fencing replaced with ornamental iron safety fencing. This ornamental fencing will be similar to that recommended for the dam's parapet walls. A gate will be installed on the southern opening of the tunnel to allow for securing access at night.

East Access (entry) to Dam

In order to eliminate maintenance vehicle/equipment traffic in adjacent residential neighborhoods, a new entry slip lane allowing direct access to the dam and basin from Oak Grove Drive will be constructed. This project will retain the existing limited parking for County maintenance vehicles as well as dam and basin access roads that will allow maintenance vehicles and equipment better access to the flood management/water conservation pool and dam. The existing road bed at the eastern end of the Devil's Gate Dam area will be raised to accommodate the new slip lane, tapering off to meet the existing east side maintenance road/trail, which will be uniformly graded and descend to the flood maintenance staging area. This access will allow maintenance vehicles a one-way access to enter the area via a secured entry gate and to drive (westbound) across the dam or down into the debris/sediment basin. The entry gate will be configured to allow bicycle access to the dam from Oak Grove Drive.

West Access (Exit) from Dam

The (westbound) flow of maintenance vehicle traffic across the dam requires an exit on the west end of the dam. This one-way exit will be provided at the location previously used as a temporary access road during construction projects on the dam. Vehicles exiting the dam at this location will be required to turn right. Maintenance vehicles will be able to drive to the 210 Freeway on-ramps at Berkshire Place without driving through a residential neighborhood.

Close La Canada Verdugo Road

The existing pipe gate at the end of the cul-de-sac on La Canada Verdugo Road will be removed and the curb restored, eliminating vehicle access from this residential street. Vehicular access to the dam will be through the proposed Oak Grove Drive Entry and Exit. A landscaped berm will be created along the edge of the cul-de-sac to further buffer the adjacent residential neighborhood from park activities. Storm drains and perimeter fencing will be modified as needed.

Dam Keeper's Quarters and Public Restroom

The existing dam keeper's quarters located on the east side of the dam will be demolished and rebuilt as a public restroom to serve park visitors in the dam area and as they enter/exit the Central Arroyo area. A new dam keeper's quarters will be built above the public restroom with sleeping quarters, a small kitchenette, and a private restroom. This second story will afford the dam keeper a view of the basin during storm events. On the ground level, connected to the public restroom, will be a storage area (single-car garage) for materials and equipment related to the operation and maintenance of the dam. The existing septic system at the former dam keeper's house (the current Arroyo Seco Resource Center) will be replaced with a gravity-feed sewer to a sewage lift station pumping sewage to the main sewer east of the La Cañada Verdugo Road cul-de-sac.

Public Safety at Dam and Observation Deck

The City of Pasadena (City) will work collaboratively with the Los Angeles County Department of Public Works (County) to enhance safety at the deck on the dam, at the observation deck south of the westside tunnel overlooking the spillway, and along the trails (see project, Dam Observation Trail) that lead down to an observation point overlooking the dam and the water conservation pool. Safety could be enhanced through the installation of ornamental fencing along the dam parapet walls and the spillway observation deck. Fencing will be similar to that installed by the City on the Colorado Street Bridge.

WESTSIDE PARK ACCESS

Park Entrance at Foothill Boulevard

The main westside park entrance will remain at Oak Grove Drive and Foothill Boulevard. The entry will receive a new park entrance sign, landscaping, and entry area lighting. This entrance will be for egress, ingress, and unobstructed access to the Metropolitan Water District (MWD) property, including the Rose Bowl Riders and Tom Sawyer Camp tenants. As needed, the use of a traffic control facility/entry kiosk for security and dissemination of information will be assessed.

Oak Grove Drive Improvements

An access lane will make entry to the park safer and more efficient, as well as alleviate the Oak Grove Drive peak-hour traffic at La Canada High School and Jet Propulsion Laboratories (JPL). A one-way access lane from Oak Grove Drive, north of the Berkshire Place intersection is proposed to allow entry during park events and morning/afternoon high school student drop-off/pick-up. The access lane will be ingress only and will have a secure gate built into the perimeter fence with appropriate signage. Due to public safety concerns, a portion of this project has been temporarily implemented.

EASTSIDE PARK ACCESS

New Park Entrance

The new park entrance will be relocated to the intersection of Windsor Avenue and Mountain View Street. The existing parking lot on Windsor Avenue will be demolished and relocated to the north end of the existing Jet Propulsion Laboratory (JPL) parking lot, once and only when the project to convert JPL Parking to Public Parking is ready to be implemented. The widening of the roadway area at the intersection of Windsor Avenue and Ventura Street with the new park entrance road will require a new retaining wall to the west of the current entrance/intersection. After the new entrance roadway is constructed, the surrounding land will be landscaped with native vegetation including oak woodland species. If the County implements any improvements to the Windsor Avenue and Ventura Street intersection prior to the implementation of this proposed project, the intersection will be evaluated for traffic volume safety and whether any further improvements will be necessary.

WATER CONSERVATION

Increasingly, water in southern California is becoming a valuable commodity. Allowing more water to recharge the Raymond basin for use and not to pass through the dam to the ocean is a major goal of the master plan. In an average rainfall year, Devil's Gate Dam, with a minimum capacity of 1,400 acre-feet below spillway height (current capacity is 1,424 acre-feet), will allow the basin behind the dam to fill with inflowing water one to three times, depending on the condition of the watershed. In a drought period, the watershed could retain all the rainfall and the dam could not even fill up once. The watershed, like a sponge, dries out during drought periods. It must reach a saturation point or have a storm of enough intensity before runoff flows to the basin. In the winter of 1992-93 (El Niño year), the basin could have filled over 40 times. Therefore, a sophisticated operating procedure needs to be developed to balance the goals of water conservation, flood control, and sediment management.

The City is obligated to the 16-member Raymond Basin Water Board to continue operation of 13.1 surface acres of spreading grounds. The Raymond Basin requires that any changes to the spreading area and annual quantity of water spread be equal to or greater than currently exists/occurs. Changing the existing method, area and pattern of recharging ground water could affect the NASA/JPL remediation activities for groundwater contaminants. Projects to improve water resource operations will require further environmental review and close coordination with NASA/JPL prior to any implementation.

Seasonal Flood Management Water Conservation Pool

The flood basin behind the dam has been filling with sediment. With an existing capacity of 1,424 acre-feet, it is approaching the minimum capacity of 1,400 acre-feet. Since 1978, when the dam was declared unsafe to hold water, vegetation has been allowed to grow in the 92 acres that will be flooded now that the dam has been reconstructed. When water conservation measures are implemented, this vegetation will begin to die as it is frequently inundated. To create new quality habitat above the spillway elevation and increase the capacity to a maximum 1,900 acre-feet, to allow for 500-acre feet of inflowing sediment capacity, this project would move 378 acre-feet of material on site and remove 243 acre feet of material off-site. This would reduce the area frequently inundated to 69 acres and create 23 acres of new recreational and habitat area. It would also create a flood control pool to better manage inflowing sediment and floating debris and a water conservation pool to allow the retention of floodwater for pump-back to the spreading basins.

Pump-Back System

This project involves the installation of the infrastructure needed to pump water at selected times from a seasonal flood management/water conservation pool behind the dam, north, to the existing improved spreading basins on the eastside the proposed spreading basins on the westside of the park. A new inlet structure with pump located near the dam would be created to pump water from the pool and into a new distribution system. The distribution system, including the size of piping and pump, will be designed to take water from the new inlet north along the eastside of the basin, at the bottom of the slope and adjacent to other domestic water distribution lines, to the highest eastside basins, continuing west across the North Bridge Crossing to gravity-feed both the proposed westside basins and existing improved eastside basins.

Overall Storm Drain Modifications

Storm water entering the proposed Flood Management Water Conservation Pool from Flint Wash, from runoff of adjacent lands, and from all storm drain outfalls, will need to comply with state-mandated water quality standards including monitoring and cleanup of pollution from runoff. Runoff pollutants include horticultural fertilizers and pesticides, pathogens from animal manure (dogs and horses), and hazardous substances in municipal waste including trash, oil, and grease from motorized vehicles. Remediation may occur at the outfall location in the Park, at a pollutant source or at the inlet to the storm drain, depending on the particular type of pollutant. This becomes important due to the planned pumpback of water held behind the dam for percolation in the spreading basins to recharge the Raymond Basin aquifer, a source of drinking water. A fiscally workable solution to some of these pollution problems remains to be found, both technically and scientifically. Best management practices will be utilized to ensure that TMDL's (Total Maximum Daily Loads) of pollutants are reduced and that a natural/biological alternative is considered first in finding a solution.

Westside Spreading Basins

This project creates three new basins (nos. 13, 14 & 15) totaling eight surface acres on the westside of the park and brings Pasadena's total spreading operation to 21 surface acres. The City has the right to divert a maximum of 25 cfs from the Arroyo Seco stream. The Water and Power Department has concluded that the optimum water surface acres for spreading, with diversion and pumpback, will be 22 to 26 acres. The master plan dedicates a total of 26 surface acres to the spreading operation. The maximum depth of the water in these ponds will be six feet. This project also involves extending the distribution system for the new spreading from two sources: a) the diversion of Arroyo Seco and Millard streams as well as from the new pumpback system infrastructure, along the eastside of the basin. This project is directly related to another project, Construction of the Northerly Perimeter Trail Bridge Crossing, described later. The bridge crossing is needed for the successful completion of the new westside spreading basins as it provides the means for a utility crossing including a water diversion and pumpback infrastructure crossings to the westside basins.

Eastside Spreading Basins

Opportunities for spreading water will be enhanced through the expansion of existing and creation of new basins in the area now occupied by the JPL east parking lot. Testing has shown the rate of percolation of water into the Raymond Basin is greater in this area than in the existing basins. Existing basins nos. 1, 2, 3 and 4 will be expanded to the east. Two new basins will be created to the north of basin no. 1 and the existing east-to-west connecting trail. The City of Pasadena's two sludge basins will be relocated and expanded to the north of the new spreading basins. This expansion will occupy approximately 75 percent of the current JPL east parking lot, and will add five surface acres on the eastside.

The City of Pasadena is required by the Raymond Basin Management Board to maintain and operate the existing total of 13.1 surface acres of spreading.

Altadena Drain Improvements

The Altadena drain extends into the stream channel north of the existing spreading basins. The extended concrete box structure was used as part of an earthen breakaway dam, which would divert water to the eastside spreading basins. This site is no longer used as a diversion facility due to the environmental impact from this diversion method. To widen the stream corridor, allowing for a more natural stream alignment, (see Habitat Project #1: Stream Corridor Alignment) the drain will be shortened and the embankment armored to prevent erosion. This stream corridor will be restored to a riparian habitat similar to, and as a continuation of, the same plant community immediately north of the JPL Bridge. Due to urban runoff, this riparian habitat also exists for a short stretch of the stream course south of the drain.

Altacrest Drain Improvements

The discharge from the forty-inch reinforced concrete pipe (RCP), adjacent to the Gabrielino Trail Road and east of the JPL east parking lot (just south of the equestrian trail), will continue downslope in an extended, enlarged single RCP. This underground drain line will run between the enlarged existing ponds and empty directly into the stream corridor. There will be an inlet to receive runoff from the eastside park road and the remaining northerly quarter of the existing parking lot.

FLOOD MANAGEMENT

An important element of the HWP master plan is flood control or management of storm events for public safety. The 1919 Lease Agreement between the County and the City designates an area for flood control that encompasses approximately 80% of the HWP acreage. Under the most extreme conditions this area could be flooded. This includes all the area behind the dam below elevation 1075.

Park elements need to be designed with these flooding considerations: The area that is most frequently inundated is below an elevation of 1040.5 (the floor of the spillway). Park elements between the elevations of 1040.5 and 1075 will need to be reviewed by all parties and designed for the possibility of a short period of inundation (maximum of several days). The capacity below the elevation of 1040.5 should be as great as possible for water conservation, sediment management, and flood management. Currently, the area at this elevation of 1040.5 covers 92 surface acres. Much of this area is covered with only a few feet of water when the water level is at spillway height (1040.5). The conceptual grading plan proposes to excavate material, creating a deeper debris and sediment basin. This excavated material will be placed so that an additional 23 acres will then be above the elevation of 1040.5. This raised area will be infrequently inundated, and could be used for habitat restoration and recreation. The areas that are frequently inundated (at 1040.5 and below) are reduced to 69 acres (from 92 acres) according to the conceptual grading plan. An additional 243 acre-feet will be removed from the site to achieve the maximum capacity of the debris and sediment management basin as shown on the conceptual grading plan. This grading will achieve the following benefits:

- The floodwater and sediment capacity of the management basin will increase, because much of the material excavated from below the 1040.5 elevation will be placed above the 1040.5 elevation.
- The needed capacities for flood management could be met by not having to move graded material off-site for three to five years. By this time, the new willow habitat will be established, existing habitat could be removed, and more sediment will have accumulated, reducing the capacity.
- There will be an additional 23 acres for habitat establishment and recreation. The Streambed Riparian Habitat, which will be infrequently inundated, will gain five acres.

Most of the existing willow habitat will be inundated if this proposed grading does not occur (see Habitat Project #2**). The habitat will begin to degenerate as more water conservation measures are taken and water is kept at the 1040.5 elevation for pump-back purposes. Water conservation measures can begin as soon as the City and the County resolve a number of liability issues.

Sediment and Debris Management

The minimum capacity for flood management is the volume below the spillway floor, which is 1,400 acre-feet (one debris event). This minimum capacity must be maintained. Therefore, as sediment inflow varies from year to year, and as the total volume of inflowing sediment decreases the capacity, to the minimum 1,400 acre-feet, sediment must be removed. The grading plan illustrates the proposed maximum capacity, which will be 1,900 acre-feet. This will inundate a 69-acre area at an elevation of 1040.5. The difference between this maximum and the minimum capacity (500 acre-feet or 806,667 cubic yards) equals 5.5 years of the historical annual average inflow of 145,200 cubic yards of sediment.

Debris and sediment removal of approximately 3,000 cubic yards will occur each summer to maintain and/or restore the dam's lowest opening, the sluice gate. This could permit the continuing operation of the flow-assisted sediment transport (FAST) program, which has accounted over the years for the removal of approximately 20% of the inflowing sediment.

Because drought years transport small amounts of sediment and large sediment transport events occur unpredictably, sediment should be removed from the park on an as-needed basis. Sediment removal could happen in consecutive years, but in reviewing historical data, it is more likely that this will only need to be done every three to seven years. Procedural policies and specifications for processing and removal of sediment need to be drafted by the City and the County.

The conceptual grading proposes to shape the basin with sides as steep as can be safe and stable (3:1 slope). This maximizes the capacity and allows the space to be easily maintained. At elevations of 1030 and below, newly deposited sediment, debris, and emerging vegetation will be excavated. One of the goals of the master plan is to establish a permitting process that will allow sediment removal to occur on an as-needed basis. This area below 1030, the debris and sediment basin (i.e., water conservation pool) will be shaped not only to facilitate the removal of deposited sediment, but also to influence where sediment is deposited. With an incoming storm event, it is ideal to have water at elevations of 1020 to 1030. This causes sediment-laden water to slow as it enters the water conservation pool, dropping out the sediment below the established habitat and upstream of the dam, thereby not affecting the dam's control features. If water is at 1040.5 (spillway height), then sediment will be deposited in the newly widened stream corridor and will inundate the streambed riparian plant community. As a storm event passes and water continues to enter the basin, it becomes less sediment laden. When this occurs, water should be allowed to accumulate to the maximum capacity. This will inundate the established willow and riparian habitat with water and nutrients, and accumulate water for the proposed pumpback (See project, Pumpback System) for water conservation purposes.

Another aspect of this project element is debris removal. For the safe operation of the dam and downstream flood-control structures, debris needs to be prevented from passing through the dam, or obstructing openings in the dam, outlet tunnel, and spillway headworks. An area on the east side of the debris and sediment management basin (i.e., water conservation pool) will be raised to an elevation of 1045, and used as a staging area for equipment to remove floating debris.

Sediment Removal Access

A permanent haul road will be constructed on the west side of the Flood Management Water Conservation Pool. It will connect Oak Grove Drive with the bottom of the basin behind the dam. A secure gate built into the perimeter fence will provide sediment removal trucks and maintenance equipment with access to the sediment and debris management basin. The 210 Freeway on-ramps at Berkshire Place provide access to all destinations eliminating trucks driving through a residential neighborhood.

OAK GROVE AREA

Group Picnic Shade Structures

Group picnic areas will accommodate four to six picnic tables. The shade structures, two south and two north of Oak Grove Field, will be designed to fit the natural character of the park and use indigenous materials as well as conform to the Arroyo Seco Design Guidelines. The floor of the group picnic area will be graded level and smooth and surfaced with a permeable material such as decomposed granite blended with native soil and a binder. Electricity will be provided to the structure, and amenities such as barbecues with counters, sinks with running water, and gray-water drains will be provided. A trash disposal area will also be provided to store multiple cans with lids. The group picnic areas will meet all ADA-accessibility requirements.

Westside Picnic Amenities

Both group picnic areas and smaller/individual picnic areas are planned for the westside park area. The Upper Oak Grove will continue to have a distribution of picnic tables within its use area. The Lower Oak Grove will serve as the location for two designated group picnic areas. The first is in the area south of the Oak Grove Field where two picnic shelters will be provided for group picnics. The other is the east end of the overnight camp area, which will also provide two picnic shelters. A minimum of two picnic areas within the westside park area will be ADA-accessible. There are currently 52 picnic tables within the westside park area. The number of picnic tables has steadily decreased over the past thirty-five years due to age, wear, and misuse. It is estimated that the total number of tables will double to accommodate the use anticipated by the park improvements proposed for the westside park area. Existing picnic tables will be moved to better positions, which will also relieve the compaction on sites where they currently sit. A program to rotate the picnic tables will be implemented, particularly in areas where a table is within the drip line of an oak tree.

Oak Grove Field Restroom

The burned-out restroom at the southwest corner of the existing Oak Grove Field has been removed and will be replaced by a new restroom facility that includes storage. The new restroom facility is east of the former location and at the southeast corner of the renovated Oak Grove Field. A sewage lift station will be constructed. The sewage lift station will transport sewage west to the main sewer system on Oak Grove Drive. The new replacement restroom will be similar in size to the existing restrooms in the Oak Grove area. The facility will also have security/safety lighting installed.

Foothill Drain Improvements

Increased runoff from the widening of Oak Grove Drive, Foothill Boulevard west of the park entrance, and a portion of the La Canada-Flintridge area has caused severe erosion on the slope above the existing Oak Grove Field. The existing twenty-four-inch concrete drain will be extended down the slope and then turn parallel to the Oak Grove Field. The drain pipe will be covered over and the slope restored. The new end of the drain will discharge stormwater into an improved existing swale that flows south at the base of the slope.

Outdoor Amphitheater

The existing amphitheater located just west of Oak Grove Field will be restored. For public safety and ease of maintenance the seating will be designed to prevent movement of the existing unsecured poles. The area will be fine-graded and surfaced with the appropriate material to make the area ADA-accessible.

Sycamore Grove Fields

Two new, approximately 2.4-acre multipurpose fields will be constructed. This field size also allows the area to be converted into multiple practice fields for youth soccer. These multipurpose play areas will also accommodate youth tournament soccer, open play, group picnics, and other group and nongroup activities. The southern field will be adjacent to and east of the expanded parking lot. This area is currently used for temporary overflow parking. Under existing conditions, the southern portion of this field is prone to flooding; therefore, the area will be built up from its current elevation of 1040 to an elevation of 1050. Fill material for construction of the southern Sycamore Grove Field and disc golf course improvements will be provided by excavated material from the conservation pool. The northern field will be adjacent to and east of the Supervised Overnight Camping Area. Under existing conditions, this area is well below the flood inundation elevation of 1040.5. Due to past mining operations, a large depression exists with the bottom at elevation at 1025. Material excavated to widen the stream channel will be used to raise this area to above elevation 1055. During disaster emergencies, these areas will be used as a staging area for fire crews and other emergency support groups. Best management practices for turf maintenance will be utilized to avoid possible impacts to ground water quality. A natural/biological alternative will be considered first for turf maintenance.

Upgrade Oak Grove Maintenance Office Sewer [Not on Map]

The Oak Grove Maintenance Office (OGMO) is currently on a septic system. The restroom facilities do not need upgrading. The current septic system will be converted to a gravity-flow system that will flow to the proposed sewage lift station near the Berkshire drain, and then be pumped up to the existing sewer main in Oak Grove Drive.

Disc Golf Course Improvements

The disc golf improvements include relocation of the back nine pins in the north Oak Grove area, and pins 6 through 9 of the front nine to the south and east of the existing parking lot. The relocation of the disc golf area provides the opportunity for habitat restoration of the north Oak Grove area. The relocated disc golf course will be developed by excavating material from the water conservation pool area (ruderal habitat areas) and placing the material in the area between the existing willow stands to an average elevation of 1046 which is above the frequently inundated elevation of 1040.5. Drainage of courses in this area will occur within the existing stands of native willow habitat. Amenities, including a bench at every tee, will be constructed in accordance with the Arroyo Seco Design Guidelines.

Expanded Parking Area

This existing parking area, immediately east of the Oak Grove Field, will be expanded to accommodate the abandoned overflow parking area. The existing parking area will be accessed via the improved access road. This parking area is intended to replace the dirt overflow lot that is being converted to Sycamore Grove Field. This project could be done in conjunction with another element, i.e., the removal of existing asphalt paving in the basin (from past mining operations). The removed asphalt could be used as base fill for the new expanded parking area. As a part of this project, the existing access road with a small adjacent parking area will be extended and improved to allow for a turnaround for park users, buses, and emergency vehicles. The Arroyo Seco Design Guidelines will provide further guidance for this project.

Native Plant Nursery

A plant nursery will be established at the existing Oak Grove Maintenance Office (OGMO). It will provide materials and equipment necessary to produce native stock for revegetation of Hahamongna Watershed Park and other areas of the Arroyo Seco. Such materials and equipment will include propagation tables, interpretive signage, storage bins for soil and amendments, and a holding area for larger container stock. An adjacent unused ruderal (weedy) area will be incorporated into the OGMO yard for this purpose, with new fencing to delineate the enhanced area.

SUPERVISED OVERNIGHT CAMPING AREA

Supervised overnight camping is proposed in the northern portion of the Oak Grove area. The overnight camping area will be available for individuals and groups during the day but will only be available to organized groups with proper supervision, such as Boy Scouts, Girl Scouts, or church groups for camping during nighttime. The facilities for group overnight camping to be provided include shade structures as described under Project 6.1, Group Picnic Shade Structures, food preparation counters with sink, barbecues, drinking fountains and a renovated restroom. Selected campsites and access will be provided for the disabled. Two gathering areas will be created. A fire ring will provide seating for small groups. Seating will be provided by wooden poles or elevated planks for easy maintenance. An outdoor amphitheater will also be sited within the area. It will be a much smaller version of the amphitheater west of the Oak Grove Field but built in the same style and of the same materials.

The overnight camping area will be administered by park staff, scheduled around the clock when the area is reserved. The existing Los Angeles County Trail maintenance and storage area will be converted to provide accommodations and administrative space for park staff. Parking for staff and overnight campers will be provided in this area. A trash-bin enclosure will be provided adjacent to the staff building. A sewage lift station will be located between the existing restroom and the converted County building (with an added bathroom and kitchenette) with gravity sewer lines from each and a force main to the gravity sewer main at Oak Grove Drive.

Selected areas of the overnight camping area will be restored to oak woodland. These areas will be identified as restoration areas and protected from human interference. With the exception of the existing trail(s) at the northernmost edge of the overnight camping area, horse trails through the oak woodland will not be allowed. Hitching posts in the central area of the overnight camping area will not be allowed. Hitching posts and a watering trough will be provided at the southeast corner of the overnight camping area near the turnaround and away from tree trunks.

Park Ranger Station Improvements

The existing building used by Los Angeles County Trail maintenance will be converted to a park ranger station to oversee the overnight group camping area. A sewage lift station will be located between the existing overnight area restroom and this converted park building (with an added bathroom and kitchenette) with gravity sewer lines from each, and a sewage lift station with force main to the gravity sewer main at Oak Grove Drive.

Restroom Improvements

The two existing restrooms in the Oak Grove area, on the upper terrace and in the overnight camping areas, will be upgraded with new fixtures, partitions, and other amenities to meet current ADA accessibility standards. This is already approved and underway as a CIP project.

Improve Existing Parking Areas

The existing dirt parking area adjacent to the ranger station will be developed as a new, decomposed granite, parking area to serve the overnight camping area. The parking area will provide overnight parking for campers west of the park road on the same side as the ranger station. A new masonry enclosure will be constructed to secure trash dumpsters at the rear of the parking area. The dirt parking area (east of park road) will be improved to accommodate a drop-off area for campers with space for buses to pull through.

EQUESTRIAN STAGING AREA

Improvements to the equestrian staging area include the following: improved vehicular access and parking for school bus and horse trailer turnaround, restroom rehabilitation, improved observation area (Sunrise Overlook), trail connections, and picnic amenities for informal gatherings.

Upgrade Existing Restroom

This existing restroom will be renovated to provide access for maintenance, upgrade the accommodations, meet ADA-accessibility standards and improve the physical appearance. The septic system will be replaced with a gravity sewer to a sewage lift station with force main. This could be combined with the sewer improvements needed at the existing OGMO with gravity sewers from both, to a central location next to the Berkshire drain, where a sewage lift station will be located to pump sewage up to the main gravity sewer line in Oak Grove Drive.

Realign and Widen Access Road

The existing access road will be widened to safely accommodate two-way traffic from the upper Oak Grove turnaround and raised to pass over an improved drain line. (See project, Berkshire Drain Improvements.) South of the Berkshire Drain, a new one-way road would allow in coming traffic to enter the existing parking area on the northern edge. All vehicular traffic will exit via the southeast corner of the parking area, loop back along the old entry road and return to two-way traffic south of the new drain crossing. The softer, wider turns and one-way traffic flow will provide easy access for horse trailers and buses. Pavement will be eliminated where possible from the existing roadway between the Berkshire Drain and the Flint Wash Bridge.

Berkshire Drain Improvements

The increased volume of runoff from the widening of Oak Grove Drive and Berkshire Place has caused severe scouring of the downstream drainage swale within the park. The park road will be raised and a new transition structure built with a new enlarged, reinforced concrete pipe running under the road and down the slope, exiting into the basin on the east edge of the Westside Perimeter Trail. The trail will cross over the Berkshire Drain at this juncture. The erosion on the slope will be filled and the area restored with Coast Live Oak woodland habitat. The area where the drain line crosses under the Perimeter Trail and from the outfall to the Water Conservation Pool will have restored Southern Willow Scrub riparian habitat stabilized to prevent future erosion. The widening of the park road during this project will allow two lanes of traffic to pass safely from and to the Equestrian Staging Area.

SUNRISE OVERLOOK

This project is located on the knoll off Oak Grove Drive, between Flint Wash and the Equestrian Staging Area (See project Sunrise Overlook). The area will be cleared of all existing vegetation (including many non-native trees, weeds, and some existing native vegetation comprised of seeded sage scrub from the 1970’s when the first Foothill Freeway (I-210) off-ramp was removed from this location) and a natural appearing hollow will be created that will accommodate a small group gathering area. The site provides a promontory overlook of the basin and the San Gabriel Mountain range in the backdrop. The site will allow groups to gather below the rim of the knoll that will create a sight and sound barrier from Oak Grove Drive and the nearby Foothill Freeway. The carved-out hollow will create an intimate gathering area that will be enhanced with planted Coast Live Oak woodland that will provide shade for the users of the site. Large boulders existing onsite will be used to form the edges of the hollow and contribute to the area’s character. Boulders and historic carved, granite curbing (from Old Pasadena) will be used to create seating terraces. The stage or front of Sunrise Overlook will sit at the top of the existing retaining wall; access to the top of this area will be provided by the existing trail from the Equestrian Staging area. The site will be ADA-accessible from new trail ramps that will be provided both from the north and the south along the top of the existing retaining wall.

SUNSET OVERLOOK

This project element is on the eastside of the park, immediately north of the Windsor/Ventura intersection. This area is at a great west-facing promontory outlook, providing an overview of the basin from this side of the park. The project element is largely a clean-up and restoration project. The area will be cleared of all weeds, brush, and dead trees. The area will be planted as specified in the habitat restoration plan. Seating and interpretive signage will be provided at this site for visitors to learn about the area and to understand what they are viewing from this location. The overlook is located at the main eastside park entrance. The project element will predominantly serve as an inspirational and educational opportunity. The site will overlook water conservation elements of the park, habitat restoration areas, and stream corridor restoration in the park. The site will provide a small area for parking.

GABRIELINO TRAIL AREA

Convert JPL Parking to Public Parking

This project proposes a new trailhead at the north end of the existing eastside JPL parking lot to bring park users into this area of the park, up the Gabrielino Trail and into the upper Arroyo Seco watershed area. This location will provide a new restroom, picnic tables, public parking, and interpretive signage for area recreational users. When the northern quarter of the existing JPL parking lot becomes available for public parking, the existing parking at Windsor Avenue and Mountain View Street can be used for a new park entrance.

New Public Restroom

A new restroom will be constructed at the north end of this remodeled parking lot to serve visitors to the park as well as those headed into the Angeles National Forest. The size of this restroom will be determined to meet the needs of those who visit this area. A public telephone will be located at the structure. This restroom may need a sewage lift station with a force main to the JPL gravity lines across the JPL bridge.

TRAIL DEVELOPMENT

Perimeter Trail

Development of the Perimeter Trail will provide a complete loop of HWP for equestrians and hikers. This trail incorporates improved existing trails and will be completed through the addition of reconstructed trail on the west side below the Equestrian Staging and OGMO areas, and new trail in association with the new Sycamore Field and the Disc Golf Course on the west side. The Perimeter Trail will also be available for security, emergency responses, and maintenance vehicles.

The trail will have a minimum elevation of not less than 1045 (4.5 feet above the 1040.5 spillway elevation), so that it can be accessed during most storm events. Storm drains will be installed under the perimeter trail at critical cross-drainage points to eliminate trail washouts and to avoid disturbing the existing drainage patterns entering the basin.

The perimeter trail will serve as a habitat protection delineator; above and outside the perimeter trail, various improvements will be for human benefit. Below and inside the perimeter trail, habitat quality will be improved to contain plant and animal species diversity allowed to thrive by minimizing human interference.

The construction of the proposed perimeter trail requires a number of project elements to connect various junctures and crossings as well as segments of reconstructed and new trail. The trail begins at the west end of the dam and follows the proposed alignment in a clockwise pattern.

Flint Wash Bridge Crossing

The bridge will provide the perimeter trail system a critical, unifying link between the east and west sides of the park. The west end of the dam will be connected to the westside park via a bridge crossing over Flint Wash. This crossing will use a prefabricated metal bridge with 12-feet-wide wood decking to span approximately 150 feet across the wash. The crossing will utilize an existing abutment from a previous historical bridge in this same location. This crossing will be used by all visitors, including bicyclists, equestrians, and hikers. Bicyclists will come onto the dam via the proposed access off of Oak Grove Drive, cross the dam, cross Flint Wash Bridge and then ride into the Oak Grove area of the park via the paved park road. Equestrians and hikers will come onto the dam via the eastside perimeter trail, the east rim trail, or from the south via the Arroyo Seco Trail (part of the Santa Monica Mountains Conservancy's Rim of the Valley trail network), cross the dam, cross Flint Wash Bridge, and then travel west up Flint Wash Trail (part of the Rim of the Valley Trail network) or north on the westside perimeter trail. The dam and Flint Wash Bridge will be "shared" crossings for these various user groups along with emergency and maintenance vehicles.

The portion of the trail on the westside, in the vicinity of Berkshire drain between and below the Equestrian Staging and OGMO areas, will be reconstructed and raised to a 1045 elevation to ensure it is out of the frequent flood zone.

The portion of the trail at the south and east edge of the relocated disc golf area will need to be raised to a 1045 elevation to ensure it is out of the flood zone.

The portion of the perimeter trail east of the relocated disc golf area and the new "Sycamore Grove Field" will go north to the edge of the second new field, around the field on the south western edge and north on the existing trail, along the western edge of the field and the new westside spreading basins to the existing westside JPL parking lot.

From the southern end of the existing JPL westside parking all the way north to the North Bridge Crossing, a paved bicycle trail will parallel the Perimeter Trail.

North Bridge Crossing

The northerly Perimeter Trail bridge crossing will be made of a style and material similar to the Flint Wash Bridge crossing and will serve as the northerly connection between the westside and eastside parks. Hikers, equestrians, bicyclists, and maintenance/emergency vehicles will share the crossing. The bridge will span 150 feet and be 12 feet wide. The bridge will also serve as a utility crossing for water and power lines needed for eastside uses in which maintenance and emergency vehicles will share the crossing. Appropriate signage will be posted. This bridge will provide the missing link in the park perimeter trail system of all-weather, all-year access from the westside of the park to the eastside for park users, emergency and maintenance vehicles. After crossing the bridge, the bicycle route will separate from the Perimeter Trail with a paved bicycle trail connecting to the eastside paved roads.

The improved eastside segment of the perimeter trail is on the western edge of spreading basins 3 through 12 (new spreading basin numbers), and Johnson Field. This alignment will be shared as a flood maintenance access road as it extends south to the dam.

East Rim Trail

Development of the East Rim Trail for pedestrians and equestrians consists of constructing new trail from the VOC Water Treatment Plant to the Arroyo Well and reconstructing abandoned trail from the Arroyo Well to the Altacrest Trail. It will be graded to accommodate pedestrians and equestrians. Construction of the East Rim Trail will require cut and fill to be balanced onsite. This project will extend the existing trail that roughly follows the upper rim of the eastside slope. The new trail will be constructed parallel to the road leading from the Arroyo Well to the VOC. It will cross the entry access road close to the proposed Interpretive Area and skirt the eastside of the existing parking lot, joining up to the existing Altacrest Trail. To further clarify, this will be a new trail going from the VOC to the Arroyo Well and a reconstructed old trail from the Arroyo Well to the northern east/west connecting trail.

Trail Connections from East Rim Trail to Basin Perimeter Trail

This project will create four trail connections along the eastside linking the upper rim trail to the lower perimeter trail. Each of the trail connections will accommodate pedestrians and equestrians. It is anticipated that cut and fill can be balanced within the segments. These connections will allow pedestrians and equestrians to access eastside park features from the upper East Rim Trail and park users to avoid or bypass sediment/debris removal maintenance operations as necessary.

West Rim Trail and Connectors

The West Rim Trail starts at the west end of the Flint Wash Bridge, past the Equestrian Staging Area, heads north through the upper Oak Grove area on the westerly edge of the park, and then continues north through the MWD property where it converges with the basin perimeter trail. A portion of the West Rim Trail runs parallel with but is separated from the bike route; this occurs in the stretch from the Equestrian Staging Area to the Flint Wash Bridge. Pedestrians and equestrians traveling south from the Foothill Boulevard equestrian tunnel currently cross-the main entry access road entering HWP from Foothill Boulevard. This component will reroute to a new constructed trail at a lower elevation to avoid conflicts with vehicle traffic at the Foothill Entrance. The new trail will connect to the existing trail just south of the big bend at the park entrance road.

Trail Connections from West Rim Trail to Basin Perimeter Trail

This component replaces the existing stairs connecting the upper level to the lower level, which is eroded and unsafe. This project element will grade a new trail linking the upper terrace restroom to the south end of the Oak Grove Field and back up to the West Rim Trail via the reconstructed old trail to the Foothill Boulevard park entrance.

Dam Observation Trail

The Dam Observation Trail establishes a trail loop from the eastern end of the reconstructed Flint Wash Bridge along the top of an existing retaining wall down to an elevation of 1045, west to an observation point, and back up to the western end of the Devil’s Gate Dam. This loop trail will only be accessed by pedestrians. This will require cut and fill to be balanced onsite. From the top of the old bridge abutment, park users have a clear view of the interior face of the dam and the water conservation pool area.

BICYCLE ROUTE

Bicycles will be allowed to travel on any existing or proposed paved surface within the park. Bicycles will not be allowed on any designated trail or unpaved surface within the park. The bicycle routes are planned to allow bicyclists to utilize the perimeter of the park and to access bikeways outside of the basin, including the routes within the Angeles National Forest. The planned route also allows riders to access the nearby existing Class III Kenneth Newell Bikeway, the Central Arroyo Seco and the southern reaches of the Arroyo Seco in Pasadena and beyond. Access by bicycles across Devil's Gate Dam and Flint Wash Bridge by will be allowed. The paved bicycle route will parallel the segment of the perimeter trail on the westside of the park from the westside JPL parking lot, north to the North Bridge Crossing. This bridge will be shared by bicyclists, equestrians and hikers. A separate paved bike route will continue east, connecting to the eastside paved roads. At this point, riders will be able to continue on the Gabrielino Trail.

HABITAT RESTORATION

Habitat establishment and restoration is proposed throughout the Hahamongna Watershed Park area, as illustrated in the comparison of the Existing and the Proposed Plant Communities Maps. Habitat establishment will be the creation of improved habitat quality in an area where a particular plant community is not present (in existing ruderal areas) or involves adding area to an existing plant community. Habitat restoration is the improvement of the habitat quality that includes increasing the plant and animal species diversity in an area where a plant community already exists. In general, all plant communities that are not impacted by proposed projects with grading, removal of exotic species, or destroyed by inundation, will be restored. Habitat quality of a site can be defined in terms of a range of its assessed attributes, functions and values as excellent, good, fair, or poor habitat. The ranking of habitat is subjective and varies widely depending on physical condition, degree of biodiversity, and the species addressed. The master plan includes a map illustrating the habitats and their associated plant communities (See Exhibit 3-7A).

The information within this section is presented in two parts. Part 1 is a listing of major habitat projects proposed by the plan. These projects are proposed for specific locations within the park. Some of these habitat projects involve the restoration of more than one plant community within the same project area and have been organized to complement the Park Project Areas phasing (See Section 4). Their listing is intended merely to help convey the location, intent, and magnitude of the proposed habitat establishment and restoration projects. Part II encompasses the goal of habitat establishment and restoration throughout the park and describes projects by Plant Community, linking the various projects previously described in this report to their proposed habitat establishment and/or restoration goals including an indication of the acreage affected. The projects in Part I are broken apart and listed in their appropriate plant community listing in Part II.

Subsequent to the approval of the Hahamongna Watershed Park (HWP) Master Plan the U.S. Fish and Wildlife Service, on February 7, 2001, designated critical habitat for the federally listed Southwestern Arroyo Toad. Those restoration projects and/or areas that are wholly or partially located within this designated critical habitat for the Southwestern Arroyo Toad are identified below with **. On October 30, 2002, the U.S. District Court for the District of Columbia nullified all designated critical habitats for the Arroyo Toad. The USFWS will complete a new analysis of economic impacts and consider updated field survey information to refine where the Arroyo Toad exists. The Interior Department will decide by 2005 which areas of critical habitat to redesignate.

Part I: Proposed Habitat Establishment and Restoration Projects

*1. Realign Stream Corridor Restore and Establish Habitat ***

This restoration project includes the area from just south of the Altadena Drain, north to the JPL bridge where the stream has been channelized. The Altadena drain extends into the Arroyo Seco stream corridor where at one time it was utilized as part of an earthen breakaway dam to contain water that was then diverted to the eastside spreading basins. This site is no longer used as a diversion facility due to the environmental impact from this diversion method. This project proposes to shorten the Altadena drain and widen the stream corridor to allow for a more natural stream alignment. For a short stretch, the stream course south of the Altadena Drain contains riparian habitat due to urban runoff. This stream corridor will be restored to a riparian habitat similar to and as a continuation of the same plant community immediately north of the JPL Bridge and south of the Altadena Drain.

*2. Restore Riversidian Alluvial Fan Sage Scrub***

This restoration project involves a number of smaller projects within a larger area. The larger area includes two plant communities: riversidian alluvial fan sage scrub and sage scrub, as shown on the plant community maps. The areas on either side of the stream corridor to the eastside spreading basins and to the westside JPL perimeter fencing and new westside spreading basins will be restored to these plant communities.

The current equestrian trail on the westside of the existing spreading basins traverses some of the best old alluvial fan sage scrub in the area designated as sage scrub on the plant community maps. The proposal is to abandon the equestrian trail, relocate the trail on the spreading basins maintenance road (asphalt to be removed) and restore the existing trail with sage scrub.

Habitat restoration will also occur at the various drain outfalls along the JPL border where exotic species need to be removed; debris and trash collected and disposed; and the riversidian alluvial fan sage scrub, sage scrub and southern willow scrub habitat restored.

The old stream crossing roadway from both the east and west was paved with asphalt by past mining operators. Most of this asphalt has been removed. The remaining asphalt needs to be removed and disposed, the stream allowed to take its course, and riversidian alluvial fan sage scrub and sage scrub habitat restored.

Additionally, this project establishes riversidian alluvial fan sage scrub at the southern end of this area where it transitions to a streambed riparian plant community. With the Stream Channel Widening Project (See Project #4), both the streambed riparian and the alluvial fan sage scrub plant community areas are enlarged.

*3. Establish Habitat at Spreading Basins***

The park master plan calls for the expansion and relocation of the existing spreading basins. There are three sites for this restoration project. Project 3a comprises nine surface acres of new spreading basins, to be numbered 13, 14, and 15, on the westside and will involve the removal of ruderal weedy species. The embankment of the new ponds will be planted with sage scrub species. Over-story tree species need to be considered because of the water they naturally draw for their establishment and growth, which could be contrary to the water conservation goal. If acceptable, sycamore woodland around the perimeter of the spreading basins is recommended. Project 3b involves two new basins north of basin 1 and the expansion of spreading basins 1 through 4 on the eastside. Project 3c involves spreading basins 5 through 10 on the eastside. Both 3b and 3c would have habitat establishment as described in 3a, above.

*4. Widen Stream Channel and Establish Riparian Habitat ***

In this project, the stream channel will be widened on its western edge to at least double its current width. This project is located in the existing narrow riparian corridor between the existing riversidian alluvial fan sage scrub area and the area that will be graded for the water conservation and sediment management pool. As winter rains saturate the upper watershed, storm water begins to flow through this habitat over a larger area, increasing the groundwater recharge for the general benefit of the Raymond Basin as well as providing surface water, encouraging a riparian habitat of higher quality. The existing channel with established vegetation and drainage course configuration to the east will be preserved and the stream channel will be widened to the west. Embankments of the stream could be stabilized to help control erosion where further study indicates that it is necessary.

*5. Establish East Entrance Habitat ***

This project involves the reconfiguration of the existing Windsor/Ventura intersection as well as the enhancement of Sunset Overlook, situated north of this intersection. Landscaping adjacent to the new park entrance will total 0.3 acre and the Sunset Overlook will total 0.5 acre. It will consist of native plants from the sage scrub and coast live oak woodland plant communities to enhance the appearance of the area and to benefit certain wildlife species. The importance of this area as a park entrance and the absence of landscaping provide the opportunity for both a park project and a habitat establishment project.

6. Restore Habitat along Westside Perimeter Trail

This project proposes to raise the perimeter trail to an elevation of 1045 and create a graded slope of habitat from the westside perimeter trail down to the conservation pool rim elevation of 1030 for the reestablishment of southern willow scrub that will be infrequently inundated up to elevation 1040.5. Material for the proposed fill will be excavated from the ruderal areas within the proposed conservation pool below elevation 1030. The existing vegetation in the area will be hand-cleared to leave willow trees that are taller than the depth of fill. After the fill is placed, these existing willows will root at the higher elevation with the help of water conservation management practices that will provide a higher local water table. This and additional habitat restoration will create a larger area of southern willow scrub of higher quality than exists in this highly disturbed and eroded area.

*7. Establish Habitat at Sycamore Fields and Relocated Disc Golf (northern Sycamore Field **)*

This portion of the project proposes to raise the elevation of the southern area (southeast of the existing parking lot) that has small pockets of willows with large expanses of ruderal habitat between them. The small areas of existing willows will be linked and receive less fill to create drainage courses with raised terraces of mule fat (disc golf fairways) between. The drainage courses will be extensions of existing drainage from elevation 1050 down to elevation 1030, the edge of the water conservation pool.

The perimeter trail at elevation 1045 will be on the eastern edge of this area. The relocated disc golf and the new southern Sycamore Grove field within this area slopes from elevation 1052 down to the perimeter trail and then down to the conservation pool rim elevation of 1030. Material for the proposed fill will be excavated from the ruderal areas within the proposed conservation pool, below elevation 1030. The existing vegetation in the area to be raised will be hand-cleared leaving willow trees that are taller than the depth of fill. After the fill is placed, these willows will root at the higher elevation with the help of water conservation management practices, which will provide a higher local water table. This and additional habitat restoration will create a riparian habitat area (above the frequent inundation elevation) of higher quality. Southern Sycamore Riparian Woodland habitat will be established around this southern field.

This portion of the project proposes to raise the elevation of the northern area, east of the Supervised Overnight Camping Area, which was excavated by past mining operations that left a large depression. Fill material from the Stream Channel Widening project will be placed to raise this area to elevation 1055, above the frequent inundation elevation of 1040.5. After the fill is placed and the northern Sycamore Field is constructed, Southern Sycamore Riparian woodland habitat will be established around this northern field.

8. Establish Oak Woodland at Sunrise Overlook

This project is located at the southwestern corner of the park, along Oak Grove Drive and immediately northwest of Flint Wash. Coast live oak woodland borders the site to the north and is proposed to be expanded south into the overlook area. Sage scrub revegetation is also recommended.

*9. Restore Oak Woodland on Westside (partially **)*

This project will increase the biological diversity of the Oak Grove area on the westside of the park by using native species prescribed for coast live oak woodland restoration. It will establish young oaks in the existing ruderal open areas to enhance the survival of this mature oak woodland community. Protection of oak and other restoration plantings at the camping area and the group activity areas in the park will be necessary.

*10. Establish Sycamore Woodland on Eastside (partially **)*

Several sites fall within this project. One area that will encompass the creation of sycamore woodland is at elevation 1030 to 1040 and immediately south of Johnson field. This mule fat habitat will be periodically inundated every winter season. To improve habitat quality it is recommended to raise the grade in the area to elevation 1045 and create sycamore riparian woodland. The establishment of native tree species such as sycamores and cottonwoods is desirable for this area; to the east and north of this area are western sycamore, black cottonwoods, and Mexican elderberry, all of which have naturalized. Sycamore Woodland is also suggested around the perimeter of the east and west spreading basins as well as around the edges of the multipurpose play areas (See proposed plant community map).

11. Establish Riparian Habitat at Perimeter of the Flood Management/Water Conservation Pool

The existing riparian southern willow scrub habitat below the 1040.5 elevation will degenerate and begin to die as soon as water conservation practices are implemented; these areas are periodically inundated during the winter season. The habitat below the 1030 elevation will be completely submerged for varying lengths of time. The 1030 to 1045 elevation zone around the water conservation pool and below the Perimeter Trail will be established habitat of good to excellent quality, that could be subject to several inundations a year. Emerging vegetation, debris, and sediment will need to be periodically removed from the newly established Flood Management Water Conservation Pool per the sediment management guidelines that will be established by the County. This project proposes a phased operation that will permit the area elevated above the floodplain (elevation 1040.5) and the perimeter of the water conservation pool (elevation 1030 to 1040.5) to become established with southern willow scrub plant community. Once these riparian areas are established, the existing southern willow scrub and ruderal plant community areas, that are below elevation 1030, will be removed in a coordinated sediment and debris removal operation. In addition to pumping storm water retained in the Water Conservation Pool back to the spreading basins for metered groundwater recharge, this storm water will provide a higher local water table, encouraging a riparian habitat of higher quality, and will provide groundwater recharge for the general benefit of the Raymond Basin.

Part II: Habitat Establishment and Restoration Projects listed by Plant Community

The following table summarizes the acreages of natural plant communities and landscaped/developed areas within Hahamongna Watershed Park, both existing and proposed.

Area Description		Existing Acres	Proposed Acres
OW	Coast Live Oak Woodland	37.8	42.6
W	Southern Willow Scrub	25.5	20.5
SS	Sage Scrub	39.9	42.9
RAFSS	Riversidian Alluvial Fan Sage Scrub	17.2	18.8
MF	Mule Fat Scrub	19.5	11.0
SSRW	Southern Sycamore Riparian Woodland	2.6	24.8
R	Ruderal	75.4	2.4
SBR	Streambed Riparian	8.1	8.3
WA	Water Conservation Pool	0.0	54.4
L	Landscaped	5.8	9.8
D	Developed	76.4	74.8
D&L	Developed and Landscaped areas not shown within a plant community polygon (such as a trail, dirt road, picnic & camping site, disc golf fairways and pole climbing area)	10.6	8.5
TOTAL STUDY ACREAGE[1]		318.8	318.8

Within the Hahamongna Watershed Park (HWP) there are Landscaped and Developed areas, which have been designated on the plant community maps. The Landscaped areas within the HWP include predominantly nonnative landscaping for playing fields and native landscaping for ornamental purposes. The developed areas within HWP include predominantly roads, parking, and buildings, with native landscaping for ornamental purposes.

Coast Live Oak Woodland

There are currently 37.8 acres of coast live oak woodland within the Hahamongna Watershed Park Master Plan (HWPMP) study area. The 26.2 acres within the park will receive habitat restoration. The following list of projects is proposed for habitat establishment and restoration of coast live oak woodland:

Project	Existing Acres	Acres Added or Subtracted	Proposed Acres
West Side Park Area MWD property	20.2 11.6	3.8	24.8
East Side Park Area	6.0	1.0	7.0
TOTAL	37.8	4.8	42.6

[1] Does not include the areas of Flint Wash and south of the 210 freeway (included in CAMP). Both are within the Park property boundary but outside the study area. These areas total 10.7 acres. Does include the MWD property, 28 acres added + 2.4 acres already included = 30.4`

West Side Park Area: The following three project areas total 3.8 acres of habitat establishment:

Oak Woodland Restoration (Habitat Project #9): This project area, which includes the upper Oak Grove Picnic area and Equestrian staging area, has been undergoing habitat restoration for eight years. This area and the slopes down to the Lower Oak Grove area, including the Oak Grove Field and the west half of the overnight area, are proposed to have an increase of 1.9 acres of oak woodland.

Oak Woodland Restoration (Habitat Project #9**): The east half of the overnight area is within the critical habitat of the Arroyo Toad. This area is proposed to have an increase of 1.0 acre of oak woodland.

Sunrise Overlook (Habitat Project #8): The Sunrise Overlook area, adjacent to the south perimeter of the Equestrian Staging Area, is proposed to have an increase of 0.9 acre of oak woodland.

Eastside Park Area: The following three project areas total 1.0 acre of oak woodland habitat establishment:

Eastside Spreading Basins (Habitat Project #3b**): Adjacent to and west of the new eastside spreading basin No. 2, it is proposed to increase the existing 0.1 acre of oak woodland by 0.2 acre for a total of 0.3 acre.

Adjacent to spreading basin 7 and west of the Arroyo Well, it is proposed to have the existing 0.4-acre oak woodland increased by 0.3 acre for a total of 0.7 acre.

East of spreading basin 14 and the overflow basin**: This area is proposed to have the existing 1.1 acres of oak woodland increased by 0.5 acre for a total of 1.6 acres. This enhances the habitat adjacent to the East Rim Trail. It will convert 0.5 acre of sage scrub to oak woodland.

Southern Willow Scrub

There are currently 25.5 acres of southern willow scrub in the park, of which only 7.7 acres will receive habitat restoration. When water conservation measures are implemented, the remaining 17.8 acres of existing habitat will begin to die as the area is frequently inundated. An additional 13.3 acres of habitat will be established along with the 7.7 acres of habitat to be restored. The following list of the projects is proposed for habitat establishment and restoration of southern willow scrub:

Project	Existing Acres	Acres Added or Subtracted	Proposed Acres
Stream Corridor Alignment (Project 1**)	0.8		0.8
Westside Spreading Basins (Project 3a**)	0.0	1.2	1.2
Stream Channel Widening (Project 4**)	0.6	3.1	3.7
Westside Perimeter Trail (Project 6)	0.6	1.3	1.9
Relocate Disc Golf (Project 7)	4.5	0.7	5.2
Water Conservation Pool (Project 11)	1.2	4.5	5.7
Storm Drain Improvements ~ JPL**	0.0	2.0	2.0
TOTAL	7.7	12.8	20.5
Habitat lost due to inundation (water conservation)	17.8		
TOTAL	25.5		

Stream Corridor Alignment (Habitat Project #1**): This project will keep the size of the habitat area unchanged, but will restore habitat found at the southern end of the project area.

Westside Spreading Basins (Habitat Project #3a**): There is currently no southern willow scrub habitat adjacent to the proposed Westside Spreading Basins. This habitat project proposes to establish 1.2 new acres of this plant community east of the spreading basins. The creation of the westside spreading basins will utilize “Landform Grading” principles to improve habitat for this and other plant communities.

Stream Channel Widening (Habitat Project #4**): The stream channel is proposed to have the existing 0.6 acre of southern willow scrub increased by 3.1 acres for a total of 3.7 acres. This restoration project will widen the stream on its western edge for a new, total stream channel width of at least double its current width. Both the east and west sides of the stream channel will be restored with this plant community. Southern willow scrub will be used on the embankments of the stream to naturalize this habitat for native fauna and to help stabilize and control erosion of the stream banks.

Westside Perimeter Trail (Habitat Project #6): The westside perimeter trail is proposed to have the existing 0.6 acre of southern willow scrub increased by 1.3 acres to a total of 1.9 acres. The restoration project proposes to raise the grade on this trail with fill excavated from ruderal areas below the 1030 elevation within the proposed conservation pool. Willows taller than the depth of fill will remain to root at the higher elevation with the help of water conservation management practices, which will provide a higher local water table. This and additional habitat restoration will create a larger area of southern willow scrub of higher quality than currently exists in this highly disturbed and eroded area.

Relocate Disc Golf (Habitat Project #7): The Disc Golf Relocation component is proposed to have the existing 4.5 acres of southern willow scrub increased by 0.7 acre to a total of 5.2 acres. This component proposes to raise the elevation of the area that has small pockets of existing willow scrub habitat. The areas of existing willows will be linked to create drainage courses that will receive less fill than the terraced areas of this project. The drainage courses will be extensions of the existing drainage patterns from elevation 1050 down to elevation 1030, the edge of the water conservation pool. The existing vegetation in the area will be hand-cleared to leave willow trees taller than the depth of fill. After the fill is placed, these willows will root at the higher elevation with the help of water conservation management practices, which will provide a higher local water table. This and additional habitat restoration will create a larger area of southern willow scrub of higher quality than exists in this highly disturbed area. However, with the close human proximity on the disc golf fairways, this area will not be habitat of a quality suitable for a diverse wildlife. It has been recommended that, during the specific project design phase, wider bands of willow scrub plant community be created within the relocated disc golf course and/or between the Perimeter Trail and the Water Conservation Pool.

Water Conservation Pool (Habitat Project #11): This project proposes a phased operation that will permit the areas elevated above the floodplain (elevation 1040) and the perimeter of the water conservation pool (elevation 1040 to 1030) to become established with southern willow scrub habitat. The Water Conservation Pool project will add 4.5 acres of southern willow scrub in this zone for a new total of 5.7 acres of southern willow scrub. These 5.7 acres, inside the Perimeter Trail, form a band around the perimeter of the pool that will provide a higher local water table, encouraging a riparian habitat of higher quality. The existing southern willow scrub habitat below the 1040 elevation, and in particular below the 1030 elevation, will degenerate and begin to die as soon as water conservation practices are implemented and this zone is periodically inundated during the winter season. The next phase of the project will remove the 17.8 acres of existing southern willow scrub areas (below elevation 1030) in a coordinated sediment and debris removal operation once the new willow habitat has become established.

Storm Drain Improvements-JPL**: This project will convert 2.0 acres of sage scrub to southern willow scrub plant community. This area is below the drainage outfalls, along the JPL border, just north of the westside parking lot, where exotic species need to be removed and debris needs to be collected. These particular drainage outfalls drain through a southern willow scrub plant community. Due to wet conditions caused by urban runoff, this project proposes to transition this 2-acre area from a sage scrub plant community to a plant community with willows as the dominant species.

Sage Scrub

There are currently 39.9 acres of sage scrub in the park of which 36.3 acres of habitat will be restored. An additional 6.6 acres of habitat will be established for a new total of 42.9 acres of sage scrub habitat. The following list of the projects is proposed for habitat establishment and restoration of sage scrub:

Project	Existing Acres	Acres Added or Subtracted	Proposed Acres
Stream Corridor Alignment (Project 1**)	1.7		1.7
Westside Spreading Basins (Project 2 & 3a**)	0.0	3.0	3.0
Eastside Spreading Basins (Project 2 & 3c**)	4.9	1.1	6.0
Stream Channel Widening (Project 4**)	0.0	2.5	2.5
Sunrise Overlook (Project 8)	1.9	-0.9	1.0
Dam Area ~ Spillway Observation -0.2 and Adjacent to the Spillway +0.2	13.2		13.2
Eastside Park Area ~ (Oak Woodland** -0.5) (East Rim Trail Extension** -0.2)	11.2	-0.7	10.5
Storm Drain Improvements ~ JPL**	7.0	-2.0	5.0
TOTAL	39.9	3.0	42.9

Stream Corridor Alignment (Habitat Project #1**): This project will keep the size of the habitat area unchanged and will restore habitat within the project area.

Westside Spreading Basins (Habitat Project #3a**): There is currently no sage scrub habitat in the area of the proposed Westside Spreading Basins. The existing area is mostly a ruderal plant community. This habitat project proposes to establish 3.0 new acres of sage scrub plant community along the slope east of the spreading basins. The creation of the westside spreading basins will utilize “Landform Grading” principles to improve habitat for this and other plant communities.

Eastside Spreading Basins (Habitat Project #2** and #3c**): The Eastside Spreading Basins project is proposed to have the existing 4.9 acres of sage scrub increased by 1.1 acre to a total of 6.0 acres. The equestrian trail on the west side of the existing spreading basins traverses some of the best old alluvial fan sage scrub in the area, designated as sage scrub on the plant community maps. Project 3c involves spreading basins 5 through 10 on the eastside. The proposal is to abandon the equestrian trail, relocate the trail on the spreading basins maintenance road (asphalt to be removed) and restore the area occupied by the existing trail with sage scrub.

Stream Channel Widening (Habitat Project #4**): There is currently no sage scrub habitat at this location of the stream channel. On the western slope of the stream channel project, 2.5 acres of sage scrub habitat will be established. This project will widen the stream on its western edge for a new total stream channel width at least twice the current width. Both the east and west sides of the stream channel will be restored with sage scrub habitat.

Sunrise Overlook (Habitat Project #8): There is currently 1.9 acre of sage scrub habitat in this project area, much of which was established by hydroseeding when the freeway access ramp was eliminated from this location. A total of 0.9 acre of this habitat will be converted to oak woodland habitat leaving 1 acre of sage scrub.

Dam Area: This project area currently has 13.2 acres of sage scrub. Although the acreage of habitat will remain the same, 0.2 acre of this habitat will be removed as a result of the spillway observation overlook project, but 0.2 acre will also be added as a result of habitat establishment on the slope adjacent to the dam spillway. The existing 13.0 acres remaining will receive habitat restoration.

Eastside Park Area: A total of 11.2 acres of sage scrub make up the eastside park area. A total of 0.7 acre of sage scrub will be eliminated due to the following projects: (a) 0.5 acre** will be converted to oak woodland east of basin 14 and the overflow basin; and (b) 0.2 acre** will be lost to the east rim trail extension project. The total remaining area in sage scrub within the Eastside Park Area will be 10.2 acres of restored habitat.

Storm Drain Improvements-JPL**: A total of 7.0 acres of sage scrub exists adjacent to JPL in the vicinity of the westside storm drains. This project will convert 2.0 acres of sage scrub to southern willow scrub plant community. This area is below the drainage outfalls, just north of the westside parking lot (Habitat Project #2**) along the JPL border, where exotic species need to be removed, and debris needs to be collected. These particular drainage outfalls drain through a southern willow scrub plant community. Due to wet conditions caused by urban runoff, this 2.0 acre area will be transitioned to a plant community with willows as the dominant species. A total of 5.0 acres will remain in this area as sage scrub plant community.

Riversidian Alluvial Fan Sage Scrub

There are currently 17.2 acres of riversidian alluvial fan sage scrub in the park. An additional 1.6 acres of habitat will be established for a new total of 18.8 acres of riversidian alluvial fan sage scrub habitat. Habitat establishment and restoration for this plant community is defined under Habitat Project #2**. A number of smaller habitat restoration projects within a larger area will occur: a) the Stream Channel Widening Project (Habitat Project #4**) will add one acre of habitat; b) the Westside Spreading Basins Project (Habitat Project #3a**) will eliminate ruderal weedy species and add 0.2 acre of habitat to the embankments of the spreading basins; c) the old east-to-west stream crossing has been abandoned and the asphalt roadway will be removed, adding 0.2 acre of habitat; and d) the various drain outfalls along the JPL border, where exotic species need to be removed and debris needs to be collected, will add another 0.2 acre of riversidian alluvial fan sage scrub.

Mule Fat Scrub

There are currently 19.5 acres of mule fat scrub in the park of which only 10.3 acres will receive habitat restoration. When water conservation measures are implemented, the remaining 9.2 acres of existing habitat will begin to die as the area is frequently inundated. An additional 3.9 acres of habitat will be established along with the 10.3 acres of habitat to be restored. The following list of the projects is proposed for habitat establishment and restoration of mule fat scrub:

Project	Existing Acres	Acres Added or Subtracted	Proposed Acres
Stream Corridor Alignment (Project 1**)	0.9	0.2	1.1
Westside Spreading Basins (Project 3a**) and Stream Channel Widening (Project 4**)	6.7	-1.7	5.0
Relocated Disc Golf (Project 7)	0.0	3.7	3.7
Northern Sycamore Field (Project 7**)	1.5	-1.5	0.0
Water Conservation Pool (Project 13)	1.2		1.2
TOTAL	10.3	0.7	11.0
Habitat Lost Due to Inundation (Water Conservation)	9.2		
TOTAL	19.5		

Stream Corridor Alignment (Habitat Project #1**): This restoration project will increase the existing 0.9 acre of mule fat scrub habitat by 0.2 acre for a total of 1.1 acres in mule fat scrub. The project will shorten the Altadena drain and realign the stream corridor to allow for a more natural stream flow.

Westside Spreading Basins (Habitat Project #3a**) and Stream Channel Widening (Habitat Project #4**): There are currently 6.7 acres of mule fat scrub habitat within these two project areas. These habitat projects propose to eliminate 1.7 acres of this plant community along the upper banks of the stream and in the vicinity of the new spreading basins. The creation of the westside spreading basins will utilize “Landform Grading” principles to improve habitat for this and other plant communities. This project will widen the stream on its western edge for a new total stream channel width of approximately 200 feet.

Relocate Disc Golf (Habitat Project #7): There is currently no mule fat scrub habitat at this location. The Disc Golf Relocation project is proposed to establish 3.7 new acres of mule fat scrub to this area of the park. This restoration project proposes to raise the elevation of the area that has small pockets of existing willow scrub habitat to create drainage courses. Raised terraces of mule fat scrub habitat, a very resilient plant community, will serve to border the fairways. The areas of existing willows will be linked to create drainage courses that will receive less fill than the terraced areas of this project.

Northern Sycamore Field (Habitat Project No.7**): This project will eliminate the 1.5 acre of mule fat present when fill is placed to raise the site above inundation level. The site is a predominantly ruderal and highly disturbed habitat due to past mining operations. There will be some debris removal of broken concrete that was dumped from previous construction projects. Until this project is implemented, the site will be flooded and when water is allowed to pass through the dam, the flooded mule fat will die and a pool of water will remain for some time.

Water Conservation Pool (Habitat Project #11): When water conservation measures are implemented, an existing 9.2 acres of mule fat scrub will die as the area is frequently inundated. This project proposes a phased operation that will permit the areas elevated above the floodplain (elevation 1040.5) and the perimeter of the water conservation pool (elevation 1030) to become established with southern willow scrub habitat. The Water Conservation Pool project will not alter the existing 1.2 acres of mule fat scrub above this zone. The next phase of the project will remove the dying 9.2 acres of existing mule fat scrub areas (below elevation 1030) in a coordinated sediment and debris removal operation.

Southern Sycamore Riparian Woodland

There are currently 2.6 acres of southern sycamore riparian woodland habitat in the park. An additional 22.2 acres will be established for a new total of 24.8 acres of southern sycamore riparian woodland habitat. Habitat Project No.10, as described in Section 3.3 of the HWP Master Plan, reflects the restoration planned for this plant community. The following list of projects is proposed for habitat establishment and restoration of southern sycamore riparian woodland:

Projects	Acres Added
Westside Area	
Around Southern Sycamore Field (Project 7)	2.1
Around Northern Sycamore Field (Project 7**)	4.7
Adjacent to Westside Spreading Basins 15,16 & 17 (Project 3a**)	1.4
Stream Corridor Alignment (Project 1**)	1.4
Eastside Area	
South of and around Johnson Field (Project 10)	3.8
Around existing overflow basin (Project 10)	3.2
Around Eastside Spreading Basins 7-14 (exist. No. 5-12 Project 3c**)	2.6
Around new Eastside Spreading Basins 1 & 2 and expanded Spreading Basins 3-6 (exist. No. 1-4 Project 3b**)	3.0
TOTAL ACRES TO BE ESTABLISHED	22.2

Ruderal

It is proposed to replace the total existing 75.4 acres, except the 2.4 acres within the MWD property, in ruderal species with other plant communities, as shown in the proposed plant communities map, or as area within the proposed water conservation pool, which will be cleared of all vegetation below elevation 1030 excavated and graded. The ruderal areas within the designated critical habitat for the federally listed endangered Southwestern Arroyo Toad are proposed to be graded using Land-form Grading principles and restored to eliminate the highly disturbed and unnatural topography, habitat of poor quality, and create habitat of good to excellent quality for native flora and fauna.

Streambed Riparian

There are currently 8.1 acres of streambed riparian habitat in the park, of which 4.9 acres will be destroyed and 5.1 acres of habitat will be established for a new total of 8.3 acres of streambed riparian habitat. The following list of the projects is proposed for habitat establishment and restoration of streambed riparian habitat:

Project	Existing Acres	Acres Added or Subtracted	Proposed Acres
Two areas inundated (Project 11)	4.9	-4.9	0
Stream Channel Widening (Project 4**)	2.4	5.0	7.4
Stream Corridor Alignment (Project 1**)	0.8	0.1	0.9
TOTAL	8.1	0.2	8.3

Two areas inundated (Habitat Project #13): There are two areas below the existing 1030 elevation that will be frequently inundated when water conservation procedures are implemented. This will cause the existing 4.9 acres of streambed riparian habitat in these areas to die. Therefore, these two areas are proposed to be cleared, excavated, and graded for the Water Conservation Pool (Habitat Project No.13).

Stream Channel Widening (Habitat Project #4**): The stream channel widening project will establish 5.0 additional acres of streambed riparian habitat to an existing 2.4 acres for a total of 7.4 acres of streambed riparian habitat. This restoration project will widen the stream on its western edge for a new total stream channel width of at least double the existing width. Landform Grading principles will be utilized here to improve the habitat for several native plant communities on the western graded slopes. As winter rains saturate the upper watershed, storm water begins to flow through this habitat, over a larger area, increasing the groundwater recharge for the general benefit of the Raymond Basin, as well as providing surface water, encouraging a riparian habitat of higher quality.

Stream Corridor Alignment (Habitat Project #1**): This restoration project will increase the existing 0.8 acre of streambed riparian habitat by 0.1 acre for a total of 0.9 acre. This area is contiguous with the same habitat, immediately north of the JPL Bridge. The project will shorten the Altadena drain and widen the stream corridor to allow for a more natural stream alignment.

Flood Management/Water Conservation Pool

The flood basin behind the dam has been filling with sediment. With an existing capacity of 1,424 acre-feet, it will soon reach the minimum safe capacity of 1,400 acre-feet. Since 1978, when the dam was declared unsafe to hold water, vegetation has been allowed to grow in the 92 acres that will be flooded now that the dam has been reconstructed. When water conservation measures are implemented and this area is inundated, as desired by the proposed plan, this vegetation will begin to die. A major goal of the proposed project is to create habitat of good to excellent quality wherever possible within this highly disturbed Hahamongna basin. To create new habitat above the spillway elevation and increase the capacity of the basin to a maximum of 1,900 acre-feet and to allow for 500 acre-feet of inflowing sediment capacity, this project will move 378 acre-feet of material on-site and remove 243 acre-feet of material off-site. This will reduce the area frequently inundated to 69 acres and create 23 acres of new recreational and habitat area and five acres of new streambed riparian habitat. Floodwater retained in the 69-acre flood management pool will be pumped back to the spreading basins located at higher elevations. The 69-acre flood management pool will include 14.6 acres of riparian habitat around the perimeter extending up the widened intermittent stream channel. This habitat could be inundated during storm events. This will leave a 54.4 acre Water Conservation Pool to better manage inflowing sediment and floating debris and to retain as much storm water as possible. In addition to pumping this water back for metered groundwater recharge, this water conservation pool will provide a higher local water table, encouraging a riparian habitat of higher quality, and will provide groundwater recharge for the general benefit of the Raymond Basin.

	Acres
Area of Flood Management Pool after increasing capacity (at elevation 1040)	69.0
Habitat:	
Willow habitat (elevation 1030 to 1040)	5.7
Streambed Riparian (elevation 1025 to 1040)**	7.4
Riversidian Alluvial Fan Sage Scrub (area below 1040 elevation)**	1.0
Southern Sycamore Riparian Woodland (inundated Flint Wash)	0.5
TOTAL ACRES TO BE INFREQUENTLY INUNDATED	14.6
AREA OF WATER CONSERVATION POOL (no habitat)	54.4

UTILITIES

Underground Pasadena's Eastside Overhead Power and Communication Lines

This project element will underground existing Pasadena overhead power and communication lines that run north and south on the east side of the park. The project will occur in two phases; the first phase will be to underground these overhead distribution lines from the VOC WTP to the Arroyo Well. The second will be to underground overhead distribution lines from the VOC WTP to Johnson Field.

Relocate the Existing Southern California Edison Power Line in the Hahamongna Basin

This project will minimize the number of overhead basin crossings as well as remove this line from the sensitive Riversidian Alluvial Fan Sage Scrub habitat, which restricts the maintenance of this utility. This overhead distribution line that runs diagonally across the basin from the JPL substation to the Windsor/Ventura intersection would be relocated. The new alignment would run North to the east-west distribution lines, adjacent to the proposed North Bridge, crossing the basin with the existing lines, then running south, along the existing Gabrielino Trail, and reconnecting to the existing SCE power distribution line along Altadena Drive.

Relocate the Existing Pasadena Power and Communication Line

This project will relocate the existing Pasadena power and communication line that traverses the basin from the VOC WTP to the MWD property and northern portions of the west side of the park. This utility will be relocated due to the undesirable aesthetics of these poles, the erosion of the pole bases, and the inaccessibility for maintenance in the Widen Stream Channel and Establish Riparian Habitat project area. The communication portion of this line will be relocated to a new line that will run to JPL from the Windsor-Ventura intersection north along the Gabrielino trail.

The power portion of this line will be relocated to the Pasadena grid that crosses the Devil's Gate Dam to feed facilities in the westside portion of the park. This alignment will go from the dam to Foothill Boulevard (preferably underground) and provide a new feed to OGMO, the Equestrian Staging Area restroom, the new restroom near the Oak Grove Field, the group picnic shelters south of the Oak Grove Field, the park ranger station, the existing restroom in the overnight area, and the group picnic shelters in the overnight camping area

Relocate the SCE North/South Transmission and South Distribution Line

These lines currently follow the toe of the western slope of the park, run the length of the basin from south to north and feed into and from JPL's main substation. The bases of 11 of the 21 power poles are frequently inundated during heavy storm events, making it impossible to access these poles. The poles will either be relocated to an alignment in Oak Grove Drive or be raised to an appropriate height in their current location after the westside perimeter trail, relocated disc golf, and improved parking lot areas are constructed with fill to raise the area above the seasonally inundated elevation of 1040.5 (spillway elevation). Relocation of the poles to Oak Grove drive is the preferred solution. Prior to implementing the proposed grading of the Flood Management/Water Conservation Pool, an analysis of alternative improvements or relocation of this utility will be completed for review and approval. This will guarantee the safety and stability of this critical utility. A mutual agreement between SCE and the City of Pasadena (and potentially other entities such as JPL, MWD, and the city of La Cañada-Flintridge) will need to be worked out.

SECURITY, SAFETY & ACCESSIBILITY

Two types of security fencing will be used. Decorative fencing consisting of some type of iron fencing with or without the use of Arroyo stone (as pillars or as a low wall on which an iron fence could be placed) will be used where appropriate and conform to the Arroyo Seco Design Guidelines. Chain link fencing will be used in areas where security fencing is needed but aesthetics are not an issue. Decorative security fencing is recommended at the following locations:

- At the south end of the park, from the west side of Flint Wash adjacent to Oak Grove Drive, north to the Gould Canyon Trail tunnel at Foothill Blvd.
- At the Windsor Avenue and Ventura Street entrance between Mountain View and Ventura Street, along the west side of Windsor Avenue.
- At the west end of Altadena Drive where a trail enters the park.

Gates will be needed at the westside tunnel entrance under Oak Grove Drive, to prevent entry onto the dam from the new parking lot at Oak Grove Drive and Linda Vista during park closure. Chain-link security fencing will be used at the end of La Canada Verdugo Road and Oak Grove Drive from the Woodbury on-ramp to Flint Wash.

Appendix F

ARROYO SECO
MASTER PLANS

Appendix F:

TECHNICAL REPORT
ATHLETIC FIELDS AT HAHAMONGNA WATERSHED PARK
prepared by
Parks and Natural Resources Division - Department of Public Works

Introduction

The City of Pasadena has proposed the Arroyo Seco Master Plan for the restoration and enhancement of the Arroyo Seco. This plan is divided into three sections, which correspond to distinct geographical features and established uses of the Arroyo Seco within Pasadena's boundaries. The Upper Arroyo Seco constitutes the northern - most section of this plan, which includes 300 acres known as Hahamongna Watershed Park (HWP)

Located just north of Devil's Gate Dam, Hahamongna Watershed Park presents a unique environment as a sediment and debris basin used for flood control, water conservation, and recreation. Existing features include active spreading basins, athletic fields, paved parking lots for JPL, a disc golf course, public parking, and an oak woodland, formerly known as Oak Grove Park. Although highly disturbed by both man and natural occurrences over the years, the area is biologically extremely diverse. The Arroyo Seco Master Plan and Draft Environmental Impact Report identify at least six native terrestrial plant communities, with over 300 plant species and approximately 100 animal species observed in the area encompassing Hahamongna Watershed Park. Included in this list are state and federally listed sensitive plant and animal species as well as designated critical habitats.

Hahamongna Watershed Park is located over a portion of the unconfined groundwater aquifer known as Monk Hill Basin. This, along with the Pasadena Sub-area aquifer, is included in the larger aquifer known as the Raymond Basin. The Raymond Basin is approximately 40 square miles and supplies drinking water to the City of Pasadena and surrounding communities. Although there are great seasonal fluctuations, the average ground water levels under HWP are between 600 and 1000 ft. (Arroyo Seco Master Plan, Hahamongna Watershed Park Master Plan).

The Master Plan proposes the addition of two new athletic fields on the west side of the stream, as well as improvements to the existing athletic field (Oak Grove field). These fields will primarily be used for youth soccer and youth softball. The two proposed new fields on the west side of the park will be known as the Sycamore Grove fields. A portion of this site is currently used for temporary overflow parking and is adjacent to the existing parking for Oak Grove Park. The existing Oak Grove athletic field accommodates youth tournament soccer and little league softball. The two new Sycamore

Grove Fields will also accommodate youth tournament soccer and serve as multi-purpose fields.

Due to the biological diversity and native habitats adjacent to the proposed and existing athletic fields, and their proximity to groundwater aquifers and surface water flows, there has been public concern regarding the effects of fertilizers, herbicides and pesticides used in the maintenance of these fields on the environment. The purpose of this report is to investigate and recommend maintenance and management practices to sustain these fields in suitable condition for youth sports, while preserving the quality and biodiversity of the surrounding environment.

Turf management

The most important element to minimize adverse effects to the environment is to apply proper horticultural practices to establish and maintain healthy turfgrass. Choosing the appropriate cultural practices, such as proper turf for the site and use, proper fertilization, aeration, irrigation and mowing practices will reduce or eliminate the need for chemical treatment of the turf. Well-maintained healthy turf with dense root systems can suppress the growth of weeds and the potential for disease, thus eliminating the need for pesticides. Although there is an obligation to maintain the best possible quality playing field, a few weeds or the mere presence of insects may not justify the use of chemical treatments. The turf manager needs to determine how much turf damage is acceptable before any treatment is needed.

In order to maintain a healthy turfgrass system the following cultural practices should be followed:

Conduct a complete soil analysis to determine exact nutrient needs. Healthy turf must have healthy soil. Determine nutrient and pH levels. Apply only nutrients that are necessary at times when they can be used most efficiently by the roots.

Use slow-release organic fertilizer. Studies have shown that regular applications of compost based organic fertilizers have been proven to significantly suppress the growth of most common turf weeds[1]. Nutrients released slowly into the soil maintain a more consistent level. Apply less fertilizer more often to maintain a more consistent level and reduce the potential for leaching and runoff by allowing the turf to utilize the nutrients. Organic fertilizer adds organic matter to the soil that is utilized by the soil microorganisms.

Mowing. There is a direct relationship between mowing height and the depth of the root system. Removal of more than 40% of the height of the blade in a single mowing stops root growth.[2] The larger percentage of the blade is removed, the longer the root

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[1] Bio-Integral Resource Center (BIRC) IOM for Turfgrass in Schools www.keyed.com/birc/ipmturf
[2] Cockerham, S. T. "Mowing Sports Fields" Feb. 2002

growth is halted, allowing the turfgrass to be more susceptible to disease and insect problems and the encroachment of weeds. Mow more often, cutting less. Mowing heights should be higher in warmer months. Higher blade heights shade the soil, conserve moisture and inhibit the development of weeds. Studies have shown that the minimum height for hybrid bermudagrass to survive in a high- traffic area, such as a sports field, is ½". [3]

Leave clippings on the ground. Turf clippings are 85-90% water. As clippings decompose, nitrogen and other nutrients are returned to the soil, contributing to the organic matter. Shorter grass clippings will decompose faster. Leaving grass clippings can reduce the need for fertilizer by 1-3 applications per year. If mowed regularly at the proper height, there will be no build-up of thatch.

Aeration – compacted soil creates conditions for limited root development and increases the turf's susceptibility to certain diseases. Athletic fields can become extremely compacted. To prevent this, fields should be aerated several times a year. This increases the ability of water to penetrate the soil, provides oxygen to microorganisms, and pushes the thatch layer into the soil, increasing the rate of decomposition and the organic matter in the soil. After aeration, a compost based organic amendment should be applied to further increase the amount of organic matter and provide nutrients to the soil. Composted organic amendments have been found to be among the most consistently effective in reducing the severity of turfgrass diseases, whether applied as a topdressing, or root zone amendment.[4]

Control thatch layer. Thatch is the accumulation of undecomposed roots and stems at the soil surface. If allowed to become too thick, this can prevent water and nutrients from entering the soil. All hybrid bermudagrass cultivars form thatch. Aeration pushes thatch into the soil, allowing for increased decomposition and increasing organic matter to the soil. Frequent mowing prevents build-up of thatch to unacceptable levels. The use of organic fertilizers also promotes thatch decomposition.

Irrigation - Proper irrigation and water management practices are crucial to healthy turf and will reduce the potential for leaching and runoff. Soil moisture levels should be tested and water should be applied only to replace water lost through evapotranspiration. Irrigation applications need to be adjusted according to weather and soil conditions.

Use of Fertilizers

The primary concern regarding the use of fertilizers is the movement of nitrogen into ground water and surface runoff. In the past several years, numerous studies have been conducted at universities throughout the country regarding the effects of nitrogen and

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[3] ibid
[4] Nelson, Eric B. "Enhancing turfgrass disease control with organic amendments" Turfgrass Trends, June 1996

nitrates on the environment. In 1991, the United States Golf Association (USGA) initiated a three-year study at various locations throughout the country to investigate the impact of golf courses to people and wildlife. This resulted in studies conducted by research scientists at 11 separate universities involving the fate of fertilizers and pesticides. Five of these studies, conducted at Iowa State University, Michigan State University, University of Nevada, Cornell University, University of California Riverside and Washington State University, specifically analyzed nitrogen leaching.[5] The results of these projects were published in the January/February 1995 *USGA Green Section Record.* In addition, independent studies (not part of this USGA project) have been conducted throughout the country, including the University of California, Riverside, involving nitrogen leaching.

All studies were conducted with test plots using various combinations of turf, soil types, fertilizers, and irrigation rates. The fertilizer application and irrigation rates ranged from standard rates to excessive rates in order to promote leaching. Both fast and slow-release fertilizers were tested on a variety of turf, including Kentucky bluegrass, tall fescue, and bermudagrass.

The results of all these studies came to an overwhelmingly consistent conclusion: *In mature, healthy, well-managed turf, nitrogen levels in leachate are insignificant.* The plants and associated soil microorganisms efficiently utilize nitrogen applied to healthy turf with a dense root system. Once established, healthy turf has such a fibrous root system that it filters the nitrogen and there is almost no movement beyond the roots. At the deepest level tested, four feet below the surface, less than .2% of the applied nitrogen was found in the leachate.[6] In one study, the turf (bermudagrass) was so efficient at utilizing the nitrogen that the nitrogen levels in the leachate were less than in the irrigation water applied[7]. The highest levels of nitrogen found in leachate were below the federal drinking water standards in all studies. There were, however, some variations found with differences in cultural and management practices. The least amount of nitrogen leaching resulted from the use of slow-release, natural organic fertilizers. An established turfgrass ecosystem supports a high level of biological activity that consumes nitrogen to support the growth of the microorganisms. In new turf that has not yet established a sufficient root system, the addition of organic matter significantly reduced nitrogen leaching[8]. Studies also indicate that more leaching occurred in newly planted

[5] USGA Green Section Record, Results from the USGA Environmental Research Program, United States Golf Association, January/February 1995

[6] Branham, Bruce, and Miltner, Eric and Rieke, Paul "Potential Groundwater Contamination from Pesticides and Fertilizers Used on Golf Courses", Michigan State University 1995

[7] Green, Robert, "Soil Type Affects NO3-N Leaching on Overseeded Bermudagrass Fairways" *BetterTurf Thru Agronomics*, June 2000

[8] Brauen, Stanton and Gwen K. Stahnke "Leaching of Nitrate from Sand Putting Greens", Washington State University, Puyallup Research and Extension Center

turf than in established turf[9] and that more leaching occurred during the dormant season of warm season grasses[10].

Recommendations:

Overall, the key to minimizing the effects of nitrogen on the environment is establishing and maintaining a healthy turfgrass system. Several management practices can be followed that have proven to be effective in reducing the movement of nitrogen and establishing healthy turf:

- Use slow-release organic fertilizer.
- Use smaller amounts of fertilizer more frequently so that the turfgrass can efficiently consume each application. Brauen and Stahnke reported significant differences in nitrogen in the leachate by applying slow-release fertilizer every 14 days vs. every 28 days.[11] Keeping grass clippings on the turf reduces fertilizer needs.
- Use foliar applications of fertilizer.
- Establish and maintain a dense, healthy root system. Apply organic matter to new turf to promote the rapid development of the root system.
- Irrigate lightly and less frequently after application of fertilizer. Christians reported that one 2" irrigation application resulted in 40% higher nitrogen levels in leachate than four 1" applications.[12]
- Water only as necessary. Irrigate at 100% evapotranspiration
- Apply fertilizer at appropriate times. Application prior to heavy rain increases the movement of nitrogen through leaching and runoff.
- Use turfgrass cultivar with a shorter dormant period to eliminate the potential of leaching during dormancy and maintain a dense root system year round.

Pesticides (including herbicides and insecticides)

Pesticides have been the cause of concern of many health and pollution problems in the last few decades. The United States Geological Survey has completed extensive monitoring programs through its National Water-Quality Assessment program over the last 20 years. Their findings concluded that pesticides are abundant in ground-water

[9] Petrovic, Martin "The Impact of Soil Type and Precipitation on Pesticide and Nutrient Leaching from Fairway Turf" Cornell University 1995
[10] Green, Robert ibid
[11] Branham, etal.
[12] Christians, N. and Shea,P.J. and Horst, G.L. "Pesticide Degradation Under Golf Course Fairway Conditions" 1995

throughout the country. In 99% of urban streams tested, pesticides were found. Over 70% of those had more than five different kinds of pesticides.

The leaching potential of pesticides in turfgrass depends upon several factors. The main factors are the properties of the pesticide itself, which include the ability of the pesticide to adsorb to the soil, water solubility, and persistence, or the time it takes for the pesticide to degrade. These factors, in turn, are dependent upon soil properties, irrigation practices, and the application and handling of pesticides.[13] The properties of the pesticide must be carefully matched with the soil properties and cultural practices to minimize the potential for leaching. Numerous university and independent research studies indicate that, like nitrogen, the effect of pesticides on the environment through leaching or runoff can be minimized through proper cultural practices. Under ideal turfgrass conditions, the dense, fibrous turfgrass root systems are capable of adsorbing and absorbing applied pesticides.[14] Appling pesticides to turfgrass is not like agricultural applications, where chemicals are often applied to bare soil, increasing the potential for groundwater leaching and surface runoff. Many turfgrass pesticides are formulated as systemic materials designed to be absorbed by the roots. It has been found that most turfgrass pesticides will rarely penetrate more than 1-1" ½" into the soil.

The negative environmental effects of pesticides, however, are not limited to groundwater leaching. There is a worldwide decline in amphibian populations and an increase in amphibian deformities that has baffled scientists for years. Recent research has linked these deformities in frogs to chemical contaminants, specifically pesticides. Because of their thin skin, frogs are more susceptible to absorption of chemicals through the skin. Research now shows that even where contaminant levels are below EPA drinking water standards, the effect on amphibians is significant. The exposure to pesticides weakens their immune system sufficiently so that they become susceptible to infections that lead to severe limb deformities.[15]

There is great diversity in the type of pesticides and their impact on health and the environment. Those products labeled "organic" or natural are not necessarily non-toxic, as there are many toxic natural materials. Because of these variations, and the inability to control all conditions in which pesticides are used, the U.S. Federal law prohibits products to be labeled "safe if used as directed" because absolute safety cannot be guaranteed.

There are alternative products available for the control of many pests. Cultural controls are the first priority. A change in irrigation, mowing or fertilization could eliminate the

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[13] Gan, Jay "How to Reduce Pesticide Leaching" PesticideWise , Spring 2002, Department of Environmental Sciences of the University of California, Riverside

[14] Cooper, Richard J. "Evaluating the Runoff and Leaching Potential of Turfgrass Pesticides" Golf Course Management February 1990

[15] Kiesecker, Joseph M. " Synergism between trematode infection and pesticide exposure: A link to amphibian limb deformities in nature?" Proceedings of the National Academy of Science, USA, Vol 99, Issue 15, July 2002

need for further treatment. If additional treatment is needed, biological controls should be considered. Biological control is the deliberate use of natural enemies to suppress and maintain populations of pest species.[16] The advantages of biological controls are that only the target species is affected; there are no residual contaminants to humans or the environment; pests cannot develop a resistance to it; and it is usually more cost effective than chemicals. In order to effectively use biological controls, the exact pest species must be known so that the appropriate, host specific natural enemy is applied. The effect of biological controls cannot, however, be predicted or controlled, and may not completely eliminate the target pest. There is also a risk that the introduction of an exotic species to the environment may have an impact on the natural enemies of a beneficial species. Careful study into the use of the appropriate biological controls for the target pest and its potential impact on other species must be examined before any new species is introduced.

Another biological control method is a product that has been developed by Dr. Nick Christians, Professor of Horticulture at Iowa State University, specializing in turfgrass science. Dr. Christians discovered a corn gluten meal that has the ability to inhibit root formation of broadleaf weeds at the time of germination. Corn gluten meal is a naturally occurring plant protein. It is effective as a pre-emergent by inhibiting the formation of root tissues during seed germination. The shoots develop, but then die back due to lack of roots. It has no effect on established plants and must be applied 4-6 weeks prior to germination. Because the corn gluten meal also contains 10% nitrogen, this product also serves as a slow-release organic fertilizer, reducing need for additional fertilizer applications. Research on turfgrass indicates a 50-60% decrease in broadleaf weeds the first year of use, and by the second and third years the corn gluten meal was as effective as synthetic herbicides.[17] It is being used on golf courses and sports fields throughout the country. There are no residual affects or contaminants involved and no known hazardous ingredients or conditions related to this product

Recommendations:

Due to the proximity of the proposed fields to natural areas and sensitive wildlife habitats, the use of chemical pesticides is not recommended. Although the amount of pesticides leaching into the groundwater could be minimized through appropriate cultural practices, the potential risk of pesticides to wildlife in HWP still exists. Cultural controls, biological controls, and new non-toxic methods should be utilized to maintain the HWP athletic fields in appropriate playing condition.

The *Arroyo Seco Master Plan – Hahamongna Watershed Park Master Plan, Planting Guidelines* states: “Herbicides should never be used near aquatic and wetland areas under

[16] Aliniazee, M.T. “The Economic, Environmental and Sociopolicial Impact of Biological Control” *Biological Controls in the Western United States*
[17] Christians, Nick “Using biological control strategies for Turf” Grounds Maintenance 34(3):28-32 March 1999

any circumstances due to the sensitive nature of these habitats and the potential for further spreading of harmful chemicals through water-borne transport. Soil tilling, mechanical cutting, solarization, and spot herbicide treatments should all be considered"…"mechanical removal of weeds is preferred over the use of herbicides" Although this clause refers to the native vegetation restoration areas of HPW it should be extended to include all of HWP for the protection of all wildlife in the park.

Rodent control

Irrigated areas, such as well-maintained turf, provide optimal conditions for both squirrels and gophers to burrow, feed, and reproduce. Their burrows pose a safety hazard for athletes as well as provide opportunities for the invasion of weeds and the potential for erosion. Squirrels are also the most prevalent sources of plague and are associated with the spread of several other diseases. Effective control measures are necessary for public health and safety.

Gophers live in burrows ranging from 6 inches to 6 feet below the ground and can cover an area of several hundred to over a thousand square feet. They do not hibernate and are active year-round. They may also be active at any hour of the day. As they dig their burrows, the soil is pushed to the surface, creating a mound of fresh soil around the opening of the burrow. Feed holes, however, where gophers come to the surface to eat the surrounding vegetation will not have a mound.

In irrigated areas, gopher burrow building can take place year-round, as the soil is always soft and moist. Breeding can also take place year-round, producing up to 3 litters per year, with 5-6 young per litter. Breeding and burrowing activity is higher in irrigated areas than in non-irrigated areas.[18] Gophers feed on a wide variety of vegetation, but prefer herbaceous plants. They feed on stems and leaves above ground, as well as roots below ground. They can pull an entire plant into their tunnel.

California ground squirrels are a native species that can be found in valley and foothill environments, but prefer disturbed areas adjacent to natural areas such as occur at Hahamongna Watershed Park. In fact, due to the creation of optimum soil conditions and abundance of food and water, in disturbed and altered environments squirrel populations can be many times more than they would be in a natural environment.[19] Like gophers, ground squirrels also excavate extensive burrows, creating a safety hazard on playing fields. They feed on seeds, vegetation and are known to prey on eggs of ground nesting birds. They hibernate in the winter, are most active in spring and fall and can produce a litter of 4-13 in the spring.

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[18] University of California Statewide Integrated Pest Management Program, UC Pest Management Guidelines, Pocket Gophers, published 1/02 www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7433.html

[19] LA County Department of Agricultural Commissioner and Weights and Measures, Ground Squirrel Control

The most serious problem with ground squirrels is that they are the most prevalent animal carriers of plague. Plague is a highly infectious bacterial disease which primarily affects rodents. However, it can be transmitted from rodents to pets and humans through fleas. In humans, if detected early, antibiotics can successfully treat it. If not treated, it can lead to plague pneumonia, which is highly contagious and can be fatal.

The City of Pasadena Environmental Health Department inspects and tests for plague annually. LA County Vector Management inspects and tests for plague in the areas outside the city limits adjacent to Hahamongna, including Altadena and the Angeles National Forest. In the year 2000, coyotes have tested positive at Switzers campground, north of Hahamongna.[20] Developed areas adjacent to known infected natural areas are highly susceptible to the spread of the disease through animal movement. Although to date there have been no positive reported cases within the city.[21]

Recommendation:

Due to the potential for serious health and safety problems, squirrels and gophers on the proposed Hahamongna fields should be controlled as soon as they appear. Since irrigated turf areas provide optimal conditions for the breeding of squirrels and gophers, allowing them to remain and reproduce will only amplify the problem. Immediate eradication will result in fewer animals to be eliminated in the long run, maintain safe playing fields, and provide proper public health policies.

Gopher control:
Elimination of broadleaf vegetation from the turf and immediately adjacent areas will minimize the presence of gophers. Turfgrasses alone do not provide enough of a food source to raise their young[22], so they will seek a location with a more ample food supply. Keeping the turf healthy and free of weeds, using cultural practices previously outlined in this report, should significantly limit gopher activity.

Encouraging natural predators to the area can also limit gopher activity, but it will not completely eliminate their presence. Although many natural predators of the gopher can be found in Hahamongna, including snakes and coyotes, these predators hunt for other prey as well, and will go where the food sources are abundant and easily obtained. Gophers can avoid capture by these predators by plugging up their burrow with dirt. There is also a public safety concern in encouraging predators to use areas of heavy human activity, such as youth sports fields, where there are expected to be large numbers of families with children and pets.

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[20] Rood, Michael Environmental Health Specialist, Vector Management, LA County Health Dept. personal communication 9/23/02
[21] Mel Lim, City of Pasadena Environmental Health, personal communication 9/23/02
[22] University of California Statewide Integrated Pest Management Program, Pest Management Guidelines Pocket Gophers, Jan 2002 www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7433.html

Attracting barn owls, another natural predator of gophers, has been used with limited success in agricultural areas to reduce rodents. Barn owls are cavity nesters, and placing nesting boxes in the area has been proven to be successful in attracting them to areas where there is abundant food. The more nesting boxes placed, the greater the likelihood that they will be used. In one study in which 10 nesting boxes were installed 100 feet apart, all boxes were used by the second year.[23] Mature barn owls can eat 10 rodents per night, and the grassy fields and natural areas of Hahamongna provide appropriate habitat for their prey. However, since they are not territorial, they hunt over large areas where food is available, and the placement of nesting boxes will not ensure they stay in the area. Barn owls and other natural predators may reduce, but not eliminate, the number of gophers on the proposed Hahamongna fields. Although they have not proven to be a reliable source of rodent control, the placement of nesting boxes would increase the potential for barn owls to reduce the gopher population.

Natural predators do not eliminate every animal, and a single gopher can cause extensive damage to a field and present a public safety hazard. A safe, effective, and reliable method of gopher control is trapping. The key to successful trapping is setting traps in the proper locations. Bait boxes are not effective and should not be used when attempting to control gophers. Proper trapping methods, types of traps, and proper placement can be obtained from the City's Pest Control Advisor, UC Pest Management Guidelines or the Los Angeles County Department of Agricultural Commissioner's office.

Squirrel control:
The least toxic method of reducing squirrel populations is by cultural practices. Squirrels are scavengers, and will find food where it is most easily obtained, which is often the area of high human activity, including picnic areas and athletic fields. Diligent litter control practices, providing covered trash containers at convenient locations, and keeping the area free of dense vegetation cover will reduce squirrel populations in these areas.

If squirrels become a problem, the options available for control are difficult to access, as each poses potential threat to other wildlife. The two methods available are the use of anticoagulant bait boxes and fumigants. Anticoagulant bait can be set in bait boxes, which the squirrel must enter to reach the bait. This option is considered safe for home use as children, pets and larger animals cannot get into the box, and there is a readily available and effective antidote. The squirrel needs to consume the bait for several feedings over a 4-5 day period. It may take 2-4 weeks for the anticoagulant to become effective in reducing the squirrel population. The box is placed in a location frequented by squirrels, such as near the entrance to the burrow, but needs to be hidden from public view and access. It should not be placed in the burrow. Smaller animals such as rabbits, snakes, mice and birds might also enter the bait box and be affected by the bait.

[23] Trapp, Douglas E. "International Barn Owl Restoration Project", 1996
ourworld.compuserve.com/homepages/DTrapp/barnowli.htm

The other alternative to squirrel control is the use of a fumigant, aluminum phosphide, which can only be applied by a licensed pest control applicator. It is injected in table form directly into active burrows. The moisture in the soil mixes with the aluminum phosphide and produces a toxic gas, hydrogen phosphide. The gas quickly dissipates, leaving no toxic substances in the atmosphere or the soil. This method is more direct, effective, and reliable for the immediate reduction of squirrel populations. However, it is also highly toxic to wildlife. Many other animals often occupy squirrel burrows, and non-target species in the burrow would be affected.

The use of either of these controls must be carefully considered, as each may be an appropriate squirrel control method depending upon the severity of the problem and urgency to reduce the squirrel population.

Conclusion

New products and technology are being tested and created to improve and ease the maintenance and management of turfgrass. Improved irrigation systems, new turfgrass cultivars, and new and creative application of fertilizers are constantly being developed. In order to provide the healthiest and most economical turfgrass system, the city needs to keep pace with these new products and ideas.

The City of Pasadena is currently in the process of installing a state-of-the-art water management system in its parks. This system measures evapotranspiration rates through remote sensors placed at key locations throughout the city, including Brookside Park and Oak Grove field at Hahamongna. These sensors can transmit evapotranspiration rates and/or soil moisture rates to a centralized computer system at the City's park maintenance yards. The computer automatically calculates evapotranspiration rates, and only the amount of water lost is applied to each location. The application rates automatically adjust to changes in soil and weather conditions. This system prevents over-watering and runoff. In addition, a flow sensor detects breaks in the system so that water flow can be turned off automatically to prevent runoff and erosion. This system will significantly increase the ability to apply proper turf management practices and minimize potential leaching and runoff of nutrients.

The University of California, Riverside, is currently conducting studies using green waste compost as a turf soil amendment. As mentioned in the cultural practices guidelines, compost based organic amendments are extremely effective in maintaining healthy turfgrass. The study used bermudagrass in a sandy loam soil and simulated heavy traffic, as would be found on a sports field, conditions similar to those at the proposed Hahamongna fields. Although only in the second year of this three-year study, the results so far indicate that with increased used of the green waste compost, there is an increase in water infiltration, softer surface of the turf, and increased organic matter. Increased traffic, however, reduced each of these conditions. As this study concludes in May 2003, this should be explored further. The use of green waste as an organic amendment on sports fields would not only improve the quality of the field, but also assist the city in complying with AB939, the requirement to reduce the amount of waste going to landfills.

New cultivars are constantly being developed. The greatest risk of leaching and damage to the turfgrass system is during dormancy, which may also be the greatest demand for use. A cultivar with a shorter dormancy period would enable more available playing time and keep the turf healthy year-round. Even with new cultivars, however, scheduling down time to maintain the fields is vital. Providing time without heavy traffic for aeration and fertilization will keep the fields healthy and in better playing condition in the long run. These times should be scheduled with the user groups well in advance to avoid conflicts.

The research presented in this report indicates that the key to maintaining fields with minimal effect on the environment is diligent management with proper cultural practices. Maintaining a healthy turfgrass system on heavily used areas such as youth sports fields is not easily accomplished. Proper cultural practices will reduce the need for treatments that would be harmful to the environment. It is recognized that many of the studies cited in this report were conducted on golf-course quality turf under constant supervision and maintenance. Sports fields in a city park rarely have the luxury of such treatment. With appropriate management, however, it is possible to obtain high quality fields and protect the surrounding environment. In order to obtain this level of maintenance, an experienced turf manager, knowledgeable in sports turf best management practices and the use of non-toxic methods should be assigned to the management of these fields. This, of course, requires appropriate funding. In a recent University of California, Riverside survey of 305 turf managers, 58% stated that applying best management practices to sports fields was not difficult, but they were restricted by financial limitations. In the long run, however, the money spent on proper management practices will be offset by the reduction of fertilizers, pesticides, and reseeding, and increased public health and safety, as well as protection of the surrounding environment.

A long-term integrated park management plan should be established for HWP. Sports fields amidst natural areas present a unique management challenge. Typically, areas managed as natural areas, such as the U.S. Forest Service area and Los Angeles County Natural Area Parks, do not allow the use of chemical pesticides or toxic materials within their boundaries. These places, however, do not have sports fields. Based on the information presented here, it is possible to establish a non-toxic policy and still maintain sports fields. An integrated park management plan that specifically outlines management practices and policies should be developed for all of Hahamongna Watershed Park. This plan will help to ensure that best management practices are utilized in maintaining sports fields within the environment they are placed in and with consideration of all other factors and uses of Hahamongna Watershed Park.

REFERENCES

Aliniazee, M.T. “The Economic, Environmental and Sociopolicial Impact of Biological Control” *Biological Controls in the Western United States*

Bio-Integral Resource Center (BIRC) IPM for Turfgrass in Schools www.keyed.com/birc/ipmturf

Branham, Bruce, and Miltner, Eric and Rieke, Paul “Potential Groundwater Contamination from Pesticides and Fertilizers Used on Golf Courses”, Michigan State University 1995

Brauen, Stanton and Gwen K. Stahnke “Leaching of Nitrate from Sand Putting Greens”, Washington State University, Puyallup Research and Extension Center

Christians, Nick, Corn Gluten Meal Research Site www.gluten.iastate.edu/home

Christians, Nick “Using biological control strategies for Turf” *Grounds Maintenance* 34(3): 28-32 March 1999

Christians, N. and Shea, P.J. and Horst, G.L. “Pesticide Degradation Under Golf Course Fairway Conditions” 1995

City of Pasadena, Arroyo Seco Master Plan, Hahamongna Watershed Park Master Plan, May 2002

City of Pasadena, Arroyo Seco Master Plan Environmental Impact Review, May 2002

Cockerham, S. T. “Mowing Sports Fields” University of California, Riverside Feb. 2002

Cooper, Richard J. “Evaluating the Runoff and Leaching Potential of Turfgrass Pesticides” *Golf Course Management* February 1990

Diegelman, Nathan “Poison in the Grass: The Hazards and Consequences of Lawn Pesticides” www.eisc.ca/poison_in_the_grass

Deubert, Karl “Environmental Fate of Common Turf Pesticides, Factors Leading to Leaching” *USGA Green Section Record* July/August 1990

Gan, Jay, Assistant Professor, Water Quality Specialist, Department of Environmental Sciences, University of California, Riverside, personal communication 8/14/02

Gan, Jay “Understanding Pesticide Risks in Different Landscape Systems, Pesticides in the Urban Environment” www.pw.ucr.edu.LandscapesJayGan-files

Gan, Jay "Understanding Pesticide Risks in Different Landscape Systems, Pesticides in Groundwater" www.pw.ucr.edu/leaching-lahontan-files

Gan, Jay "How to Reduce Pesticide Leaching" PesticideWise , Spring 2002, Department of Environmental Sciences of the University of California, Riverside

Gan, Jay "Pesticide and Groundwater Quality" *PesticideWise*, Winter 2002 www.pw.ucr.edu.textfiles/PesticideWiseWinter 2002

Gilliom, Robert J. "Pesticides in the hydrologic system, what do we know and what's next?" *Hydrological Processes* 2001

Gibeault, Victor, Extension Environmental Horticulturist, University of California, Riverside, personal communication

Gibeault, Victor "Turfgrass Selection and Culture" University of California, Riverside

Gibeault, Victor; Marylynn Yates; Jewell Meyer; Mathew Leonard "Movement of Nitrogen Fertilizer in a Turfgrass System" *California Turfgrass Culture* vol 48, nos.1 &2, 1998

Green, Robert Department of Botany and Plant Sciences, University of California, Riverside, personal communication 7/15/02

Green, Robert, "Soil Type Affects NO3-N Leaching on Overseeded Bermudagrass Fairways" *BetterTurf Thru Agronomics*, June 2000

Harivandi, Ali "Thatch, The Turf Manager's Hidden Enemy", *California Turfgrass Culture* vol 34, no.1, 1984

Hartman, Jim, LA County Dept. of Agricultural Commissioner and Weights and Measures, personal communication 8/27/02

Huddelston, J.H. "How soil properties affect groundwater vulnerability to pesticide contamination" Oregon State University Extension Service 1996

Kiesecker, Joseph M. " Synergism between trematode infection and pesticide exposure: A link to amphibian limb deformities in nature?" Proceedings of the National Academy of Science, USA, Vol 99, Issue 15, July 2002

Klein,Grant J and Robert Green, "A Survey of Professional Turfgrass Managers in Southern California Concerning Their Use of Turfgrass Best Management Practices" University of California, Riverside, 1999

Lim, Mel, City of Pasadena Environmental Health, personal communication 9/23/02

Lind, Pollyanna "Preparing a Landscape Site without Chemicals" *Journal of Pesticide Reform* vol 19, no.4 1999

Lloyd, John; Daniel Herms; Benjamin Stinner; Harry Hoitink; "Organic Mulches Enhance Overall Plant Growth" *Turfgrass Trends*, April 1, 2002

Long, Mickey, Acting Administrator, LA County Natural Area Parks, personal communication, 7/15,02, 10/10/03

Los Angeles County, Environmental Health Vector Management Program "Facts About Plague in Los Angeles County"

Los Angeles County, Department of Agricultural Commissioner and Weights and Measures "Ground Squirrel Control"

McDade, Meliisa "Corn gluten meal and corn gluten hydrolysate for weed control" Masters thesis, Iowa State University, 1999

Monroe, Michael, City of Pasadena Parks Supervisor, Parks and Natural Resources personal communication, 9/17/02

Nelson, Eric B. "Enhancing turfgrass disease control with organic amendments" Turfgrass Trends, June 1996

Petrovic, Martin "The Impact of Soil Type and Precipitation on Pesticide and Nutrient Leaching from Fairway Turf" Cornell University 1995

Ransom, Viveka, "Corn Gluten Meal, byproduct to wonder Product" *The Iowa Horticulturist*

Rao, R.S. Mansell; L.B. Baldwin, M.F.Laurent, "Pesticides and Their Behavior in Soil and Water" *Florida Turf Digest*, vol2, no12, Dec. 1985

Rood, Michael Environmental Health Specialist, Vector Management, LA County Health Dept. personal communication 9/23/02

Trapp, Douglas E. "International Barn Owl Restoration Project", 1996 www.ourworld.compuserve.com/homepages/DTrapp/barnowli.htm

University of California Statewide Integrated Pest Management Program, *UC Pest Management Guidelines, Pocket Gophers*, published 1/02 www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7433.html

University of California, Division of Agriculture and Natural Resources, *UC Pest Management Guidelines, Turfgrass,* publication 3365T. July 2000

University of California, Division of Agriculture and Natural Resources *Biological Controls in the Western United States, Accomplishments and Benefits of Regional Research Project W-84 1964-1989*, publication 3361

University of California, Cooperative Extension, Division of Agriculture and Natural Resources, "Selecting the Best Turfgrass" leaflet 2589

USGA Green Section Record, Results from the USGA Environmental Research Program, United States Golf Association, January/February 1995

Weeden,C.R., A.M. Shelton, Y Li, M.P. Hoffmann, editors, "Biological Control, A Guide to Natural Enemies in North America", Cornell University April 2002

Young, Steve L. "Alternative Methods for Controlling and Maintaining Vegetation Along Roadsides: Annual Summary Report for Corn Gluten Meal, Year 1" UC Hopland Research and Extension Center

Zingiro, Ralph, Bio-Scape, Inc. personal communication 8/27/02

EXHIBIT E

August 12, 2016

Mr. Mitchell M. Tsai
Mitchell M. Tsai, Attorney At Law
1055 East Colorado Boulevard, Suite 500
Pasadena, California 91106

Subject: Comments on the Habitat Utilization for the Least Bell's Vireo. Prepared for the Devil's Gate Reservoir Sediment Removal and Management Project

Dear Mr. Tsai:

This letter summarizes my review of the proposed Devil's Gate Reservoir Sediment Removal and Management Project as it relates Least Bell's Vireo habitat. My comments are based on a review of the following environmental and regulatory documents: California Department of Fish and Wildlife Section 1600[1][1], and the Incidental Take Permit 2081 prepared for the proposed Devil's Gate Reservoir Sediment Removal and Management Project (Project), and related reference material pertaining specifically to the Least Bell's Vireo (LBV).

I am a senior level regulatory specialist/biologist with experience in wetlands and regulatory permitting with an emphasis in resource management. I have 25 years of professional experience in research biology and wetland ecology. For the past twelve years, I have served as an environmental consultant focusing on biological and regulatory permitting (i.e., wildlife surveys, jurisdictional delineations, restoration and conservation biology, and Sections 1600, 404, and 401permits). Prior to environmental consulting, I worked ten years for the U. S. Geological Survey (USGS), Biological Resource Division (Maryland and California) and six years for the Smithsonian Institution Museum of Natural History, Division of Vertebrate Zoology in Washington, D.C. In addition to my professional experience as a regulatory specialist and research biologist, I've served as an adjunct professor instructing courses in general biology, cellular biology, and human anatomy for the Rancho Santiago Community College District in southern California. My educational background includes M.S. in Biology/Ecology and B.S. in Zoology/Chemistry from Howard University, Washington, DC.

BACKGROUND

The Project site is owned by the Los Angeles County Department of Public Works within the City of Pasadena, Los Angeles County, California at 1065 La Canada Verdugo Road, Pasadena, Los Angeles County, California, 91103. The proposed Project boundary encompasses approximately 120 acres within an approximately 258-acres reservoir that has wetlands, braided channels, and drainage features surrounded by an urban matrix.

The Los Angeles County Flood Control District (LACFCD, herein referred to as County) proposes to excavate 2.4 million cubic yards of sediment (inclusive of vegetation) that has accumulated behind the dam within Devil's Gate Reservoir, to restore reservoir capacity for storm and sediment inflows to minimize the level of flood risk to downstream communities along the Arroyo Seco waterway.

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[1] Devil's Gate Reservoir Sediment Removal and Management Project, Final Environmental Impact Report (FEIR) prepared for the Los Angeles County Flood Control District by Chambers Group, Inc.

The activities would result in temporary discharges of fill within waters of the United States through periodic excavation of accumulated sediment and removal of riparian vegetation. Activities would be conducted within an approximately 71-acre footprint, of which approximately 38 acres would directly impact waters of the United States (10.8 acres of wetland, and 27 acres of non-wetland). The proposed maintenance baseline would be maintained by future sediment excavation activities. The Project proposes construction activities would excavate sediment, remove native willows and mulefat occurring within the excavation area or where haul roads are proposed [2].

Biological Opinion

- Based on a five year review and summary evaluation of LBV by the USFWS it was determined that informal status reviews have lead to biological opinions, habitat conservation plans, and draft recovery plans for the successful protection of LBV[3].
- Based on the LBV observations recorded within the reservoir and footprint of the project site a Biological Opinion and habitat conservation plan should be implemented for the protection of the LBV within the reservoir[4] (USFWS 2006).

Suitable Habitat Detected Onsite

- Suitable least Bell's vireo (LBV) riparian habitat exist onsite. Based on the most recent field studies for the Project site there have been 5-6 individuals detected on the Project site. The individual sightings have included adult males, females, and juveniles[5].
- Since the 2012 field surveys 5-6 individual LBV's have been detected within the Project footprint to include two separate family units[6].
- The largest number of individual LBV was documented during the 2015 field season. As such, the Project site has began recording a growing trend with LBV activity[7].
- Impacting these locations will have a negative impact on the species. Field studies by USGS indicate vireo productivity increased by one young for each 30% decrease in nest cowbird parasitism[8] .
- Additionally, the eradication of brown-headed cowbirds and non-native plants from Project sites within locations occupied by the vireo and replacing non-native plants with native willows and mulefat plant species.
- LBV require a territorial range from 0.5 acre to 7.5 acres but in general are 1.5 to 2.5 acres[9][10]. There is ample acreage on the Project site to support viable metapopulations of LBV.
- Dense vegetation occurs on the Project site. Dense vegetation has clearly been identified as suitable and preferred habitat for LBV[11][12].
- Scattered patches of dense vegetation occur on the Project site. Locations where native willows and mulefat occur should be protected.
- Construction activities should be minimized if not completely avoided within locations that have documented the presence of LBV.
- Territories are often linear in nature, following the stream course[13].

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[2] CDFW 1600 Draft Lake and Streambed Alteration Agreement.
[3] USFWS (U.S. Fish and Wildlife Service). 2006. *Least Bell's vireo (*Vireo bellii pusillus*), 5-year* 28 *review summary and evaluation.* U.S. Fish and Wildlife Service, Carlsbad, CA.
[4] Ibid
[5] Chambers, 2015. 2015 Focused survey report for the Western yellow-billed cuckoo at the Devil's Gate Reservoir, Los Angeles County, California (November 17, 2015).
[6] Ibid
[7] ECORP, 2016. Devil's Gate Sediment Removal and Management Project, Application for Incidental Take of Endangered Species.
[8] Kus, B. and M. J. Whitfield. 2005. Parasitism, productivity, and population growth: Response of 25 least Bell's vireo (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax* 26 *traillii extimus*) to cowbird (*Molothrus* spp.) control. *Ornithological Monographs* 57:16–27 27.
[9] Kus, B. 2002. Least Bell's Vireo (Vireo belli pusillus) In Riparian Bird Conservation: A strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. http://www.prbo.org/calpit/htmldocs/riparian-v-2.html
[10] USFWS (U.S. Fish and Wildlife Service). 1998. *Draft recovery plan for the least Bell's vireo.* 26 U.S. Fish and Wildlife Service, Portland, OR.
[11] Baird K., 1998. High Quality Restoration of Riparian Ecosystems. Restoration and Management 7:2.
[12] RHJV (Riparian Habitat Joint Venture). 2004. Version 2.0. *The riparian bird conservation plan:* 10 *A strategy for reversing the decline of riparian associated birds in California*. California 11 Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian.v-2.pdf.

LBV Site Fidelity

- LBV data collected indicate these birds have a high site fidelity among adults, with many birds not only returning to the same territory, but placing nests in the same shrub used the previous year[14] (*Salata 1983, Kus unpubl. data: LBV site fidelity is high among adults with birds returning to the same territory and placing nests in the same shrubs used the previous year.*).
- Return rates of first-year breeders to their natal drainages ranged from 15-18% over the course of nine years of study on the Santa Ynez River in Santa Barbara County (Greaves 1987; Greaves and Gray 1991).
- Proximity to existing LBV habitat locations outside of the Project site and within the vicinity of the Project site has documented. As such, the Project site has developed overtime suitable LBV habitat and features capable of supporting viable LBV metapopulations.

LBV Territory Size Ranges (by known and recorded studies)

Based on studies by USGS, LBV have high species richness within the following territory sizes:

Tijuana River:
- 2.5 ± 1.2 acres, Kus 1991[15]; 1992[16]
- 2.7 ± 1.4 acres, Kus1992[17]; 1993[18]
- 1.8 ± 0.8 acres, Kus 1993[19]

Sweetwater River:
- 1.9 ± 0.8 acres, RECON 1989[20]

Prado Basin (Santa Ana River):
- 1.9 ± 0.9 acres, Hays 1988[21]:
- 1.6 ± 0.9 acres, Hays 1988[22]

San Diego River:
- 2.1 ± 1.0 acres, Kus 1989[23]
- 1.7 ± 0.9 acres, Kus 1989[24]

Willows and Mulefat Plant Species

- Planting plan should have a dominance of willow and mulefat species for the utilization of LBV. Studies have indicated that replanting the above listed species will take a minimum of three to five years before LBV begin to utilize the restored vegetative community. As such, the project should take measures to avoid thick vegetative communities within the reservoir where willows and mulefat occur, especially near standing water and active stream flow locations.

Brown-headed Cow Bird Trapping and Non-Native Plant Eradication Program

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[13] Rourke, J. W. and Kus, B. E. 2006. Distribution and breeding activities of the least Bell's vireo and southwestern willow flycatcher at the San Luis Rey River, San Diego County, California. 2005 Annual Report. Prepared for the State of California, Department of Transportation, District 11.
[14] Kus, B. (unpublished data).
[15] Rourke, J. W. and B. E. Kus. 2006. Distribution, abundance and breeding activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California. 2005 Annual Report. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.
[16] Ibid
[17] Ibid
[18] Ibid.
[19] Ibid
[20] Kus, B. (unpublished data).
[21] Pike J., D. Pellegrini, L. Hays, and R. Zembal. 2004. Least Bell's Vireos and Southwestern Willow Flycatchers in Prado Basin of the Santa Ana Watershed, CA. Prepared for Orange County Water District and U.S. Fish and Wildlife Service.
[22] Ibid
[23] Kus, B. E. 1998. Use of restored riparian habitat by the endangered least Bell's vireo. 7 *Restoration Ecology* 6:75–82
[24] Ibid.

- Brown-headed cowbird trapping program should be established as part of the mitigation measures for the Project area.
- A recent study found that vireo productivity increased by one young for each 30% decrease in brown-headed cowbird nest parasitism[25] .
- Eradication of nonnative plant species especially in locations where LBV have been documented.
- Replace non-native plant species with native willows and mulefat.

CONCLUSION

For the proposed Project, I have outlined specific concerns regarding LBV habitat preference and utilization. Based on a review of the Project site and habitat requirements for the LBV, the following recommendations are suggested:

- Limit the destruction of riparian habitat within the project site where dense patches occur and along drainage courses,
- Implement a less invasive sediment removal plan,
- Avoid sediment removal within locations where LBV individuals have been documented,
- Avoid construction activities during March through July, of each calendar year,
- Implement an exotic plant species and brown-headed cowbird eradication and control measures,
- Protect and preserve willow trees and mulefat shrubs located near and adjacent standing water and flowing drainage features,
- Limit the destruction of riparian habitat within the Project area,
- Approximately 3-5 years is required for restoration habitat to exhibit features allowing nesting LBV to be supported entirely within restored sites. As such, a closer examination is required for vegetative and shrub removal.

Sincerely,

T'Shaka Touré, M.S.,
Senior Regulatory Specialist/Biologist

[25] Kus, B. and M. J. Whitfield. 2005. Parasitism, productivity, and population growth: Response of 25 least Bell's vireo (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) to cowbird (*Molothrus* spp.) control. *Ornithological Monographs* 57:16–27

ATTACHMENTS

1. Resume for T'Shaka Touré, M.S, Senior Regulatory Specialist / Biologist;

2. USFWS (U.S. Fish and Wildlife Service). 2006. Least Bell's vireo (Vireo bellii pusillus), 5-year 28 review summary and evaluation. U.S. Fish and Wildlife Service, Carlsbad, CA;

3. Chambers, 2015. 2015 Focused survey report for the Western yellow-billed cuckoo at the Devil's Gate Reservoir, Los Angeles County, California (November 17, 2015);

4. Kus, B. and M. J. Whitfield. 2005. Parasitism, productivity, and population growth: Response of 25 least Bell's vireo (Vireo bellii pusillus) and southwestern willow flycatchers (Empidonax 26 traillii extimus) to cowbird (Molothrus spp.) control. Ornithological Monographs 57:16–27 27;

5. Kus, B. 2002. Least Bell's Vireo (Vireo belli pusillus) In Riparian Bird Conservation: A strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. http://www.prbo.org/calpit/htmldocs/riparian-v-2.html;

6. USFWS (U.S. Fish and Wildlife Service). 1998. Draft recovery plan for the least Bell's vireo. 26 U.S. Fish and Wildlife Service, Portland, OR;

7. Baird K., 1998. High Quality Restoration of Riparian Ecosystems. Restoration and Management 7:2;

8. RHJV (Riparian Habitat Joint Venture). 2004. Version 2.0. The riparian bird conservation plan: 10 A strategy for reversing the decline of riparian associated birds in California. California 11 Partners in Flight, http://www.prbo.org/calpif/pdfs/riparian.v-2.pdf;

9. Rourke, J. W. and Kus, B. E. 2006. Distribution and breeding activities of the least Bell's vireo and southwestern willow flycatcher at the San Luis Rey River, San Diego County, California. 2005 Annual Report. Prepared for the State of California, Department of Transportation, District 11.

10. Kus, B. (unpublished data);

11. Rourke, J. W. and B. E. Kus. 2006. Distribution, abundance and breeding activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California. 2005 Annual Report. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton;

12. Pike J., D. Pellegrini, L. Hays, and R. Zembal. 2004. Least Bell's Vireos and Southwestern Willow Flycatchers in Prado Basin of the Santa Ana Watershed, CA. Prepared for Orange County Water District and U.S. Fish and Wildlife Service; and

13. Kus, B. E. 1998. Use of restored riparian habitat by the endangered least Bell's vireo. 7 Restoration Ecology 6:75–82.

EXHIBIT 1

T'Shaka Touré, M.S.
Senior Regulatory Specialist/Biologist

Education
- MS, Biology (Emphasis in Ecology), Howard University, Washington D.C.
- BS, Zoology/Chemistry, Howard University, Washington D.C.

Registrations / Certifications
- USFWS Section 10(a)(1)(A) Recovery Permit CRLF
- CDFW SCP # 5444
- QSD/QSP Certification
- Swainson's hawk surveys/monitoring
- Construction Management for SWPPP Compliance
- Wetland Delineation, Emphasis on Hydric Soils

Areas of Expertise
- CEQA/NEPA compliance
- Environmental re-examination
- Regulatory permitting
- Biological assessments
- SWPPP Implementation
- Water pollution control planning
- Water quality sampling and analysis
- Special-status species surveys
- Pre-construction surveys
- Construction monitoring

Training/Workshops
- Arid West Supplement Wetland Delineation. Wetland Training Institute, 2007.
- Wetland Delineation with Emphasis in Hydric Soils. Wetland Training Institute, 2005.

Water Quality Monitoring
- EnviroCert International, Inc. Certified Erosion, Sediment and Storm Water Inspector (CESSWI Number 4348). 2015
- Certificate of Training, California Construction General Permit. Qualified SWPPP QSD/QSP. (Certificate # 25370). 2015
- Applied Hydrogeological Site Characterization & Monitoring Well Construction. NETC, 2009.

Mr. Touré has over 25 years of diverse experience in CEQA and NEPA compliance by providing biological and regulatory permitting services with an emphasis in natural resources management, environmental re-examination, wildlife studies, open space management planning, wetland ecology, and hydrology. Mr. Touré has conducted technical studies and prepared regulatory permits, jurisdictional delineations, and provided USFWS Section 7 consultation for endangered species to include mitigation and monitoring plans for impacts to special-status species.

T'Shaka has prepared and implemented natural resources management plans for artificially created wetland design planning, open space planning, and water quality control planning. He has an expansive experience in habitat assessments and regulatory permitting concerns for Federal and State endangered, threatened, special-status species, to include mitigation banks and conservancy lands. Mr. Toure is experienced in working with regional regulatory agency personnel, CDFW, RWQCB, USACE to include city and county municipalities.

T'Shaka is an experienced senior level regulatory specialist in navigating through the regulatory permitting process and identifying appropriate site locations to establish conservation to meet mitigation requirements, when appropriate. He has provided document reviews, expert testimonies, environmental re-examination, and implementation of required technical studies. He has prepared regulatory permitting packages for CDFW Sections 2081, 1602, Regional Board Section 401 Certification, and USACE 404 Permit pursuant to the Clean Water Act. His knowledge of natural resources extends from agricultural to wetlands and from temperate to tropical regions.

He has provided environmental compliance services for public works, solar energy farms, railway, and large scale linear transportation projects for Caltrans, U.S. Bureau of Reclamation, U.S. Bureau of Land Management, U.S. Geological Survey, PG&E, and multiple municipality projects throughout cities and counties of northern, bay area, southern, coastal, and central California. Additionally, Mr. Toure has conducted biological field work and technical studies in the states of Maryland, Virginia, and Washington, DC to include technical studies abroad in the Republic of Panama and the islands of Trinidad and Tobago.

Professional Experience:
- Touré Associates, Senior Biologist/Regulatory Specialist, Fresno, CA. January 2009 – present.
- Michael Brandman Associates, Senior Biologist/Regulatory Specialist, Fresno, CA December 2008 – January 2009.
- Rancho Santiago Community College, Adjunct Professor of Biology, City of Orange, CA., January 2006 – December 2009.
- Glenn Lukos Associates, Senior Biologist/Regulatory Specialist, Lake Forest, CA., July 2004 – October 2008.
- U.S. Geological Survey, Western Ecological Research Center, Research Ecologist, San Diego Field Station, Carlsbad Office, August 2000 – July 2004.
- Smithsonian Institution Museum of Natural History, Div. Vert. Zoology, Asst. Research Zoologist, Washington, D.C., August 1993 – July 2000.

PROJECT EXPERIENCE:

Moita Road Improvement Project (Regulatory Specialist/Biologist) – Contra Costa County, CA
Mr. Touré is providing biological and regulatory permitting services for road construction across a portion of the ECCC Habitat Conservancy Lands in the City of Clayton, East Contra Costa County. Environmental services include technical studies in the areas of water quality, biological assessments, jurisdictional delineation, regulatory permitting, and project coordination with lead agencies and contractor. The biological and regulatory services for the project required an understanding of CEQA compliance for construction approval within a Habitat Conservancy Plan/Natural Community Conservation Plan (HCP/NCCP) to include Regional Board, USACE, and CDFW permitting process.

Oak Creek Canyon Project (Regulatory Specialist) – Contra Costa County, CA
Conducted wetland delineation survey for an approximately 9.0–acre project site located in unincorporated Clayton. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the 9.0-acre study area. Wetland delineation report to include wetland data sheets was prepared. Coordinated with open space conservancy organizations and mitigation banks for project mitigation measures.

Riverwalk Project (Regulatory Specialist) –Solano County, CA
Conducted wetland delineation survey for an approximately 257.68–acre project site located in City of Rio Vista. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the study area. Wetland delineation report to include wetland data sheets were prepared. Additionally, Mr. Touré coordinated with open space conservancy organizations and mitigation banks for project mitigation measures.

Italian Bar Bridge Replacement Project (Regulatory Specialist/Biologist) – Fresno County, CA
Mr. Touré is providing biological and regulatory permitting services for the Italian Bar Bridge Replacement project along Redinger Lake in the Sierra National Forest. Mr. Touré prepares the regulatory permits and conducts surveys, scheduling, and supervision of staff biologists. Environmental services include technical studies in the areas of water quality, biological assessments, jurisdictional delineation, regulatory permitting, and project coordination with lead agencies and contractor. The environmental services for the project require an understanding of CEQA/NEPA compliance for construction activities above and within the San Joaquin River, surrounding natural resources, and the approval and issuance of regulatory permits to achieve project milestones.

Fresno 40 Project, Biological Resources (EIR), (Principal Biologist) – Fresno County, CA
Mr. Touré served as the Senior Project Biologist for the biological resources section of the Fresno 40 Environmental Impact Report (EIR) prepared by MBA and approved by the City of Fresno. Mr. Touré conducted San Joaquin kit fox and burrowing owl surveys on the project site and provided mitigation recommendations to meet local and regional natural resource management goals.

Avenue 416 Kings River Bridge Replacement Project (Regulatory Specialist) – Tulare County, CA
Conducted review of wetland delineation survey report prepared for the approximately 7.50-acre project site located near the City of Dinuba. Prepared and coordinated the regulatory permitting process for CFGC Section 1602 LSAA of the CDFW; RWQCB Section 401 Certification; and USACE PCN and Section 404 NWP to include Mitigation Plan for riparian re-vegetation and elderberry shrubs.

Tulare Basin Project (Regulatory Specialist) – Tulare County, CA
Conducted wetland delineation surveys for an approximately 323-acre project site located within the City of Tulare's agricultural lands. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of wetlands features and other drainage features was performed within the study area. Wetland delineation report to include wetland data sheets and biological assessment report was prepared.

Tharp Remediation Project (Regulatory Specialist) – Tulare County, CA
Provided the review of the biological reports prepared for the project and prepared the CFGC Section 1602 Lake and Streambed Alteration Notification permit application of the CDFW for unavoidable impacts associated with the projects vegetation and tree removal activities within riparian habitat along Tule River.

Calabazas Creek Bridge Project (Regulatory Specialist/Biologist) – Santa Clara County, CA
Mr. Touré provided the scheduling, surveys, supervision of staff, and environmental compliance oversight for construction activities within the Santa Clara Valley Water District (SCVWD). The construction activities required replacement of bridge structures and box culverts where BNSF tracks occurred. Environmental compliance services included document reviews, environmental re-examination, and implementation of required technical studies. The construction activities were conducted in wetland, riparian, and upland habitats. In addition to the issuance of standard regulatory permits the project required knowledge of BNSF requirements and scheduling coupled with the USFWS Biological Opinion issued for the project.

Seismic Retrofit Park Boulevard Project (Regulatory Specialist/Biologist) – Alameda County, CA
Mr. Touré provided the scheduling, supervision of staff, and environmental compliance oversight for construction activities and water quality control associated with structural improvements to three bridges along Park Boulevard in the City of Oakland, Alameda County. Environmental compliance services included the review of regulatory permits, environmental awareness training, pre-construction surveys, habitat assessments, and daily construction monitoring for the protection of special-status species. Additionally, SWPPP inspections were conducted weekly in accordance with the regulatory permits.

Modesto Junior College Project, (Biologist) – Stanislaus County, CA
Mr. Touré provided biological service for MBA by conducting a biological assessment of the 288-acre Modesto Junior College east and west campus facilities. Mr. Touré conducted onsite surveys and prepared Biological Resources Assessment reports that included habitat assessments and focused surveys for special-status species to include Swainson's hawk in compliance with the California Department of Fish and Game. The project required a field site surveys, comprehensive analysis of physical environmental impacts, and mitigation measures for proposed campus construction.

Los Banos Landfill Project (Biologist) – Merced County, CA
Mr. Touré provided on-call biological service for MBA to conduct a biological assessment of the 50-acre landfill site. Mr. Touré conducted onsite surveys and prepared Biological Resources Assessment reports that included habitat assessments and focused surveys for special-status species in compliance with the California Department of Fish and Game.

Schulte Road Bridge Replacement Project (Environmental Specialist/Water Pollution Control Manager) – Monterey County, CA
Mr. Touré provided the scheduling, supervision of staff, and environmental compliance required for construction of a bridge replacement where BNSF track occurred along the project and above the Carmel River, Monterey County. Environmental services consisted of regulatory permitting compliance and environmental awareness training to contractor, SWPPP preparation and implementation to include SMARTS data entry and reporting. Weekly inspections, sampling and analysis during storm events, monthly, quarterly, and annual reporting. Coordination with the contractor and County inspectors to ensure environmental protective measures were adequate in order to maintain compliance with RWQCB, USFWS, and CDFW regulatory permits. In addition to the issuance of standard regulatory permits the project required knowledge of BNSF requirements and scheduling protocols.

Stoneridge Ranch Project (Regulatory Specialist/Biologist) – Los Angeles County
Conducted wetland delineation survey for an approximately 238 single family residential project site located in City of Lancaster. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the project site. Wetland delineation report to include wetland data sheets were prepared. Prepared and coordinated the regulatory permitting process for CFGC Section 1602 LSAA of the CDFW; RWQCB Section 401 Certification; and USACE PCN and Section 404 NWP to include mitigation bank activities.

Caltrans District 10, North Stockton I-5 Widening Project (Environmental Specialist/Biologist) – San Joaquin County, CA
Mr. Touré provides scheduling, supervision of staff, and oversight of environmental compliance to include review of regulatory permits with contractor during construction activities occurring within or adjacent to waterbodies to ensure protection of natural resources and special-status species. Water Pollution Control Manager and environmental specialist required to attend weekly meetings with the contractor and Caltrans staff, prepare weekly, monthly, quarterly, and annual reports. Coordination of environmental compliance with Caltrans staff in accordance with the regulatory permits issued for the project.

Caltrans District 6, Cane Brake SR 178 Project (Biologist) – Kern County, CA
Mr. Touré provided the scheduling, supervision of staff, and biological construction monitoring for the bridge culvert replacement along SR-178. Monitoring services included providing environmental awareness training, pre-construction surveys, and daily construction monitoring for the desert tortoise, Mojave ground squirrel, Swainson’s hawk, southern willow flycatcher, western yellow-billed cuckoo, Kern red-winged blackbird, tricolored blackbird, least Bell’s vireo, and other regulated species. The monitoring was performed in accordance with Caltrans Special Provisions and regulatory agency compliance.

Caltrans District 5, State Route 17 Downdrain Rehabilitation Project (Environmental Specialist/Biologist) – Santa Clara County, CA
Mr. Touré provided the scheduling and supervision of SWPPP and biologist services required for drain improvement project along SR-17. Environmental services included providing environmental awareness training, pre-construction surveys, and daily construction monitoring for the special-status species. Environmental compliance to include the submission of the monthly SWPPP and biological reports required pursuant to the regulatory permits issued for the project.

Caltrans District 4, I-80 Truck Scale Relocation Project (Environmental Specialist/Biologist) – Solano County, CA
Mr. Touré provided the scheduling and supervision of environmental services to include initial site assessment, pre-construction, and presence/absence surveys for special-status species along I-80 within the vicinity of Fairfield, Solano County. Additional services include providing environmental awareness training, construction monitoring, monthly and annual biological monitoring reports. Mr. Touré conducted surveys and construction monitoring for the valley elderberry longhorn beetle, California red-legged frog, western pond turtle, bat species, Swainson’s hawk, western burrowing owl, white-tailed-kite, loggerhead shrike, central California coast steelhead, Central Valley Chinook salmon, river lamprey, swallows, and other special-status species.

San Mateo Creek Restoration Project (Regulatory Specialist) – San Diego County, CA. Camp Pendleton Marine Base
Conducted wetland delineation surveys for a restoration project that consisted of riparian and coastal sage scrub areas. Prepared and initiated and supervised the mitigation and monitoring plan required for the restoration activities.

SCLA Lead Track and Southern Industrial Area Project (Regulatory Specialist/Biologist) – San Bernardino County, CA
Conducted wetland delineation surveys for an approximately 130-acre site in the City of Victorville. Surveys identified the location of waters of the U.S. and state to include ephemeral drainage features that could potentially be considered as jurisdictional features. Detailed mapping of waters of the U.S. and other waters was performed within the 130-acre study area. Wetland delineation report to include wetland data sheets and biological assessment report was prepared.

PROFESSIONAL PUBLICATIONS

Touré, T. *et al* 2005. Common Reptiles, pp. 82-87, *In* Schoenherr, A., D. Clarke, and E. Brown. 2005. Docent Guide to Orange County Wilderness, 142 pp.

Touré, T.A., 2004, Checklist of amphibians and reptiles of Arroyo Seco and Los Angeles River Basin: U.S. Geological Survey Fact Sheet prepared for Los Angeles River–Arroyo Seco Confluence Park Project.

Touré, T.A., Backlin, A.R., and Fisher, R.N., 2004, Eradication and control of the African clawed frog (Xenopus laevis) on Irvine Ranch Land Reserve, Orange County, California, 2003: U.S. Geological Survey Final Report prepared for Irvine Ranch Land Reserve, Irvine, Calif., 31 p.

Touré, T. *In* J.W. Gibbons and M. E. Dorcas. 2004. North American Watersnakes, A Natural History. University of Oklahoma Press, Norman. 438 pp.

Touré, T.A., and R.N Fisher., 2003, Quarterly Report – African clawed frog, pond turtle and spadefoot toad project: U.S. Geological Survey Technical Report prepared for The Nature Conservancy.

Touré, T. A. and G. A. Middendorf. 2002. Colonization of herpetofauna to a created wetland. Bulletin of the Maryland Herpetological Society 38(4): 99-117.

Touré, T. A. 2001. A report on the population status and conservation of Rosy boa (*Charina trivirgata*): A two-year study in Anza Borrego State Park and Joshua Tree National Monument, 19 pp.

Touré, T.A., and R.N. Fisher, 2001, Monitoring program for amphibians and reptiles in the Nature Reserve of Orange County, Summary Report 2001: U.S. Geological Survey Technical Report prepared for Nature Reserve of Orange County, Calif.

Touré, T. A. 1999. Herpetofauna of a constructed wetland and adjacent forest. Howard University, Washington DC. 20 tbs., 7 figs., 63 pp. [Also catalogued at the Smithsonian, U.S Natural History Museum, Washington, D.C.]

McDiarmid, R. W., J. C. Campbell, and T. A. Touré. 1999. Snake Species of the World Catalogue. A Geographical and Taxonomic Reference. Volume 1. The Herpetologist' League. Washington, DC. 511 pp.

McDiarmid, R. W., J. S. Savage, and T. A. Touré. 1997. The proper name of the tropical tree boa (*Hortulanus corallus*). J. Herpetology 30(3): 320-326.

Touré, T. A. 1995. Snakes: Suborder Serpentes, pp. 204-261, *In* Frank, N. and E. Ramus. 1995. A complete guide to scientific and common names of reptiles and amphibians of the world, 377 pp.

PROFESSIONAL PRESENTATIONS

2007. Wetland and aquatic habitats of Orange County. [Education Series: Donna O'Neill Land Conservancy]
2006. Aquatic and riparian restoration ecology. [Seminar: Orange County Natural History Museum/Acorn Naturalist Center]
2004. Floral and faunal species conservation and management [Seminar: Santa Ana Park Naturalist Program, Department of Parks and Recreation]
2004. Spadefoot toad habitat enhancement training [Education Series: Laguna Coast Wilderness Park]
2003. Amphibian management: Concerns and opportunities. [Seminar: Nature Reserve of Orange County]
2003. Vernal pool ecology and spadefoot toads (*Spae hammondii*) of Orange County. [Seminar: Orange County Natural History Museum/Acorn Naturalist Center]
2003. Long-term monitoring of fragmented habitats in coastal southern California. [George Wright Society and ASIH, annual meeting]
2003. Exotic amphibians, current status and possible impacts. [Western Division of the American Fisheries Society, annual meeting]
2002. What's a herp? [Education Lecture Series: The Nature Conservancy of Orange County]
2001. Vertebrate abundance and diversity in fragmented habitats of coastal southern California. [Society for Conservation Biology, annual meeting]
2000. Constructed wetland and its ability to sustain amphibian and reptile populations. [Society of Wetland Scientists, annual meeting]
2000. Herpetofauna of a constructed wetland and adjacent forest. [ASIH, annual meeting]
2000. Reptiles and amphibians of the Sands Road Wetland Sanctuary. [ASIH, annual meeting]
1996. Snake species of the world: A taxonomic view. [ASIH, annual meeting]

PROFESSIONAL AFFILIATIONS

The Wildlife Society, Western Section
Association of Environmental Professionals
American Society of Ichthyologists and Herpetologists
Society for the Study of Amphibians and Reptiles
Partners in Amphibian and Reptile Conservation

AWARDS

2000. U.S. Geological Survey, Scientific Achievement Award, Patuxent Wildlife Research Center, Maryland
1999. Smithsonian Institution Libraries, Distinguished Subject Award
1998. Graduate Symposium Award, Howard University
1990. Smithsonian Tropical Research Institution, Research Internship Award, Republic of Panama

EXHIBIT 2

Least Bell's Vireo
(Vireo bellii pusillus)

5-Year Review
Summary and Evaluation

Photo by B. Moose Peterson

U. S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California

September 2006

5-YEAR REVIEW

Species reviewed: Least Bell's vireo (*Vireo bellii pusillus*)

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5-YEAR REVIEW
Least Bell's vireo/*Vireo bellii pusillus*

I. GENERAL INFORMATION

I.A. Methodology used to complete the review:

Dr. Donald McGraw was contracted by the U. S. Fish and Wildlife Service (Service) to gather and synthesize information regarding the status of the least Bell's vireo (*Vireo bellii pusillus*, "vireo"). This review was subsequently compiled by Peter Beck of the Carlsbad Fish and Wildlife Office (CFWO) and considered Dr. McGraw's final report (McGraw 2006), office files, available literature, new survey information, and interviews of individuals involved with surveying, research and management of this species. Vireo survey reports submitted to the Ventura Fish and Wildlife Office (VFWO) were supplied to CFWO by Chris Dellith of the VFWO.

I.B. Reviewers

Lead Region: Diane Elam and Mary Grim, California-Nevada Operations Office, 916-414-6453.

Lead Field Office: Karen Goebel, Gjon Hazard, and Peter Beck, Carlsbad Fish and Wildlife Office, 760-431-9440.

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review:

The notice announcing the initiation of this 5-year review and opening of the first comment period for 60 days was published on July 7, 2005 (70 FR 39327). A notice reopening the comment period for 60 days was published on November 3, 2005 (70 FR 66842). No comments were received during the comment period.

I.C.3. Listing history:

Original Listing:
FR notice: Federal Register 51(85):16474-16481.
Date listed: May 2, 1986.
Entity listed: Least Bell's vireo (*Vireo bellii pusillus*); subspecies.
Classification: Endangered.

I.C.5. Associated rulemakings:

Critical Habitat: Federal Register 59(22):4845-4867.

I.C.6. Review History:

No formal status review (per the criteria set in the March 27, 2006, draft 5-Year Review Guidelines) has been conducted since the original listing of the species. Informal status reviews have been conducted on a regular basis and incorporated into multiple biological opinions, habitat conservation plans, and the 1998 draft recovery plan developed for this subspecies.

I.C.7. Species' Recovery Priority Number at start of review:

3C. This priority number, as identified in the 2005 Recovery Data Call, indicates a high degree of threat but a high potential for recovery for a listed subspecies.

I.C.8. Recovery Plan or Outline:

A draft recovery plan for the least Bell's vireo was printed and distributed within and outside of the Service in 1998 (Service 1998). This plan was never finalized and remains in draft form.

Name of plan: Draft Recovery Plan for the Least Bell's Vireo (*Vireo bellii pusillus*).
Date issued: 1998.

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS?

____ ***Yes**, go to section II.A.2.*
_X_ ***No**, go to section II.A.4.*

II.A.4. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy?

____ ***Yes**.*
_X_ ***No**, go to Section II.B., Recovery Criteria.*

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

____ ***Yes***
_X_ ***No***

Although a draft recovery plan was distributed to the public in 1998 (Service 1998), it was not finalized due to other higher priority listing and recovery actions. The draft recovery plan constituted a thorough summary of the status of the species at the time it was distributed and provided broadly measurable recovery goals aimed at reducing threats and increasing the number of breeding pairs within the species' present and historic range.

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

____ ***Yes;*** *go to section II.B.2.b.*
_X_ ***No****; Explain and continue to section II.B.2.b.*

The draft recovery plan provides broadly measurable vireo population goals (occurrence for 5 consecutive years of "several hundred" breeding pairs of vireos at 14 distinct current or historical sites), but the draft recovery plan did not include a habitat-based assessment to evaluate whether the identified current and historical sites, even with restoration, could support these population goals. Due to new information regarding the species and an improved understanding of ongoing recovery actions to reduce threats, the recovery goals and strategies should be modified and refined.

II.B.2.b. Are all of the five listing factors* that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

____ ***Yes****, go to section II.B.3.*
_X_ ***No****, Explain and continue to section II.B.3.*

Two of the five listing factors, habitat loss (listing factor 1) and brown-headed cowbird (*Molothrus ater*, "cowbird") nest parasitism (listing factor 5), are partially addressed in the recovery criteria. Listing factor 2 is not relevant for this subspecies. Listing factors 3 and 4 do not appear to be addressed explicitly. Although not discussed in detail in the original listing, one recovery criterion within the draft recovery plan recognizes and addresses habitat degradation and loss resulting from invasion of riparian habitat by introduced exotic plant species (primarily *Arundo donax*, "giant reed"; listing factor 1). The plan could be improved by more directly addressing a solution to the underlying threats that led to the initial decline and listing.

II.B.3. List the recovery criteria as they appear in the recovery plan and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors[*] are addressed by that criterion. If any of the five listing factors are not relevant to this species, please note that here.

Downlisting Criterion 1:

"For a period of 5 consecutive years...Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, are protected and managed at the following sites: Tijuana River, Dulzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, San Luis Rey River, Camp Pendleton/Santa Margarita River, Santa Ana River, an Orange County/Los Angeles County metapopulation, Santa Clara River, Santa Ynez River, and an Anza Borrego metapopulation."

Although the draft recovery plan does not define when an area is "protected and managed," the required population increase is most likely to occur when overall habitat loss and degradation is substantially reduced or reversed through enhancement and restoration actions at the 11 specific locations listed in Criterion 1; therefore, this criterion appears to primarily address listing factor 1. It is possible that this criterion was also intended to address cowbird control (listing factor 5), although this is not explicit.

Since listing of the species in 1986, there has been tremendous growth of the vireo populations in specific areas in San Diego and Riverside. However, only the Camp Pendleton/Santa Margarita River and the Santa Ana River populations have clearly met and exceeded the target of "several hundred or more breeding pairs" of vireos at the designated site (Table 1). Population increases at both of these locations have likely been driven by habitat protection, habitat quality improvement by the removal of invasive exotic plants, and thorough, consistent cowbird control (Griffith and Griffith 2000; Zembal *et al.* 2003) achieved as a result of ESA section 7 consultations.

While other vireo populations have not reached target levels set by Downlisting Criterion 1, the general population trend has been positive (Table 1). It should be noted that while these 11 populations only represent a portion of the known vireo populations, they contain approximately 90 percent of the known vireo territories (refer to Section II.2.C. Biology and Habitat for a full discussion of vireo abundance). New information about vireo population dynamics and the observed patterns in the vireo population growth since the listing suggests this downlisting criterion may need to be revised.

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1)Present or threatened destruction, modification or curtailment of its habitat or range;
2) Overutilization for commercial, recreational, scientific, or educational purposes;
3) Disease or predation;
4) Inadqequacy of existing regulatory mechanisms;
5) Other natural or manmade factors affecting its continued existence.

Table 1: Most Recent Comprehensive Estimates of Vireos at 11 Population Units.[1]

Location	County	Year[2]	Vireo Territories[3]	Population Trend[4]
Tijuana River	San Diego	2004-2005	150	+ / -
Dulzura Creek/Jamul Creek/Otay River[5]	San Diego	2001-2005	36	+ / I
Sweetwater River	San Diego	2001	103	+ / +
San Diego River	San Diego	1997	66	+ / I
San Luis Rey River[6]	San Diego	2000	233	+ / I
Camp Pendleton/Santa Margarita River[7]	San Diego	2005	827	+ / -
Santa Ana River[8]	Orange Riverside, San Bernardino	2005	813	+ / +
Orange and Los Angeles Counties[9]	Orange Los Angeles	2001-2005	180	+ / +
Santa Clara River	Los Angeles Ventura	2001	119	+ / +
Santa Ynez River	Santa Barbara	2001	11	- / -
Anza Borrego Desert State Park	San Diego	2002	117	+ / +

1 As designated in the 1998 draft recovery plan.
2 Year(s) of most recent extensive surveys. Composite of surveys across multiple years used where within-year surveys not considered adequately comprehensive.
3 Minimum estimate; generally a composite of multiple survey efforts covering different reaches; may exclude large stretches of non-surveyed habitat. All estimates based on survey reports submitted to the Carlsbad Field Office or values obtained from the U.S. Geological Survey (USGS) database (USGS 2006).
4 Overall trend since original listing / Trend comparing 1996-2000 to 2001-2005. "+"=Increasing, "-" =Declining, "I"=Inadequate data to evaluate.
5 Primarily derived from Otay River surveys. No comprehensive surveys of Dulzura and Jamul Creeks since 1996.
6 Mainstem only; excludes Pilgrim Creek.
7 Includes all willow riparian habitat on MCB Camp Pendleton; excludes portions of Santa Margarita River off of MCB Camp Pendleton.
8 Mainstem and Prado Basin study area only: excludes San Timoteo Creek, Temescal Wash, and other tributaries.
9 Excluding Santa Ana River and Santa Clara River mainstems.

Delisting Criterion 2:

"Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, having become established and are protected and managed at the following sites: Salinas River, a San Joaquin metapopulation, and a Sacramento Valley metapopulation."

Like Downlisting Criterion 1, Delisting Criterion 2 appears to primarily address listing factor 1, and possibly listing factor 5 (cowbird parasitism). No breeding vireos have been recorded in Salinas Valley since 1986, and none have been recorded in the Sacramento Valley since prior to the listing of the vireo. In 2005, the first breeding pair of vireos detected in the San Joaquin Valley since the listing of the vireo successfully bred at the San Joaquin National Wildlife Refuge in Stanislaus County. Again in 2006, a single pair of vireos (including the same male banded at the site in 2005) bred successfully at this site. This pair may represent the nascent re-colonization of the San Joaquin Valley.

A few incidental sightings of vireos after the breeding season have occurred within the last five years in the Salinas Valley, but territorial and reproductive status for these birds has not been established. It is possible that a few more vireo territories are dispersed across the San Joaquin and Salinas Valleys and have not been detected due to extremely low population densities and minimal or no formal vireo surveys. There have been no sightings of vireos in the Sacramento Valley since prior to the listing, and there are no known source populations nearby; therefore, it is unlikely that any breeding vireos have occurred within recent years in the Sacramento Valley. Although a few vireos and at least one breeding territory have been detected in the combined area of the Salinas, San Joaquin, and Sacramento Valleys within recent years, Delisting Criterion 2 has not been met. With the current knowledge of vireo population increases within its present range and in consideration of a population viability analysis (PVA), this Delisting Criterion may need to be revised.

Delisting Criterion 3:

"Threats are reduced or eliminated so that least Bell's vireo populations/metapopulations listed above are capable of persisting without significant human intervention, or perpetual endowments are secured for cowbird trapping and exotic plant (Arundo) control in riparian habitat occupied by least Bell's vireos."

This criterion implicitly addresses all listing factors ("threats"), but most explicitly addresses listing factors 1 (habitat degradation caused by exotic plant invasion) and 5 (cowbird parasitism). Since the listing of the vireo there has been substantial progress made in controlling cowbird populations and giant reed invasion in specific areas in southern California, but these threats have not been adequately reduced even across most of the vireo's current range. It is unlikely that these threats can be completely eliminated, but they may be controlled with coordinated, consistent, widespread management efforts. Thus, while substantial progress has been made, Delisting Criterion 3 has not been fully met (refer to section II.C.2 Five Factor Analysis for a full discussion of current threats).

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat:

Abundance

The vireo population in the U. S. has increased 10-fold since its listing in 1986, from 291 to 2,968 known territories (Table 2). The population has grown during each five-year period since the original listing, although the rate of increase has slowed over the last 10 years. Population growth has been greatest in San Diego County (621 percent increase) and Riverside County (2,997 percent increase), with lesser but significant increases in Orange County, Ventura County, San Bernardino County, and Los Angeles County. The population in Santa Barbara County has declined by 54 percent since the original listing and 79 percent since its post-listing peak in 1986, although it is uncertain whether this population was historically significant. Kern, Monterey, San Benito, and Stanislaus Counties have had a few isolated individuals and/or breeding pairs since the original listing, but these counties have not supported any sustained populations. Although the number of individuals in Inyo County has increased to up to 11 territorial locations, these birds occur over widely dispersed locations, and there is some uncertainty whether these individuals are *V. b. pusillus* or *V. b. arizonae* (Arizona Bell's vireo; Patten *et al.* 2003).

Table 2: Estimate of Least Bell's Vireo Territories by County

	Estimate of Vireo Territories (and Percentage of the Total Population) for a given Range of Years[1]				
County	1977-1985[2]	1986-1990	1991-1995	1996-2000	2001-2005
San Diego[3]	223 (77%)	401 (76%)	1118 (78%)	1899 (76%)	1609 (54%)
Riverside[4]	29 (10%)	50 (9%)	223 (16%)	395 (16%)	898 (30%)
Orange	1 (<1%)	3 (1%)	16 (1%)	68 (3%)	177 (6%)
San Bernardino	0 (0%)	2 (<1%)	5 (<1%)	20 (1%)	87 (3%)
Los Angeles	6 (2%)	1 (<1%)	4 (<1%)	13 (1%)	56 (2%)
Ventura[5]	5 (2%)	8 (2%)	35 (2%)	86 (3%)	117 (4%)
Santa Barbara[6]	26 (9%)	57 (11%)	32 (2%)	12 (<1%)	12 (<1%)
Inyo	0 (0%)	4 (1%)	5 (<1%)	0 (0%)	11 (<1%)
Kern	0 (0%)	0 (0%)	1 (<1%)	0 (0%)	0 (0%)
Monterey	0 (0%)	3 (1%)	0 (0%)	0 (0%)	0 (0%)
San Benito	1 (<1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Stanislaus	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (<1%)
Total	**291**	**529**	**1439**	**2493**	**2968**
Percent Increase from Previous Period	-	82%	172%	73%	20%
Percent Increase since Listing	-	82%	394%	753%	920%

[1] Estimates based on a composite of surveys across the specified range of years.
[2] From the original listing (51 FR 16474).
[3] Approximately 50% or greater from Camp Pendleton.
[4] Approximately 90% or greater from the Santa Ana River and its tributaries.
[5] Approximately 90% or greater from the Santa Clara River.
[6] Approximately 90% or greater from the Santa Ynez River.

Preliminary reports from vireo surveys conducted in 2006 indicate that the vireo population at two key locations, Camp Pendleton and the Prado Basin on the Santa Ana River, may have declined by up to 15 percent. Possible causes for these reported declines are uncertain. Although single year declines should be viewed with caution when evaluating population trends, they indicate population volatility associated with a higher risk of extinction (Fagan *et al.* 1999).

As discussed in section II.B.3., vireos have recently been discovered in the San Joaquin Valley. Although incidental vireo sightings have been reported for the Salinas Valley, no territories have been recently identified for the Salinas or Sacramento Valleys.

No systematic surveys of the vireo population in Mexico have been conducted since the listing of this species. Vireos appear to be dispersed from the international border down through at least Cataviña (approximate latitude North 29° 45') in Baja California Norte, but these populations are subject to ongoing habitat loss and uncontrolled cowbird parasitism (Service 1998). It is uncertain whether the vireo populations in Mexico are self-sustaining or are being augmented by dispersal of vireos from populations in the U. S.

The draft recovery plan includes a PVA for 8 vireo populations, including 7 of the 11 target recovery populations (*i.e.*, the Tijuana River, Sweetwater River, San Diego River, San Luis Rey River, Santa Margarita River, the Santa Ana River, and the Santa Ynez River; Service 1998). Based on historical data collected from the selected sites and reasoned assumptions about other demographic parameters for the vireo, the PVA concluded that vireo populations at seven of these eight sites had a zero probability of going extinct within the next 100 years. Only the Santa Ynez River population was determined to be at risk of extinction.

A fundamental assumption of this PVA was that intensive cowbird control (*i.e.*, cowbird trapping) would be continued at each of these locations into the future. The PVA was based on an average annual reproductive rate of 2.6 offspring produced per pair. Although this annual reproductive rate was based on empirical data, these rates are from populations that had high levels of cowbird control and low to moderate parasitism rates. Without cowbird control, the average annual reproductive rate is likely to decline substantially (Kus and Whitfield 2005). The draft recovery plan indicates that without intensive cowbird control, or some other solution to the continuing threat that cowbird parasitism poses to vireos (*i.e.*, development of sufficient anti-parasitism defenses by the vireo), that vireo populations at each of these sites are likely to return to the low levels that occurred at the time of the listing.

In summary, the U. S. population from Ventura County southward has increased significantly, while the population from Santa Barbara County northward has actually declined. At the time the draft recovery plan was distributed in 1998, there were no demographic features or trends identified that would indicate limitations on recovery. No limiting demographic features or trends have been identified since the development of the draft recovery plan.

Distribution

Greater than 99 percent of the remaining vireos were concentrated in southern California (Santa Barbara County and southward) at the time of the listing in 1986 (51 FR 16474), with San Diego County containing 77 percent of the population. Although the population has grown 10-fold since the listing, greater than 99 percent still remain in southern California (Table 2). The populations are now more evenly distributed in southern California with 54 percent of the total population occurring in San Diego County and 30 percent of the population occurring in Riverside County; however, there has been only a slight shift northward in the species' overall distribution. Historically, the San Joaquin and Sacramento Valleys were considered to be the center of the vireo's breeding range

(60 to 80 percent of the historic population; 51 FR 16474), but the vireo has not yet meaningfully re-colonized those areas. Thus, despite the significant increase in overall population numbers, the population remains constricted to the southern portion of its historic range.

Habitat Conditions

Riparian habitat suitable for vireos had declined by an estimated 95 percent at the time of the listing, primarily driven by anthropogenic modification (*e.g.*, flood control, water impoundment and diversion, urban development, agricultural conversion, and livestock grazing; Service 1998). An objective, systematic estimate of the amount of available riparian habitat in California does not currently exist, although estimates for smaller regions indicate stable to increasing riparian habitat (Faber 2003). The Riparian Habitat Joint Venture ("RHJV"; a cooperative association of Federal, State and private organizations) plans to systematically map existing riparian habitat in California starting in 2007 (RHJV 2006).

Though some unauthorized and not quantified loss of riparian habitat continues to occur (Hays 2006), and no systematic estimate of the State's available riparian habitat exists, riparian habitat in San Diego County appears to have stabilized since the listing of the vireo and has improved locally where afforded protection by the ESA and other Federal and State legislation (*i.e.*, Clean Water Act; California Fish and Game Code Sections 1600-1616 addressing lake or streambed alterations). It appears that riparian habitat connectivity may also be improving along the mainstems of some major rivers in southern California (*e.g.*, on the Santa Margarita, Santa Ana Rivers, and to a lesser extent the San Luis Rey River) due to giant reed removal, restoration, and the reduction of high impact activities like sand mining operations (Service 1998), but fragmentation may still be occurring on lower order tributary streams due to increasing urban development and associated flood control (Kus 2006).

In many situations where riparian habitat is impacted by authorized Federal and State actions, an equal or greater amount of riparian habitat is restored (*i.e.*, through active planting and maintenance of riparian habitat) or enhanced (*i.e.*, through giant reed and other exotic plant removal) to offset the impacts. Restoring or enhancing riparian habitat through giant reed removal has met with some success on the Santa Ana River in southern California (Hays 2006) and the Russian River (outside of the vireo's range) in northern California (Gaffney and Gledhill 2003).

Despite the localized and likely improved condition overall of Southern California's riparian habitats, associated native upland plant communities (*i.e.*, coastal sage scrub, chaparral, oak woodlands) adjacent to riparian habitat are not afforded the regulatory protections of wetlands because they are often outside of the jurisdiction of the regulatory agencies and thus do not receive the same degree of consideration when impacted by State and Federal actions. Although no baseline assessment is available, it appears that riparian areas are increasingly bordered by urbanization where they would have historically been bordered by native upland plant communities (Kus 2002). Vireo territories bordering on agricultural and urban areas are less successful in producing young than territories bordering on native upland plant communities (RECON 1989 *in* Kus 2002).

A thorough evaluation of the change in riparian habitat in the northern portion of the vireo's historic range (*i.e.*, the Salinas Valley, San Joaquin Valley, and Sacramento Valley) has not been conducted, but it appears that there has been substantially increased protection and restoration of riparian habitats in northern California (Faber 2003). Restoration of riparian habitat has occurred on the Cosumnes, Kern, Merced, Sacramento, and San Joaquin Rivers since the listing of the species (Faber 2003).

In summary, historic loss of riparian habitat contributed to the decline of the species and factored in the decision to list the vireo as endangered in 1986. Since then, the amount of riparian habitat loss has been reduced and to some extent restoration efforts have increased vireo habitat. Most of this improvement has occurred in southern California, although it appears that protection and restoration efforts in the northern portion of the vireo's historic range have been successful also.

Genetics and taxonomy
No in-depth studies of genetic variation in the least Bell's vireo have been published since the listing of the species. One study (Spiegelberg 1997) used genetic analyses to evaluate the incidence of extra-pair paternity in this species within a limited sample of vireo families (n = 12 families; "families" consist of both adults in a pair and at least one offspring) in San Diego County, but this study did not evaluate broader genetic variation within the subspecies or across subspecies. Spiegelberg (1997) found no evidence of extra-pair paternity among sampled vireos and considered this to be atypical among bird species.

No changes to the vireo taxonomic classification or the accepted nomenclature have been published or otherwise proposed since the listing.

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms):

II.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

At the time of listing, loss of habitat due to agricultural practices, urbanization, and exotic plant invasion was identified as a major threat to vireo populations. Since the listing of the vireo, destruction and modification of riparian habitat within its current range has been curtailed significantly, primarily as a consequence of protections provided by the original listing in 1986 (51 FR 16474), the subsequent designation of critical habitat in 1994 (59 FR 4845), and other Federal and State regulatory processes.

Urbanization
Urbanization appears to have displaced former agriculture and grazing operations in

many areas within southern California, thereby indirectly reducing riparian habitat degradation caused by these activities. Agriculture and grazing continue to threaten riparian habitat within the larger historic range, particularly the Salinas, San Joaquin, and Sacramento valleys (Service 1998). Where the impacts of grazing and agriculture are reduced as a consequence of being displaced by urbanization, improved habitat quality may come at the cost of increased habitat fragmentation and decreased riparian/urban buffering.

will, in turn, depend on the effectiveness of exotic plant control at this location.

Invasive Plants
Within the past decade, control of giant reed and other exotic plants has been and continues to be systematically conducted on both the Santa Ana River and at Camp Pendleton. This effort has been effective at removing giant reed over large portions of these specific population areas. Recovery of riparian habitat after giant reed removal has been limited at some locations, but recovery has been more noticeable on the Santa Ana River near Prado Basin (Hays 2006). In general, giant reed removal has been effective but will require continued annual efforts to achieve local eradications and address new invasions.

Giant reed removal on Camp Pendleton is currently a funding priority due to, in part, the endangered status of the vireo. Control of giant reed within the Santa Ana River Watershed is organized through a multi-agency partnership (Santa Ana Watershed Association, "SAWA") and is funded by the proceeds from an endowment and through competitive grants (Zembal *et al.* 2003). Giant reed removal has also been initiated within several other watersheds within southern California and has been organized through cooperative partnerships with funds provided from competitive grants (Natural Resources Conservation Service 2006). Giant reed is also found and has been recognized as a problem within northern California watersheds, and associated eradication efforts have been initiated at several locations (Sacramento and Russian Rivers; Faber 2003).

Although control of giant reed has made great progress since the original listing of the vireo, invasions by other exotic plants (*e.g., Tamarix* species, perennial pepperweed [*Lepidium latifolium*]) continue to degrade existing riparian habitat and impede recovery efforts (Kus and Beck 1998; Hoffman and Zembal 2006).

Protection and Restoration
A primary factor to consider in addressing the current threat of vireo habitat destruction and modification is today's greater public awareness of the value of riparian habitat to conserving California's overall biodiversity. The importance of conserving California's riparian habitats is widely recognized by Federal, State, and private partnerships such as the California Riparian Habitat Conservation Program formed by State law in 1991, the California Chapter of Partners in Flight (CalPIF) established in 1992, and the California Riparian Habitat Joint Venture initiated (RHJV) by CalPIF in 1994. These programs share the common mission of coordinating and implementing conservation efforts aimed at protecting and restoring California's riparian ecosystems.

Rehabilitation of riparian habitats and processes has been identified as a major conservation priority in California (RHJV 2006), leading to many riparian restoration and conservation actions that are not driven by Federal or State regulatory processes (Faber 2003). Compliance driven and voluntary riparian restoration activities throughout the historic range may have contributed to an increase in riparian habitat since the listing of the vireo, although this cannot be established without a thorough evaluation of riparian habitat within California.

In summary, the trend of riparian habitat loss and degradation appears to have been substantially abated, and possibly reversed on a local level. While there are currently no quantified, range-wide estimates of the change in riparian habitat since the listing (see section II.C.1.e), there is recognition that the degree of threat to the vireo caused by habitat loss has been significantly reduced, albeit not entirely eliminated.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization has not been identified as a threat to the vireo.

II.C.2.c. Disease or predation:

Nest predation (*i.e.*, by native and introduced nest predators; see Service 1998) rates between 25 to 40 percent were reported in the listing rule, which was considered abnormally high by the Service at the time of the listing in 1986. Although nest predation rates on vireos can exceed 60 percent of the vireo nests in a given area within a year (Kus 1999), typical nest predation rates average around 30 percent (Franzreb 1989). Although nest predation rates for this species appear to be high, they are comparable to nest predation rates for other North American passerines (Martin and Clobert 1996).

In highly urbanized areas, where habitat is fragmented and upland plant community buffers are minimal or non-existent, there is a potential for an increase in nest and adult predation due to mesopredator release and/or the addition of non-native predators (*i.e.*, domestic cats, *Felis catus*) (Crooks and Soule 1999). This process may lead to local extirpation of small, isolated bird populations. The only empirical study (Peterson 2002; Peterson *et al.* 2004) that has directly investigated vireo nest predation relative to habitat fragmentation found that most local landscape features (including urbanization) did not appear to elevate vireo nest predation rates; from a larger spatial perspective, nest predation appeared to be a somewhat random process. There have been no studies published that directly investigate the impact of domestic cats on adult or nestling vireos, although Peterson *et al.* (2004) did not observe vireo depredation by domestic cats or detect them in the vicinity of vireo nests.

Argentine ants (*Linepithema humile*), a non-native ant species whose spread is generally believed to be augmented by urbanization (Suarez *et al.* 1998), has been observed to be a predator of vireo nests where they co-occur (Peterson *et al.* 2004). Although not identified as a threat at the time of the listing, Argentine ants may pose a problem to vireos if the riparian-urban interface of occupied vireo habitat increases without adequate buffers.

Although background nest predation rates on vireos reported at the time of listing appeared high, they are comparable to that of other species (Martin and Clobert 1996) and do not appear to have impeded vireo population expansion where cowbird control and riparian habitat conservation has been effective (*e.g.*, at Camp Pendleton and at the Prado Basin on the Santa Ana River; Griffith and Griffith 2000; Zembal *et al.* 2003). With a continued increase in riparian habitat conservation and restoration (as described in sections II.C.1.e and II.C.2.a), the potential risk of increased predation due to habitat fragmentation (as listed in 51 FR 16474) has and should continue to decline. Predation does not currently appear to constitute an imminent threat to the survival of the vireo. Expansion of the Argentine ant population in association with ongoing urban development may constitute a previously unrecognized predation threat to the vireo, but this threat needs further study.

West Nile virus is a potential disease threat not known at the time of the listing. The vireo has likely been exposed to West Nile virus, as displayed by *Corvus sp.* mortalities in Los Angeles and Orange Counties (Turell *et al.* 2002, 2005; Reisen *et al.* 2006); however, direct mortalities of vireos from this disease have not been reported.

II.C.2.d. Inadequacy of existing regulatory mechanisms:

State Protections

Least Bell's vireo is listed as an endangered species under the California Endangered Species Act of 1984 (CESA). This legislation requires State agencies to consult with the California Department of Fish and Game (CDFG) on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat.

The California Environmental Quality Act (CEQA) requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA Sec. 21002). In the latter case, projects may be approved that cause significant environmental damage, such as destruction of listed endangered species or their habitat. Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

The Natural Communities Conservation Planning Act (NCCP) program purpose is to conserve natural communities at the ecosystem scale while accommodating compatible land use, including urban development. NCCPs identify and provide for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity.

Another state regulatory program promoting the recovery of the vireo is the California Lake and Streambed Alteration Program (California Fish and Game Code Sections 1600-1616). This program provides a permitting process to reduce impacts to fish and wildlife from projects affecting important water resources of the State, including lakes, streams, and rivers. Because riparian habitats are closely associated with lakes, streams, and rivers, this program provides recognition of the importance of riparian habitats to sustaining California's fish and wildlife species and helps prevent the loss and degradation of riparian habitats important to the vireo.

Federal Protections

The National Environmental Policy Act (NEPA) provides some protection for least Bell's vireo. For activities undertaken, authorized, or funded by Federal agencies, NEPA requires the project be analyzed for potential impacts to the human environment prior to implementation (42 U.S.C. 4371 et seq.). For instances where that analysis reveals significant environmental effects, the Federal agency must propose mitigations that could offset those effects (40 CFR 1502.16). These mitigations are usually developed in coordination with the Service during section 7 consultation and should provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, and so some impacts could still occur. Additionally, NEPA is only required for projects with a Federal nexus, and therefore, actions taken by private landowners are not required to comply with this law.

Under section 404 of the Clean Water Act, the USACE regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the USACE criteria of having hydric soils, hydrology (either sufficient flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any actions within the vireo's habitat that has the potential to impact waters of the United States would be reviewed under the Clean Water Act as well as NEPA and the Endangered Species Act. These reviews would require consideration of impacts to the vireo and its habitat, and when significant impacts could occur, mitigations would be recommended.

The Endangered Species Act (Act) is the primary Federal law providing protection for the vireo. Since its listing, the Service has analyzed the potential effects of many projects under section 7(a)(2) of the Act, which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild or reducing its reproduction, numbers or distribution (50 CFR § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of vireo from a project. Incidental take refers to taking that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by a Federal agency or applicant (50 CFR § 402.02). While projects that are likely to result in adverse effects often include minimization measures, the Service is limited to requesting minor modifications in the project description. In instances where some incidental take is unavoidable, the Service requires that additional measures be performed by the project proponents to compensate for negative impacts.

A prime example of the protection provided by the Act is the conservation benefit that resulted at two main population centers at Camp Pendleton and within the Prado Basin of the Santa Ana River. Interagency section 7 consultations made necessary by the listing of the vireo were the basis of existing Federal partnerships between the Service and the U. S. Marine Corps and the USACE aimed at promoting the recovery of the vireo. Coordination of Federal agency actions at these two essential locations has resulted in significant habitat management, habitat restoration, and research activities. Today, these two populations support the largest concentrations of vireo and likely represent the major source populations providing for expansion of the vireo in southern California (Griffith and Griffith 2000; Zembal *et al.* 2003).

Incidental take permits, pursuant to Section 10(a)(1)(B) of the Act, may be issued for projects without a Federal nexus. This section provides protection for vireo through the approval of habitat conservation plans (HCPs) that detail measures to minimize and mitigate the potential impacts of the project to the maximum extent practicable. Regional HCPs in San Diego, Orange, and Riverside counties now provide an additional layer of regulatory protection for the vireo over much of its current range, and these HCPs are coordinated with the related NCCP-State program identified above. This regulatory protection was not wholly realized prior to the listing of the vireo. The vireo is now a "covered species" under most existing and planned regional NCCP/HCPs in southern California. Under any permitted NCCP/HCP, covered species conservation is provided regardless of the Federal or State-listed status of a species. Thus, even if the status of the vireo was changed under the Act, the requirements for vireo conservation under the existing regional NCCP/HCPs would remain in effect for the life of the permit (generally 50 to 75 years), and most of the habitat protection and management benefits would continue in perpetuity.

Protection on Department of Defense Lands

The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs on military reservations and to establish outdoor recreation facilities. The Sikes Act also provides for the Secretaries of Agriculture and the Interior to develop cooperative plans for conservation and rehabilitation programs on public lands under their jurisdiction. While the Sikes Act of 1960 was in effect at the time of the vireo's listing, it was not until the amendment of 1997 (Sikes Act Improvement Act) that Department of Defense (DOD) installations were required to prepare Integrated Natural Resource Management Plans (INRMP). Consistent with the use of military installations to ensure the readiness of the Armed Forces, INRMPs provide for the conservation and rehabilitation of natural resources on military lands. They incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically a regulatory mechanism because their implementation is subject to funding availability, they address the conservation of natural resources on military lands and can be an added conservation tool in promoting the recovery of endangered and threatened species.

In 2001, the Marine Corps adopted an INRMP for Camp Pendleton (U.S. Marine Corps 2001). Like other INRMPs, it is largely ecosystem-based except where biological opinions direct species-specific actions. Camp Pendleton's INRMP incorporated the Service's *1995 Biological Opinion on Programmatic Activities and Conservation Plans in Riparian and Estuarine/Beach Ecosystems on Marine Corps Base, Camp Pendleton* (1-6-95-F-02) (the "Riparian BO"), which addresses the majority of vireo breeding habitat at Camp Pendleton. Because it incorporates the provisions of this consultation, Camp Pendleton's INRMP provides specific direction regarding vireo management and conservation. It is possible, therefore, that management actions specific to maintaining vireo populations at Camp Pendleton (such as cowbird trapping) may receive lower priority under the current INRMP if the vireo was no longer listed under the ESA. The INRMP would likely continue to provide benefit to the vireo through the protection and management of its habitat; however, these benefits would be subject to military funding allocations that generally give higher priority to endangered species management issues.

Prior to its listing in 1986, the vireo was also afforded the regulatory protections of the Migratory Bird Treaty Act, which prohibits generally the take, capture, killing, or possession of migratory birds, their eggs, parts, and nests but does not protect habitat except where habitat alterations would directly kill or injure birds (*e.g.*, felling a tree with an active nest). On January 10, 2001, Executive Order 13186 was issued to address the responsibilities of Federal Agencies to Protect Migratory Birds. The Executive Order directed Federal agencies whose actions have a measurable negative impact on migratory bird populations to develop Memoranda of Understanding (MOU) with the Service to promote the conservation of migratory birds. Under a July 31, 2006, Memorandum of Understanding (MOU) between the Service and the Department of Defense (DoD), the vireo, as a migratory bird species, will receive certain benefits on DoD lands.

The MOU addresses certain DoD activities including natural resources management, installation support functions, industrial activities, routine construction or demolition activities, and hazardous waste cleanup. Through the MOU, the parties will strive to protect migratory birds, work to protect habitat adjacent to DoD lands, and promote collaborative projects. Additionally, the DoD will follow migratory bird permitting requirements, incorporate or encourage incorporation of migratory bird conservation into INRMPs and other environmental documents, manage military lands and non-military readiness activities in a manner that supports migratory bird conservation, and develop and/or implement monitoring programs. The MOU provides that the management of DoD installations should be done in consideration to habitat protection (with specific attention to riparian habitats), fire and fuels management, and invasive species management.

Like INRMPs, this MOU is subject to budgetary limits; however, it provides an added level of recognition to the importance of conserving migratory birds and their habitats that was not in existence at the time the vireo was listed. We anticipate that this MOU will further emphasize the importance of riparian vegetation communities (vireo habitat) to decision makers on DoD installations, such as Camp Pendleton, and otherwise promote migratory bird conservation, which could directly or indirectly benefit vireo recovery.

Summary of Factor D

In summary, at the time of the vireo listing in 1986, Federal and State laws, while in place, were not effective in reducing impacts to riparian habitats suitable for vireo, which had declined by an estimated 95 percent (51 FR 16474). Listing of the vireo provided greater incentives for Federal agencies to conserve and manage vireo habitat. At the same time, planning and development of regional NCCP/HCPs in Southern California provided additional conservation benefits to the vireo on private lands. In recent years, greater emphasis has been placed on conserving natural resources and, in particular, migratory birds, on military lands. With these overall improvements, it is unlikely that the increasing trend for riparian habitat conservation would be negatively affected by a change in the legal status of the vireo under the ESA. Thus, the inadequacy of existing regulatory mechanisms is no longer a primary threat to the recovery of the vireo.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

The 1986 listing rule identifies brood parasitism by cowbirds as a substantial threat to the vireo. As noted in the rule, cowbirds were historically rare within the range of the vireo. Laymon (1987) detailed the rapid spread of cowbirds across California: the invasion started in the southeast in about 1900, expanded throughout southern California by 1920, and spread through the northern portion of the vireo's historical range by the 1940s. Cowbirds are now common throughout most of the current range of the vireo (Garrett and Dunn 1981). It is thought that the meteoric rise and expansion of cowbirds is largely due to anthropogenic changes in the landscape (Rothstein 1994).

Brood parasitism represents a novel threat to the vireo, in evolutionary terms. The first documentation of brood parasitism in this subspecies was in 1907 (Linton 1908; Franzreb 1987). Grinnell and Miller (1944) noted that cowbirds heavily parasitize the vireo. They also indicated a "noticeable decline" in the vireo, "apparently coincident with [the] increase of cowbirds." Brown (1993) summarized nest parasitism rates for the vireo to be between 30 and 50 percent. Nest parasitism rates in some populations of vireos have been as high as 80 percent (Jones 1985 *in* Franzreb 1987). As modeled by Laymon (1987), nest parasitism rates of 30 to 48 percent would allow vireo populations to be unstable, potentially suffering extinction from stochastic events, while rates higher than 48 percent would lead to extinction in a short time. More recently, Kus and Whitfield (2005) found that annual productivity of vireos increased by one young for each drop of 30 percent in parasitism frequency.

To promote recovery of the vireo, cowbird management has been implemented in many areas. This management has primarily been implemented through cowbird trapping programs initiated as a result of the ESA section 7 interagency consultation process. Cowbird trapping has been especially effective at the local level. For example, on Camp Pendleton (Griffith and Griffith 2000; Griffith Wildlife Biology 2001) and at the

Sweetwater Reservoir (Famolaro 2006) active cowbird control has, at least over the short term, reduced the rate of cowbird nest parasitism in least Bell's vireos to nearly 0 percent. Cowbird trapping, in general, has been attributed in promoting an increase in the overall vireo population rangewide (Kus 1999; Kus and Whitfield 2005). Despite the intensive trapping that has occurred at some locations over a number of years, it does not appear that cowbird numbers have been affected (Griffith Wildlife Biology 2004).

Although cowbird trapping has been lauded as a short-term management technique, it has been criticized for not promoting the long-term recovery of the vireo. Both Kus and Whitfield (2005) and Peer *et al.* (2005) have suggested that removing cowbirds from the vireo's environment limits or prevents selective pressures that may allow the vireo to evolve nest parasitism defenses. If the vireo had natural defenses to brood parasitism, they argue, cowbird trapping would not be necessary (Kus and Whitfield 2005; Peer *et al.* 2005). Such defenses have been observed in the nominate subspecies of the Bell's vireo (*V. b. bellii*), which has been in contact with cowbirds over a longer period of evolutionary time (Parker 1999).

Further, Sharp and Kus (2006) found that high microhabitat cover around vireo nests reduces the rate of cowbird parasitism. They suggest that the effect of cowbirds on vireos can be managed through management of vireo habitat. Also, Rothstein (2004 *in* Peer *et al.* 2005) suggests that small host populations may be parasitized more heavily than larger host populations.

In summary, cowbird nest parasitism continues to be a significant threat to the vireo. Cowbird trapping has proven a successful tool to halt vireo population declines over the short term, but trapping may not be the best method for long-term recovery of the vireo. It remains unclear as to the best way to manage this threat and additional research is needed to resolve this issue.

II.D. Synthesis:

The vireo population has grown robustly since the listing in 1986, primarily in response to improvements in habitat abundance and quality and effective cowbird control. The rapid loss and degradation of riparian habitat occurring across the vireo's range prior to the listing appears to have been halted and possibly reversed to some degree. Listing of the vireo under the ESA helped bring about a greater awareness of the importance of conserving riparian habitats for the benefit of many wildlife species.

Several regional NCCP/HCPs have been developed that include long-term conservation goals for vireo. Additional protections have been added for migratory bird conservation on military lands through the Sikes Act Improvement Act and the 2006 MOU between the Service and DoD. More effective implementation of Federal and State regulatory programs addressing water resource issues directly and indirectly provide conservation benefits to riparian habitats and the vireo, and public/private partnerships are now in existence with the specific mission of conserving riparian habitats and migratory birds, including the vireo.

Although nest parasitism by cowbirds has been reduced on a local level in southern California, it remains the primary threat limiting the vireo's overall recovery. A PVA conducted in 1998 determined that vireo populations at seven significant sites would not likely go extinct within the next 100 years, as long as habitat size and quality remains the same or increases and cowbird control continues. Thus, to sustain the vireo, continued cowbird control and exotic plant removal in riparian areas are likely to be necessary for the foreseeable future. Confounding the issue of nest parasitism by cowbirds, new studies have questioned the use of cowbird trapping as the only management tool in recovering the vireo over the long-term, and additional research is needed to resolve this issue.

Although the vireo has not met the downlisting goals of the draft recovery plan for several hundred or more breeding pairs of vireo at all 11 identified sites, these goals were not habitat-based, and the overall population trend since the time of the listing for 10 of the 11 sites has been positive. Despite the ongoing threat of nest parasitism by cowbirds, the vireo population has increased by 10-fold since the time of its listing to an estimated 2,968 territories. Cowbird trapping is well established at Camp Pendleton and within the Prado Basin of the Santa Ana River, which support the two largest concentrations of vireo. Wholesale loss and degradation of riparian habitats has halted, and riparian habitat restoration efforts are ongoing. This suggests that the species is no longer in danger of extinction throughout all or a significant portion of its range and warrants reclassification to threatened status.

We are not recommending delisting of the vireo at this time because: 1) further research is needed to address the primary threat of cowbird parasitism on the long-term recovery of the vireo; 2) without intensive cowbird control at the main population sites, which is linked to section 7 consultations under the Act, or new evidence to suggest that vireo can persist without management intervention, vireo populations are likely to return to the low levels that necessitated its listing; 3) the PVA determined that there was no imminent threat of extinction to the vireo, but this was based on maintaining reproductive rates correlated with cowbird control; and 4) draft recovery goals established for delisting need further assessment based on current knowledge of population trends and species distribution throughout the State.

III. RESULTS

III.A. Recommended Classification: Downlist to threatened status.

III.B. New Recovery Priority Number:

9. Per our listing and recovery priority guidance for threatened or endangered species (48 FR 43098), the least Bell's vireo, as a subspecies with moderate degree of threat and a high recovery potential, has a recovery priority number of 9. Much of the past economic conflict has been alleviated within the vireo's current range through ESA section 7 consultations and regional HCPs.

III.C. If a reclassification is recommended, indicate the Listing and Reclassification

Priority Number (FWS only):

This species should be given a reclassification priority of "4," which indicates an unpetitioned action with a moderate management impact.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Complete a functional recovery plan for the vireo with realistic, objectively based recovery goals.

2. Provide funding and technical support for further studies investigating continuing threats to the vireo from cowbird parasitism, exotic plant invasion of riparian habitats, and potentially elevated predation pressures due to habitat fragmentation or presence of exotic predators (*i.e.*, domestic cats and Argentine ants).

3. Complete an assessment or support other efforts (such as the RHJV effort) to assess the amount and distribution of riparian habitat in California including:

    a. Establishment of baseline values for comparison to past and future estimates, including an assessment of various riparian habitat subtypes.

    b. An evaluation of changes in distribution and connectivity of riparian habitat at different stream-order levels (*i.e.*, primary, secondary, tertiary, *etc.*).

    c. An evaluation of the amount of riparian habitat restoration attempted and successfully completed since the listing, including restoration not driven by regulatory compliance.

4. Develop and implement:

    a. A systematic survey program to locate vireo re-colonizations of the Salinas, San Joaquin, and Sacramento Valleys so that appropriate management can be developed and implemented.

    b. Systematic survey programs for watersheds in southern California that are no longer regularly surveyed within a given 5-year period (*e.g.*, Dulzura Creek/Jamul Creek/Otay River, San Diego River, San Dieguito River/Santa Ysabel Creek, San Gabriel River, *etc.*). It is possible that these systematic surveys may need to rely on volunteer efforts organized and supported by the Service.

V. REFERENCES

Brown, B. 1993. Bell's Vireo. *In*: A. Poole, P. Stettenheim, and F. Gill, editors. The Birds of North America, No. 35. Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

Crooks, K., and M. Soule. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563–566.

Faber, P. (editor). 2003. California Riparian Systems: Processes and Floodplain Management, Ecology, and Restoration. 2001 Riparian Habitat and Floodplains Conference Proceedings, Riparian Habitat Joint Venture, Sacramento, California. Pickleweed Press, Mill Valley, California.

Fagan, W., E. Meir, and J. Moore. 1999. Variation thresholds for extinction and their implication for conservation strategies. The American Naturalist 154:510-520.

Famolaro, P. 2006. 2005 threatened and endangered species survey report. Unpublished report prepared the Sweetwater Authority for U. S. Fish and Wildlife Service, Carlsbad Field Office, Carlsbad, California.

Franzreb, K. 1987. Endangered status and strategies for conservation of the least Bell's vireo (*Vireo bellii pusillus*) in California. Western Birds 18:43-49.

__________. 1989. Ecology and Conservation of the Endangered Least Bell's Vireo. U. S. Fish and Wildlife Service, Biological Report 89(1). 17pp.

Gaffney, K., and K. Gledhill. 2003. Giant reed in the Russian River riparian zone: distribution, plant community effects and control methods. *In*: P. Faber, editor. California Riparian Systems: Processes and Floodplain Management, Ecology, and Restoration. Pp. 180-189. Pickleweed Press, Mill Valley, California.

Garrett, K. and J. Dunn. 1981. Birds of Southern California: status and distribution. The Artisan Press, Los Angeles, California.

Griffith, J. and J. Griffith. 2000. Cowbird control and the endangered least Bell's vireo: a management success story. *In*: J. Smith, T. Cook, S. Rothstein, S. Robinson, and S. Sealy, editors. Ecology and management of cowbirds and their hosts. Pp. 342-356. University of Texas Press, Austin, Texas.

Griffith Wildlife Biology. 2001. The status of the least Bell's vireo at Marine Corps Base Camp Pendleton in 2001. Unpublished draft report prepared for AC/S ES, Marine Corps Base Camp Pendleton (Contract No. M00681-99-C-0003). December 15, 2001. 21 pp. + 21 figures.

__________. 2004. 2003 Marine Corps Base Camp Pendleton Brown-headed cowbird control program. Unpublished final report prepared for AC/S ES, Marine Corps Base Camp Pendleton (Contract No. M00681-00-P-0566)

Grinnell, J., and A. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna No. 27.

Hays, L. 2006. U. S. Fish and Wildlife Service volunteer. Personal communication to P. Beck, Carlsbad Fish and Wildlife Office, California.

Hoffman, S., and R. Zembal. 2006. Status and management of the least Bell's vireo and southwestern willow flycatcher in the Santa Ana River Watershed. Unpublished report prepared by the Santa Ana Watershed Association for the Orange County Water District and the U. S. Fish and Wildlife Service. 56 pp.

Jones, B. 1985. The status of the least Bell's vireo on the San Diego, Sweetwater, and San Luis Rey Rivers, San Diego, California. Unpublished report to California Department of Fish and Game, 1416 9th St., Sacramento, California. [*In* Franzreb 1987].

Kus, B. 1999. Impacts of brown-headed cowbird parasitism on productivity of the endangered least Bell's vireo. Research and management of the brown-headed cowbird in western landscapes. Studies in Avian Biology 18:160-166.

__________. 2002. Least Bell's Vireo (*Vireo bellii pusillus*). *In*: The Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html

__________. 2006. Research Ecologist, Western Ecological Research Center, U. S. Geological Survey. Personal communication to P. Beck, Carlsbad Fish and Wildlife Office, California.

Kus, B. and P. Beck. 1998. Distribution and abundance of the least Bell's vireo (*Vireo bellii pusillus*) and the southwestern willow flycatcher (*Empidonax traillii extimus*) at selected southern California sites in 1997. Unpublished report prepared for the California Department of Fish and Game. 76 pp.

Kus, B., and M. Whitfield. 2005. Parasitism, productivity, and population growth: response of least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) to cowbird (*Molothrus* spp.) control. Ornithological Monographs 57:16-27.

Laymon, S. 1987. Brown-headed cowbirds in California: historical perspectives and management opportunities in riparian habitats. Western Birds 18:63-70.

Linton, C. 1908. Notes from Buena Vista Lake, May 20 to June 16, 1907. Condor 10:196-198.

Martin, T., and J. Clobert. 1996. Nest predation and avian life-history evolution in Europe versus North America: A possible role of humans? American Naturalist 147:1028-1046.

McGraw, D. 2006. Five-year literature review for the least Bell's vireo (*Vireo bellii pusillus*). Unpublished document produced under contract to the Carlsbad, California Office of the U. S. Fish and Wildlife Service, Department of the Interior. June 2006.

Natural Resources Conservation Service (NRCS). 2006. California district helps watershed look like its old self again. http://www.nrcs.usda.gov/news/thisweek/2004/041124/caarundodonax.html

Parker, T. 1999. Responses of Bell's vireos to brood parasitism by the brown-headed cowbird in Kansas. Wilson Bulletin 11:499-504.

Patten, M., G. McCaskie, and P. Unitt. 2003. Birds of the Salton Sea: Status, Biogeography, and Ecology. University of California Press, Berkeley, California.

Peer, B., S. Rothstein, M. Kuehn, and R. Fleischer. 2005. Host defenses against cowbird (*Molothrus* spp.) parasitism: implications for cowbird management. Ornithological Monographs 57:84-97.

Peterson, B. 2002. A multi-scale approach to nest predation of the least Bell's vireo (*Vireo bellii pusillus*). M.S. Thesis, San Diego State University. vii + 55 pp.

Peterson, B., B. Kus, and D. Deutschman. 2004. Determining nest predators of the least Bell's vireo through point counts, tracking stations, and video photography. Journal of Field Ornithology 75(1):89-95.

RECON (Regional Environmental Consultants). 1989. Comprehensive species management plan for the least Bell's vireo (*Vireo bellii pusillus*). Prepared for San Diego Association of Governments, San Diego.

Reisen, W., Y. Fang, H. Lothrop, V. Martinez, J. Wilson, P. O'Connor, R. Carney, B. Cahoon-Young, M. Shafii, and A. Brault. 2006. Overwintering of West Nile virus in southern California. Journal of Medical Entomology 43:344-355.

Riparian Habitat Joint Venture (RHJV). 2006. Website describing plans and objectives. http://www.prbo.org/calpif/htmldocs/rhjv/.

Rothstein, S. 1994. The cowbird's invasion of the Far West: history, causes and consequences experienced by host species. Studies in Avian Biology 15:301-315.

Rothstein, S. 2004. Brown-headed cowbird: villain or scapegoat? Birding 36: 372-381. [*In* Peer *et al.* 2005].

Sharp, B., and B. Kus. 2006. Factors influencing the incidence of cowbird parasitism of least Bell's vireos. Journal of Wildlife Management 70:682-690.

Spiegelberg, M. 1997. Investigation of extra-pair paternity in least Bell's vireo, *Vireo bellii pusillus*. M.S. Thesis, San Diego State University. v + 28 pp.

Suarez, A., D. Bolger, and T. Case. 1998. Effects of fragmentation and invasion on native ant communities in coastal southern California. Ecology 79:2041-2056.

Sweetwater Authority and USGS. 2006. Summary of brown-headed cowbird trapping for the southern California region, 2003 and 2004. Unpublished data compiled by P. Famolaro, Sweetwater Authority, and made available through the USGS Western Ecological Research Center, San Diego Field Station, San Diego, California.

Turell, M., M. O'Guinn, D. Dohm, J. Webb Jr., and M. Sardelis. 2002. Vector competence of *Culex tarsalis* from Orange County, California, for West Nile virus. Vector Borne Zoonotic Diseases 2:193-196.

U. S. Fish and Wildlife Service (Service). 1998. Draft Recovery Plan for the Least Bell's Vireo. Fish and Wildlife Service, Portland, Oregon. 139 pp.

U. S. Geological Survey (USGS). 2006. Least Bell's vireo distribution and abundance: Summary Tables for 2000 through 2004. Unpublished data compiled by and available from the USGS Western Ecological Research Center, San Diego Field Station, San Diego, California.

U. S. Marine Corps. 2001. Integrated Natural Resource Management Plan, Marine Corps Base and Marine Corps Air Station Camp Pendleton. October 2001.

Zembal, R., J. Pike, and L. Hays. 2003. The least Bell's vireos and southwestern willow flycatchers in Prado Basin of the Santa Ana River Watershed, CA. *In*: Faber, P., editor. California Riparian Systems: Processes and Floodplain Management, Ecology, and Restoration. Pp. 35-48. Pickleweed Press, Mill Valley, California.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Least Bell's Vireo (*Vireo bellii pusillus*)

Current Classification: endangered

Recommendation resulting from the 5-Year Review:

_X_ Downlist to Threatened

____ Uplist to Endangered

____ Delist

____ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: 4

Review Conducted By: Karen Geobel, Gjon Hazard and Peter Beck

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve ______________________ Date 9-21-06

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve ______________________ Date 9/26/2006

EXHIBIT 3

November 17, 2015

Stacey Love
Recovery Permit Coordination
United States Fish and Wildlife Service
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

SUBJECT: 2015 FOCUSED SURVEY REPORT FOR WESTERN YELLOW-BILLED CUCKOO AT THE DEVIL'S GATE RESERVOIR, LOS ANGELES COUNTY, CALIFORNIA

Dear Ms. Love:

Chambers Group, Inc. (Chambers Group) biologists conducted focused surveys for western yellow-billed cuckoo (*Coccyzus americanus*, WYBC) during the breeding season of 2015 for the Devil's Gate Reservoir Sediment Removal and Management Project located in the City of Pasadena, Los Angeles County, California. The results of the surveys are presented in this letter report.

SURVEY LOCATION

The survey area is located in the Devil's Gate Reservoir in the city of Pasadena in Los Angeles County, California, on Assessor's Parcel Numbers 5823015902, 5823004900, 5823003911, 5823003910, 5823003907, 5823003909, and 5823031900. Devil's Gate Reservoir is found in the La Cañada, San Pascual-Grafias, and San Rafael special survey areas in the California United States Geological Survey (USGS) 7.5-minute *Pasadena* topographic quadrangle. A map of the survey area is provided in Attachment 1.

WESTERN YELLOW-BILLED CUCKOO NATURAL HISTORY

The western yellow-billed cuckoo (nesting) is a federally-listed threatened and a state-listed endangered species. The WYBC is found primarily in the Eastern United States, but this subspecies is an extremely rare and localized summer resident of the southwestern U.S. Historically, it was found commonly throughout the Central Valley and California coastline until the early 20th century. It is a medium-sized bird with a brown back, a yellow, decurved bill, and a long grey-brown tail with distinctive white spots on the outer retrices. This species primarily inhabits mature, open riparian woodlands along the broad, lower flood-bottoms of larger river systems. Habitat features usually include some relatively open patches and intermixed low, dense, scrubby vegetation typical of these watercourses. In the southwestern U.S., the western WYBC also occupies desert riparian woodlands composed of willows (*Salix* spp.), Fremont cottonwoods (*Populus fremontii*), and dense mesquite (*Prosopis* spp.). It typically nests in willows and forages more so among the cottonwoods and other trees. Its diet includes caterpillars, grasshoppers, other large insects, frogs, and some small lizards. Populations of the western WYBC in California were decimated before the mid-20th century by the extensive loss of riparian habitat to agriculture and development as well as by heavy pesticide use, and have not rebounded since that time (Hughes 1999).

In California, breeding populations of greater than five pairs which persist every year are currently limited to the Sacramento River from Red Bluff to Colusa, and the South Fork Kern River from Isabella Reservoir to Canebrake Ecological Reserve. Other sites where small populations of cuckoos (<5 pairs) breed or possibly breed (but not necessarily every year) are: The Feather River from Oroville to Verona, Butte, Yuba and Sutter counties; the Prado Flood Control Basin, San Bernardino and Riverside counties; the Amargosa River near Tecopa, Inyo Co.; the Owens Valley near Lone Pine and Big Pine, Inyo Co.; the Santa Clara River near Santa Clarita, Los Angeles Co.; the Mojave River near Victorville, San Bernardino Co.; and the Colorado River from Needles, San Bernardino Co. to Yuma, Imperial Co. (Laymon 1998).

METHODS

Focused surveys were conducted within habitat that was determined to be suitable for WYBC by the surveying biologist in 2015 (Attachment 2).

Breeding season WYBC surveys were conducted by United States Fish and Wildlife Service (USFWS)-permitted biologist John Griffith (TE-758175). Survey methodology followed the WYBC survey protocol (Halterman et al 2015). Each survey was conducted during favorable weather conditions to maximize detection probability.

A permitted biologist was not secured until July, after the first survey pass window was closed. After consultation with LACDPW and the USFWS, it was decided to proceed with the remaining 3 survey passes, on a slightly altered schedule (2 surveys in August, 10 day periods between surveys instead of 12 to 15 days). The USFWS advised that the three surveys would not be formally accepted as determining WYBC absence; however, if the species was observed, the “present” status would be accepted/established. In addition, one survey was conducted on June 24 during the first survey pass; however, the survey was not conducted by a permitted biologist and therefore was not considered a protocol level survey.

All surveys were conducted on foot by looking and listening for the target species in all suitable riparian habitat within the survey area and a 500-foot buffer (Attachment 2).

Observations of the songs, scolds, whisper calls, flight patterns, behaviors, and plumage characteristics were used in conjunction to ascertain presence/absence of WYBC. The biologist conducted the surveys from optimal stationary locations to see and hear the target species without harming any other wildlife species in the area.

Permitted biologists used prerecorded WYBC vocalizations to elicit WYBC within and/or adjacent to all suitable habitat for 5 minutes (a short call with a 50-55 second listening period repeated 5 times) at 100 meter intervals across the length and breadth of the suitable habitat. If a WYBC was detected, the taped vocalization broadcast was ceased at that location, and the location, numbers, status, and demographic data of the target species were recorded.

All observed wildlife species were recorded for each survey day, all sensitive wildlife species incidentally observed were recorded and corresponding GPS points were mapped (Attachments 3 and 4).

RESULTS

Survey Conditions

Survey conditions are presented in Table 1.

Table 1. Survey Conditions

Date	Surveyor	Time		Temperature*		Wind**		Cloud Cover		Precipitation	
		Start	End	Start	End	Start	End	Start	End	Start	End
07/25/15	John Griffith	5:35 A.M.	11:00 A.M.	61	85	0	2	0%	0%	0	0
08/04/15	John Griffith	5:15 A.M.	11:00 A.M.	64	83	0	1	25%	95%	0	0
08/14/15	John Griffith	5:35 A.M.	11:20 A.M.	65	96	0	0	0%	0%	0	0

*All temperature readings are in Fahrenheit
**All wind readings are in miles per hour

No WYBC were detected within the survey area during the 2015 surveys.

Other Sensitive Species

Least Bell's vireo

Two least Bell's vireo (*Vireo belli pusillus*; LBVI) family groups were incidentally observed during the August 14 survey (Attachment 3). The LBVI is both a state and federally listed endangered species. The LBVI observed included one likely family group (one adult singing male with two juveniles, 3 birds total) and one family group or possibly a juvenile group (either an adult with one or more juveniles, or 2-3 juveniles).

Southwestern willow flycatcher

One southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL) family group was incidentally observed during the last survey conducted on August 14 (Attachment 3). The SWFL is listed as both federally and state endangered. The family group included one or more adults and one or more young of the year (3 birds total in the group observed).

Yellow Warbler

Nine male yellow warblers (*Setophaga petechia*) were incidentally observed during all three surveys conducted (Attachments 3). The yellow warbler is a state Species of Special Concern (SSC).

Yellow-breasted Chat

Two male yellow-breasted chats (*Icteria virens*) were incidentally observed. The individuals were observed during the first two surveys conducted on July 25 and August 4 (Attachment 3). The yellow-breasted chat is a state Species of Special Concern (SSC).

CONCLUSIONS

No western yellow-billed cuckoo were found within the survey area during the 2015 focused surveys. Several least Bell's vireo, southwestern willow flycatcher, and yellow warbler individuals were observed incidentally. One yellow-breasted chat was observed incidentally.

Please contact me at (949) 261-5414 ext. 7232 if you have any questions or concerns regarding these results.

Sincerely,

CHAMBERS GROUP, INC.

Heather Franklin
Staff Biologist

ENCLOSURES

Attachment 1 – Survey Location
Attachment 2 – Suitable Habitat
Attachment 3 – Sensitive Species Locations Map
Attachment 4 – Wildlife Species Observed

REFERENCES

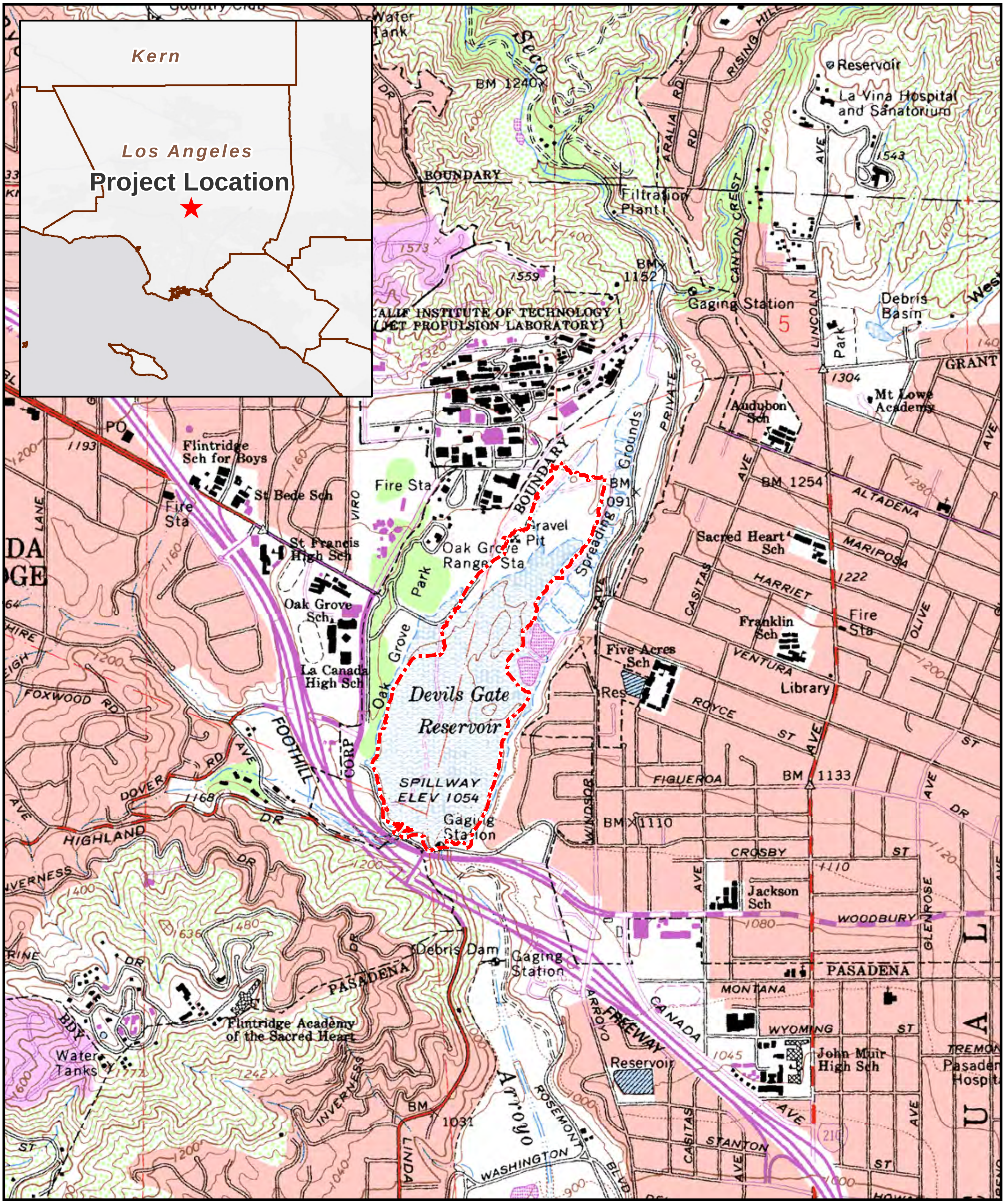
California Department of Fish and Wildlife (CDFW)
2013 California Natural Diversity Database, Rarefind 4. Biogeographic Data Branch, Sacramento, CA.

Halterman, M., M.J. Johnson, J.A. Holmes and S.A. Laymon.
2015 A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo: U.S. Fish and Wildlife Techniques and Methods, 45 p.

Hughes, J. M.
1999 Yellow-billed Cuckoo (*Coccyzus americanus*). In The Birds of North America, No. 418 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Laymon, S. A.
1998. Yellow-billed Cuckoo (*Coccycus americanus*). *In* The Riparian Bird Conservation Plan: A strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html

ATTACHMENT 1 – SURVEY LOCATION



Legend

Survey Area

N

0 500 1,000 2,000

Feet

Attachment 1

Devil's Gate Reservoir Sediment Removal and Management Project

Survey Location

Name: 20767 Attach 1 Survey Location.Mxd

Print Date: 12/22/2014, Author: phuls

CHAMBERS GROUP

ATTACHMENT 2 – SUITABLE HABITAT

Legend

Photo Point (with direction)

Yellow-Billed Cuckoo Suitable Habitat

Survey Area

N

0 250 500 1,000
Feet

Attachment 2

Devil's Gate Reservoir Sediment Removal and Management Project

YBCU 2015 Suitable Habitat

Name: 20767 Attach 2 YBCU Suit Habitat.Mxd
Print Date: 9/16/2015, Author: msimmons

CHAMBERS GROUP

ATTACHMENT 3 – SENSITIVE SPECIES LOCATIONS MAP

Legend

Survey Area

Yellow-Billed Cuckoo Suitable Habitat

Sensitive Species Observations

Least Bell's Vireo

Willow Flycatcher

Yellow Warbler

Yellow-breasted Chat

N

0 250 500

Feet

Attachment 3

Devil's Gate Reservoir Sediment Removal and Management Project

YBCU 2015 Survey Results

Name: 20767 Attach 3 YBCU Survey Results.Mxd

Print Date: 9/23/2015, Author: msimmons

ATTACHMENT 4 – WILDLIFE SPECIES OBSERVED

Attachment 4. Wildlife Species Observed

order	family	subfamily	*Genus*	*species*	English name
ANSERIFORMES					
		Anatinae			
			Anas	***platyrhynchos***	Mallard.
GALLIFORMES					
	ODONTOPHORIDAE				
			Callipepla	***californica***	California Quail.
CICONIIFORMES					
	ARDEIDAE				
			Ardea	***herodias***	Great Blue Heron.
			Butorides	***virescens***	Green Heron.
	CATHARTIDAE				
			Cathartes	***aura***	Turkey Vulture.
FALCONIFORMES					
	ACCIPITRIDAE				
		Accipitrinae			
		CSC-3	***Accipiter***	***cooperii***	Cooper’s Hawk.
			Buteo	***lineatus***	Red-shouldered Hawk.
			Buteo	***jamaicensis***	Red-tailed Hawk.
	FALCONIDAE				
		Falconinae			
			Falco	***sparverius***	American Kestrel.
CHARADRIIFORMES					
		Charadriinae			
			Charadrius	***vociferus***	Killdeer.
	SCOLOPACIDAE				
		Scolopacinae			
			Tringa	***melanoleuca***	Greater Yellowlegs.
COLUMBIFORMES					
	COLUMBIDAE				
			Columba	***livia***	Rock Pigeon.
			Zenaida	***macroura***	Mourning Dove.
CUCULIFORMES					
	CUCULIDAE				
		Neomorphinae			
			Geococcyx	***californianus***	Greater Roadrunner.
APODIFORMES					
	APODIDAE				
		Apodinae			
			Aeronautes	***saxatalis***	White-throated Swift.
	TROCHILIDAE				
		Trochilinae			
			Archilochus	***alexandri***	Black-chinned Hummingbird.
			Calypte	***anna***	Anna’s Hummingbird.
			Selasphorus	***sasin***	Allen's Hummingbird.
PICIFORMES					
	PICIDAE				
		Picinae			
			Picoides	***nuttallii***	Nuttall's Woodpecker.
			Picoides	***pubescens***	Downy Woodpecker.
			Melanerpes	***formicivorus***	Acorn Woodpecker.
PASSERIFORMES					
		Fluvicolinae			
		FE	***Empidonax***	***traillii extimus***	Southwestern Willow Flycatcher.
			Empidonax	***difficilis***	Pacific-slope Flycatcher.
			Sayornis	***nigricans***	Black Phoebe.
			Sayornis	***saya***	Say's Phoebe.
		Tyranninae			
			Myiarchus	***cinerascens***	Ash-throated Flycatcher.
			Tyrannus	***vociferans***	Cassin's Kingbird.

order	family	subfamily	Genus	species	English name
	VIREONIDAE				
		FE	***Vireo***	***bellii pusillus***	Least Bell's Vireo.
			Vireo	***huttoni***	Hutton's Vireo.
			Vireo	***gilvus***	Warbling Vireo.
	CORVIDAE				
			Aphelocoma	***californica***	Western Scrub-Jay.
			Corvus	***brachyrhynchos***	American Crow.
			Corvus	***corax***	Common Raven.
	ALAUDIDAE				
			Eremophila	***alpestris***	Horned Lark.
	HIRUNDINIDAE				
		Hirundininae			
			Tachycineta	***bicolor***	Tree Swallow.
			Stelgidopteryx	***serripennis***	Northern Rough-winged Sw.
			Petrochelidon	***pyrrhonota***	Cliff Swallow.
			Hirundo	***rustica***	Barn Swallow.
	AEGITHALIDAE				
			Psaltriparus	***minimus***	Bushtit.
	TROGLODYTIDAE				
			Thryomanes	***bewickii***	Bewick's Wren.
			Troglodytes	***aedon***	House Wren.
	TURDIDAE				
			Sialia	***mexicana***	Western Bluebird.
			Catharus	***ustulatus***	Swainson's Thrush.
			Turdus	***migratorius***	American Robin.
	TIMALIIDAE				
			Chamaea	***fasciata***	Wrentit.
	MIMIDAE				
			Mimus	***polyglottos***	Northern Mockingbird.
			Toxostoma	***redivivum***	California Thrasher.
	PTILOGONATIDAE				
			Phainopepla	***nitens***	Phainopepla.
	PARULIDAE				
			Vermivora	***celata***	Orange-crowned Warbler.
			Dendroica	***petechia***	Yellow Warbler.
			Geothlypis	***trichas***	Common Yellowthroat.
			Wilsonia	***pusilla***	Wilson's Warbler.
			Icteria	***virens***	Yellow-breasted Chat.
	EMBERIZIDAE				
			Pipilo	***maculatus***	Spotted Towhee.
			Pipilo	***crissalis***	California Towhee.
			Melospiza	***melodia***	Song Sparrow.
	CARDINALIDAE				
			Pheucticus	***melanocephalus***	Black-headed Grosbeak.
	ICTERIDAE				
			Molothrus	***ater***	Brown-headed Cowbird.
			Icterus	***cucullatus***	Hooded Oriole.
			Icterus	***bullockii***	Bullock's Oriole.
	FRINGILLIDAE				
		Carduelinae			
			Carpodacus	***purpureus***	Purple Finch.
			Carpodacus	***mexicanus***	House Finch.
			Carduelis	***psaltria***	Lesser Goldfinch.
			Carduelis	***tristis***	American Goldfinch.
				Total	64

EXHIBIT 4

Ornithological Monographs
Volume (2005), No. 57, 16–27

CHAPTER 2

PARASITISM, PRODUCTIVITY, AND POPULATION GROWTH: RESPONSE OF LEAST BELL'S VIREOS (*VIREO BELLII PUSILLUS*) AND SOUTHWESTERN WILLOW FLYCATCHERS (*EMPIDONAX TRAILLII EXTIMUS*) TO COWBIRD (*MOLOTHRUS* SPP.) CONTROL

Barbara E. Kus[1,3] and Mary J. Whitfield[2]

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Abstract.—Cowbird (*Molothrus* spp.) control is a major focus of recovery-oriented management of two endangered riparian bird species, the Least Bell's Vireo (*Vireo bellii pusillus*) and Southwestern Willow Flycatcher (*Empidonax traillii extimus*). During the past 20 years, annual trapping of cowbirds at Least Bell's Vireo and Southwestern Willow Flycatcher breeding sites has eliminated or reduced parasitism in comparison with pretrapping rates and, thereby, significantly increased seasonal productivity of nesting pairs. Enhanced productivity, in turn, has resulted in an 8-fold increase in numbers of Least Bell's Vireos; Southwestern Willow Flycatcher abundance, however, has changed little, and at some sites has declined despite cowbird control. Although generally successful by these short-term measures of host population response, cowbird control poses potential negative consequences for long-term recovery of endangered species. As currently employed, cowbird control lacks predetermined biological criteria to trigger an end to the control, making these species' dependence on human intervention open-ended. Prolonged reliance on cowbird control to manage endangered species can shift attention from identifying and managing other factors that limit populations—in particular, habitat availability. On the basis of our analysis of these long-term programs, we suggest that cowbird control be reserved for short-term crisis management and be replaced, when appropriate, by practices emphasizing restoration and maintenance of natural processes on which species depend.

Resumen.—El manejo orientado hacia la recuperación de dos especies de aves ribereñas *Vireo belli pusillus* y *Empidonax trailli extimus* se ha focalizado principalmente en el control de los *Molothrus* spp parásitos. Durante los pasados 20 años, la captura anual de los *Molothrus* en las áreas de nidificación de *Vireo belli pusillus* y *Empidonax trailli extimus* ha eliminado o reducido el parasitismo en comparación con las tasas previas a la captura y, en consecuencia, ha incrementado significativamente la productividad estacional de las parejas reproductivas. Ese mejora en productividad, a su vez, ha resultado en que el número de *Vireo belli pusillus* se incrementara 8 veces. La abundancia de *Empidonax trailli extimus* en cambio, ha variado poco, e incluso en algunos sitios, se ha reducido a pesar del control de los *Molothrus*. Aunque aparentemente el control de *Molothrus* fue exitoso por los resultados obtenidos a corto plazo, el control de los *Molothrus* posee consecuencias potencialmente negativas para la recuperación a largo plazo de las especies en peligro. De la forma en que es actualmente aplicado, el control de los *Molothrus* carece de criterios biológicos predeterminados que permitan dejar de aplicarlo. Esto implica que las especies que se quiera proteger dependan eternamente de la intervención humana. El hecho de que que el manejo de las especies en peligro se base en la dependencia prolongada en el control de los *Molothrus* podría distraer la atención sobre la identificación y el manejo de otros factores que limitan dichas poblaciones- en particular, la disponibilidad de hábitat. Basándonos en nuestro análisis de estos programas a largo plazo, sugerimos que el

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control de *Molothrus* quede reservado para las crisis de manejo de corto plazo. Cuando fuera apropiado, es de esperar que dicho manejo sea reemplazado por prácticas enfatizadas hacia la restauración y el mantenimiento de los procesos naturales de los cuales esas especies en realidad dependen.

Least Bell's Vireo (*Vireo bellii pusillus*; hereafter "vireo") and Southwestern Willow Flycatcher (*Empidonax traillii extimus*; hereafter "flycatcher") are two federally endangered passerines that have been managed with cowbird (*Molothrus* spp.) control for the better part of the past two decades. Along with Kirtland's Warbler (*Dendroica kirtlandii*; DeCapita 2000), the vireo was one of the earliest endangered species for which cowbird control formed a prominent component of recovery-oriented management, providing a model for management of other parasitized species, such as the Black-capped Vireo (*V. atricapilla*; Hayden et al. 2000) and the flycatcher (U.S. Fish and Wildlife Service [USFWS] 2002). That, in turn, has stimulated interest in the use of cowbird control to enhance populations of riparian birds in general, many of which are major cowbird hosts (e.g. Griffith and Griffith 2000). Because managers are increasingly considering the use of cowbird control as a tool for protecting sensitive birds, it is essential that the results of established control programs and their efficacy be made available to inform their decision making. Here, we evaluate the effectiveness of cowbird control for increasing populations of vireos and flycatchers, expanding and updating earlier assessments (Whitfield et al. 1999, Griffith and Griffith 2000, Whitfield 2000), and comment on the role of cowbird management in recovery of endangered species.

Study Species

Vireos and flycatchers share many similarities in life histories and population trends over the past half-century (Brown 1993; USFWS 1998, 2002; Sedgwick 2000). Both species are riparian obligates, limited during the breeding season to dense shrubby vegetation along the margins of rivers and lakes. Predation accounts for approximately 20–50% of nest failures annually, and pairs of both species typically attempt 1–3 nests in a season (Kus 1999, Griffith and Griffith 2000, Whitfield 2000). Breeding-site fidelity is high in both species, and vireos and flycatchers have a similar life expectancy of 1–3 years.

Despite these similarities, vireos and flycatchers differ in their vulnerability to cowbird parasitism. Vireos begin nesting approximately two weeks before the arrival of locally breeding cowbirds; thus, the earliest nesting pairs can avoid parasitism (Kus 1999). In contrast, the flycatchers' breeding season in California completely overlaps the period of cowbird laying (mid-April to late July), and flycatchers are one of the few hosts still nesting by late summer. Male vireos participate in all aspects of nesting, including nest construction and incubation, and often sing from the nest; whereas male flycatchers' contribution is largely limited to feeding nestlings, and they are generally quiet around nest sites, which may reduce parasitism (Uyehara and Narins 1995). Vireos cannot fledge their own young from nests in which cowbirds hatch (Kus 1999), but flycatchers sometimes do so (Whitfield and Sogge 1999).

Vireos and flycatchers were considered common and widespread by late-19th-century and early-20th-century naturalists (Mearns 1890, Behle 1943, Grinnell and Miller 1944, Oberholser 1974, J. Hubbard unpubl. data). By the 1950s, both species were declining concurrently with widespread habitat loss and degradation, as agriculture, grazing, flood control, aggregate extraction, and urbanization reduced southwestern U.S. riparian forests to 5% of their former extent (Goldwasser et al. 1980, Unitt 1987). Cowbird parasitism probably played a secondary role in these declines, as vireo and flycatcher populations became small, fragmented, and unable to withstand heavy parasitism (Whitfield and Sogge 1999). Vireos were particularly susceptible to parasitism, with 100% of nests parasitized in some populations (Goldwasser et al. 1980). Parasitism was also high among flycatcher nests (Hanna 1928, Unitt 1987). When the vireo was listed as endangered under the Federal Endangered Species Act in 1986, its population included only 300 males and was restricted to a few southern California drainages (USFWS 1998). Flycatchers were listed in 1995, at which time they still occupied most of their historic range but in much reduced numbers (Marshall 2000), with a rangewide population of ~350 territories in seven states (USFWS 2002).

Recovery plans for the vireo and flycatcher both emphasize the need to arrest and reverse the loss of riparian habitat throughout the southwest through preservation and restoration of remaining sites. However, they differ in their treatment of the need for cowbird management and its role in eventual species de-listing. The plan for the vireo, in its second draft but still not approved by USFWS, calls for reduction or elimination of threats "so that Least Bell's Vireo populations/metapopulations…are capable of persisting without significant intervention, or perpetual endowments are secured for cowbird trapping and exotic plant control in riparian habitat occupied by Least Bell's Vireos" (USFWS 1998, p. v). The recovery plan for the flycatcher, approved in 2002, takes a more conservative approach to cowbird control, recommending it only after baseline data document a parasitism frequency of more than 20–30% of nests for two or more successive years in the population under consideration (USFWS 2002).

Methods

We evaluated vireo and flycatcher responses to cowbird control using a combination of published and new information. We supplemented data reported for vireos at Marine Corps Base Camp Pendleton, California (Camp Pendleton) in 1981–1996 (Griffith and Griffith 2000) and flycatchers at the South Fork Kern River, California (Kern) in 1989–1997 (Whitfield et al. 1999, Whitfield 2000) with data collected at these sites in recent years, and we updated analyses comparing pre- and postcontrol parasitism frequencies and host responses. We assessed the generality of results from the two sites by expanding the analyses to include additional vireo and flycatcher populations (see below), and extended earlier investigations by performing new analyses quantifying the effect of parasitism on annual productivity of both vireos and flycatchers.

Study sites.—Our assessment draws on data from long-term studies at four California sites. In addition to Camp Pendleton and the Kern River, described in detail in Griffith and Griffith (2000b) and Whitfield et al. (1999), respectively, we analyzed data from a 16-km reach of the San Luis Rey River (Kus 1999) and a 5-km reach of the San Diego River upstream of Padre Dam in San Diego County. Breeding flycatchers occur at Kern River and at Camp Pendleton, whereas vireos nest at Camp Pendleton, the San Luis Rey, and San Diego rivers.

The four sites represent the range of conditions under which breeding vireos and flycatchers occur in California. The Kern River and Camp Pendleton are relatively large and undeveloped sites, in contrast to the San Luis Rey River, which is bordered by roads, residential and commercial developments, agricultural fields, pastures, and golf courses, all of which have increased in extent over the study period. The San Diego River site is intermediate to these sites with regard to land use, with half the narrow riparian corridor bordered by native upland vegetation and the other half lying within an urban setting.

Population size and nest monitoring.—Vireo and flycatcher numbers were determined through area searches of all riparian habitat within specified study areas. When accompanied by nest monitoring, surveys were performed at least weekly to determine the status (paired, single–floater, migrant–transient) of each bird detected and to document the nesting activities of all breeding birds (Kus 1999, Whitfield et al. 1999, Griffith and Griffith 2000). Nests were located, and their contents checked periodically, more often early in the cycle, when cowbirds are likely to deposit eggs in nests. Any cowbird eggs found in vireo or flycatcher nests were removed or addled, taking care to leave a clutch of at least two eggs whenever possible to deter abandonment (Kus 1999). Pairs were monitored throughout the breeding season to allow determination of annual nesting effort and success, parasitism frequencies, and pair productivity.

Surveys of vireos and flycatchers at Camp Pendleton have been performed each year since 1981, though surveys in 1992–1994 were less intense and are not analyzed here (Table 1). Nest monitoring was conducted for vireos in 1981–1991 and 1995–2002 and for flycatchers in 1999–2003. Vireos at the San Luis Rey River were monitored in 1984, 1986 (B. Jones unpubl. data), and annually since 1988 (except for 1997, 1998, and 2002). Monitoring data for the San Diego River vireo population were collected in 1984 (B. Jones unpubl. data), 1986 (G. Collier and B. Jones unpubl. data), and 1987–1996. At the Kern River, flycatcher surveys and nest monitoring have been conducted every year since 1989.

Cowbird control.—Cowbirds were removed from vireo and flycatcher breeding sites through annual trapping, as described in Whitfield et al. (1999) and Griffith and Griffith (2000). Cowbird trapping at vireo nesting sites was conducted between mid-March and late July, whereas trapping at flycatcher sites began in May.

Cowbird trapping was initiated at Camp Pendleton in 1983 and at the San Diego River in 1987; trapping continued at both sites throughout the study period (Table 1). Trapping was conducted annually at the

Table 1. Annual rates of parasitism and productivity of Least Bell's Vireos and Southwestern Willow Flycatchers at four California sites, 1981–2003.

Site	Year	Cowbird control?	Number of pairs monitored	Number of nests with eggs	Percentage of nests parasitized	Number of fledglings per pair	Source
			Least Bell's Vireos				
San Diego	1984	No	18 [a]	25	80	0.2	b
	1986	No	21	40	33	1.6	c
	1987	Yes	21	29	0	2.9	d
	1988	Yes	28	44	2	3.6	d
	1989	Yes	25	38	11	3.3	d
	1990	Yes	24	37	22	2.7	d
	1991	Yes	27	42	29	1.7	d
	1992	Yes	24	46	26	2.2	d
	1993	Yes	28	61	7	4.5	d
	1994	Yes	32	62	8	2.7	d
	1995	Yes	37	56	9	2.3	d
	1996	Yes	30	43	0	2.9	d
San Luis Rey	1984	No	8 [e]	11	64	0.3	b
	1986	No	18	37	62	0.9	b
	1988	Yes	38	75	28	1.9	d
	1989	Yes	25	29	38	1.4	d
	1990	Yes	27	45	42	2.2	d
	1991	Yes	35	61	28	2.3	d
	1992	Yes	51	102	41	2.0	d
	1993	Yes	60	84	37	1.3	d
	1994	Yes	68	104	32	1.7	d
	1995	Yes	71	79	22	1.5	d
	1996	Yes	66	72	21	2.4	d
	1999	No	74	89	46	1.5	d
	2000	No	97	115	31	1.7	d
	2001	No	70	119	24	2.5	d
	2003	No	58	125	56	1.4	d
Pendleton	1981	No	14	15	47	0.6	f
	1982	No	48 [g]	93	47	2.1	f
	1983	Yes	54	86	10	2.9	f
	1984	Yes	63	78	18	1.6	f
	1985	Yes	66	26	4	3.2	f
	1986	Yes	68	32	6	2.7	f
	1987	Yes	97	70	17	2.6	f
	1988	Yes	175	244	1	2.7	b
	1989	Yes	129	166	1	3.5	h
	1990	Yes	156	151	1	3.0	h
	1991	Yes	133	124	0	3.0	h
	1995	Yes	60	89	1	2.4	i
	1996	Yes	60	74	0	2.1	h
	1997	Yes	60	81	0	2.8	h
	1998	Yes	59	89	0	2.2	h
	1999	Yes	53	82	0	2.1	h
	2000	Yes	58	80	0	2.9	h
			Southwestern Willow Flycatchers				
Kern	1989	No	30	34	50	0.8	j
	1990	No	30	38	61	0.7	j
	1991	No	31	45	78	0.8	j
	1992	Yes	24	36	69	1.4	j
	1993	Yes	26	33	38	1.4	j

TABLE 1. Continued.

Site	Year	Cowbird control?	Number of pairs monitored	Number of nests with eggs	Percentage of nests parasitized	Number of fledglings per pair	Source
Kern	1994	Yes	24	32	16	1.8	j
	1995	Yes	23	34	19	1.7	j
	1996	Yes	28	29	11	2.1	j
	1997	Yes	38	51	20	1.0	j
	1998	Yes	25	31	3	1.6	d
	1999	Yes	23	29	21	1.1	d
	2000	Yes	12	19	0	1.2	d
	2001	Yes	11	13	23	1.4	d
	2002	Yes	13	16	25	1.2	d
	2003	Yes	15	26	20	2.8	d
Pendleton	2000	Yes	10	8	0	2.3	d
	2001	Yes	18	29	0	1.9	d
	2002	Yes	16	29	0	1.5	d
	2003	Yes	16	25	0	2.9	d

[a] Includes data from five territories 3 km upriver of study site.
[b] B. Jones unpubl. data.
[c] G. Collier and B. Jones unpubl. data.
[d] Present study.
[e] Includes data from eight territories 2 km downriver of study site.
[f] L. Salata unpubl. data.
[g] Includes six pairs 3 km upriver of study site.
[h] Griffith and Griffith 2000, J. C. Griffith and J. T. Griffith unpubl. data.
[i] B. Kus unpubl. data.
[j] Whitfield et al. 1999, M. Whitfield and E. Cohen unpubl. data.

San Luis Rey River from 1988 to 1998, but historically it has been insufficient to eliminate parasitism at the site (Kus 1999). No trapping has been performed there since 1998. Cowbird control was initiated at the Kern River site in 1992 with shooting of cowbirds and expanded in 1994 to include seven traps.

Analyses.—We analyzed the effect of parasitism on vireo and flycatcher productivity using linear regression to evaluate the number of young fledged per pair as a function of annual parasitism frequency, combining data from all years. We calculated parasitism frequency, or the proportion of nests parasitized, using only nests observed with eggs; we excluded nests that failed before egg-laying had been confirmed and nests not located but known by detection of family groups. Although it is unlikely that nests in the latter group were parasitized, we excluded them to avoid a potential underestimate of parasitism created by the possible nondetection of unsuccessful nests, some of which could have been parasitized. Seasonal productivity was defined as total number of young produced per pair, including young fledged from nests not located. Possible nondetection of unsuccessful nests does not affect the calculation, because seasonal productivity is a function of successful nesting and is independent of the number of nest attempts. We obtained data for calculations from original sources of information reported in Griffith and Griffith (2000) for 1981–1996 to ensure consistency with our definitions. Data were analyzed separately for each site. A general linear model was used to test for homogeneity of slopes and to determine the statistical legitimacy of pooling across sites.

We assessed the effectiveness of trapping for reducing parasitism frequency by comparing pre- and post-trapping averages at each site using independent-sample one-tailed t-tests, predicting that post-trapping parasitism frequencies would be lower. In the same manner, we compared pre- and postcontrol levels of seasonal productivity, expecting to see an increase in that parameter after control was initiated. Finally, we present data from annual surveys to evaluate population growth of vireos and flycatchers in response to cowbird control.

All statistical analyses were performed with SYSTAT 10, with significance set at $P \leq 0.05$. Means are reported ± SD.

RESULTS

Effect of parasitism on productivity.—Seasonal productivity of vireos was inversely related to parasitism frequency at all three sites. At the San Diego River, where parasitism ranged from 0 to 80% between 1984 and 1996, 71% of the variability in seasonal productivity was explained by parasitism (Fig. 1A; $F = 24.8$, df = 1 and 10,

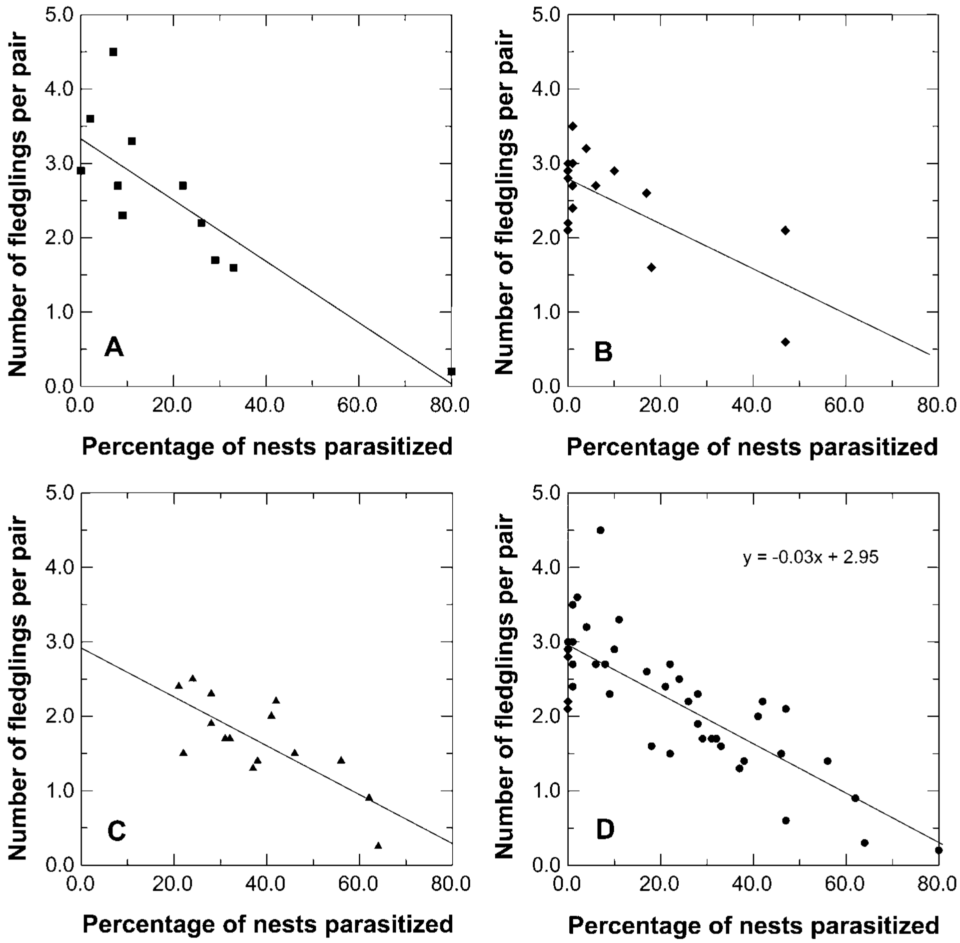

Fig. 1. Seasonal productivity of Least Bell's Vireos as a function of annual parasitism rate at (A) the San Diego River, (B) Camp Pendleton, (C) the San Luis Rey River, and (D) the three sites combined.

n = 12 years, P = 0.001). The effect of cowbirds on vireo productivity was similar at Camp Pendleton, where parasitism explained 62% of the variability in seasonal production of young between 1981 and 2000 (Fig. 1B; F = 11.8, df = 1 and 15, n = 17 years, P = 0.004). Parasitism was considerably higher at the San Luis Rey River than at the other two sites, ranging from 21% to 64% over the 20-year study period; nevertheless, vireo productivity increased with decreasing cowbird parasitism even at these high levels of parasitism (Fig. 1C; r^2 = 0.58, F = 17.9, df = 1 and 13, n = 15 years, P = 0.001). Finding no significant difference between the slopes of the three regression lines (F = 0.7, df = 2, n = 44 site-years, P = 0.53), we combined the data to determine the effect of parasitism on productivity over the full range of parasitism levels observed throughout the vireo's range, and found that parasitism explained 65% of the interannual variability in production of vireo young (Fig. 1D; F = 77.7, df = 1 and 42, n = 44 site-years, P < 0.001). Annual productivity of vireos increased by one young for each drop of 30% in parasitism frequency.

Like vireos, flycatchers at the Kern River exhibited a decline in productivity with increasing parasitism, though the relationship was not quite significant (Fig. 2; r^2 = 0.23, F = 4.0, df = 1 and 13, n = 15 years, P = 0.07). No parasitism of flycatchers occurred at Camp Pendleton during the study period, and flycatchers fledged 1.5–2.9 young per year (Fig. 2). Data from the Kern show that, over a wide range of parasitism from 0 to nearly 80% of nests, 23% of the annual variability

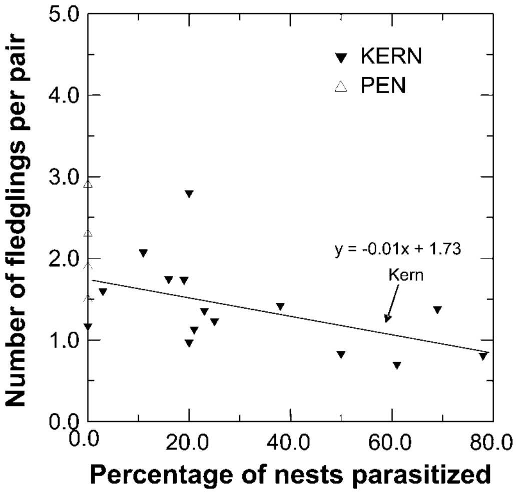

Fig. 2. Seasonal productivity of Southwestern Willow Flycatchers as a function of annual parasitism rate at Kern River (KERN) and Camp Pendleton (PEN).

in flycatcher productivity is attributable to cowbird parasitism. In flycatchers, a difference of 91% in parasitism frequency produces a change in annual productivity of one young.

Response to cowbird control.—Implementation of cowbird control at all four sites significantly reduced the incidence of parasitism of vireo and flycatcher nests (Table 1). Parasitism of vireos at Camp Pendleton dropped from an average of 47% of nests (SD = 0, n = 2 years) prior to cowbird trapping to 4% of nests (SD = 6) in the 15 years after trapping was initiated (t = 9.6, df = 15, P < 0.001). At the San Diego River, parasitism of vireo nests dropped from an average of 57% (SD = 33) during the two years before trapping to 11% (SD = 11) after (t = 4.0, df = 10, P = 0.001). Even at the San Luis Rey River, where parasitism has remained high in comparison with the other two vireo sites, between 1988 and 1996, parasitism declined from an average of 63% (SD = 1.4, n = 2 years) to 32% (SD = 7.9; t = 5.3, df = 9, P < 0.001). Since 1999 and the cessation of trapping at the San Luis Rey River, average parasitism (39%; SD = 15, n = 4 years) has not changed (t = –1.2, df = 11, P = 0.13). Parasitism of flycatcher nests at Kern River declined from 63% (SD = 14) in the 3 precontrol years to 22% (SD = 18) in the 12 postcontrol years (t = 3.66, df = 13, P = 0.001). No parasitism of flycatcher nests at Camp Pendleton has been detected during four years of monitoring since trapping began.

Associated with declines in parasitism were significant increases in seasonal productivity of both species. Vireo pairs at Camp Pendleton increased production of young from 1.4 ± 1.1 year^{-1} (mean ± SD) prior to trapping to 2.7 ± 0.5 after (t = –3.1, df = 15, P = 0.003). At the San Diego River, pretrapping productivity of 0.9 ± 1.0 young per pair increased to 2.9 ± 0.8 after trapping (t = –3.2, df = 10, P = 0.01), the highest average productivity recorded at any site with long-term monitoring. Productivity tripled at the San Luis Rey River from 0.6 ± 0.5 young per pair before trapping to 1.9 ± 0.4 in 1988–1996 (t = –4.0, df = 9, P = 0.002). The response of flycatchers to trapping, though less dramatic than that of vireos, was nevertheless significant, with pairs increasing seasonal production of young from 0.8 ± 0.1 before trapping to 1.6 ± 0.5 after (t = –2.6, df = 13, P = 0.01).

Population growth of vireos occurred at all three sites following implementation of cowbird control. At the San Luis Rey River, vireo abundance increased from 24 territories in 1984 to 132 territories in 1999; in the four subsequent years, it leveled off and declined slightly (Fig. 3A). Similarly, vireo numbers at Camp Pendleton increased from 27 territories in 1981 to >1,000 in 1998 (Fig. 3B; note different scale), then declined to an apparent equilibrium of ~800 territories. Vireos at the San Diego River exhibited a modest increase over the 13-year study period from the low 20s to the high 30s.

In contrast, flycatcher numbers at the Kern River grew for a few years post-trapping, reaching a peak of 37 territories in 1997, but then declined steeply to reach the lowest level recorded at the site in 2002 (Fig. 3C). Camp Pendleton flycatchers, in the absence of trapping, have maintained stable numbers of approximately 18–20 territories since 1995.

Discussion

Least Bell's Vireo.—Cowbird control has been effective in reducing the incidence of parasitism and consequently increasing the productivity of vireos, as shown previously by Griffith and Griffith (2000). Our analysis of data collected at several sites during the past 20 years suggests that parasitism is a major determinant of seasonal production of young in vireos, illustrating another connection between cowbird control, parasitism frequencies, vireo nesting success,

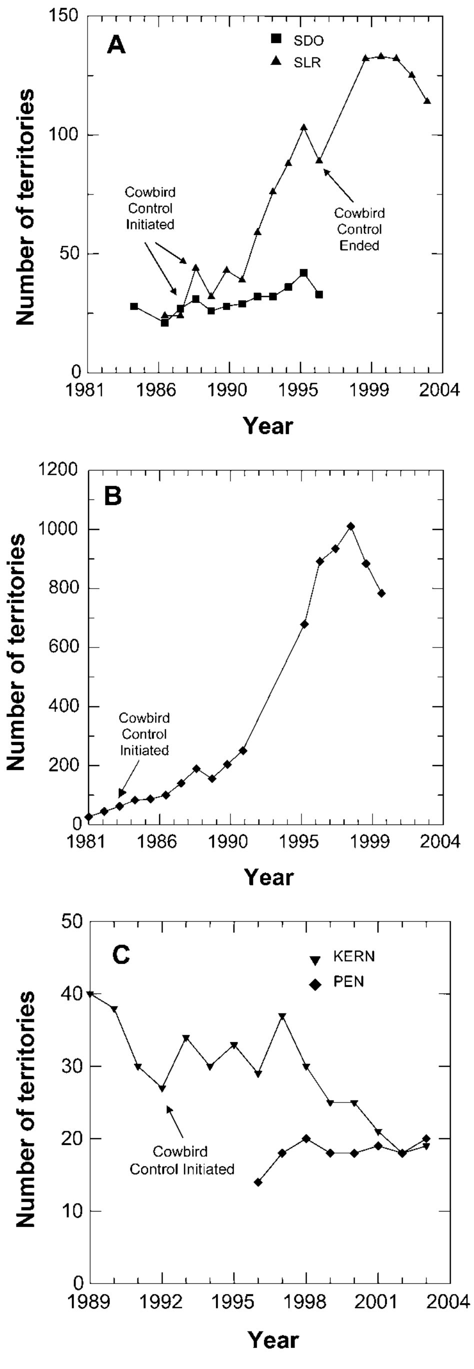

Fig. 3. Population size, between 1981 and 2003, of Least Bell's Vireos at (A) San Diego (SDO) and San Luis Rey (SLR) rivers and (B) Camp Pendleton; and of Southwestern Willow Flycatchers at (C) Kern River (KERN) and Camp Pendleton (PEN). Sources (in addition to those in Table 1): J. C. Griffith and J. T. Griffith unpubl. data.

and population size. The relationship between parasitism and productivity was consistent across several sites and maintained over a wide range of environmental conditions, including periods of drought and of high precipitation. Although other factors influenced annual productivity, parasitism accounted for ~65% of the annual variation in that measure of breeding success.

Reduction or elimination of parasitism over time and a corresponding increase in productivity have resulted in population increases in vireos at all sites where trapping has been employed. Rangewide, vireo territories now number ~2,500 (B. Kus and L. Hays unpubl. data), >8× the number that existed at the time of listing. However, allowing that trapping is clearly effective as a short-term means of increasing vireo abundance, the perspective afforded by 20 years of monitoring indicates that all of the populations described here may have reached carrying capacity, having exhibited little change during the past five years.

Despite cessation of local population growth, cowbird control is likely still contributing to vireo recovery by promoting the role of these populations as sources of dispersers that are essential for the recolonization of the vireos' historical range and maintenance of populations within an overall metapopulation. Evidence from studies of banded birds indicates that each of the populations discussed here has produced dispersers traveling as far as 250 km from their natal sites to colonize new sites, including areas along the Santa Clara and Ventura rivers in Ventura County (Greaves and Labinger 1997, Griffith and Griffith 2000, B. Kus unpubl. data) that together now support a population of >100 vireo territories (J. Greaves unpubl. data). However, saturation of habitat at vireo breeding sites that 20 years ago were among the largest remaining indicates that we have reached a pivotal point with regard to recovery, where our management priority needs to shift from enhancing numbers at historical sites to ensuring that adequate habitat exists for establishment of new populations.

Cowbird control will remain effective in increasing bird abundance only as long as suitable habitat is available to support population growth. Although no one disputes the critical need for habitat protection in recovering both vireos and flycatchers, translation of that awareness into action has been slow in coming (USFWS 1998, 2002). Practically speaking, cowbird trapping is a more straightforward and easy form of management for regulatory agencies, resource managers, and mitigants than is habitat protection, which is a complex and costly process often requiring years to accomplish. Protection of unoccupied habitat through acquisition or other agreements and creation of suitable habitat through restoration of degraded sites both present the uncertainty of whether and when sites will be colonized by the species of interest, whereas cowbird control produces immediate results. These challenges often serve as deterrents to aggressive pursuit of habitat protection, yet they underscore the need for planning and investment of resources to meet the future habitat needs of recovering species.

Southwestern Willow Flycatchers.—Unlike vireos, flycatchers have not responded to cowbird control with population increases, at least not with sustained increases. Although a significant determinant of productivity, parasitism has less of an effect on flycatchers than on vireos and minimal detectable effect on population growth, outside of a brief initial increase immediately following implementation of trapping (Whitfield et al. 1999). Today, nearly a decade after listing, flycatcher territories number only ~200 in California (Kus et al. 2003), 20% of the species' population throughout its U.S. range (Sogge et al. 2003). Clearly, factors other than parasitism are currently limiting flycatcher abundance and distribution, and exclusive emphasis on trapping will not aid in identifying or managing these factors. A similar situation was encountered in the use of cowbird trapping to increase populations of Kirtland's Warblers (DeCapita 2000). After two decades of trapping and reduction of parasitism to ~5%, Kirtland's Warbler numbers failed to increase until a wildfire created thousands of hectares of new jack pine (*Pinus banksiana*) nesting habitat, indicating that habitat availability rather than parasitism was the primary factor limiting population growth. It appears unlikely that flycatchers have saturated their existing habitat, given the decline at Kern River and the disparity in numbers of flycatchers and vireos at Camp Pendleton, where they occur sympatrically and are subject to the same management. Ongoing investigations of declining egg hatchability, possibly related to contaminants (M. Whitfield unpubl. data), and other demographic factors on both the breeding and wintering grounds, should shed light on their roles as possible limiting factors.

Cowbird control.—Cowbird control has affected the recovery of vireos and flycatchers differently. The ways that they differ are instructive when considering cowbird control in management of other species. In vireos, cowbird control has been highly effective in producing a rapid reversal of population decline, and the species is now in the process of recolonizing its historical range. Given that success, it was logical and appropriate that cowbird trapping was initiated to protect flycatchers once they were listed as endangered, and that effort, too, has advanced flycatcher recovery—not by increasing abundance, but by revealing that something other than parasitism is limiting flycatcher populations. In both cases, cowbird control has brought us to a point where a redistribution of management effort is warranted, and becoming complacent because of prior success will likely delay or prevent achievement of full recovery.

Recommendations for cowbird control.—With that in mind, we note that a critical component missing from all the cowbird control programs with which we are familiar is a plan for ending the control. Rothstein and Cook (2000) raised the same concern. Given the growth in our understanding of both the effectiveness and limitations of prolonged cowbird control and the potential for reliance on open-ended control to detract from exploring or implementing other, more appropriate forms of management, we recommend that control programs give consideration to the desired results of the control and specify criteria for ending it.

Reasons for avoiding open-ended control whenever possible include a number of economic, political, and ethical issues (Rothstein and Cook 2000, Rothstein et al. 2003). A possible biological consequence is that cowbird control interferes with the evolutionary processes necessary for establishment of genetically based natural defenses that would allow for the continued existence of host species in the absence of human intervention. We refer not to the appearance of new defenses, but to enhancement of defenses already present and expressed to some degree, a process requiring far less evolutionary time. For example, desertion of parasitized nests followed by successful renesting is a defense exhibited by many small hosts (Friedmann 1963), including other subspecies of vireos (Kus 2002). Least Bell's Vireos share an evolutionary history with these subspecies, and like them, desert parasitized nests, but at a much lower rate (29% of nests [Kus 1999] as compared with 43–74% of nests [Averill-Murray 1999, Parker 1999, Budnik et al. 2001]) and within an ecological context different from that in the Great Plains portion of the Bell's Vireo's range, where cessation of cowbird breeding 2–3 weeks before vireos stop nesting allows renesters to be successful (Parker 1999, Budnik et al. 2001). The result is that deserting Least Bell's Vireo pairs fledge only half as many young as unparasitized pairs (Kus 2002). However, they produce more young than they would if they failed to desert, creating positive selection for desertion if that behavior is heritable. Cowbird control, done effectively, removes the selective pressure necessary for promoting an increase in such a response.

Nest manipulation is another form of cowbird control that interferes with the evolution of antiparasite behaviors. Removal of cowbird eggs from vireo nests allows rescued pairs (nondeserters with at least one parasitized nest; Kus 2002) to attain seasonal productivity comparable with that of unparasitized pairs, an outcome considered a management success—which it is, in the short term. In fact, vireo young from manipulated nests are twice as likely to survive to breeding age as those from unparasitized nests (B. Kus unpubl. data), which compensates for the reduced number of young fledged from parasitized nests (Kus 1999). Again, cowbird control in the form of nest manipulation reduces the selective costs of heritable behaviors yielding vireo nests vulnerable to parasitism, which could include those involved in nest placement, timing of nest initiation, and activity at the nest. Variability exists in all of these behaviors and, if genetically based, provides the raw material on which natural selection can act given the opportunity.

We recognize that establishing goals and endpoints for cowbird control programs is a formidable challenge requiring a commitment to the practice of adaptive management as we test and evaluate various possibilities. The data summarized here offer a starting point for addressing questions of when, how, and where trapping might be reduced and eventually discontinued. For example, on the basis of a simple estimate of two young per female as the level of annual productivity needed to maintain a stable population (Franzreb 1989), our analysis indicates that Least Bell's Vireos are apparently able to maintain equilibrium numbers at parasitism frequencies of up to ~30%, supporting the frequencies proposed elsewhere (Smith 1999, USFWS 2002) as a threshold for initiating cowbird control to protect endangered species. That may be a reasonable goal for managing populations that have reached carrying capacity. The increased cost and effort of managing for 0% parasitism as opposed to 20–30% is considerable, and unjustified if unaccompanied by corresponding biological gains. Other sites might be managed as source populations with lower parasitism thresholds, again using existing data to evaluate incremental differences in the cost:benefit ratios of different options. Experimentation with some large populations on number of traps, dates of operation, and annual trapping frequency needed to achieve desired goals will be a necessary part of research on how to minimize unproductive use of cowbird control. Further studies of hosts' natural defenses are needed to establish which are genetically based and, thus, subject to natural selection, followed by analyses combining selection models and host population dynamics to identify management regimes that minimize the risk of extinction while providing conditions under which selection can operate.

Conclusion

We believe that cowbird control is an appropriate and effective short-term management tool in recovery of endangered hosts and has been instrumental in preventing extinction of vireo and flycatcher populations in California. It is not a panacea, however, and is effective only so long as parasitism is the primary limitation to population growth. The degree to which that is the case will vary from species to species, as illustrated by differences between vireos and flycatchers in their responses to control, and over time as populations encounter other obstacles to growth. We encourage managers to be mindful of that in the design of recovery-oriented management for these and other species, and to be prepared to adapt management as species' needs change. In particular, we stress the need to consider the potential negative effects of long-term cowbird control on the ability of species to persist without management intervention, and avoid creating permanent dependence on humans for survival. We encourage research exploring natural defenses in endangered hosts to guide the design of cowbird management that balances the short- and long-term needs of averting extinction and facilitating evolutionary processes necessary for host persistence.

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Literature Cited

Averill-Murray, A., S. Lynn, and M. L. Morrison. 1999. Cowbird parasitism of Arizona Bell's Vireos (*Vireo bellii arizonae*) in a desert riparian landscape: Implications for cowbird management and riparian restoration. Pages 109–120 *in* Research and Management of the Brown-Headed Cowbird in Western Landscapes (M. L. Morrison, L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich, Eds.). Studies in Avian Biology, no. 18.

Behle, W. H. 1943. Birds of the Pine Valley Mountain region: Southwestern Utah. University of Utah Biological Series, no. 7.

Brown, B. T. 1993. Bell's Vireo (*Vireo bellii*). *In* The Birds of North America, no. 35 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, D.C.

Budnik, J. M., D. E. Burhans, M. R. Ryan, and F. R. Thompson III. 2001. Nest desertion and apparent nest protection behavior by Bell's Vireos in response to cowbird parasitism. Condor 103: 639–643.

DeCapita, M. E. 2000. Brown-headed Cowbird control on Kirtland's Warbler nesting areas in Michigan, 1972–1995. Pages 333–341 *in* Ecology and Management of Cowbirds and Their Hosts (J. N. M. Smith, T. L. Cook, S. I. Rothstein, S. K. Robinson, and S. G. Sealy, Eds.). University of Texas Press, Austin.

Franzreb, K. E. 1989. Ecology and conservation of the endangered Least Bell's Vireo. U.S. Fish and Wildlife Service Biological Report, no. 89.

Friedmann, H. 1963. Host relations of the parasitic cowbirds. U.S. National Museum Bulletin, no. 233.

Goldwasser, S., D. Gaines, and S. R. Wilbur. 1980. The Least Bell's Vireo in California: A de facto endangered race. American Birds 34:742–745.

Greaves, J., and Z. Labinger. 1997. Site tenacity and dispersal of Least Bell's Vireos. Transactions of the Western Section of The Wildlife Society 33: 18–23.

Griffith, J. T., and J. C. Griffith. 2000. Cowbird control and the endangered Least Bell's Vireo: A management success story. Pages 342–356 *in* Ecology and Management of Cowbirds and Their Hosts (J. N. M. Smith, T. L. Cook, S. I. Rothstein, S. K. Robinson, and S. G. Sealy, Eds.). University of Texas Press, Austin.

Grinnell, J., and A. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna, no. 27.

Hanna, W. C. 1928. Notes on the Dwarf Cowbird in southern California. Condor 30:161–162.

Hayden, T. J., D. J. Tazik, R. H. Melton, and J. D. Cornelius. 2000. Cowbird control program at Fort Hood, Texas: Lessons for mitigation of cowbird parasitism on a landscape scale. Pages 357–370 *in* Ecology and Management of Cowbirds and Their Hosts (J. N. M. Smith, T. L. Cook, S. I. Rothstein, S. K. Robinson, and S. G. Sealy, Eds.). University of Texas Press, Austin.

Kus, B. E. 1999. Impacts of Brown-headed Cowbird parasitism on productivity of the endangered Least Bell's Vireo. Pages 160–166 *in* Research and Management of the Brown-Headed Cowbird in Western Landscapes (M. L. Morrison, L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich, Eds.). Studies in Avian Biology, no. 18.

Kus, B. E. 2002. Fitness consequences of nest desertion in an endangered host, the Least Bell's Vireo. Condor 104:795–802.

Kus, B. E., P. P. Beck, and J. M. Wells. 2003. Southwestern Willow Flycatcher populations in California: Distribution, abundance, and potential for conservation. Pages 12–21 *in* Ecology and Conservation of the Willow Flycatcher (M. K. Sogge, B. E. Kus, S. J. Sferra, and M. J. Whitfield, Eds.). Studies in Avian Biology, no. 26.

Marshall, R. M. 2000. Population status on breeding grounds. Pages 3-11 *in* Status, Ecology, and Conservation of the Southwestern Willow Flycatcher (D. M. Finch and S. H. Stoleson, Eds.). U.S. Department of Agriculture, Forest Service General Technical Report RMRS-GTR-60.

Mearns, E. A. 1890. Observations on the avifauna of portions of Arizona. Auk 7:45–55, 251–264.

Oberholser, H. C. 1974. The Bird Life of Texas. University of Texas Press, Austin.

Parker, T. H. 1999. Responses of Bell's Vireos to brood parasitism by the Brown-headed Cowbird in Kansas. Wilson Bulletin 111: 499–504.

Rothstein, S. I., and T. L. Cook. 2000. Cowbird management, host population limitation, and efforts to save endangered species: Introduction. Pages 323–332 *in* Ecology and Management of Cowbirds and Their Hosts (J. N. M. Smith, T. L. Cook, S. I. Rothstein, S. K. Robinson, and S. G. Sealy, Eds.). University of Texas Press, Austin.

Rothstein, S. I., B. E. Kus, M. J. Whitfield, and S. J. Sferra. 2003. Recommendations for cowbird management in recovery efforts for the Southwestern Willow Flycatcher. Pages 157–167 *in* Ecology and Conservation of the Willow Flycatcher (M. K. Sogge, B. E. Kus, S. J. Sferra, and M. J. Whitfield, Eds.). Studies in Avian Biology, no. 26.

Sedgwick, J. A. 2000. Willow Flycatcher (*Empidonax traillii*). *In* The Birds of North America, no. 533 (A. Poole and F. Gill, Eds.). The Birds of North America, Philadelphia.

Smith, J. N. M. 1999. The basis for cowbird management: Host selection, impacts on hosts, and criteria for taking management action. Pages 104–108 *in* Research and Management of the Brown-Headed Cowbird in Western Landscapes (M. L. Morrison, L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich, Eds.). Studies in Avian Biology, no. 18.

Sogge, M. K., S. J. Sferra, T. D. McCarthey, S. O. Williams, and B. E. Kus. 2003. Distribution and characteristics of Southwestern Willow Flycatcher breeding sites and territories: 1993-2001. Pages 5–11 *in* Ecology and Conservation of the Willow Flycatcher (M. K. Sogge, B. E. Kus, S. J. Sferra, and M. J. Whitfield, Eds.). Studies in Avian Biology, no. 26.

Unitt, P. 1987. *Empidonax traillii extimus*: An endangered subspecies. Western Birds 18:137–162.

U.S. Fish and Wildlife Service. 1998. Draft recovery plan for the Least Bell's Vireo. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2002. Southwestern Willow Flycatcher recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Uyehara, J. C., and P. M. Narins. 1995. Nest defense by Willow Flycatchers to brood-parasitic intruders. Condor 97:361–368.

Whitfield, M. J. 2000. Results of a Brown-headed Cowbird control program for the Southwestern Willow Flycatcher. Pages 371–377 *in* Ecology and Management of Cowbirds and Their Hosts (J. N. M. Smith, T. L. Cook, S. I. Rothstein, S. K. Robinson, and S. G. Sealy, Eds.). University of Texas Press, Austin.

Whitfield, M. J., K. M. Enos, and S. P. Rowe. 1999. Is Brown-headed Cowbird trapping effective for managing populations of the endangered Southwestern Willow Flycatcher? Pages 260–266 *in* Research and Management of the Brown-Headed Cowbird in Western Landscapes (M. L. Morrison, L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich, Eds.). Studies in Avian Biology, no. 18.

Whitfield, M. J. and M. K. Sogge. 1999. Range-wide impact of Brown-headed Cowbird parasitism on the Southwestern Willow Flycatcher (*Empidonax traillii extimus*). Pages 182–190 *in* Research and Management of the Brown-Headed Cowbird in Western Landscapes (M. L. Morrison, L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich, Eds.). Studies in Avian Biology, no. 18.

EXHIBIT 5

The Riparian Bird Conservation Plan

A strategy for reversing the decline of riparian associated birds in California

A project of California Partners in Flight and the Riparian Habitat Joint Venture

The Riparian Bird Conservation Plan

A strategy for reversing the decline of riparian associated birds in California

Version 2.0

2004

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FIGURES

TABLES

Executive Summary

This Riparian Bird Conservation Plan is a collaborative effort of the Riparian Habitat Joint Venture (RHJV, all acronyms are defined in Appendix C on page 144 and California Partners in Flight (CalPIF) and has been developed to guide conservation policy and action on behalf of California's riparian habitats and wildlife. The Conservation Plan focuses on data concerning bird species associated with riparian habitat, but conservation recommendations, if implemented, should benefit many riparian associated species. The plan, which includes both this written document and an associated web site, is intended to provide a source of information on riparian bird conservation for managers, agencies, landowners, academic institutions and non-governmental organizations. This Conservation Plan "takes a heroic step forward in tightening the link between science and on-the-ground management" (Golet 2001). This is not a regulatory document, nor does it represent the policies of any agency or organization.

This Conservation Plan, along with the associated Geographic Information System (GIS) database of riparian monitoring projects maintained by PRBO Conservation Science (PRBO), is the second iteration of a continuing process of updating habitat conservation recommendations based on the latest scientific data. This Conservation Plan, combined with the associated RHJV Strategic Plan, provides the foundation for adaptive conservation planning in California's riparian habitats (RHJV 2003a). The plan applies broadly to many of the conservation efforts now underway in the state, including, but not limited to: the California Bay-Delta Program (CALFED); the California Biodiversity Council; California Legacy Project, all habitat-based Joint Ventures (i.e., Central Valley, Intermountain West, Pacific Coast, San Francisco Bay, and Sonoran); the Sacramento and San Joaquin River Basins Comprehensive Study of the U.S. Army Corps of Engineers (Corps); the SB 1086 Program; programs of the Natural Resources Conservation Service; US Fish and Wildlife Service refuges and 'Partners for Wildlife' program; The Nature Conservancy Ecoregion Plans; the California Wildlands Project; and updates to resource management plans (RMPs) and environmental assessments of the USDA Forest Service and Bureau of Land Management.

An important extension of this Conservation Plan is the on-line GIS database of riparian monitoring projects and focal species breeding status available through the CalPIF section of PRBO's website at http://www.prbo.org/calpif/htmldocs/riparian.html (Ballard et al. 2003a). Contributing to and managing data in this database is accomplished through a web interface, to which access is available by request. This database is used for cataloguing new information and new analysis and for updating conservation recommendations and goals. Bird and study site data will be posted on this website, periodically updated, and made available for use by the public. Therefore, this Conservation Plan is a "living" document.

Biological Need

More than 225 species of birds, mammals, reptiles, and amphibians depend on California's riparian habitats. Riparian ecosystems harbor the most diverse bird communities in the arid and semiarid portions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). Riparian vegetation is critical to the quality of in-stream habitat and aids significantly in maintaining aquatic life by providing shade, food, and nutrients that form the basis of the food chain (Jensen et al. 1993). Riparian vegetation also supplies in-stream habitat when downed trees and willow mats scour pools and form logjams important for fish, amphibians, and aquatic insects. The National Research Council (2002) concluded that riparian areas perform a disproportionate number of biological and physical functions on a unit area basis and that the restoration of riparian function along America's waterbodies should be a national goal.

Riparian vegetation in California makes up less than 0.5% of the total land area, an estimated 145,000 hectares (CDF 2002). Yet, studies of riparian habitats indicate that they are important to ecosystem integrity and function across landscapes (Sands 1977, Johnson and McCormick 1979, Katibah 1984, Johnson et al. 1985, Faber 2003). Consequently, they may also be the most important habitat for landbird species in California (Manley and Davidson 1993). Despite its importance, riparian habitat has been decimated over the past 150 years. Today, depending on bioregion, riparian habitat covers 2% to 15% of its historic range in California (Katibah 1984, Dawdy 1989).

Due to their biological wealth and severe degradation, riparian areas are the most critical habitat for conservation of Neotropical migrants and resident birds in the West (Miller 1951, Gaines 1974, Manley and Davidson 1993, Rich 1998, Donovan et al. 2002). California's riparian habitat provides important breeding and over wintering grounds, migration stopover areas, and corridors for dispersal (Cogswell 1962, Gaines 1977, Ralph 1998, Humple and Geupel 2002, Flannery et al. 2004). The loss of riparian habitats may be the most important cause of population decline among landbird species in western North America (DeSante and George 1994).

Photo by Eric Preston, ericpreston.com

Riparian areas provide habitat for numerous birds, including Song Sparrows.

Mission and Objectives

The mission of Partners in Flight (PIF) is to stop the decline of, and maintain or increase, healthy populations of landbirds in North America. This mission translates into identification of habitat conservation and management priorities for bird species at risk in California. By developing the Riparian Bird Conservation Plan, CalPIF seeks to promote conservation and restoration of these habitats to support long-term viability and recovery of both native bird populations and other native species. The goals of the Riparian Bird Conservation Plan are:

- Emphasize what is needed to conserve both populations of species, and species assemblages, which are defined here as groups of naturally co-occurring bird species.

- Synthesize and summarize current scientific knowledge of the requirements of birds in riparian habitats.

- Provide recommendations for habitat protection, restoration, management, monitoring, and policy to ensure the long-term persistence of birds and other wildlife dependent on riparian ecosystems.

- Support and inform efforts to increase the overall acreage and effectiveness of riparian habitat conservation efforts in California by funding, and promoting on-the-ground conservation projects.

This Conservation Plan concentrates on a subset of riparian bird species, with the aim of contributing to the conservation of riparian ecosystems as a whole. By focusing appropriate conservation efforts on well-chosen "focal" riparian bird species, many other animals and plants may also benefit (Lambeck 1997). For example, demographic monitoring of bird species is especially valuable if those species serve as indicators of the presence of a threatened biological community (Chase et al. 2000), or are sensitive to a particular type of environmental change, such as habitat fragmentation (Noss 1990). Other species, especially those with large area requirements, may qualify as "umbrella species;" those whose protection will result in the protection of many other species (Noss 1990).

The RHJV and CalPIF recognize that the subject of land managment and land use, whether on private or public lands, can be contentious. Because many California riparian areas are on private lands, the RHJV and CalPIF supports the need for land managers and landowners to have flexibility to develop systems that accommodate their needs while seeking to achieve the desired habitat characteristics that will maximize benefits to wildlife. CalPIF supports and will seek to maximize the benefits of new and ongoing efforts to ensure a critical level of riparian habitat is protected, monitored, and properly managed for future generations of Californians and wildlife.

Findings and Recommendations

This Conservation Plan has been developed collaboratively by the leading bird researchers in California through a process designed to:

- Capture the conservation needs for the complete range of riparian habitat types throughout the state.
- Develop biological conservation objectives using current data on riparian-associated focal species.

At more than 520 monitoring sites throughout California, researchers have been collecting data on riparian songbirds and are contributing to the CalPIF songbird monitoring database (http://cain.nbii.gov/prbo/calpifmap/index.html). Some of these data have contributed to the focal species accounts and recommendations presented in this plan. This document emphasizes a suite of 17 bird species chosen because of their conservation interest and as focal species representative of riparian habitats in the state. Preliminary analyses of the 17 focal species habitat requirements reveal:

- Eleven of these species have suffered reductions in a significant portion of their former breeding range and eight of 17 continue to decline. Extirpation appears to have resulted primarily from historical loss and fragmentation of riparian habitat throughout the state.

- Loss of appropriate habitat condition also often contributes to the decline or extirpation of a population. Ten of the focal species depend upon shrub cover and early successional habitat for successful nesting. These species particularly rely upon willow/alder shrub habitats with dense understory cover, which in turn require natural hydrological processes for establishment. Four of the focal species depend on late successional high canopy tree species. Cottonwood and willow tree regeneration is often compromised in riparian systems with altered hydrological processes such as peaks and timing of flows. The extensive alteration of California's streams and hydrological processes by humans contributes significantly to this habitat loss and degradation.

- Current restoration and rehabilitation efforts throughout the state need to be assessed with sound research and monitoring techniques (see Appendix B for more information). Many projects aim to increase riparian habitat by restoring natural hydrological processes or by managing dam releases. While these are excellent first steps in riparian restoration, success can only be gauged by observing their effects on wildlife.

- Riparian restoration and protection sites should be prioritized by:
    1. The ability to restore the natural hydrology of the area.
    2. Location of sites within potential dispersal range of existing "source" populations, which will maximize the potential for range expansion.
    3. The ability to protect and manage adjacent upland habitats for foraging, flood refugia, and/or nesting habitat.
    4. The extent to which land use within 7-12 kilometers from the riparian corridor (or even better, throughout the watershed) can be protected, influenced or is likely to remain under management that is beneficial to birds.

- High levels of brood parasitism by Brown-headed Cowbirds and high predation rates by native and nonnative predators significantly reduce the reproductive success of many species of birds. The structure and diversity of riparian vegetation heavily influence both factors. The size and isolation of remnant riparian patches, coupled with landscape-scale factors such as the type and configuration of surrounding land use, further influence avian productivity. Conservation efforts must initiate protection, management, and development of riparian and surrounding upland areas from a landscape-scale perspective. This will include promoting compatible types of agriculture, grazing, and recreation management, as well as comprehensive land use planning by local governments.

- Seven specific recommendations to increase the benefits of cultivated riparian restoration for landbirds are offered. Most of these recommendations will add little to the cost of restoration, but will significantly enhance benefits to songbirds in riparian habitats.

- Numerous specific recommendations concerning land management practices are offered that will benefit birds. Many recommendations can be implemented on farms and rangelands in California either to protect and enhance riparian habitats or to provide a beneficial buffer to riparian zones and reduce the impacts that negatively affect bird populations.

- The cost-effectiveness of many habitat restoration, management, and mitigation projects can be maximized by incorporating elements from this Conservation Plan, even if the project does not expressly aim to restore bird populations.

California Partners in Flight and Riparian Habitat Joint Venture Partners

California Department of Fish and Game
California Department of Water Resources
California State Lands Commission
Ducks Unlimited
Kern River Research Group (now defunct)
Klamath Bird Observatory
National Audubon Society
National Fish and Wildlife Foundation
National Park Service
Natural Resources Conservation Service
PRBO Conservation Science
River Partners
The Nature Conservancy
The Trust for Public Land
The Resources Agency State of California
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S.D.A. Forest Service
Wildlife Conservation Board

Photo by Peter Knapp.

Common Yellowthroat, a riparian focal species.

Chapter 1. Introduction

Updates to Version 2.0

This document represents the second iteration of the Riparian Bird Conservation Plan. A review of the original focal species list revealed the need to add three new species to better capture the diversity of habitat niches found in California riparian systems and to account for species which are experiencing range reductions in the state. Following the same criteria established in the selection of the original 14 focal species, Spotted Sandpiper, Tree Swallow, and Tricolored Blackbird were added. Species accounts for these new additions are currently in preparation and will be available at http://www.prbo.org/calpif/htmldocs/riparian.html. Their summary information has been added to this document. Static range maps of all 17 focal species, with 2004 data incorporated, are included in this version of the Plan (Figures 5-2 through 5-18). As always, the most recent updates for these maps can be viewed on the web site.

Photo by James Gallagher, Sea and Sage Audubon

Tree Swallow, a new focal species to Version 2.0.

In spring of 2001, the RHJV, the Wildlife Society and sponsors and supporters from numerous state, federal, and private entities hosted the Riparian Habitat and Floodplains Conference in Sacramento, California. This meeting was the largest one-time gathering of wildlife biologists and managers in the western United States in several years. Approximately 400 scientific papers were presented and more than 1,500 people attended. The proceedings derived from this conference were published in 2003 and present results from several projects that have been implemented since Version 1.0 of the Riparian Bird Conservation Plan (Faber 2003). References from these proceedings and other recent scientific publications have been incorporated into this revision of the Plan and added to the already extensive Literature Cited section.

Also new to this version is a description of a process for setting population objectives for select focal species using current monitoring data and GIS data layers (Chapter 6). In this version, examples from Central Valley Basins are used to estimate current and potential population size. Potential populations or "targets" are estimated using GIS data layers based on the historical extent of riparian forests, corrected for permanent habitat loss (urbanization). Densities estimated (using the values for the top 25% of surveyed sites currently available) are extrapolated to provide a target population. Target values for key demographic parameters (primarily nest success and survival) also are provided to evaluate and project a population's viability ('health'). In Chapter 7, we refined the definition of a Portfolio Site, and invited experts from each bioregion to supplement the existing list with new sites. In Chapter 8, we incorporated the most current riparian songbird data from several California bioregions into the Conservation Recommendations section and included the latest topical references from the scientific literature. Tables reflecting bird and habitat associations, estimates of nest success, and riparian songbird nesting seasons by bioregions have been added to better assist land managers with data pertaining to their specific area. In Chapter 9, we provided updates on the North American all-bird initiatives and the recent activities of the RHJV. In Chapter 10, we identified more opportunities for private citizens to be involved in bird conservation and to help enhance bird populations. Finally, we added a new chapter (Chapter 3) with information pertaining to landscape-scale factors that affect riparian birds.

As always, this Plan is a "living document" which will constantly be revised to best fit the needs of the land management, research, education, policy and conservation communities. Perhaps one of the most essential uses of this document is to demonstrate where information gaps exist, or where existing information has been overlooked. For this reason, and with the spirit of the RHJV in mind, we encourage you, the reader, to provide us with your feedback, data, and experiences. Version 3.0 is planned for release in September of 2006.

Riparian Habitat Joint Venture

Following a series of strategic meetings with members of the CalPIF Management Committee in 1993, the Riparian Habitat Joint Venture project was launched in a public ceremony along the American River in Sacramento in September 1994. The RHJV, modeled after the successful Central Valley Habitat Joint Venture project of the North American Waterfowl Management Plan, reinforces other collaborative efforts currently underway that protect biodiversity and enhance natural resources and the human population they support. The RHJV seeks to restore, enhance, and protect a network of functioning riparian habitat across California to support the long-term viability of birds and other species. The RHJV will provide leadership and guidance to promote effective riparian conservation from the local to state level. This will be accomplished by the following goals:

- **Identify and develop technical information for a strategic approach to riparian conservation in California.** To develop a strategic statewide approach to riparian conservation, the initial step is to assess the extent and condition of riparian habitat in California. In addition, the latest riparian management and scientific information must be continually assessed to refine and update RHJV conservation goals.

- **Promote and support riparian conservation on the ground by providing guidance, technical assistance and a forum for collaboration**. Through meetings, workshops, and technical assistance the RHJV provides a forum where members, as well as other organizations, can develop new collaborative opportunities for planning, funding and implementing riparian conservation projects.

- **Guide and promote riparian conservation policy through outreach and education.** The RHJV can raise the awareness of local constituents and state policy makers to the critical importance of riparian habitat for wildlife and plants as well as to the many benefits and services it provides to human society.

Partners in Flight

This Conservation Plan is one of many to be created under the aegis of the national movement known as Partners in Flight (PIF), which seeks to protect North American landbirds throughout their ranges by reversing species declines, stabilizing populations, and "keeping common birds common." PIF is an international cooperative endeavor initiated in 1990 in response to alarming population declines noted among species of Neotropical migratory birds. The program encourages conservation through partnerships before species and their habitats become threatened or endangered and provides a constructive framework for guiding nongame landbird conservation activities throughout the United States, Canada, Mexico, and Central America.

California Partners in Flight (CalPIF) was formed in 1992 with the full participation of the state's land and wildlife managers, scientists and researchers, and private organizations interested in the conservation of nongame landbirds. Noting that the major cause of population declines in California appeared to be habitat loss, CalPIF began identifying critical habitats important to birds and worked cooperatively to protect and enhance remaining habitat fragments. Recognizing their critical importance, CalPIF initially focused on riparian zones throughout the state. However, CalPIF has developed plans for several other ecosystems, including oak woodlands, coastal scrub and chaparral, grasslands, coniferous forests, shrubsteppe, and the Sierra Nevada. Visit http://www.prbo.org/calpif/plans.html for more information and current versions of these plans.

Photo by James Gallagher, Sea and Sage Audubon

The international initiative Partners in Flight strives to keep common birds common, such as this Black-headed Grosbeak.

Justification for the Conservation Plan

The justification for conservation can be articulated from various philosophical perspectives:

- An ecological perspective
- A perspective that emphasizes intrinsic value
- A primarily utilitarian or humanist perspective

Ecological Perspective

"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

-Aldo Leopold, *The Sand County Almanac.*

The ecological arguments for conserving birds as a component of biodiversity emphasize the critical role that birds play in ecological systems. A conservation plan based on the needs of birds makes sense for a number of reasons. Birds are critical components of natural ecosystems, and they occupy an extremely diverse range of niches within riparian systems. A large number of bird species breed in riparian habitat in California; many others use riparian areas during some portion of their life cycle. By managing for a diversity of birds, we will also protect many other elements of biodiversity and the natural processes that are an integral part of the riparian ecosystem (e.g., Bank Swallows depend upon regular high-water events to create exposed riverbank sites that they use for nesting). Also, because of their high metabolic rate, their relatively high position in the food chain and their distribution across a wide variety of habitats, birds are sensitive indicators of environmental conditions (Temple and Wiens 1989, Uliczka and Angelstam 2000, Bryce et al. 2002). Finally, birds are relatively easy and cost effective to monitor and they provide an excellent means by which to track larger changes in natural systems. Our rapidly expanding capacity to monitor demographic processes in birds (reproduction and survivorship) provides us with the ability to proactively address root causes of population declines and increases (Pienkowski 1991, DeSante and Rosenberg 1998).

Intrinsic Perspective

Modern philosophers and environmental leaders have increasingly recognized the intrinsic value of plants, animals, and even the inanimate physical environment (Callicott 1986, Sober 1986). Throughout human history, many cultural belief systems have greatly valued birds and other elements of the natural world for reasons other than materialistic needs. This tradition continues today and is meeting with broader acceptance in political and public life.

Utilitarian or Humanist Perspective

A strictly utilitarian or humanist argument for conservation of bird species focuses on the direct, tangible benefits that people and society derive from their "services." For example, many passerine species (including Neotropical migrants) play an indispensable role in control of forest and agricultural insect pests, saving millions of dollars in the application of deleterious pesticides. Additionally, bird watching is a popular outdoor recreation and is currently enjoyed by an estimated 67.8 million Americans according to the 2000-2002 National Survey on Recreation and the Environment (NSRE 2000-2002). Non-consumptive bird use contributes 16,000 jobs and more than $622 million in retail sales annually to the California economy, which leads the nation in economic benefits derived from "birders." Ecotourism, with bird watching as a primary component, is increasingly seen as the best new source of income that can cushion resource based economies as they transition to a sustainable level of resource use.

Objective of the Riparian Bird Conservation Plan

The Riparian Bird Conservation Plan seeks to synthesize and summarize the current state of scientific knowledge concerning the requirements of birds in riparian habitats. It provides recommendations for habitat protection, restoration, management, research, monitoring, and policy to ensure the long-term persistence of birds dependent on riparian ecosystems. This Conservation Plan is complemented by the RHJV Strategic Plan and the RHJV Annual Operating Plan (RHJV 2003a, 2003b) that will guide the RHJV in accomplishing its objectives. Both the Conservation and Strategic plans are "living" documents; new information and data analysis will be incorporated into the recommendations and conservation targets regularly.

Photo by Steve Zack, WCS

Yellow-breasted Chats nest in early successional riparian habitats.

Chapter 2. Riparian Vegetation in California

Riparian vegetation in California makes up less than 0.5% of the total land area, an estimated 145,000 hectares (CDF 2002, Table 2-1, Figure 2-1). Yet, riparian habitats have long been recognized as important to ecosystem integrity and function across landscapes, and have received much attention at scientific conferences and symposia (Sands 1977, Johnson and McCormick 1979, Warner and Hendrix 1984, Johnson et al. 1985, Faber 2003).

Riparian habitats have been identified as the most important habitats to landbird species in California (Manley and Davidson 1993, Davidson 1995), yet they have been decimated over the past 150 years. Reservoir construction, levee and channelization projects, livestock grazing, timber harvest, water pollution, introduction of non-native species, gravel and gold mining, and clearing for agricultural and domestic uses have all contributed to riparian destruction (see Knopf et al. 1988 for review). While no estimates exist for the total historical extent of riparian habitat in California, there were at least 600,000 miles of streams in the state that were capable of supporting this type of vegetation (Warner and Hendrix 1984). Current estimates of remaining riparian habitat in the state range from 2% to 7% for the Central Valley and desert areas and approximately 15% for the northern coastal streams (Katibah 1984, Dawdy 1989).

Table 2-1. Approximate extant hectares of riparian habitat in each California bioregion. Derived from composite 100-m pixel landcover GIS data compiled by the California Department of Forestry's Fire and Resource Assessment Program, 2002 (CDF 2002). CWHR codes are given in parentheses.

Bioregion	Aspen (ASP)	Montane Riparian (MRI)	Valley Foothill Riparian (VRI)	Desert Riparian (DRI)	Palm Oasis (POS)	Wetland Meadow (WTM)	Freshwater Emergent Wetland (FEW)
North Coast / Klamath	6	15,230	552	0	0	5,162	374
Modoc	1,345	1,609	12	0	0	22,570	93
Sacramento Valley	0	112	8,015	0	0	43	12,585
Bay Area / Delta	0	568	3,102	0	0	20	6,626
San Joaquin Valley	0	2	2,596	0	0	12	11,627
South Central Coast	0	3,454	2,925	0	0	3	83
South Coast	0	2,874	6,496	12	0	1,116	461
Sierra	5,252	10,620	68	0	0	14,884	794
Colorado Desert	0	46	220	826	15	47	55
Mojave	0	210	187	2,827	0	109	5
Total in California	**6,603**	**34,725**	**24,173**	**3,665**	**15**	**43,966**	**32,703**

Riparian Habitat

The word *riparian* is derived from the Latin word *ripa*, meaning bank or shore (as of a stream), and this meaning remains intact today. Warner and Hendrix (1984) define *riparian* as pertaining to the banks and other adjacent terrestrial environs of freshwater bodies, watercourses, estuaries, and surface emergent aquifers (springs, seeps, and oases). These areas can be perennial, intermittent, or ephemeral, and include estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, providing linkages between waterbodies and adjacent uplands and include portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (NRC 2002). The available water provides soil moisture in excess of that typically available through local precipitation and potentially supports the growth of mesic vegetation. Here, *vegetation* refers to all the plant species in a region and the way they are arranged (i.e., plant assemblages Sawyer and Keeler-Wolf 1995).

The terms *riparian habitat* and *riparian vegetation* represent broad physiographic units and may include areas with few or no plant species in common. This is especially true in California, where differences in species diversity, topography, biogeography, climate, and geology are great. The California Wildlife Habitat Relationships (CWHR) system of classification provides general descriptions of wildlife habitats in California. The following brief descriptions of the major riparian habitats in California offer a window into the diversity of riparian vegetation. CWHR codes are given in parentheses. For complete accounts see Mayer and Laudenslayer (1988), updated periodically by the CA Department of Fish and Game (http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html). For Latin names of species, please refer to Appendix D.

Montane Riparian (MRI)

Montane riparian habitats (elevation = sea level to 2,440 m) are found in the Klamath, Cascade, Coast, Transverse, and Peninsular ranges and in the Sierra Nevada south to Kern and Northern Santa Barbara counties. Associated with lakes, ponds, seeps, bogs, meadows, rivers, streams, and springs, they are structurally diverse with variable vegetation. The composition of montane riparian zones varies widely by region. In northwestern California, west of the Klamath mountains, black cottonwood is the dominant species, sometimes codominant with bigleaf maple, and often associated with dogwood and boxelder. In northeastern California, black cottonwood, white alder and thinleaf alder are dominant, with Oregon ash and willow associates. Characteristic species of Sierra Nevada montane riparian zones include thinleaf alder, aspen, black cottonwood, dogwood, wild azalea, willow and water birch, white alder, and dogwood. Bigleaf maple and California bay are dominant in the southern Coast Ranges, the Transverse Ranges, and the Peninsular Range. Along the immediate coast, from San Luis Obispo to Del Norte counties, red alder is the dominant species in the coastal subtype of montane riparian.

Valley Foothill Riparian (VRI)

Valley foothill riparian habitats (elevation = sea level to 1,000 m) occur in the Central Valley and the lower foothills of the Cascade, Sierra Nevada, and Coast ranges. These habitats are associated with variable flow velocities and topographies, ranging from swift rapids and waterfalls of steep canyons to slow moving water in floodplains of gentle topography. They comprise a complex structure with a canopy, subcanopy, and understory shrub layer (usually impenetrable). Wild grape festoons trees and shrubs and constitutes a high percent of the groundcover. Dominant trees include valley oak, cottonwood, California sycamore, white alder, box elder, and Oregon ash, and California bay. Shrub layer plants include wild grape, wild rose, California blackberry, blue elderberry, poison oak, buttonbush, and willows. The herbaceous layer is diverse.

Desert Riparian (DRI)

Desert riparian habitats (elevation < 900 m) are found in scattered locations throughout the 1.4 million hectares of the Mojave, Colorado, and Great Basin deserts and in the desert canyons of the Peninsular ranges along permanent streams, seeps, and springs. They are often characterized by dense groves of low trees and tall shrubs; other patches are sparser, with medium-sized trees. The dominant canopy species vary but often include velvet ash, mesquite, Fremont cottonwood, willows and tamarisk (an invasive non-native species also known as Salt Cedar). The shrub layer comprises smaller individuals of canopy species as well as quailbush, Mojave seablight, desert lavender, seep willow, and arrowweed. Cattail and common reed are also important components of the understory.

Palm Oasis (POS)

Palm oasis habitats (elevation < 1,066 m) are found around the Salton Sea basin, especially along the San Andreas Fault zone, and are restricted to areas with permanent water of seeps, springs, and streams. Density of vegetation varies from sparse, scattered trees to dense, closely packed vegetation. The California fan palm frequently dominates the vegetation, but the habitat may also include coyote willow, velvet ash, California sycamore, naturalized date palms, Fremont cottonwood, mesquite, and tamarisk. Alkali sacaton and wiregrass dominate the herb layer. The understory also includes young individuals of canopy species and arrowweed, squaw waterweed, and alkali goldenbush.

Freshwater Emergent Wetland (FEW)

Fresh emergent wetland is found throughout California (most prevalent at elevation < 2,270 m) with the bulk of acreage in the Klamath Basin, Sacramento Valley, San Joaquin Valley, Delta, and Imperial Valley/Salton Sea. It primarily occurs at the edges of rivers and lakes. All emergent wetlands are flooded frequently. Dominant plant species include common cattail, tule bulrush, sedge, river bulrush, and baltic rush. Fresh emergent wetlands are an extension of many riparian areas, often grading into land with nonhydric soils.

Wetland Meadow (WTM)

Wet meadows (elevation = 1200-2400 m) usually occur in ecotones between fresh emergent wetlands and perennial grasslands. Where wet meadows merge with fresh emergent wetlands, slight differences in water depth significantly contribute to the animal species composition of the area. At all elevations, wet meadows generally have a simple structure consisting mainly of a layer of herbaceous plants. Trees and shrubs are an important part of the meadow, usually occurring around the edges. Wet meadows occur with a great variety of plant species, but several genera, including bent grass, oat grass, and rushes, occur commonly throughout the state.

Aspen (ASP)

Most aspen habitats (elevation = 2,000-3,000 m) in California are found within 80 km of the Nevada border from Mono County to Modoc County. Aspen habitats are found near seeps and streams on both the eastern and western slopes of the Sierra Nevada and eastern slope of the Cascade Range. East of the Sierra crest, aspens are found in the Carson and Monitor ranges and the Sweetwater and White mountains. Aspen stands tend to become more extensive in the north and east of their range. They comprise relatively open canopies associated with willows, alders, black cottonwoods, lodgepole pines, Jeffrey pine, ponderosa pine, red fir, and white fir. Important understory shrubs include sagebrush, roses, snowberry, chokecherry, and serviceberry with an extremely rich herbaceous layer. Additional aspen habitats are found on upland sites with increased associations with sagebrush and western juniper.

Photo by Eric Preston, ericnpreston.com

Aspens in Mono County, California.

A Standardized California Vegetation Classification

Recognizing the importance of broad, habitat-based classification schemes (e.g., CWHR), a detailed floristic system of California vegetation classification has been developed by Sawyer and Keeler-Wolf (1995). Their Manual of California Vegetation (MCV) provides a system of classification at a more specific level; floristically based on lower units of plant associations (referred to as series). With a standardized classification system one can describe vegetation associated with many aspects of bird biology and conservation across space and time. A single, widely accepted terminology provides land managers, natural resources specialists, and conservationists with a common language that promotes clear communication and hence better-informed decisions. CalPIF has adopted the Sawyer and Keeler-Wolf/MCV system of vegetation classification as the standard used for all CalPIF objectives. The Sawyer and Keeler-Wolf system ties in with continental planning efforts of The Nature Conservancy and is compatible with most previous schemes used in California, such as that of the California Biodiversity Council (see Chapter 7, Bioregional Conservation Objectives). As of 2004, the second edition of the Manual of California Vegetation, a new hierarchical vegetation classification system consistent with the National Vegetation Classification Standard (NVCS), is being developed by Sawyer and Keeler-Wolf, in coordination with a statewide committee (Sawyer and Keeler-Wolf *in prep*). In the NVCS, there are several upper levels of classification (currently six, may be reduced to three) representing growth form, leaf characters, hydrology, and environment and two lower levels, representing floristics (Alliance, Association). Alliances are defined by the dominant one to three species, while Associations are distinguished by secondary associated species, usually in the understory. Appendix E contains descriptions of riparian and semi-riparian alliances identified by the 2004 California Vegetation classification by Sawyer and Keeler-Wolf.

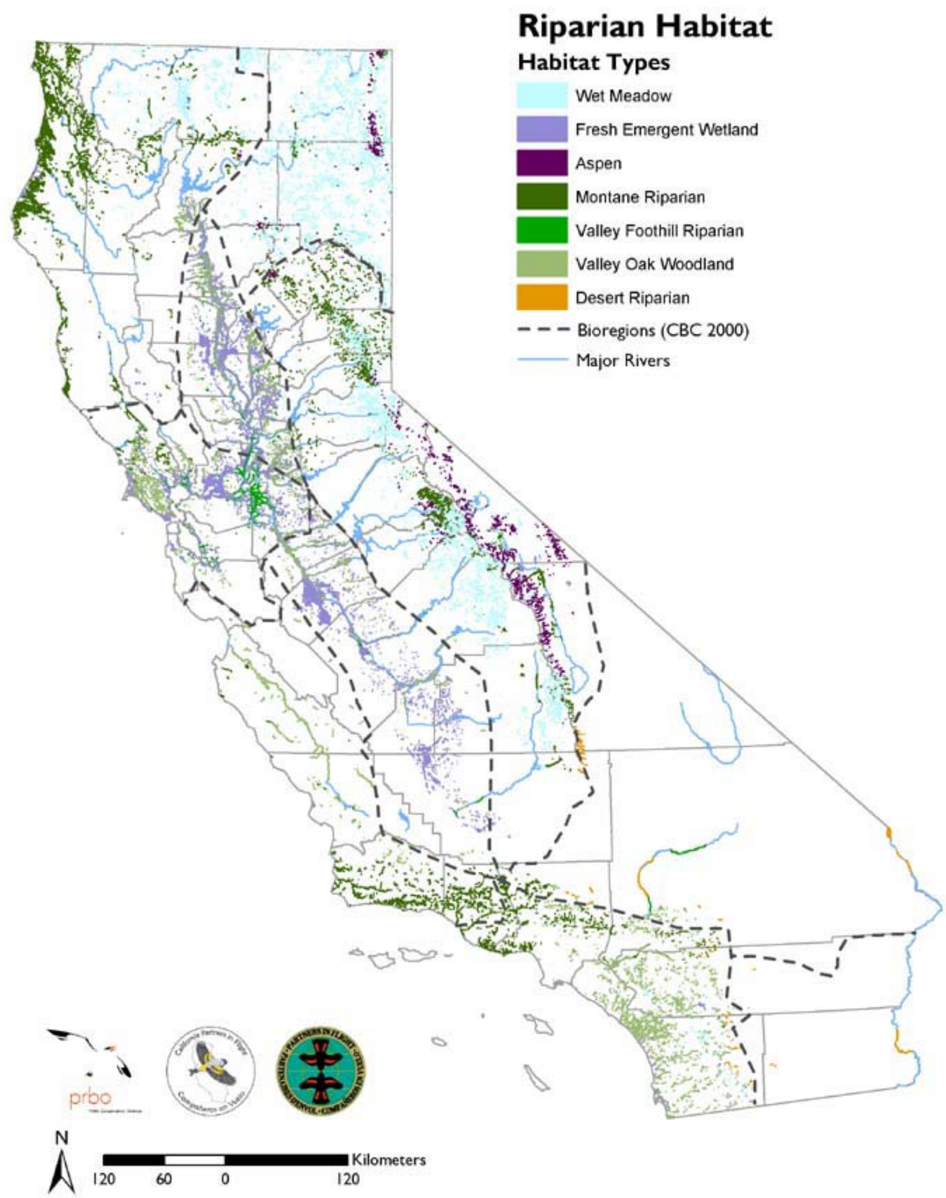


Figure 2-1. Approximate current coverage of riparian habitats throughout California.

Chapter 3. Riparian Habitat Conservation at the Landscape Scale

A number of issues covered in this Conservation Plan are united by the fact that they must be addressed on a relatively large spatial scale. When targets are set for restoring healthy population sizes of a given species (Chapter 6), researchers and land managers have to consider habitat at the scale of many hectares or square kilometers, and prioritizing land parcels for conservation and habitat restoration (Chapter 8) usually occurs at similar scales. Agricultural development in California's Central Valley, for example, has left remnant patches of riparian forest that measure from a few to a few hundred hectares (Hunter et al. 1999), and the conservation and restoration of this habitat involves consideration of the ecology of entire landscapes in which remnants are situated (Figure 3-1). Ecological conditions required for healthy wildlife populations in riparian habitats, such as complex vegetation structure that provides birds with nesting sites, are often measured at the scale of square meters (Kareiva and Andersen 1988); but additional conditions exist at much larger scales, and managers must also provide for these.

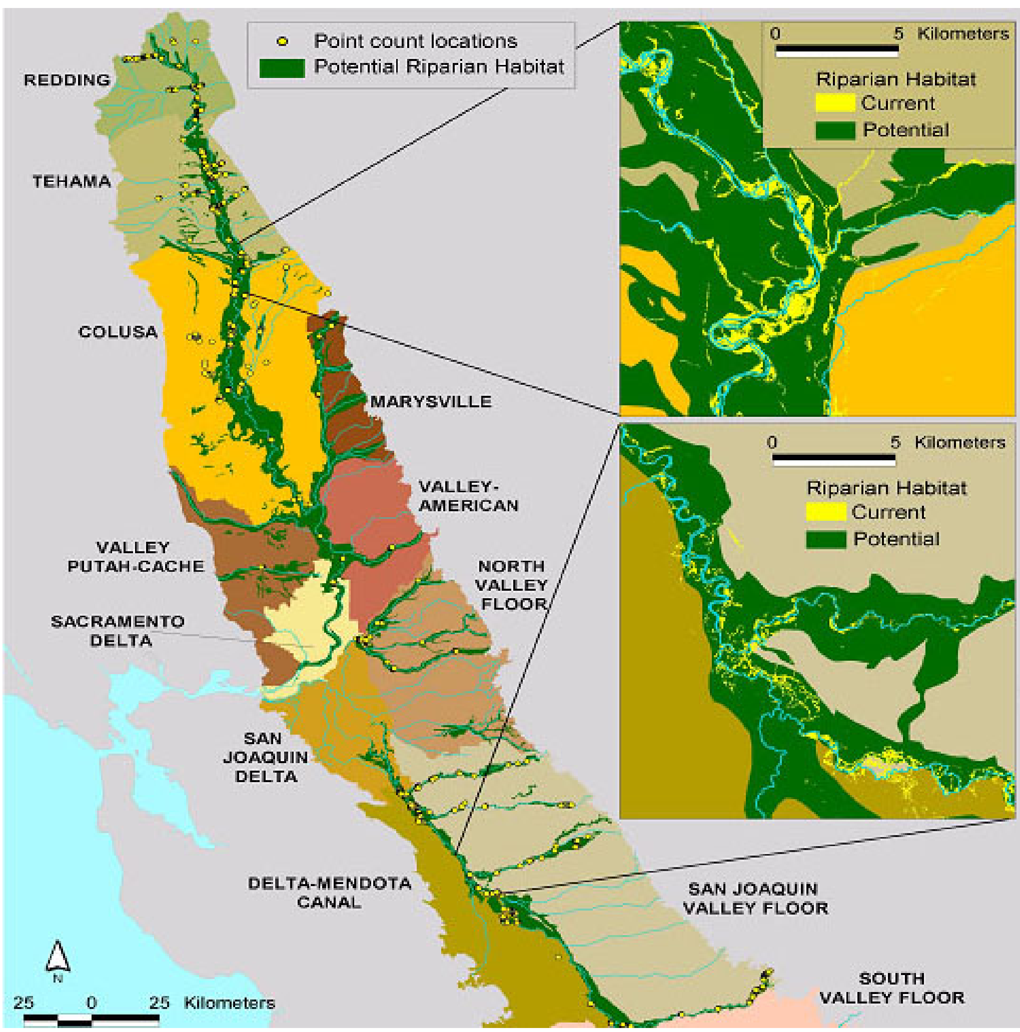


Figure 3-1. Point count locations and riparian data layers of the Central Valley basins.

The need for research focused on large-scale issues has been stressed in bird conservation initiatives (Ruth et al. 2003) and other conservation efforts partly because this is the scale at which parcels of land are owned and managed, and partly because many important ecological processes occur, and can only be studied, at large scales. Since the emergence of landscape ecology, research has increasingly been directed toward understanding the consequences for wildlife of alterations to, and the potential restoration of, natural habitats at large scales.

What is Landscape Ecology?

Landscape ecology takes into consideration the large-scale heterogeneity of areas containing species or natural communities that might be targeted for conservation. Although the size of a landscape is not strictly defined and can vary widely, landscapes typically exist at the general scale of a vista that can be seen in all directions around an observer from a single point. Such a landscape is normally a complex mosaic of multiple component areas (landscape elements or *patches*) under varying management practices or natural succession regimes (Forman and Godron 1986). Different patches may have different values for wildlife; some may be largely unoccupied by a given species while other areas are densely occupied, and occupied areas may be sites of largely successful or largely unsuccessful breeding and reproduction (i.e., population sources and sinks—Pulliam 1988, With and King 2001).

Landscape ecology, then, is concerned with interactions among these patches, in terms of the flow of species, materials, and energy among them. It also focuses on the ways that the specific shapes and spatial arrangements of landscape elements affect their interactions. That is, landscape ecology is a spatially explicit science (Forman and Godron 1986, Wiens et al. 1993, Forman 1995). While patches can be defined at nearly any scale, landscape ecology often investigates interactions of biological populations or communities with relatively large-scale environmental features and processes, such as regional topography, the expansion of urban areas into wildlands, and forest fragmentation. The growth of landscape ecology as a discipline has been paralleled by growing recognition that conclusions drawn from ecological investigations can depend upon the scale at which a system is studied (Wiens 1989, Riitters et al. 1997, Saab 1999, Wiens 1999, Schneider 2001). Environmental factors may affect bird populations differently at different scales, may only have important effects at certain scales, and may affect different species at different scales. For example, Hochachka et al. (1999) found for sites across the western U.S. that, while rates of songbird nest parasitization by Brown-headed Cowbirds decreased with increasing forest cover within 10 km of nesting sites, the relationship reversed when forest cover within 50 km was considered. Thus, the explicit consideration of scale has become an important aspect of ecological investigations, with consequences for conservation activities (Schneider 2001).

Landscape-scale factors that affect riparian birds

Many environmental factors can affect riparian bird populations at large scales. We mention here some of the more important ones that are of immediate conservation relevance.

Altered hydrology

Little research has investigated the impacts of California's large-scale alteration of natural hydrologic regimes to bird communities. Artificial flow regulation with local or upstream dams and diversions, as well as channel alteration and containment with levees and channelization, can alter plant communities at watershed scales (Ohmart 1994, Hunter et al. 1999). Vegetation, and therefore vegetation-dependent wildlife, can be dramatically affected by distant upstream water management practices (Ohmart 1994), so that restoration efforts at specific sites may depend ultimately on the cooperation of partners managing water in the wider landscape.

Habitat fragmentation and landscape condition

More attention has been paid to the topic of habitat fragmentation because fragmentation has been perhaps the most apparent human-caused transformation of natural systems, aside from their outright reduction in size (Meffe and Carroll 1997). As riparian forests have been converted to agricultural fields, for example, remnant undeveloped habitat has been left as a disconnected series of fragments of varying size and shape. Such habitat fragments have been likened to islands in a "sea" of inhospitable habitat. The Theory of Island Biogeography (MacArthur and Wilson 1967) maintains that smaller, more isolated islands (or fragments) support fewer species, due to a higher likelihood of local population extirpation. This general property of small populations results from numerous ecological mechanisms working at relatively small scales within islands or fragments, as well as at larger scales around them. For example, small remnant patches of breeding bird habitat in urban areas may contain such low numbers of a particular species that small increases in predation rates can cause extirpation. In such cases, increased densities of cats and other predators subsidized by the surrounding urban landscape can be sufficient to cause the loss of several songbird species (Soulé et al. 1988, Bolger et al. 1991, Crooks and Soulé 1999, Crooks et al. 2001). Donovan et al. (1997) found that in Midwestern forest habitats, nest predation was higher on habitat edges within moderately and highly fragmented landscapes, compared to unfragmented landscapes. Chalfoun et al. (2002) found that edge effects on nest predators were stronger in agricultural landscapes than in more heavily forested landscapes. In western riparian habitats, which are more naturally fragmented than eastern deciduous forests, densities of both nest predators and nest parasites (Brown-headed Cowbird) in forest fragments may depend more on surrounding land use, such as the prevalence of agriculture in the landscape, than on fragment size or amount of edge (Tewksbury et al. 1999). Nest parasitism by Brown-headed Cowbirds can affect the reproductive success of songbirds (Chapter 4), so landscape features that influence cowbird abundance are an important consideration.

Barriers to Movement

In addition to affecting habitat patch quality, surrounding landscape conditions can also affect wildlife movement among habitat patches. In naturally patchy systems such as desert riparian woodland, and possibly in artificially fragmented systems, it may be appropriate to consider bird populations in patches as parts of a metapopulation, or group of interconnected populations (Hanski and Gilpin 1997). In this framework, the probability of a local population's extirpation is reduced by occasional immigration from other patches, so that the long-term stability of the entire metapopulation depends on some minimum level of patch interconnectivity. In other words, a particular habitat fragment may be too small to meet minimum requirements for a stable population of a given species, but effective movement of individuals (such as dispersing juveniles or adults seeking mates) among multiple fragments can render each fragment a functioning component of the whole population. Movement among fragments may be hindered by hostile conditions in developed areas around fragments, and such movement can become increasingly unlikely with increasing distance between fragments (e.g., Norris and Stutchbury 2001, Cooper and Walters 2002).

Conservation Approaches

Weaselhead.org photo.

Female Brown-headed Cowbird.

Clearly, the quality of remnant habitat fragments can depend not only on their size and internal characteristics, but also on their configuration relative to one another and the characteristics of the surrounding landscape (Andren 1992, 1994; Sisk et al. 1997; Tewksbury et al. 1998; Saab 1999; Tewksbury et al. 2002). Prioritization of sites for bird conservation should therefore consider surrounding landscape conditions, such as the proximity and prevalence of other natural areas, urban areas, agricultural areas, or Brown-headed Cowbird foraging areas. Managing for healthy wildlife populations in remnant natural areas may entail developing cooperative relationships with the managers of adjacent lands.

Fragmentation vs. natural patchiness

The fragmentation of formerly contiguous habitat can reduce the usefulness of remaining habitat for wildlife conservation in some cases, so preservation and restoration efforts should in these cases prioritize large contiguous blocks of habitat and connectivity among those blocks. However, many natural systems are patchy or heterogeneous at large scales, and organisms can be adapted to naturally patchy environments. For example, desert riparian gallery forests often occur naturally as discreet patches along river stretches where conditions are favorable. This contrasts with the riparian forests of California's Central Valley, which were historically relatively wide, contiguous stands following river courses for long distances. Natural patchiness generates habitat heterogeneity that single organisms may use, as when bird species nest in one habitat and forage in another. In desert riparian systems, many riparian woodland-dependent species also forage in surrounding scrub habitat (Szaro and Jakle 1985). Thus, efforts to restore natural conditions must be tailored to the needs of specific systems, with consideration for the natural large-scale heterogeneity of many systems. In extreme cases of critical habitats that are very patchy, such as freshwater wetlands, conservation efforts may be best directed towards multiple small reserves where remnant habitat exists (Haig et al. 1998).

The landscape paradigm

It is increasingly recognized that viewing habitat remnants as islands embedded in a sea of unsuitable habitat is an oversimplification of reality, and conservation planning should not necessarily follow this model. Each of the patches that compose a landscape is more accurately seen as falling somewhere along a continuous gradient of habitat quality, and quality varies depending on what particular wildlife species or community one considers as well as the scale at which patches are defined (Wiens 1995). As discussed above, habitat quality is also mediated by landscape composition and interactions among patches.

Advances in landscape ecology have therefore generated a framework for conservation planning within which the structure and function of all elements of a landscape can be considered together in a spatially explicit, scale-explicit manner. Resulting conservation approaches might identify priority areas for strict preservation of remnant and restored natural systems, surrounding areas for less strict forms of mixed-use conservation management, and management applications in permanently degraded areas that will minimize their adverse impacts on the broader landscape.

"Placing the conservation reserves firmly within the context of the surrounding landscape and attempting to develop complementary management strategies seems to be the only way to ensure the long term viability of remnant areas… This has important implications for land managers since it involves a radically new way of viewing management and requires that neighboring land uses, and hence neighboring landowners, interact in a positive way. This is difficult, but not impossible…"(Saunders et al. 1991).

Chapter 4. Problems Affecting Riparian Birds

Riparian areas are the most critical habitat for conservation of Neotropical migrant and resident birds in California (Miller 1951, Gaines 1974, Manley and Davidson 1993) and throughout the west (Rich 1998). Riparian ecosystems harbor the highest number of bird species found in the arid and semiarid portions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). Consequently, the loss of riparian habitats may be the most important cause of population decline among landbird species in western North America (DeSante and George 1994). In addition to providing important breeding grounds, riparian habitat offers vital overwintering and migration stopover areas and corridors for dispersal (Gaines 1977, Ralph 1998, Humple and Geupel 2002).

Habitat loss and degradation are probably the most important factors causing the decline of riparian bird populations. Alteration of riparian landscapes narrows or destroys important population dispersal corridors. Disruption of natural hydrological conditions by dams, levees and diversions, clearing associated with farming and development, overgrazing, and invasion by exotic species have all contributed to degradation of riparian zones. Nest predation and parasitism by the Brown-headed Cowbird may reduce the reproductive success of many riparian birds in California (Gaines 1977, Harris 1991, Geupel et al. 1997[b], Laymon and Williams 1997, Gardali et al. 1998, USFWS 1998). Long-term studies of migrant landbirds in California suggest that reproductive success on the breeding grounds is the primary factor limiting populations (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000). However, the situation is complex and it is likely that many factors, in and across all stages in the annual cycle, are operating to influence population dynamics (Martin 1993, Rappole and McDonald 1994, Sherry and Holmes 1995, Faaborg 2002, Ballard et al. 2003b).

Nest Parasitism

Local habitat features around the nest, such as vegetation composition and structure, as well as habitat configuration and landscape context, have been shown to affect levels of nest parasitism and predation (Freemark et al. 1995, Larison et al. 1998, Hochachka et al. 1999, Tewksbury et al. 2002, Chapter 3). As a result of the conversion of native habitats to farms and pastures, the Brown-headed Cowbird has undergone a population explosion and range expansion during the twentieth century (Rothstein et al. 1980, Laymon 1987, Lowther 1993). Agriculture and livestock grazing near riparian zones provide Brown-headed Cowbirds with ample foraging habitat close to songbird breeding grounds (Mathews and Goguen 1997, Tewksbury et al. 1998). Cowbird parasitism contributes to lowered productivity in host species through direct destruction of host eggs; through competition between cowbird and host chicks, resulting in increased mortality; and through nest abandonment in some species, thus lowering overall fecundity within a season.

Nest Predation

In addition, the expansion of agricultural and urban land conversion tends to enhance favorable conditions for native and non-native predators that can decimate bird communities. The elimination of top predators, such as mountain lions and wolves, often results in an increased population of midlevel predators (Soule et al. 1988, Crooks et al. 1999). Raccoons, skunk and domestic cats, for example, are well-documented avian predators (Winter 1999, Pietz and Granfors 2000, Thompson and Burhans 2003, Sawin et al. 2003). Land conversion can also favor nest predators such as jays, crows and magpies (Andren 1992).

The identification and protection of source populations (production of young exceeds adult mortality) is vital to bird conservation. By recognizing those habitat and landscape factors that exist in these healthy (i.e., source) populations, conservation efforts can increase and enhance favorable conditions for birds (Martin 1995). To identify source populations, scientists must gather specific demographic information on the productivity, survivorship and dispersal rates of the bird community. Determination of these variables for every species breeding in riparian habitat is not currently feasible; however, recent advances in the monitoring demographic parameters of bird populations (Martin and Geupel 1993, DeSante 1995, DeSante and Rosenberg 1998) have allowed biologists to model a population's potential health at specific sites (e.g., Robinson et al. 1995, Tewksbury et al. 1998). In general, nest success rates of 20% or less, for most species, indicate unsustainable or "sink" populations (Martin 1992, Robinson et al. 1995, Trine 1998, Budnik et al. 2000). The number of young produced in a bird community is probably the most important factor influencing many species' occurrence and persistence (Martin 1992, Martin and Geupel 1993) and may be the easiest way to identify a healthy population. Table 4-1 provides an example of how productivity can vary among riparian sites among California's bioregions.

Photo by Ian Tait

Western Scrub-Jay, a common nest predator.

However, nest success alone cannot entirely substitute for an actual measure of annual productivity that takes into account re-nesting attempts after nest failure, double brooding, and the number of young fledged per successful nest (Thompson et al. 2001). Several recent studies have demonstrated that the Mayfield method underestimates population productivity (summarized in Anders and Marshal *in press*). Intensive studies that follow color-marked birds throughout the breeding season are feasible, and yield the most accurate productivity data. Powell et al. (1999) describe a model that may be used to predict breeding-season productivity as a function of adult survival, juvenile survival, nesting success, season length, re-nesting interval, and juvenile care intervals. For species with nests that are difficult to find or monitor, or when logistical constraints prohibit locating every nest on a study plot, nest monitoring may be supplemented by color-marking breeding adults and counting fledglings on breeding territories to measure annual productivity (Porneluzi and Faaborg 1999).

Many of California's riparian birds face potential population declines and local extirpations. Of these, Least Bell's Vireo, Yellow-billed Cuckoo, and Willow Flycatcher have suffered the most drastic reductions in their overall populations and breeding ranges (Laymon and Halterman 1985, USFWS 1998), resulting in state or federal listing for each. Habitat loss, in concert with brood parasitism and nest predation, affects most open cup nesting species throughout the state. Events in California may be illustrated by the demise of Yellow Warbler populations along the Colorado River. There, a combination of massive habitat loss, breeding failure in "replacement" habitats and, finally, high cowbird pressure in remaining habitat patches resulted in near extirpation of the species (Rosenberg et al. 1991).

Table 4-1. Mayfield (1975) estimates of nest success for select species among riparian songbird monitoring sites by California bioregion, using same data collection and analysis methods.

Species	Sacramento Valley	Bay-Delta	Modoc	Sierra Nevada
Black-chinned Hummingbird	0.44[3]	--	--	0.39[6]
Western Wood-Peewee	--	0.64[4]	0.17[5]	0.63[6]
Warbling Vireo	--	0.06[1]	--	0.09[6]
Bushtit	--	0.44[4]	--	0.44[6]
Swainson's Thrush	--	0.29[1]	--	--
American Robin	--	0.21[1]	--	0.49[6]
Yellow Warbler	0.32[2]	--	0.89[5]	0.30[7]
Wilson's Warbler	--	0.05[1]	--	--
Common Yellowthroat	--	0.63[4]	--	--
Spotted Towhee	0.28[3],0.05[2]	0.43[4]	--	0.24[6]
Song Sparrow	0.28[8]	0.58[4],0.24[1]	0.59[5]	0.29[7]
Black-headed Grosbeak	0.27[3], 0.33[2]	0.27[1]	--	0.57[6]

[1] Gardali et al. 1999, [2] Wood et al. 2001, [3] Small et al. 1999, [4] Haff et al. 2001, [5] King et al. 2001, [6] Heath et al. 2001, [7] Heath et al. 2002[b], [8] Hammond and Geupel 2000

Least Bell's Vireo: An Example of Conservation Need and Action

The Least Bell's Vireo provides an excellent example of the problems facing riparian birds in California and how adaptive management and restoration efforts can reverse population declines. Historically, the Least Bell's Vireo was one of the most common breeding birds in riparian habitat in California (Grinnell and Miller 1944). In 1973, extensive searches of their former breeding grounds between Tehama and San Joaquin counties failed to detect any Least Bell's Vireos (Gaines 1974). By 1980, the species was extirpated from the entire Central Valley (USFWS 1998). Once characterized as abundant (for review see USFWS 1998), there remained only about 300 pairs of breeding birds when the species received federal listing as endangered in 1986 (RECON 1989). Today, the Least Bell's Vireo remains absent from the bulk of its historical range and is restricted to eight southern counties, with the majority of birds occurring in San Diego County (Figure 5-7).

Habitat destruction and degradation have severely reduced the range of Least Bell's Vireo in California. Agricultural land uses and water projects have not only actively destroyed riparian habitat, but have reduced water tables to levels that inhibit the growth of the dense vegetation the vireos prefer. The remaining vireo populations cling to small, increasingly isolated patches of habitats; as such, populations are more vulnerable to catastrophic events, demographic failure and loss of dispersal corridors. Dams, levees and other flood control structures hinder riparian reestablishment, creating more "old-growth" conditions (dense canopy and open understory) that are unfavorable to breeding vireos. Finally, habitat degradation encourages nest predation and parasitism.

Photo by Big Sur Ornithology Lab

Cowbird parasitism of Least Bell's Vireo nests further encourages their decline. Livestock grazing has reduced and degraded the lower riparian vegetation favored by the Least Bell's Vireo (Overmire 1962) and provided foraging areas for the Brown-headed Cowbird. Row crops and orchards also provide feeding grounds for the parasite. By as early as 1930, nearly every Least Bell's Vireo nest found in California hosted at least one cowbird egg (USFWS 1998). Since a parasitized nest rarely fledges any vireo young, nest parasitism of Least Bell's Vireo results in drastically reduced nest success (Goldwasser 1978, Goldwasser et al. 1980, Franzreb 1989, Kus 1999, Kus 2002).

Since federal listing and concordant restoration and management activities, the population increased dramatically up until 1998 (USFWS 1998). The Camp Pendelton population increased from 15 males in 1980 (Salata 1980) to 1011 in 1998 (Griffith 1999). In addition to population growth, observations indicate that the species is expanding its range northward. Currently, Least Bell's Vireos are recolonizing areas unoccupied for decades and may potentially reestablish breeding populations in the central and northern portions of their historic range (USFWS 1998). Since the peak in 1998, however, the Camp Pendelton population has declined to 757 in 2002 (W. Berry pers. comm.).

Chapter 5. The Conservation Planning Process

The national Partners in Flight program requested that state working groups define and prioritize the most threatened habitat types in each region, weighted by their importance to birds. In California, riparian habitats were unanimously chosen as the top priority because they provide the richest habitats for both breeding and wintering birds (Miller 1951, Cogswell 1962, Gaines 1977, Manley and Davidson 1993). Thus, California Partners in Flight formed the Riparian Habitat Joint Venture to spearhead the conservation planning process.

Prioritization schemes developed for the state's Neotropical migrants consistently ranked riparian as the most important habitat type (Davidson 1995). California's riparian habitats have many endemic species and subspecies that are known as riparian-obligate species. In addition to high species richness, riparian areas during the breeding season can harbor individuals at densities up to ten times greater than surrounding upland habitats. Although riparian habitat is recognized as extremely important, the magnitude of its destruction and degradation has been greater than for any other habitat in California, with the possible exception of perennial grassland.

The Riparian Bird Conservation Plan has been developed cooperatively by leading bird researchers in California through a process designed to:

- Capture the conservation needs of the complete range of riparian habitat types throughout the state.
- Develop, by consensus, biological conservation objectives for selected riparian bird species.

Photo by Kevin McKereghan

Song Sparrow, a riparian focal species.

Criteria for Selecting Riparian Focal Species

The majority of the PIF planning efforts use the national PIF database (Carter et al. 2000) to prioritize species in need of conservation attention and then select focal species by region for conservation plans. The RHJV elected against this method for the Riparian Bird Conservation Plan for a number of reasons. The national PIF prioritization scheme relies heavily on BBS trend estimates that likely do not adequately monitor riparian birds in California. Additionally, the PIF database does not yet recognize many subspecies including the Western Yellow-billed Cuckoo, a California endangered species. These factors render such a "priority" species list less representative than the RHJV preferred. Instead, the RHJV chose to emphasize the ecological associations of individual species *as well as* those of conservation concern (Chase and Geupel *in press*). In doing so, the RHJV included a suite of focal species whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a "healthy" system (Table 5-2). Additionally, the RHJV decided that some of the most useful indicators were those with populations and distributions large enough to be easily monitored and to provide sufficient sample sizes for statistical analysis across sites and/or regions.

The RHJV included species in the conservation planning process based on five factors (although not all species meeting these criteria were selected, and species selected did not necessarily meet all criteria, note: most are not special management species; see Table 5-1). The species considered:

- Use riparian vegetation as their primary breeding habitat in most bioregions of California.
- Warrant special management status—endangered, threatened, or species of special concern on either the federal or state level.
- Have experienced a reduction from their historical breeding range.
- Commonly breed throughout California's riparian areas—allowing adequate sample sizes for statistical comparisons and therefore the ability to rapidly assess responses to changes in management (such as restoration).
- Have breeding requirements that represent the full range of successional stages of riparian ecosystems—to assess the success of restoration efforts.

Because birds occupy a wide diversity of ecological niches in riparian habitat (Figure 5-1), they serve as useful tools in the design of conservation efforts. Birds are relatively easy to monitor in comparison with other taxa and can serve as "focal species," whose requirements define different spatial attributes, habitat characteristics and management regimes representative of a healthy riparian system (Chase and Geupel *in press* for review of CalPIF's strategy of choice and use of focal species). For example, the bird that requires the largest area to survive in a certain habitat will determine the minimum suitable area for that habitat type. Likewise, the requirements of non-migratory birds that disperse short distances to establish new territories will define the attributes of connecting vegetation. The species with the most demanding or exacting requirements for an ecological characteristic, such as stream width or canopy cover, determines its minimum acceptable value. Therefore, the assumption is that a landscape designed and managed to meet the focal species' needs encompasses the requirements of other species (Lambeck 1997).

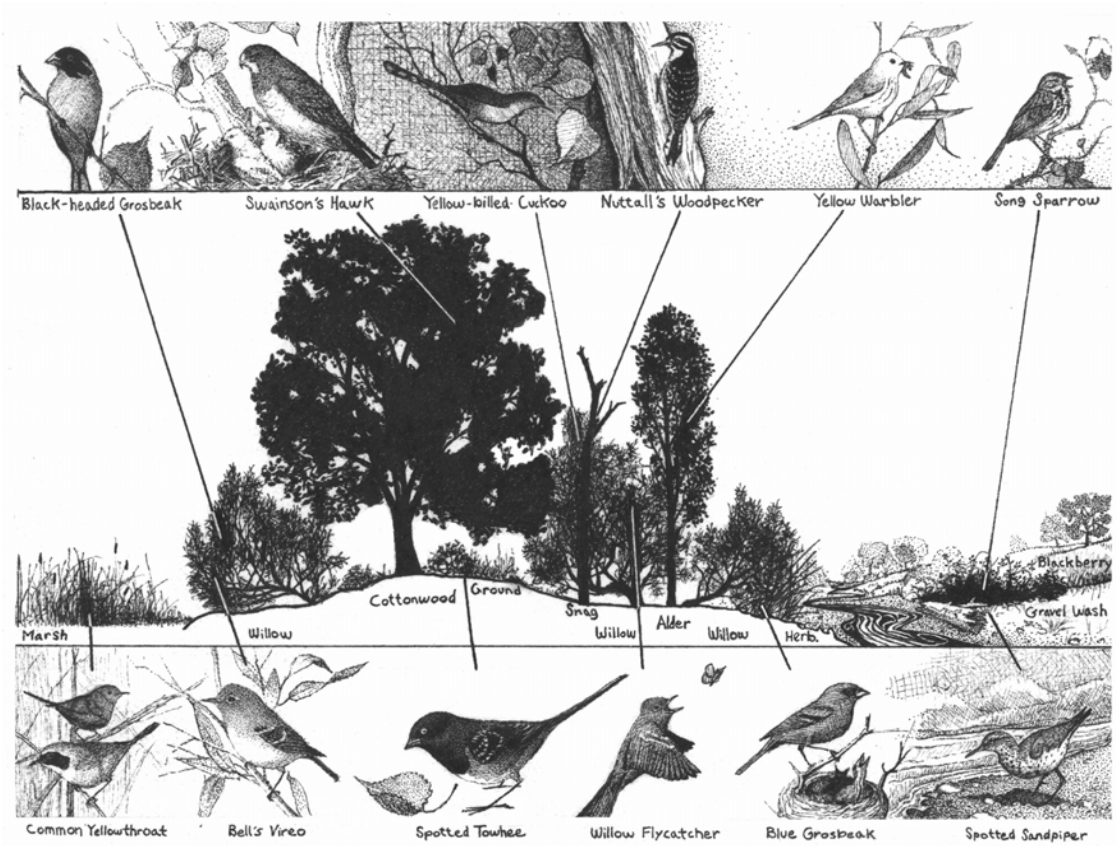


Figure 5-1. A healthy system needs diverse vegetative structure to best support birds. Illustration by Zac Denning.

Focal Species

The following were selected as focal species for preparing the Conservation Plan. They are listed below followed by the species account author and any special-status designations. Latin names are given in Appendix D. New for this version are: Spotted Sandpiper, Tree Swallow, and Tricolored Blackbird.

Swainson's Hawk: California listed as threatened. Brian Woodbridge, U.S. Fish and Wildlife Service

Spotted Sandpiper: Chris McCreedy and Nils Warnock, PRBO Conservation Science

Western Yellow-billed Cuckoo: California listed as endangered. Steve Laymon, Bureau of Land Management

Willow Flycatcher: California listed as endangered, USFS Region 5 sensitive species; the Southwestern Willow Flycatcher subspecies is federally listed as endangered. Mary Whitfield, Southern Sierra Research Station; Diana Craig, USDA Forest Service and Pamela Williams, Kern National Wildlife Refuge

Warbling Vireo: Tom Gardali, PRBO Conservation Science

Least Bell's Vireo: Federally listed as endangered. Barbara Kus, San Diego State University

Bank Swallow: California listed as threatened. Barry Garrison, California Department of Fish & Game

Tree Swallow: David Winkler, Cornell University

Swainson's Thrush: Jennifer White and Stacy Small, University of Missouri, Columbia

Yellow Warbler: California species of special concern for species and Sonoran subspecies. Sacha Heath, PRBO Conservation Science

Common Yellowthroat: California listed as species of special concern for San Francisco subspecies. Tina Menges, U.S. Fish and Wildlife Service

Wilson's Warbler: Chris Otahal, U.S. Fish and Wildlife Service

Yellow-breasted Chat: California species of special concern. Matt Ricketts, LSA Associates and Barbara Kus, San Diego State University

Song Sparrow: Diana Humple and Geoff Geupel, PRBO Conservation Science

Black-headed Grosbeak: Stacy Small, University of Missouri, Columbia and Mike Lynes, Hastings University

Blue Grosbeak: Jeanne Hammond, Humboldt State University

Tricolored Blackbird: Bill Hamilton, UC Davis

Key findings from the species accounts are available at http://www.prbo.org/calpif/htmldocs/riparian.html. These findings and the detailed information found in each species account provide the basis for the conclusions and conservation recommendations presented in this Conservation Plan. Account authors and other conservation and land management experts gathered to discuss and synthesize their results into a summary of concerns, habitat requirements, conservation objectives, and action plans (or recommendations). The species accounts and the results from this meeting form the backbone of this Conservation Plan.

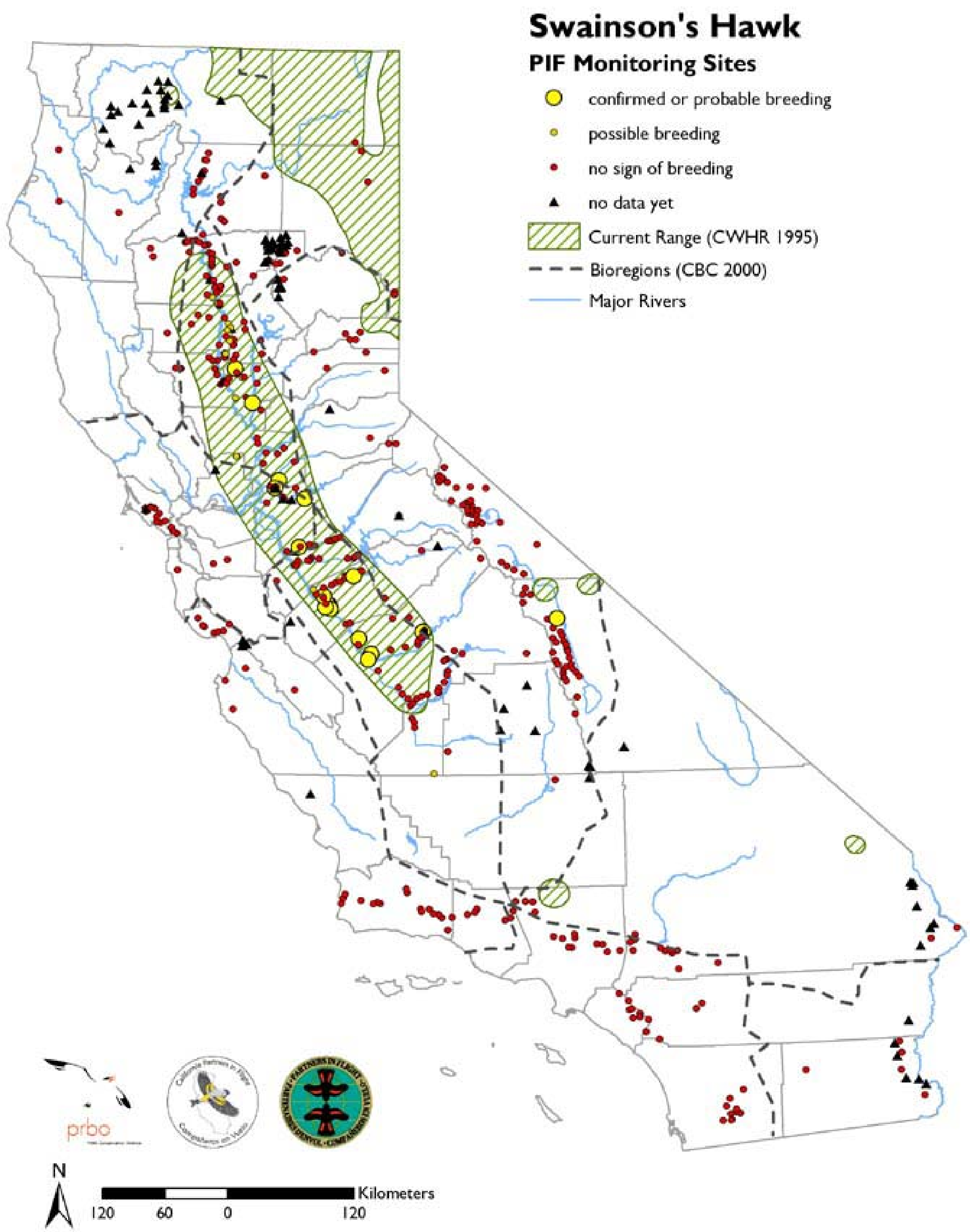


Figure 5-2. CalPIF monitoring sites, breeding status, and current range for the Swainson's Hawk in California.

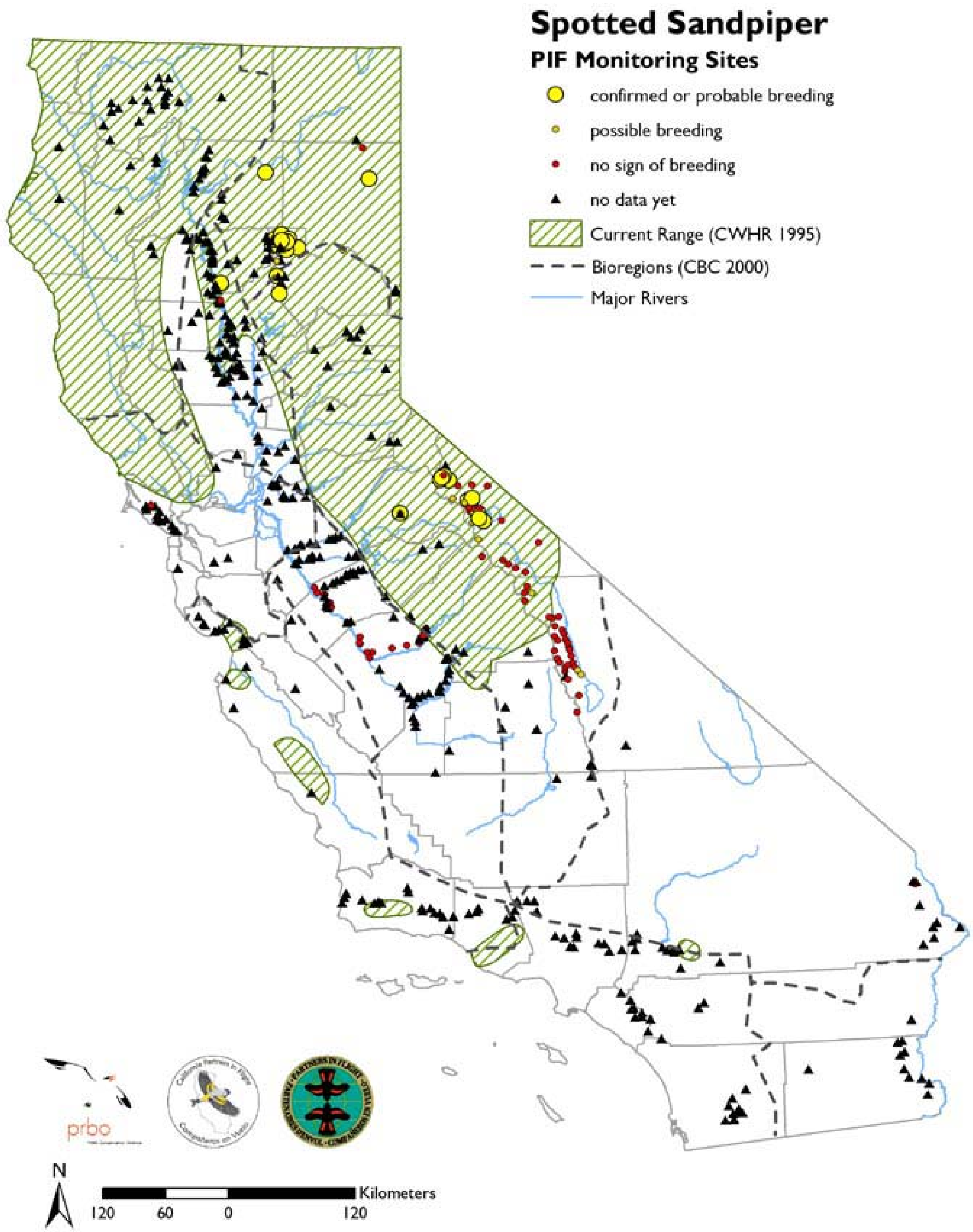


Figure 5-3. CalPIF monitoring sites, breeding status, and current range for the Spotted Sandpiper in California.

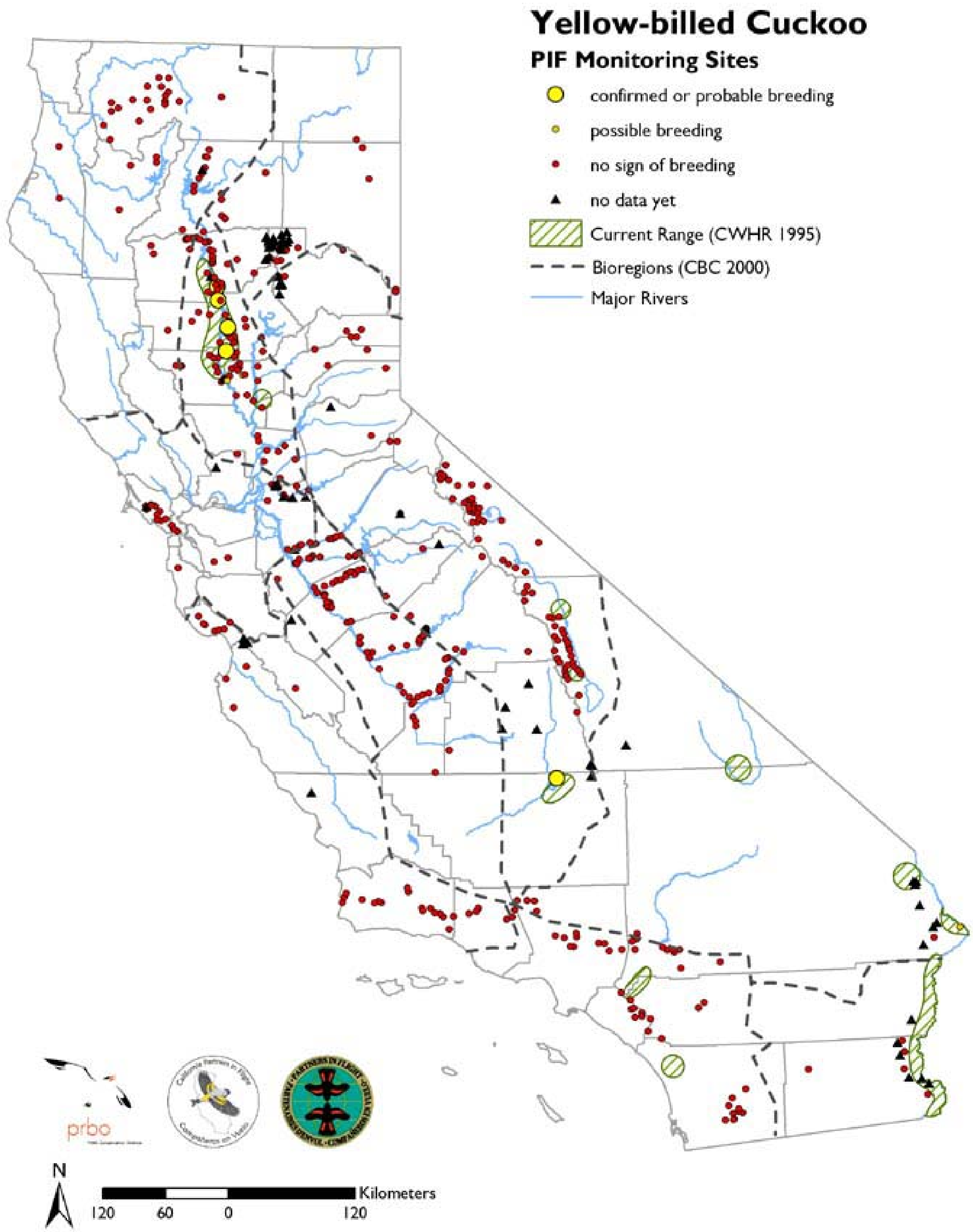


Figure 5-4. CalPIF monitoring sites, breeding status, and current range for the Western Yellow-billed Cuckoo in California.

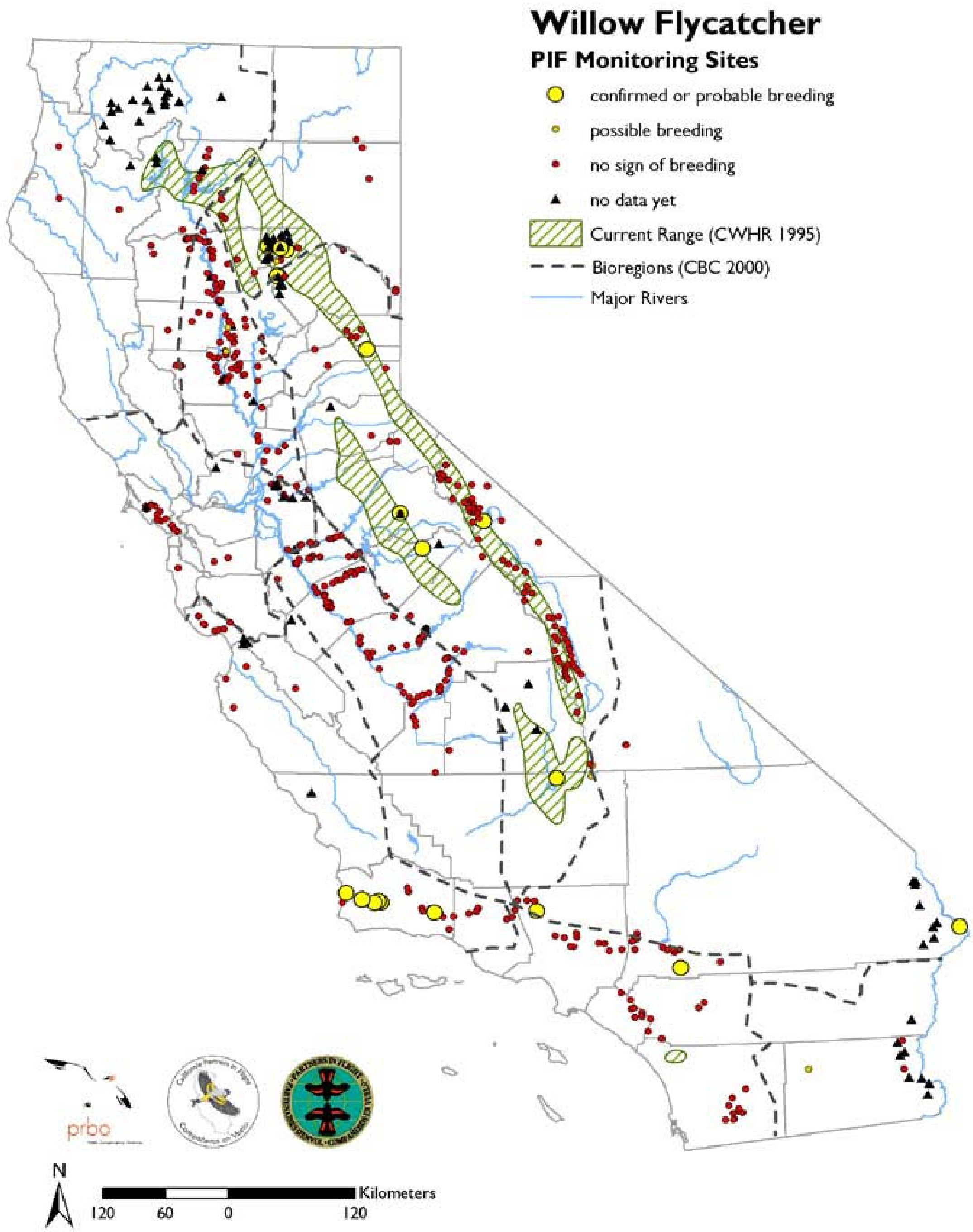


Figure 5-5. CalPIF monitoring sites, breeding status, and current range for the Willow Flycatcher in California.

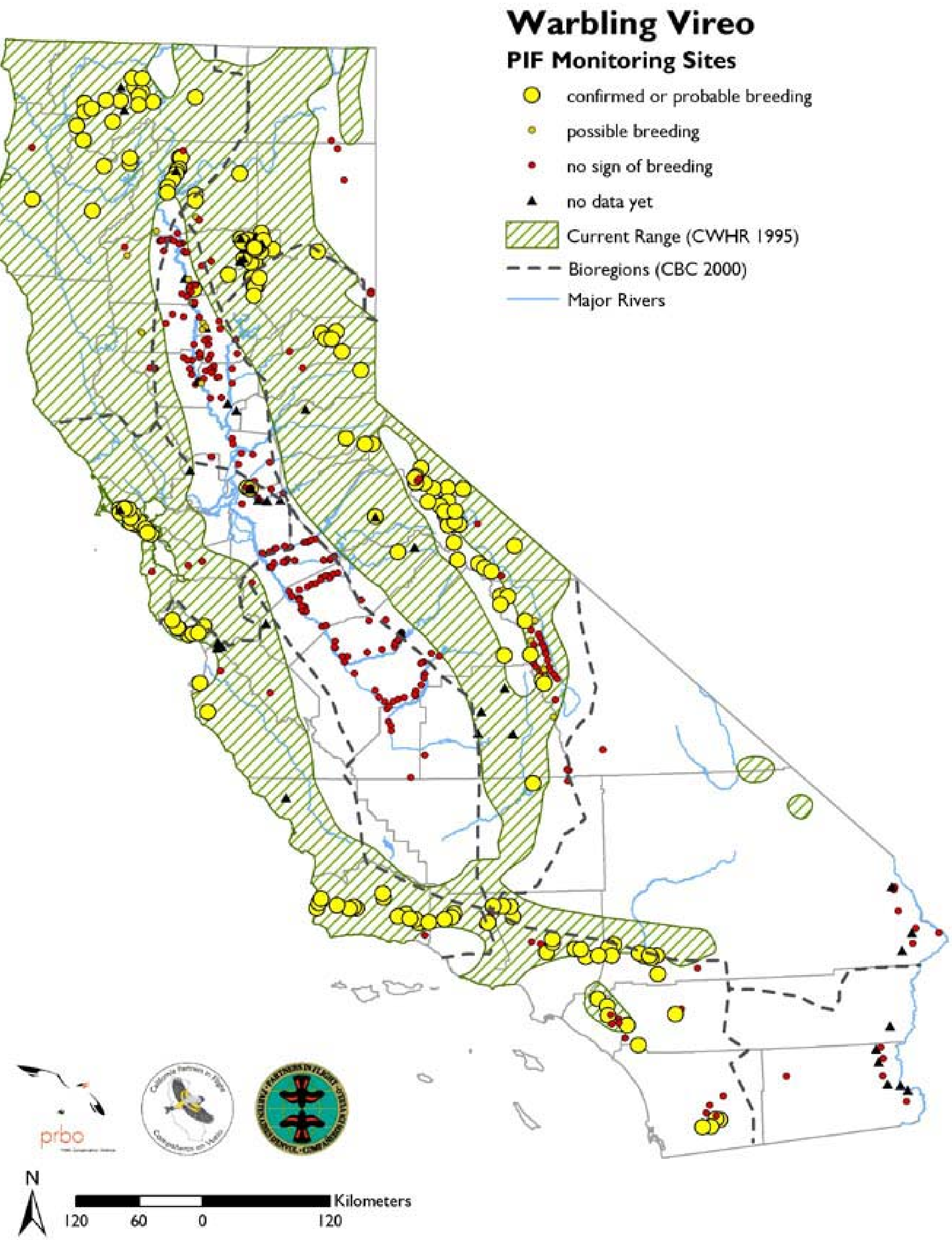


Figure 5-6. CalPIF monitoring sites, breeding status, and current range for the Warbling Vireo in California.

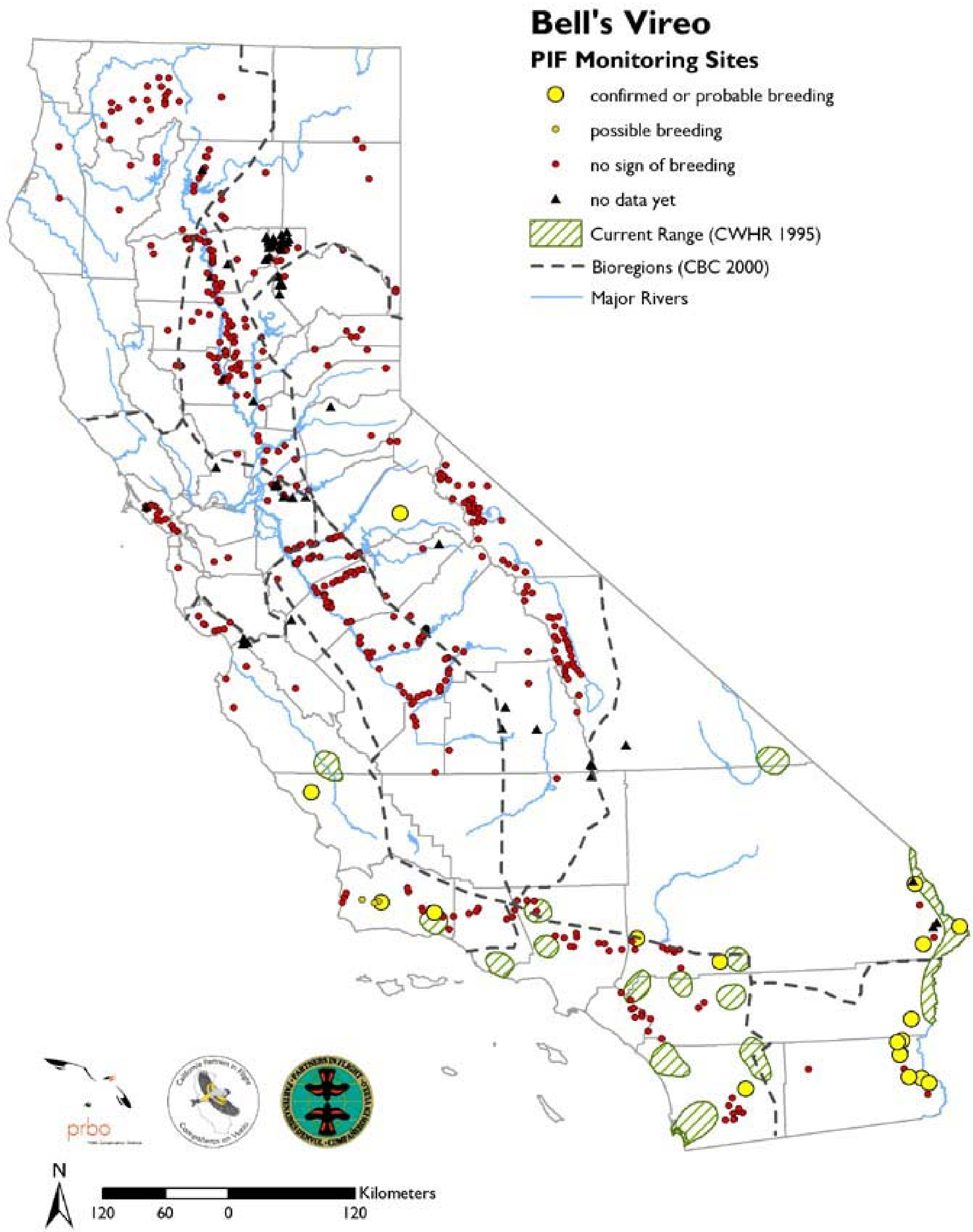


Figure 5-7. CalPIF monitoring sites, breeding status, and current range for the Least Bell's Vireo in California.

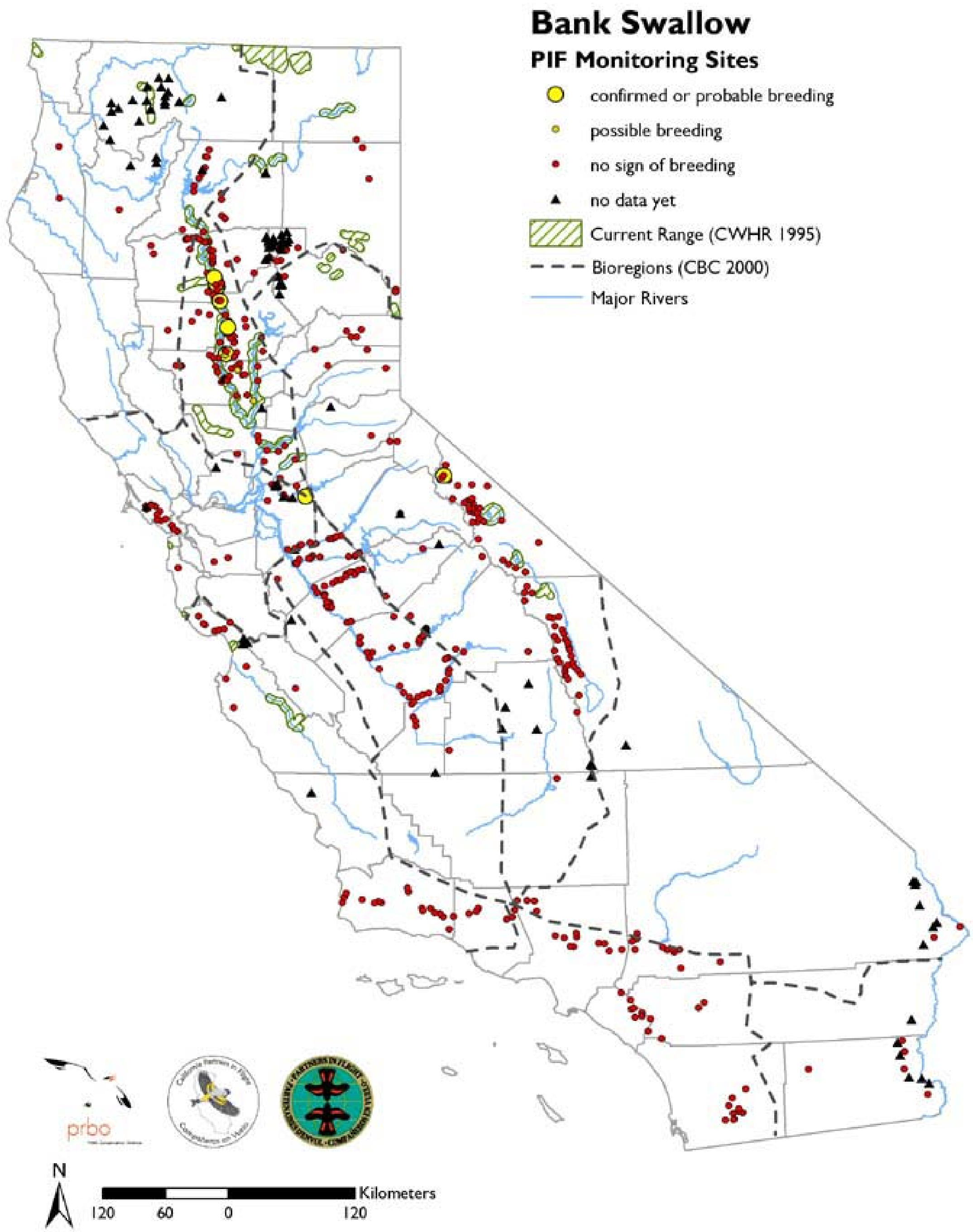


Figure 5-8. CalPIF monitoring sites, breeding status, and current range for the Bank Swallow in California.

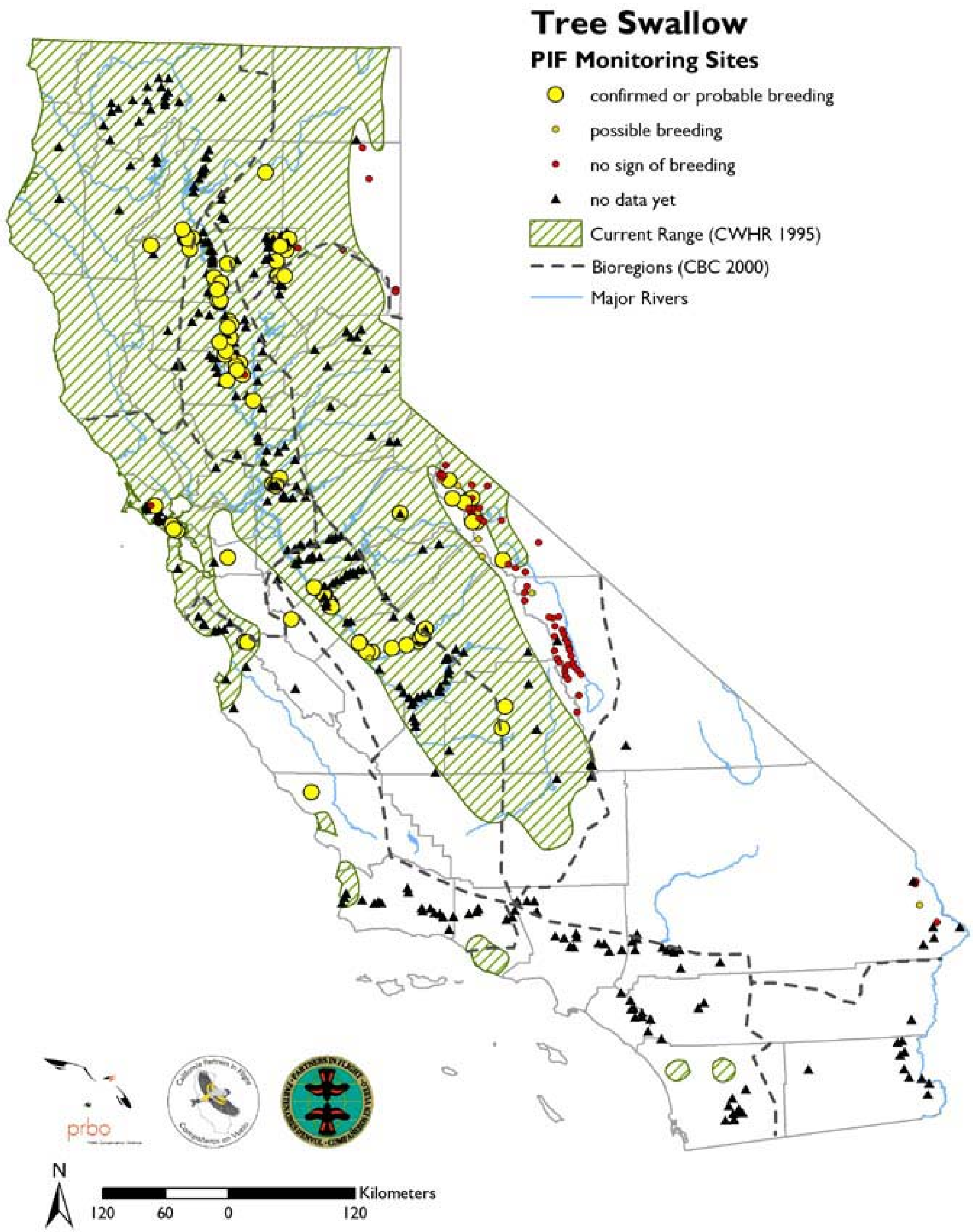


Figure 5-9. CalPIF monitoring sites, breeding status, and current range for the Tree Swallow in California.

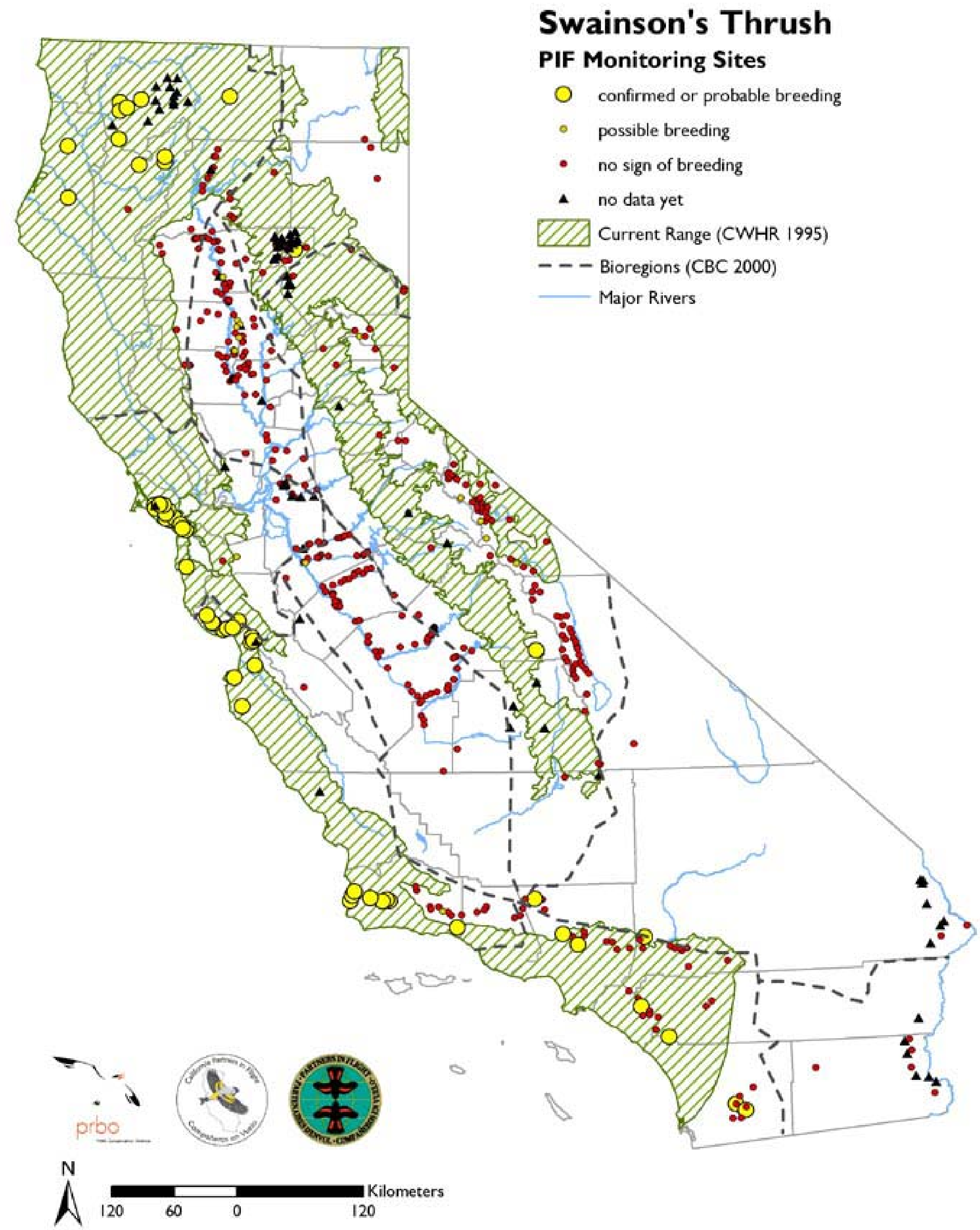


Figure 5-10. CalPIF monitoring sites, breeding status, and current range for the Swainson's Thrush in California.

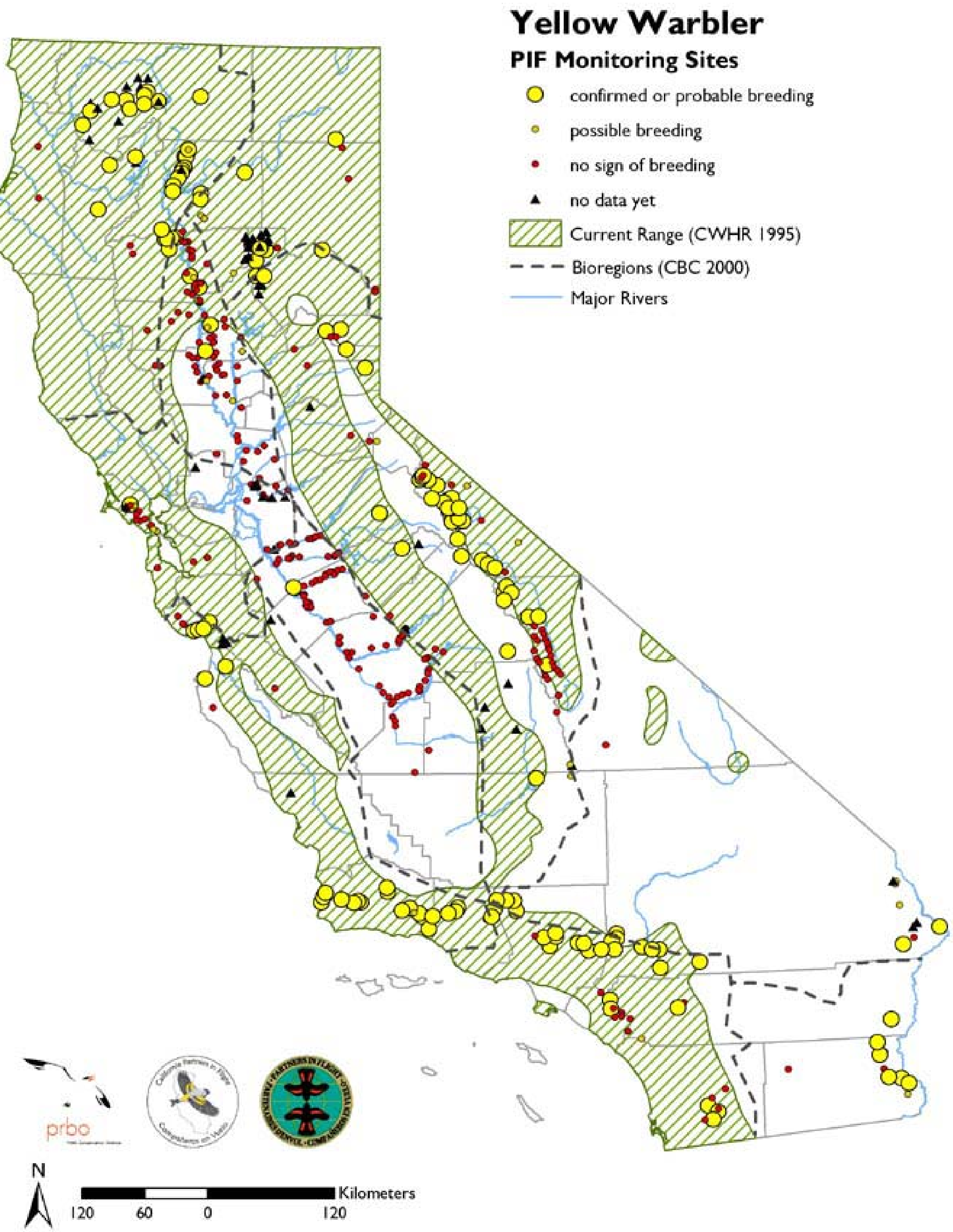


Figure 5-11. CalPIF monitoring sites, breeding status, and current range for the Yellow Warbler in California.

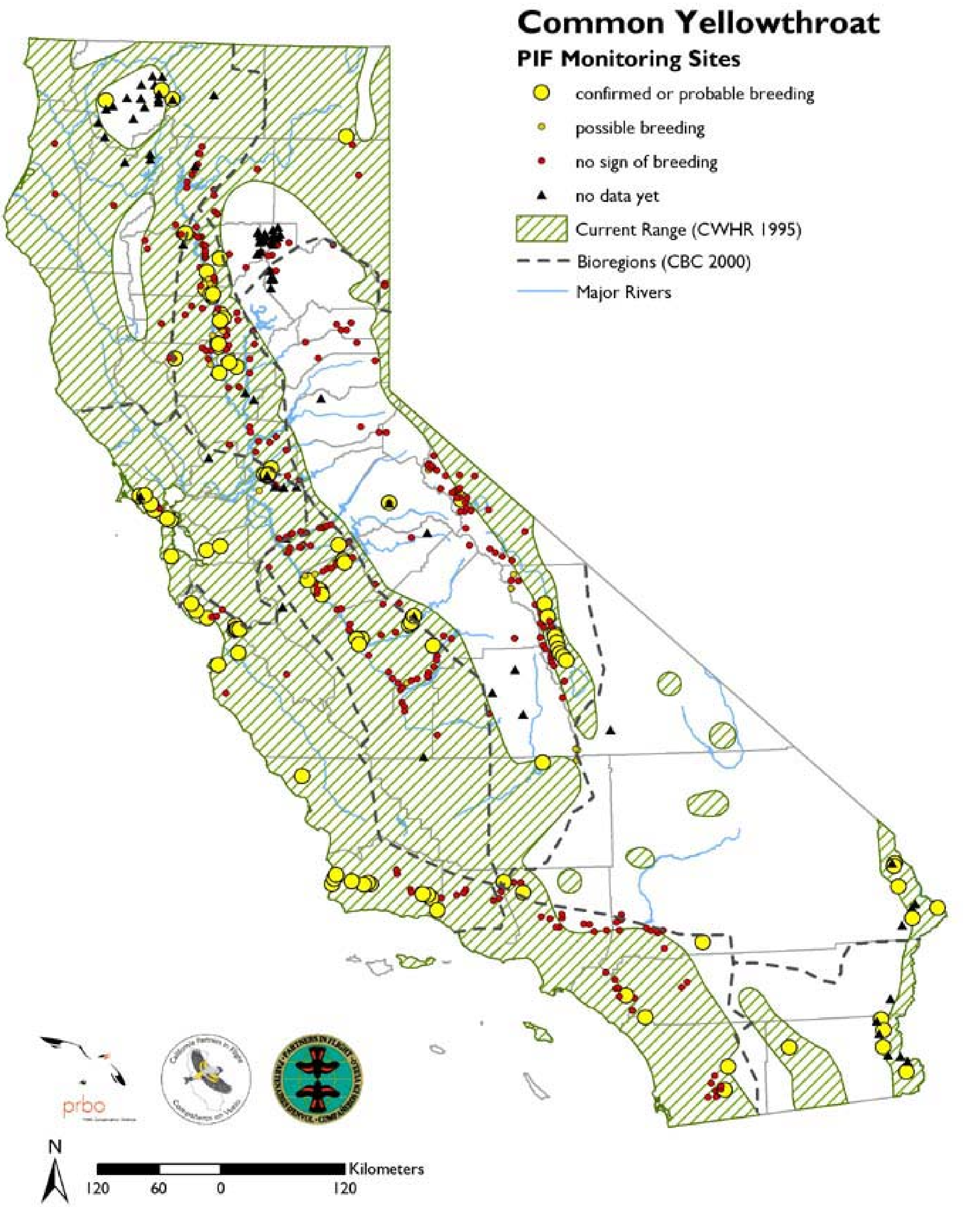


Figure 5-12. CalPIF monitoring sites, breeding status, and current range for the Common Yellowthroat in California.

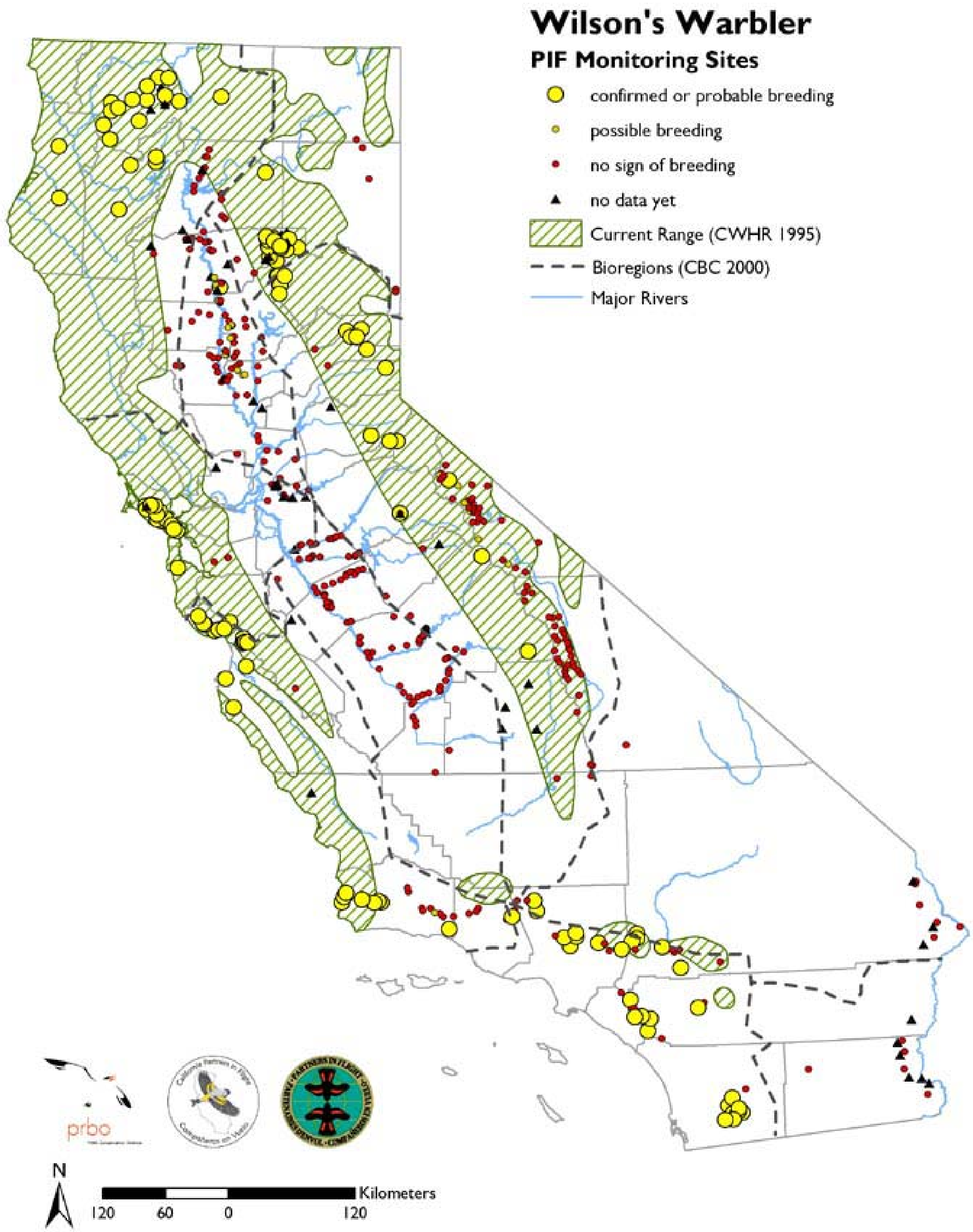


Figure 5-13. CalPIF monitoring sites, breeding status, and current range for the Wilson's Warbler in California.

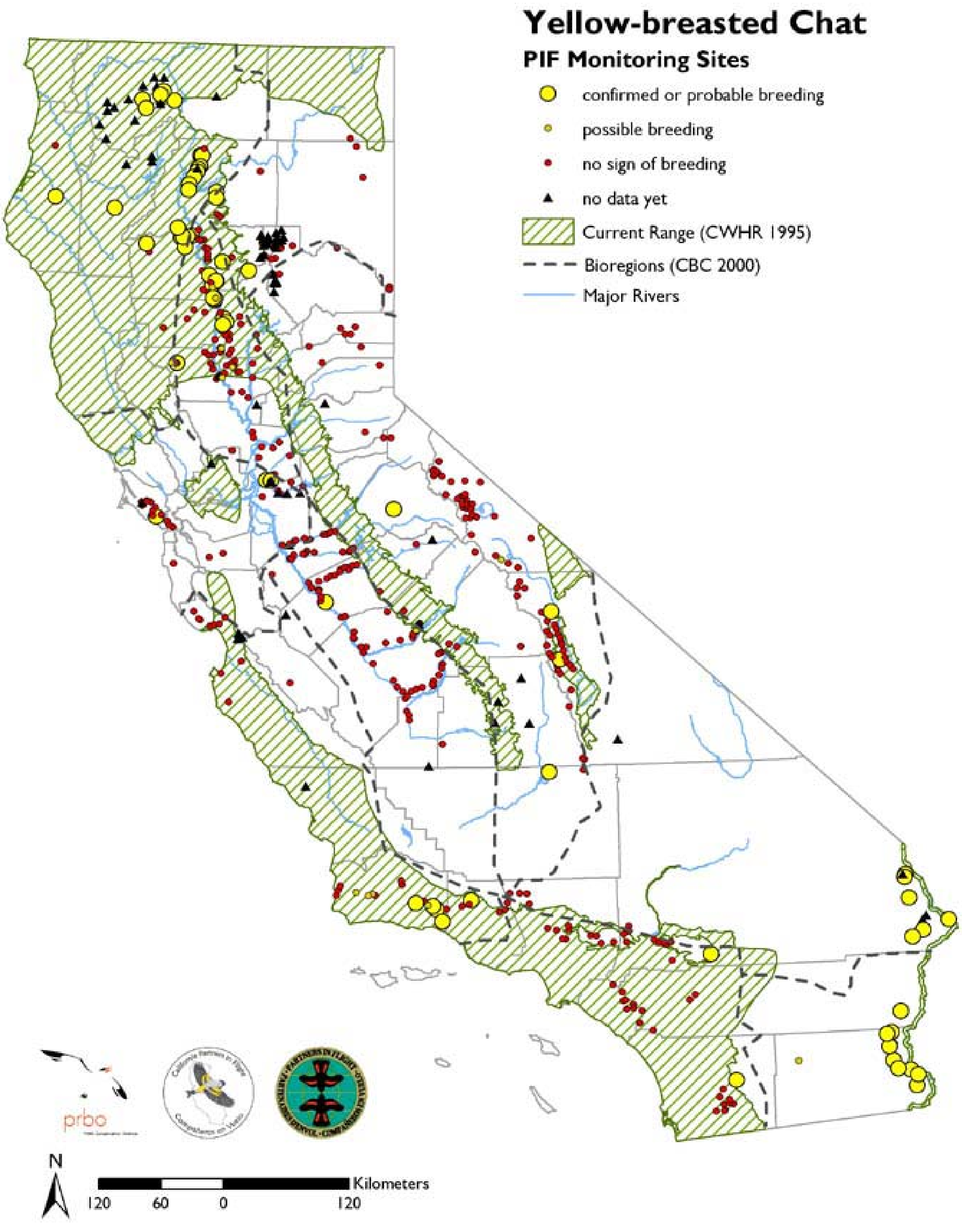


Figure 5-14. CalPIF monitoring sites, breeding status, and current range for the Yellow-breasted Chat in California.

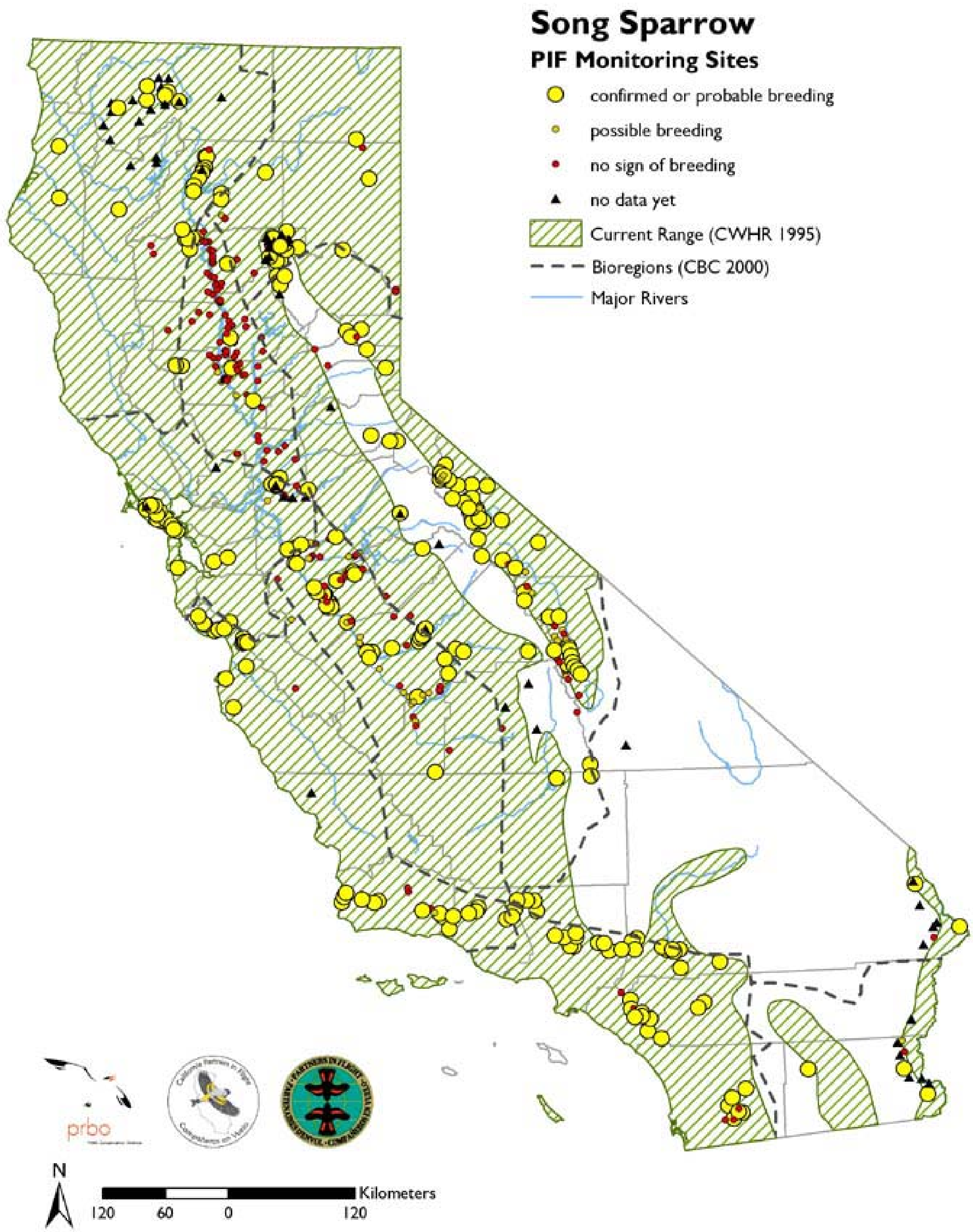


Figure 5-15. CalPIF monitoring sites, breeding status, and current range for the Song Sparrow in California.

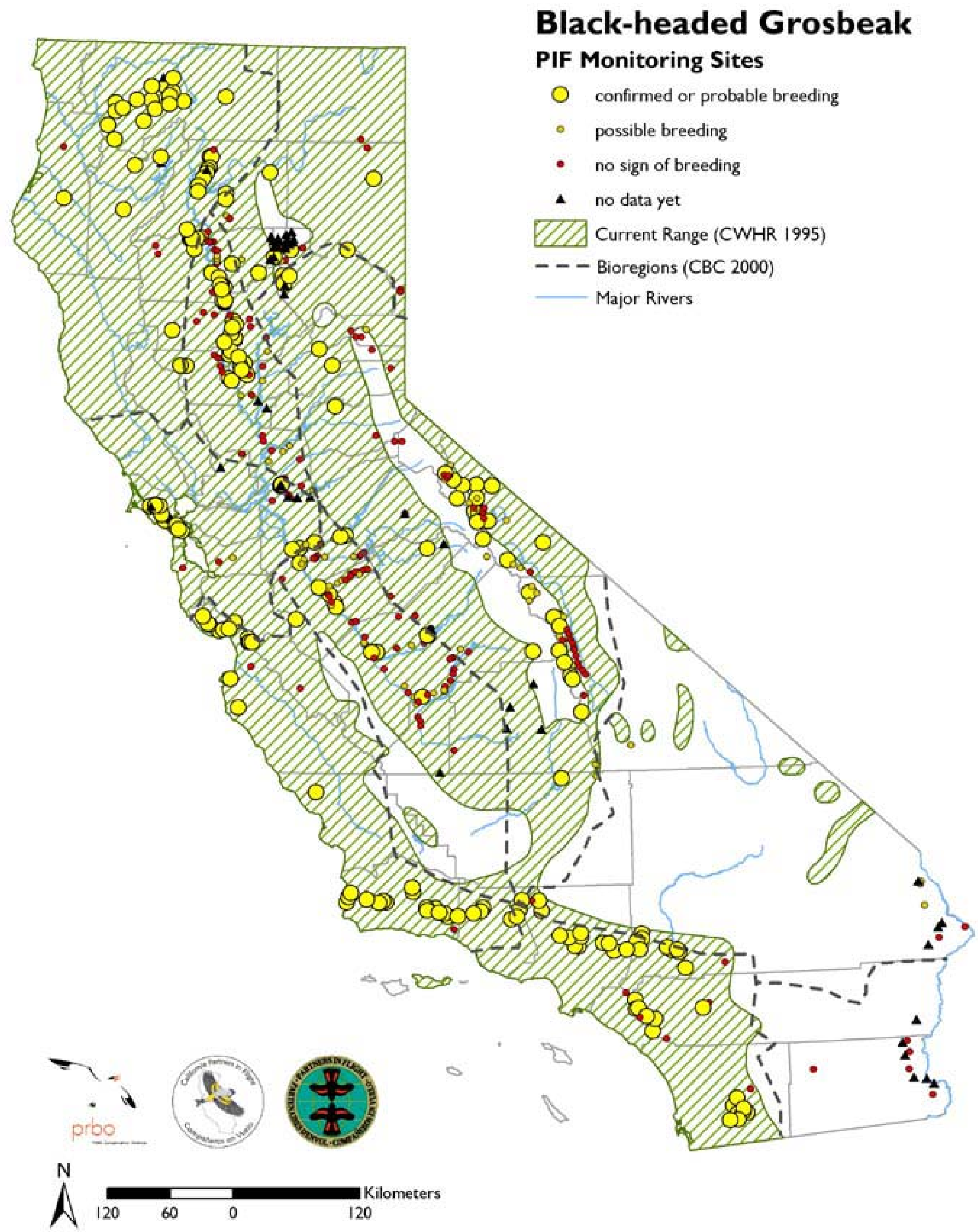


Figure 5-16. CalPIF monitoring sites, breeding status, and current range for the Black-headed Grosbeak in California.

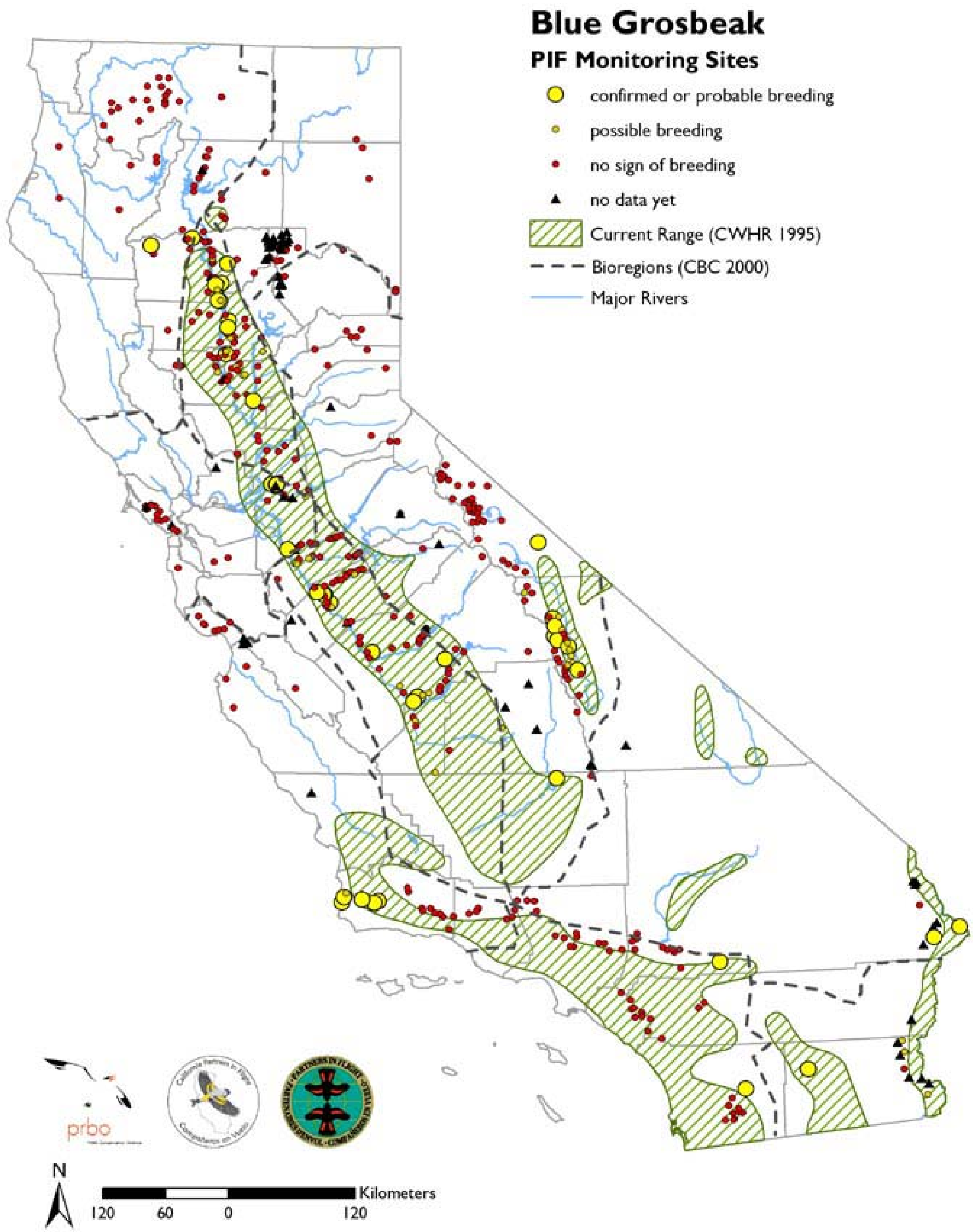


Figure 5-17. CalPIF monitoring sites, breeding status, and current range for the Blue Grosbeak in California.

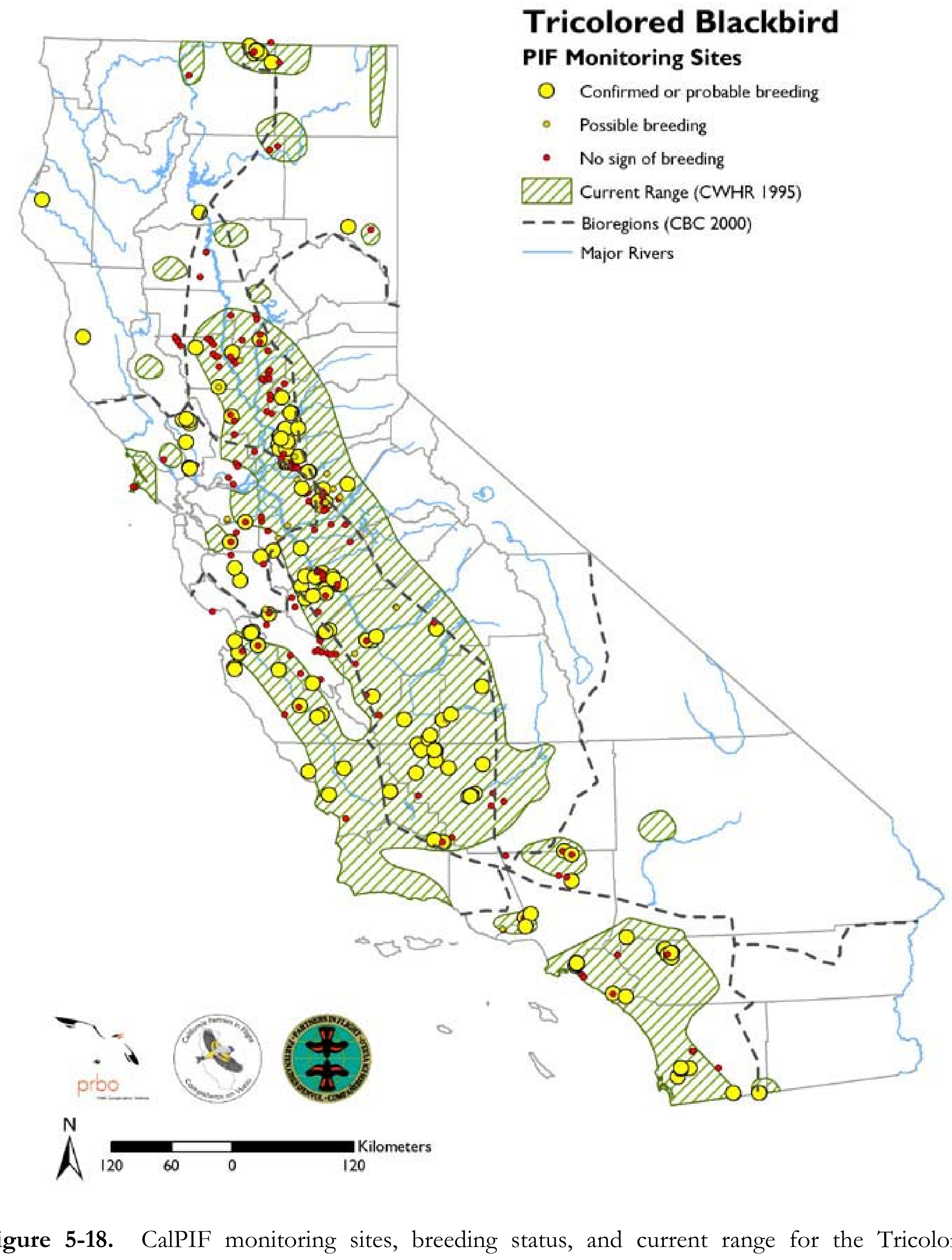


Figure 5-18. CalPIF monitoring sites, breeding status, and current range for the Tricolored Blackbird in California.

Table 5-1. Criteria for selecting the Riparian Bird Conservation Plan focal species.

Focal Species	Riparian Breeder	Special status	Reduction in breeding range	Abundant breeder in CA	Nest Site Location
Swainson's Hawk	X	X	X		Canopy
Spotted Sandpiper	X			X	Gravel Bar
Yellow-billed Cuckoo	X	X	X		Midstory to Canopy
Willow Flycatcher	X	X	X		Understory
Warbling Vireo	X		X	X	Canopy
Bell's Vireo	X	X	X		Understory
Bank Swallow	X	X	X		Sandy banks
Tree Swallow	X			X	2º Cavity
Swainson's Thrush	X		X	X	Understory
Yellow Warbler	X	X	X	X	Midstory
Common Yellowthroat	X	X	X	X	Understory
Wilson's Warbler	X			X	Understory
Yellow-breasted Chat	X	X	X		Understory
Song Sparrow	X		X	X	Understory
Black-headed Grosbeak	X			X	Midstory
Blue Grosbeak	X	X	X		Understory
Tricolored Blackbird	X	X	X		Understory

Data-Gathering Effort

Identifying the causes of population fluctuations requires an understanding of how demographic and physiological processes—annual survival, reproductive success, dispersal, and recruitment—vary across habitats, landscapes, and management practices. This information must be gathered using scientifically sound research and monitoring techniques (see Appendix A for a summary, Ralph et al. 1993, Bonney et al. 2000 for review). The Breeding Bird Survey (BBS), coordinated by the USFWS and the Canadian Wildlife Service, produces most of the available information regarding changes in the sizes and ranges of landbird populations in North America (Sauer 2003). These roadside counts provide an excellent baseline by which to assess long-term population trends, but they do not identify factors contributing to these changes (e.g., habitat and landscape variables) and may fail to adequately monitor bird populations away from roads and human disturbance (Peterjohn et al. 1995). In the West, Breeding Bird Surveys cover riparian habitat poorly because most survey routes occur on public lands and along roads, whereas riparian habitat tends to occur on private lands and/or away from roads. Furthermore, the inability of BBS data to detect trends within certain habitats, particularly patchily distributed habitats such as riparian, contributes to the need for more intensive, site-specific monitoring techniques.

Biologists throughout California have contributed data to this document. They have sent information garnered from constant-effort mist netting, nest searching, point counts and other standardized techniques. The locations of study areas, contact information, types of data collected, and breeding status information for all focal species are stored and updated in real time via an interactive map interface to a relational database system (Ballard et al. 2003a). In some cases, more extensive data will be linked to this interface, allowing for calculations of population estimates and demographic parameters. Figure 5-19 provides a map of riparian bird data showing biodiversity "hotspots" in California riparian habitats as defined by the richness of 16 of the 17 focal species.

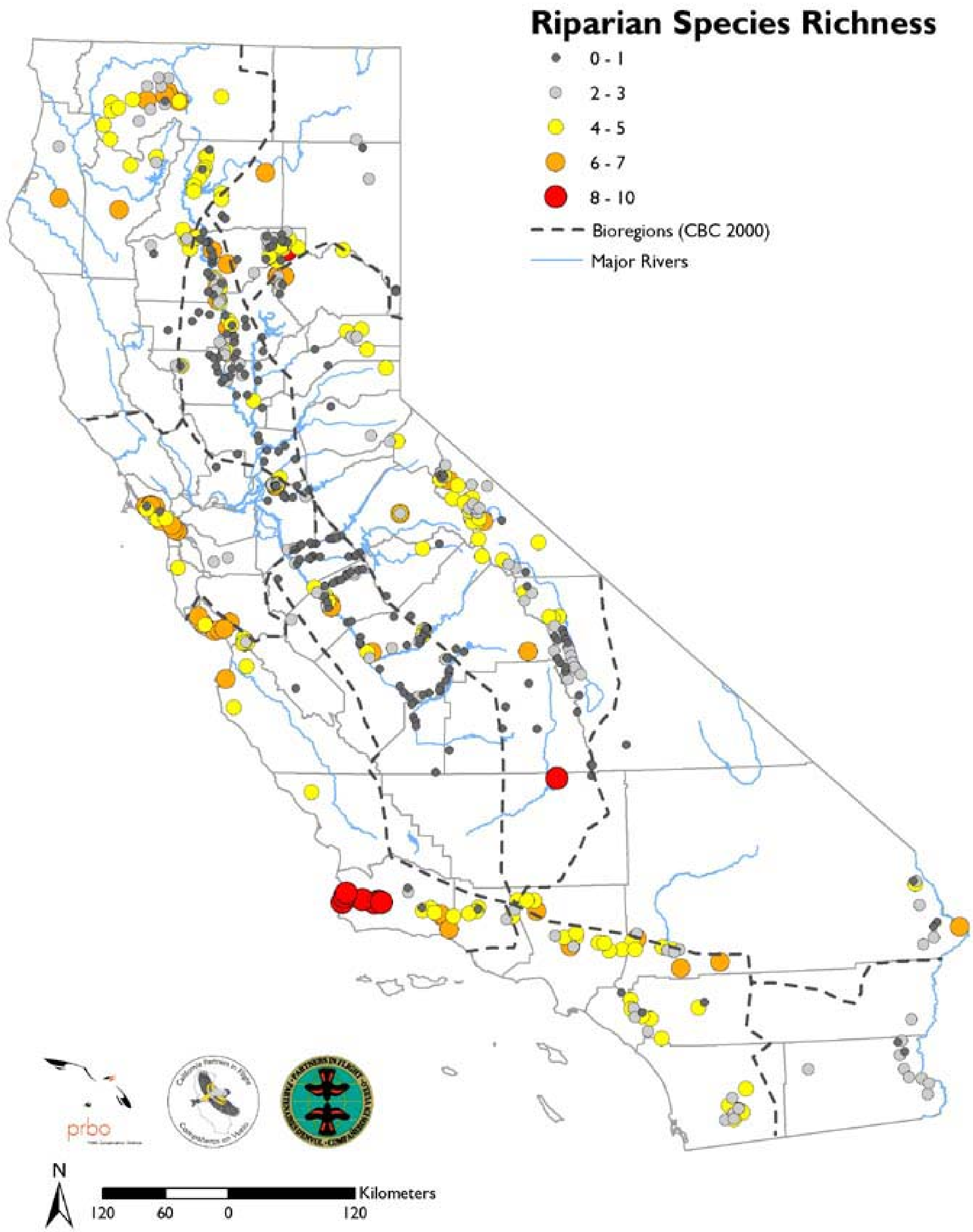


Figure 5-19. Species richness for 16 of the 17 focal riparian species at census sites throughout California. Data were collected and submitted by CalPIF contributors.

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Swainson's Hawk	• CA Threatened species • CA may have declined by as much as 90%.	SACR, BA/DE[2], SAJO, CECO[2], SINE, MOJA[2], COLD[2]	• Disturbance can lead to nest abandonment. • Poisoned by pesticides during migration and over winter.	Varied. Constructs nests in wide variety of trees.	Occupy a wide variety of open habitats with suitable nest trees, typically riparian forest or remnants.	Variable. Home range varies from 69-8,718 ha. Depends on availability of nest trees.
Spotted Sandpiper	• None	KLAM[2], MODO[2], BA/DE[2], SINE, SOCO[2], CECO[2], MOJA[2]	• Loss of nesting habitat from flood control projects and water diversions. • Abrupt changes in water level from human management or recreation during breeding season can cause nest failure. • Responds quickly to restoration efforts. • Benefits from healthy riparian systems in which flooding, and thus early successional vegetation and exposed gravel are prevalent.	Exposed gravel bars along streams, lakes and reservoirs. Often utilizes slight vegetative cover and litter.	Prefers early successional riparian.	Polyandrous. Sierra Nevada: 0.10 – 0.39 nest/ha found and 0.19 – 0.50 females/ha (PRBO data).

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Willow Flycatcher	• All three subspecies in CA listed as State Threatened and USFS Region 5 Sensitive Species. *E.t. extimus* is federally listed as Endangered. • Extirpated from much of historical breeding range.	KLAM², MODO, BA/DE², SAJO², SINE, CECO, SOCO, COLD (AZ).	• Negatively affected by livestock grazing, which changes riparian hydrology and vegetation composition, and damages nests. • Common Brown-headed Cowbird host. Trapping at South Fork Kern River reduced parasitism by 30-50%. • Recreational activities in riparian areas can reduce the quality of habitat for WIFL. • Not adequately monitored by many multispecies census	Generally in willows, alders, and cottonwoods or other riparian deciduous vegetation. Will also nest in non-native vegetation, such as tamarisk.	Varies by subspecies. Please refer to species account. Typically prefers dense patches and early successional riparian areas.	Varies by subspecies and region. *E.t. brewsteri* in eastern Fresno Co.; territories averaged 0.18 ha, and in Sierra Co. averaged 0.34 ha. *E.t. extimus* averaged 0.06-1.5 ha in Arizona and 0.6-1.1 ha on South Fork Kern River.
Warbling Vireo	• Declining in CA.	KLAM, MODO, SACR², BA/DE, CECO, SAJO², SINE, SOCO	• Common Brown-headed Cowbird host; parasitism in Sierra Nevada may be severe enough to depress population • Sensitive to loss of deciduous trees. • Population size likely limited primarily on breeding grounds from Brown-headed Cowbird parasitism and nest predation.	Nests high in deciduous trees. In Marin County, prefers willows and red alders.	Prefers large deciduous trees associated with streams, semi-open canopy. Shrub layer seems unimportant.	1.2 ha according to only reported account. Density: 1.1 pairs/ha in Bay-Delta. In AZ, densities were 0.52-0.63 pairs/ha in unlogged forests although they were 0.88-1.1 pairs/ha in selectively logged areas
Least Bell's Vireo	• Federal Endangered species. • Extirpated from or reduced in much of historical range.	SACR², SOJA², BA/DE², SINE², SOCO, MOJA, COLD, CECO	• Common Brown-headed Cowbird host. • Benefits from Brown-headed Cowbird control efforts.	Nests typically within 1 m of the ground in dense vegetation.	Prefers early successional riparian areas.	Territory size ranges from 0.2-3.0 ha; averages 0.6 (SD=0.3) to 1.1 (SD=0.6) ha.

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Bank Swallow	• California Threatened Species. • Nesting populations appear to be declining.	KLAM, MODO, SACR, CECO, SINE, SOCO[2]	• Loss of nesting habitat from bank protection and flood control projects. • Abrupt changes in water level from human management or recreation during breeding season can cause nest failure.	Burrows in vertical faces of bluffs or banks higher than 1 meter tall. Requires friable soils.	Variable. Requires vertical banks and bluffs, often from flooding and associated erosion events.	NA. Nest burrows are placed 1-59 cm apart. Varies from solitary to 1,500 pairs in a colony.
Tree Swallow	• None	KLAM, MODO, SACR, BA/DE, SAJO[2], SINE, GRBA, CECO, SOCO	• Natural nests require trees of considerable trunk diameter (>13cm), but nest-boxes can provide habitat in the absence of large trees. • Requires open areas for coursing feeding flights. • Eggs are vulnerable in shrubby habitats to puncturing by male House Wrens. • Nests near livestock can be subject to intense nest site competition from House Sparrows, sometimes resulting in the death of the defending swallows.	Uses cavities in the range of heights that are available, but appears to prefer sites 1.5-6.1 meters above the ground. Natural cavities in cis-montane California likely in cottonwoods or sycamore. In mountain and Great Basin habitats, often nests in aspen.	Without nest-boxes, prefers edges of riparian areas with large trees for nesting. Nest-boxes encourage this species to nest in a wide variety of habitats, from upland areas to sewage ponds. All foraging is done in open areas, preferably near water, and not in dense riparian forest.	Territory limited to immediate vicinity of nest-cavity. Fighting over nest-cavities, with own and other species, can be quite intense. Territory is not defended more than a few yards away from the nest. Nest densities depend on availability of nesting cavities, and nearest neighbor distances of 15 meters or less are not uncommon if cavity availability is high.

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Yellow Warbler	• CA Species of Special Concern (both as species and as subspecies *D. p.sonorana*). • Extirpated or declining in much of historical breeding range.	KLAM, MODO, SACR?, BA/DE, SAJO[2], SINE, GRBA, CECO, MOJA, SOCO, COLD	• Common Brown-headed Cowbird host. • Needs more subspecies-specific information in regards to Brown-headed Cowbird parasitism and habitat needs. • More data on productivity needed in CA. • Grazing reduces quality of nesting habitat. • Species seems to respond quickly to management actions such as restoration and Brown-headed Cowbird control.	Varies by bioregion. Often nests in deciduous riparian plant species, such as willows and cottonwoods, but also breeds locally in wild rose and more xeric plant species and habitats.	Generally found in wet areas with early successional riparian communities, or in remnant or regenerating canopy species stands. Will also breed locally in xeric shrub fields.	In early successional restored habitats in the eastern Sierra Nevadas, density ranged from 0.4 – 2.74 territories/ha. Territory sizes ranged from 0.06 – 0.75 ha.
Wilson's Warbler	• Shows significant decline in CA from 1966-1996 according to BBS data.	KLAM, MODO, BA/DE, SINE, GRBA, CECO, SOCO.	• Common Brown-headed Cowbird host. Abundance negatively correlated with abundance of Brown-headed Cowbird. • Loss of herbaceous cover during breeding season may reduce nest success. • Grazing may result in increased frequency of above points. • Loss of nesting habitat and pressure from Brown-headed Cowbird has resulted in reduction of breeding range.	Nests in riparian deciduous plants as well as grass, nettles, and ferns. Nest height from 0.3-3.0 meters, but mostly below 0.9 meters.	Prefers willows, alders, and shrub thickets and areas with tall trees and moderate to thick canopy cover.	In the Bay-Delta region: 0.57/ha (range 0.2-1.3 ha)

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Yellow-breasted Chat	• California Species of Special Concern. • Appears to be reduced in much of historical range.	KLAM, MODO, SACR,COLD BA/DE, SAJO?, SINE[2], CECO, MOJA, SOCO .	• Common Brown-headed Cowbird host[5]. • Any activity, such as grazing, that leads to the disappearance of dense, shrubby areas will be detrimental[5].	Nests in low, dense shrubs 0.3-2.4 meters high.	Prefers riparian habitat and marsh margins[5]. Often found in early successional riparian habitat.	In California riparian habitat, densities ranged from 6.5-27 males/100 ha[5].
Black-headed Grosbeak	• Population appears stable.	KLAM, MODO, SACR, BA/DE, CECO, SINE, SOCO	• Vulnerable to loss of riparian habitat for nesting. • Highest quality territory of males are where densities of Western Scrub-jays are low. • Responds quickly to restoration efforts.	Highly variable. In riparian, nests in willow, alder, and ash with fairly high nest cover.	Prefers semi-open canopy with moderate shrub cover and vertical stratification of vegetation layers. Often nests in early to mid-successional riparian areas.	No data for California. 1.9-3.9/ha in n. Utah.
Blue Grosbeak	• Appears to be reduced in much of historical range.	SACR, BA/DE, CECO, SINE, MOJA, COLD, CECO	• Common Brown-headed Cowbird host, but can raise both parasite and own young. • Benefits from a healthy riparian system where herbaceous annuals and early successional plant species are abundant. • Patch size and fragmentation seem unimportant to this species.	Nests in vertical forbs, young willows and cottonwoods, and herbaceous annuals.	Riparian edge species, preferring the annual forbs, young deciduous plants, and low canopy cover found in early successional riparian habitat.	No data for California. 1.2-6.2/ha in southeast U.S.
Song Sparrow	• *M.m.mailliardi* subspecies is a California Species of Special Concern[4].	KLAM, MODO, SACR, SINE, SAJO,COLD CECO, SOCO	• Common Brown-headed Cowbird host. • Responds quickly in many areas to restoration efforts (PRBO data).	Varies by bioregion.	Varies by bioregion. Breeds in early successional riparian, wetlands, coastal scrub, and marshes (PRBO data).	Bay Delta Coastal Scrub: 0.88 terr./ha. Bay Delta Salt Marsh: 14.9 detected per hectare (PRBO data).

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Tricolored Blackbird	• California Species of Special Concern.	KLAM, MODO, SACR, BA/DE, SAJO, SINE[2], CECO, SOCO	• Loss of nesting and foraging and habitat due to agricultural and urban development[3]. • Significant reproductive losses annually due to crop harvesting activities[3]. • Failure of entire nesting colonies due to pesticides and other contaminants[3].	Dense patches of cattails and/or bulrushes. Blackberry[3].	Prefers freshwater wetlands and weedy, fallow fields[3].	Male territory size ranges from 1.8m^2 to 3.25m^2

1. Bioregions included in historical breeding range as estimated from Grinnell and Miller 1944: KLAM=Klamath; MODO=Modoc; SACR=Sacramento; BA/DE=Bay-Delta; SAJO=San Joaquin; SINE=Sierra Nevada; CECO=Central Coastal; GRBA=Great Basin; MOJA=Mojave; SOCO=South Coastal; COLD=Colorado Desert. See the range maps and species accounts at http://www.prbo.org/calpif/data.html.for more information.

2. Not recently detected and/or extirpated from this bioregion.

3. Beedy and Hamilton 1999.

4. CDFG and PRBO 2001.

5. Eckerle and Thompson 2001.

Chapter 6. Population Targets

California Partners in Flight and the Riparian Habitat Joint Venture seek to develop population targets that will guide avian and habitat conservation efforts and provide them with a gauge of success. Although ambiguous and based on assumptions difficult to test, numerical population targets provide a compelling means of communicating with the public and policy makers. Furthermore they provide: 1) monitoring objectives and an evaluation procedure of project success ('accountability'); 2) ranking criteria for project proposals that allow reviewers to determine which sites or projects will be more advantageous for a particular species or suite of species; 3) current data for scientifically sound biological objectives; and 4) integration and comparison with population objectives of larger regional, national, and international schemes (e.g., Rosenberg and Blancher *in press*).

In this document, two approaches for deriving population targets of riparian focal species are examined. The first approach provides estimates of population size, where data exists, from two avian monitoring techniques (point counts and spot mapping) for the 17 focal species in each bioregion (Table 6-1). These density estimates are to be used with caution and are provided as a reference for comparison when collecting similar data. In general, these estimates are taken from the highest recorded density in regions where populations are believed to be viable as estimated from demographic monitoring (Sherry and Holmes 2000). The second approach is a process still in development that has been completed for six species in the 12 basins of the Central Valley (Figure 3-1). The following six species were used primarily because of data availability and distribution in the Central Valley: Yellow Warbler, Common Yellowthroat, Yellow-breasted Chat, Spotted Towhee, Song Sparrow, and Black-headed Grosbeak. Other species estimates and more detailed descriptions may be found on the CalPIF website. The description as follows has been presented and critiqued at various meetings (Geupel et al. 2003) and incorporated into the Strategic Plan of the RHJV.

Photo by James Gallagher, Sea and Sage Audubon

Population targets will help guide avian and habitat conservation efforts.

Table 6-1. Estimates of maximum breeding abundance by species and bioregion[a].

Species	Bay-Delta Point Count[b]	Bay-Delta Spot Map[b]	South Coast Point Count	South Coast Spot Map[c]	Sierra Point Count[d]	Sierra Spot Map[e]	San Joaquin Point Count[b]	San Joaquin Spot Map	Central Coast Point Count	Central Coast Spot Map
Swainson's Hawk	-	-	-	-	-	-	-	-	-	-
Spotted Sandpiper	-	-	-	-	-	-	-	-	-	-
Yellow-billed Cuckoo	-	-	-	-	-	0.85	-	-	-	-
Willow Flycatcher	-	-	-	-	-	9.6	-	-	-	-
Warbling Vireo	1.30	18.0	-	-	1.20	-	-	-	0.54[b]	-
Bell's Vireo	-	-	-	-	-	-	-	-	-	-
Bank Swallow	-	-	-	-	0.56	-	-	-	-	-
Tree Swallow	0.16	-	-	-	0.20	-	1.50	-	-	-
Swainson's Thrush	1.90	322.2	-	-	0.04	-	-	-	0.56[b]	-
Yellow Warbler	-	-	-	0.20	2.50	-	-	-	0.30[b]	-
Common Yellowthroat	0.42	-	-	-	0.83	-	0.53	-	0.10[b]	-
Wilson's Warbler	1.69	288.6	-	-	-	-	0	0	1.20[b]	-
Yellow-breasted Chat	-	-	-	-	0.40	-	-	-	0.15[b]	-
Black-headed Grosbeak	0.91	117.6	-	-	0.17	-	0.43	-	0.72[b]	-
Blue Grosbeak	-	-	-	-	0.05	-	0.33	-	0.07[b]	-
Song Sparrow	3.10	509.6	-	-	1.20	-	3.00	-	1.53[b]	-
Tricolored Blackbird	-	-	-	-	-	-	-	-	-	-

Notes:

[a]Numbers provided from point counts are the average number of detections within 50 meters of the observer during five minute counts. Numbers from spot mapping are pairs per 40 hectares during the breeding season. Reference populations are cited and may not be representative of healthy populations. Point count data provide an *index* of abundance, generally thought to be conservative. Spot mapping numbers are probably closer to true abundance. Dashes represent "no data." Zeroes indicate the species probably never bred in that bioregion.

[b]PRBO unpublished data: Bay Delta data are from Point Reyes Nat'l Seashore; Central Coast data from Salinas River, Scott Creek and Moore Creek.

[c]Cardiff (1996).

[d]Heath and Ballard (1999).

[e]Shaver and Kern River.

Table 6-1. Estimates of maximum breeding abundance by species and bioregion[a].

Species	Klamath		Sacramento Valley		Modoc		Mojave		Colorado Desert	
	Point Count[b]	Spot Map[b]	Point Count[b]	Spot Map[f]	Point Count[b]	Spot Map[b]	Point Count	Spot Map	Point Count	Spot Map[g]
Swainson's Hawk	-	-	-	-	-	-	-	-	-	-
Spotted Sandpiper	-	-	-	-	0.25[h]	-	-	-	-	-
Yellow-billed Cuckoo	-	-	-	-	-	-	-	-	-	-
Willow Flycatcher	-	-	-	-	0.45	7.9	-	-	-	-
Warbling Vireo	0.41	-	-	-	1.30	33.2	0	0	0	0
Bell's Vireo	0	0	-	-	0	0	-	-	-	-
Bank Swallow	-	-	0.04	-	-	-	-	-	-	-
Tree Swallow	0.50	-	0.98	-	1.20	-	-	-	-	-
Swainson's Thrush	-	-	-	-	0.06	-	0	0	0	0
Yellow Warbler	1.60	16.0	0.13	0.13	1.10	33.2	-	-	-	-
Common Yellowthroat	-	-	1.0	-	-	-	-	-	-	-
Wilson's Warbler	-	-	0	0	0.95	33.2	0	0	0	0
Yellow-breasted Chat	1.20	25.0	0.32	-	-	-	-	-	-	-
Black-headed Grosbeak	0.87	32.0	1.80	-	1.0[h]	-	-	-	-	-
Blue Grosbeak	0	0	0.19	-	0	0	-	-	-	5.0
Song Sparrow	0.79	16.8	1.33	-	1.80	77.6	-	-	-	-
Tricolored Blackbird	-	-	-	-	-	-	-	-	-	-

[a]Numbers provided from point counts are the average number of detections within 50 meters of the observer during five minute counts. Numbers from spot mapping are pairs per 40 hectares during the breeding season. Reference populations are cited and may not be representative of healthy populations. Point count data provide an *index* of abundance, generally thought to be conservative. Spot mapping numbers are probably closer to true abundance. Dashes represent "no data." Zeroes indicate the species probably never bred in that bioregion.

[b]PRBO unpublished data: Sacramento Valley data are from Sul Norte, La Baranca, Dye Creek, Llano Seco, Ohm, and Kopta Slough. Modoc data are from Lassen Volcanic NP and Lassen Volcanic NF. Klamath data are from Lower Clear Creek Floodway Restoration Project.

[f]Gaines (1974).

[g]Rosenberg (1991).

[h]Humple et al. (2002).

Population Size Estimates

Estimates of current population sizes were calculated for select species using mean values from current point count data (1994-2002) for each basin. As a first step, density was calculated using the number of detections within 50 meters x 1/detectability coefficient. Because of variation of species detectability using the point count method, coefficients were derived from sites where point count surveys overlaid spot mapping plots. Spot map data was used for density estimates for species whose populations were rare and patchily distributed (Song Sparrow and Yellow Warbler). Density estimates were then extrapolated across basins using current riparian habitat data layers as determined (Figure 3-1).

Population Target Estimates

Estimates of target populations were calculated with the median of the top 50% (75^{th} percentile) of corrected density estimates from current point count data. This correction of 75% was used in preference to the true mean due to the assumption that most current populations were degraded but could be enhanced. Spot map data also were used from the nearest suspected viable population when point count data were not available (normally due to lack of detections). A riparian data layer based on historical extent of riparian forests and/or the current extent of soil types (The Bay Institute 1998) was used and corrected for permanent habitat loss (urbanization) to extrapolate the 75^{th} percentile density. The amount of current and potential riparian habitat as determined from the GIS data (Table 6-3) was used to calculate population targets in each basin for two select species: Black-headed Grosbeak (Figure 6-1) and Song Sparrow (Table 6-2).

Demographic data (primarily nest success) also may be used to qualify density estimates (see Small and Gardali *in prep*, Sherry and Holmes 2000). The range of nest success observed for Song Sparrow in the Central Valley of 5% to 24% does not allow the growth rate to be positive (lamda > 1). This suggests that populations of Song Sparrows are not viable and will decline in the absence of immigration. Based on the information presented, a minimum target value for nest success of Song Sparrows in the Central Valley should be at least 27%.

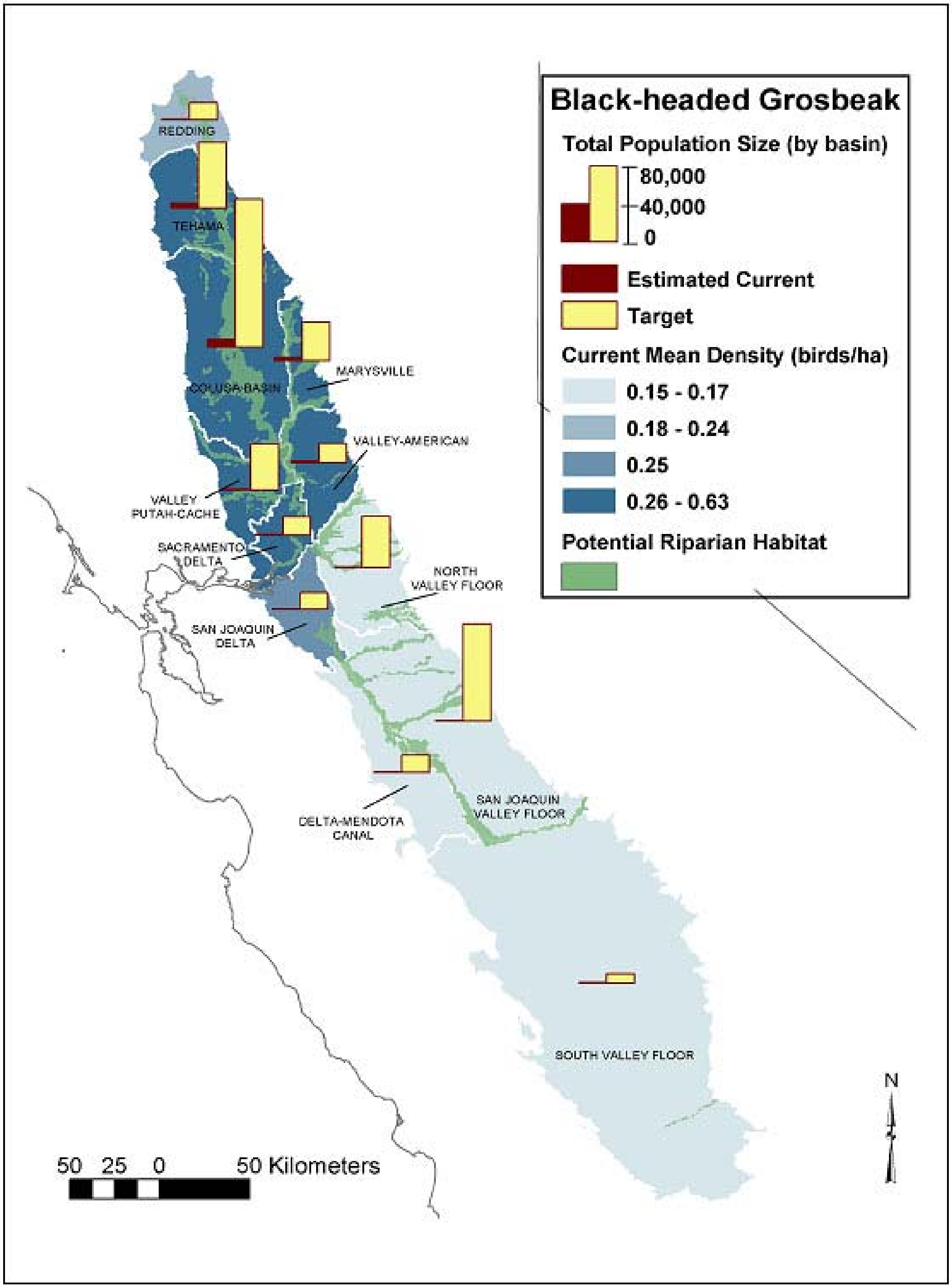


Figure 6-1. Black–headed Grosbeak current population estimates and targets for 12 basins in the Central Valley.

Table 6-2. Song Sparrow current population estimates and targets for 12 basins in the Central Valley.

Basin	Current Birds/Ha, Riparian Point Counts	±SE**	Current Population Size	±SE**	Target Birds/Ha	Target Population Size
Colusa Basin	0.09	±0.06	1128	±750	0.99 (1)	112,360
Marysville*	0.10	na	617	na	0.99 (1)	29,550
North Valley Floor*	0.90	na	2581	na	2.65 (2)	103,937
Redding	0.33	±0.12	1297	±448	0.99 (1)	13,132
Sacramento Delta*	0.10	na	168	na	0.99 (1)	14,279
Tehama	0.01	±0.004	39	±30	0.99 (1)	50,012
Valley Putah-Cache*	0.10	na	122	na	0.99 (1)	34,771
Valley-American*	0.10	na	280	na	0.99 (1)	14,747
Delta-Mendota Canal	1.24	±0.22	1949	±356	2.65 (2)	35,319
San Joaquin Delta	1.22	±0.24	2180	±420	2.65 (2)	33,894
San Joaquin Valley Floor	0.70	±0.16	3403	±788	2.65 (2)	198,253
South Valley Floor	0.93	±0.30	4440	±1444	2.65 (2)	18,805

* If a basin contained less than 30 point count stations, current density estimates were derived from all stations in the respective valley (Sacramento or San Joaquin) and standard errors are not presented (because sample size is not specific to basin). (1) In the Sacramento Valley, spot map densities from known source populations were used as target densities for *Melospiza melodia mailliardi*. (2) In the San Joaquin Valley point counts (75th percentile) were used *for Melospiza melodia heermani.*

** Estimates of population sizes are the product of: a) estimate of number of detected birds per ha for each basin (N); b) inverse of the detectability coefficient; and c) estimate of the number of ha of riparian habitat. There was uncertainty, and thus error, associated with each component. As a first approximation to estimating overall error in population size, we assumed the contribution of the latter two factors to the overall standard error was equal in magnitude to the standard error associated with estimation of N (which could be directly assessed). We thus used the standard error obtained in estimating N and multiplied by 2 to yield a rough estimation of the overall standard error.

Table 6-3. Amount of riparian habitat by Central Valley basin.

Basin	Current Riparian Hectares	Potential Riparian Hectares	Proportion Currently Forested	Number of Riparian Point Counts
Colusa Basin	12,380	113,610	0.11	139
Marysville	6,041	29,879	0.19	16
North Valley Floor	2,880	39,175	0.07	22
Redding	3,903	13,278	0.25	108
Sacramento Delta	1,647	14,438	0.10	9
Tehama	8,131	50,568	0.15	199
Valley Putah-Cache	1,199	35,158	0.03	8
Valley-American	2,746	14,911	0.11	6
Delta-Mendota Canal	1,578	13,312	0,12	90
San Joaquin Delta	1,787	12,775	0.13	46
San Joaquin Valley Floor	4,884	74,724	0.06	166
South Valley Floor	4,751	7,088	0.57	56
Central Valley Totals	51,927	418,916	0.12	865

Species-Specific Objectives

Although the RHJV strongly endorses the concept of multiple species management, it recognizes that special-status species often receive more careful management than non-listed species due to legal mandate. Special status species are those whose populations have been reduced or are in decline, the magnitude of which warrants more immediate conservation action relative to other taxa. Therefore, more information on listed species exists and the species-specific objectives offered in this plan reflect that special knowledge. However, conservation actions must include efforts to monitor their effects on multiple species, not only those on special-status lists. What positively affects one species may have a negative impact upon another. Minimal adjustments to conservation efforts targeting single species may positively impact multiple species, thereby greatly increasing the effectiveness of conservation dollars. Finally, conservation planners must bear in mind that population dynamics are influenced by many factors other than breeding habitats (e.g., over wintering survival) and may result in population declines even as efforts increase available habitat.

Data and figures presented in this section are from the species accounts developed by the authors listed on pages 22-23. Species accounts are an electronic appendix to this document and may be found at http://www.prbo.org/calpif/htmldocs/riparian.html.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis)*

Population:

The current Western Yellow-billed Cuckoo population is about 60 to 100 pairs statewide (Halterman et al. 2001; see Figure 5-4 for statewide range). The RHJV recommends restoring habitat in 25 locations to support 625 pairs (25 pairs per location). Simulation modeling indicates that populations of less than 10 pairs are very unstable, becoming extinct in a short period of time. Current predictions suggest that a minimum of at least 25 pairs in a subpopulation with interchange with other subpopulations should be reasonably safe from extinction by stochastic events. Given that presumably stable populations are at least 25 pairs and that territory size averages 20 to 25 hectares (a minimum of 10 hectares), the optimal goal for each population is to protect and restore habitat in minimum 20-hectare patches that collectively total 500 hectares within a watershed or river reach. The statewide habitat restoration and protection target, in addition to that currently managed for the cuckoo, equals approximately 21,000 hectares statewide, including areas in Arizona along the Colorado River. See Table 6-4 for a summary of the recommended habitat restoration sites.

Table 6-4. Minimum management goals for subpopulations, pairs, and reforestation of suitable habitat, based on 40 hectares per pair, for Western Yellow-billed Cuckoos.

Locality	Subpopulation	Number of Pairs	Current Suitable (hectares)	Reforestation Suitable (hectares)
		Northern California		
Sacramento R.	6	150	2,370	3,700
Feather R.	1	25	240	770
Stanislaus R.	1	25	240	770
Cosumnes R.	1	25	0	1,010
Merced R.	1	25	0	1,010
Kings R.	1	25	0	1,010
Mendota	1	25	0	1,010
Subtotal	**12**	**300**	**2850**	**9,280**
		Southern California		
Kern R.	1	25	400	610
Prado Dam	1	25	240	770
Mojave R.	1	5	80	930
Owens R.	1	25	0	1,010
Subtotal	**4**	**100**	**720**	**3,320**
		Colorado River		
Needles-Parker	4	100	670	3,380
Parker-Blythe	2	50	0	2,020
Blythe-Yuma	3	75	0	3,040
Subtotal	**9**	**225**	**670**	**8,440**
TOTAL	**25**	**625**	**4,240**	**21,040**

MANAGEMENT

Habitat patch size:

Restoration to benefit the Western Yellow-billed Cuckoo requires patches be a minimum of 20-40 hectares, with a minimum width of 100 meters. Optimal habitat for a pair would be 75 hectares or more in length, with a width of more than 600 meters. Research by Laymon and Halterman (1989) led to the development of these parameters based on occupancy rates of existing habitat patches along the Sacramento River. Additionally, higher canopy closure, higher foliage volume, intermediate basal area, and intermediate tree height relative to random sites are preferred by cuckoos for nesting. The best habitats for nesting are therefore at large sites with high canopy cover and foliage volume and moderately large and tall trees. The cuckoo's primary food source, katydid and sphinx moth larvae, hibernate underground and are therefore not available in lowland floodplains in wet years with late-spring flooding. Therefore, upland refugia habitats for foraging in wet years should also be a component of Western Yellow-billed Cuckoo habitat protection and restoration projects.

Pesticide use:

Occasionally, cuckoos nest or forage in orchards adjacent to riparian areas. Pesticide use by farmers may deter cuckoos from more frequent use of these crops. More research is needed as to whether or not Western Yellow-billed Cuckoos more readily use orchards grown with integrated or organic pest management techniques.

Other factors:

Areas of apparently suitable habitat are unoccupied by Western Yellow-billed Cuckoos every year (e.g., Kern River Preserve). Other factors (e.g., over winter survival, juvenile survival and dispersal) should therefore be addressed (M. Halterman pers. comm.).

Photo by Claire DeBeauvoir, Sea and Sage Audubon

Least Bell's Vireo *(Vireo bellii pusillus)*


Photo by James Gallagher, Sea and Sage Audubon

Population:
Grinnell and Miller (1944) once characterized Least Bell's Vireo as one of the most common birds found in riparian habitat throughout the state (Figure 5-7). Over the past sixty years, destruction of riparian habitat and the invasion of California by the parasitic Brown-headed Cowbird have contributed to a steep decline in the vireo's population. Currently, Least Bell's Vireos are restricted to approximately eight counties in southern California and are on the federal Endangered Species List (USFWS 1998).

To be reclassified as "threatened," the Least Bell's Vireo population must achieve one of the following criteria for at least a period of five consecutive years (taken from USFWS 1998):

- Stable or increasing populations/metapopulations, each consisting of several hundred or more breeding pairs, are protected and managed at the following sites: Tijuana River, Salzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, Camp Pendelton/Santa Margarita River, Santa Ana River, an Orange County/Los Angeles County metapopulation, Santa Clara River, Santa Ynez River, and an Anza Borrego Desert metapopulation.

- Stable or increasing Least Bell's Vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, become established and are protected and managed at the following sites: Salinas River, a San Joaquin Valley metapopulation, and a Sacramento Valley population.

- Threats are reduced or eliminated so that Least Bell's Vireo populations/metapopulations listed above are capable of persisting without significant human intervention, or perpetual endowments are secured for cowbird trapping and exotic plant control in riparian areas occupied by least Bell's Vireos.

MANAGEMENT

Habitat enhancement:
Riparian habitat creation and restoration is underway throughout the state. Much of this effort in southern California has been propelled by the need for more Bell's Vireo habitat. Bell's Vireos have responded favorably to restoration efforts, demonstrating increases in occupation at restored sites, and nest success rates similar to non-restored natural habitat (Kus 1998).

The Santa Clara River Enhancement and Management Plan:
This plan seeks to protect the ecological integrity of the longest, unchannelized river in the South Coast bioregion. Current efforts to develop along the Santa Clara and its tributaries may endanger the integrity of the plan.

Brown-headed Cowbird control:
In the short-term, trapping of cowbirds is one of the most effective ways to increase the reproductive success of Least Bell's Vireo on a local scale. At Camp Pendelton, nest parasitism dropped from 47% to less than 1% in less than 10 years (USFWS 1998). However, cowbird trapping is only a temporary remedy to be used in emergency situations. The population cannot be considered healthy until it can survive without significant human intervention.

Monitoring and research:
Research elucidates the habitat variables required to re-establish healthy populations. Monitoring provides important information on population trends, allowing for the employment of appropriate adaptive conservation techniques.

Willow Flycatcher (*Empidonax traillii*)

Photo by James Gallagher, Sea and Sage Audubon

Population:
Willow Flycatchers historically nested throughout California, preferring riparian deciduous shrubs, particularly willow thickets. Currently, three subspecies of the Willow Flycatcher breed in California (Figure 5-5). Each has been listed as state endangered and US Forest Service Region 5 Sensitive in California. The USFWS designated the Willow Flycatcher as a sensitive species in Region 1 (Washington, Oregon, Idaho, California and Nevada). Furthermore, the Southwestern Willow Flycatcher *(Empidonax traillii extimus*) is federally listed as endangered.

Management:
Sierra Nevadan populations have dropped precipitously in the last 50-60 years. Most Sierran meadows are already publicly owned, but many are grazed under permit. Goals for increasing Willow Flycatcher populations focus on increased monitoring, improving management and restoration of habitat, and where necessary, through proper grazing management.

Southwestern Willow Flycatcher:
These flycatchers are concentrated in lowland habitats. The UFWS has recently released a Southwest Willow Flycatcher Recovery Plan (http://ifw2es.fws.gov/Library/ListDocs.cfm) that details management recommendations for this imperiled subspecies. Managers should prioritize the protection and restoration of riparian deciduous shrub vegetation and address the problem of cowbird parasitism, which has severely affected populations in southern California. For example, at the South Fork Kern River Preserve, an average of 63.5% of nests were parasitized from 1989 to 1992, with a range from 50% in 1989 to 80% in 1991. However, Brown-headed Cowbird trapping at the South Fork Kern River Preserve has resulted in a decreased rate of parasitism, "buying time" for this population as riparian habitat restoration proceeds.

Tricolored Blackbird (*Agelaius tricolor*)


Photo by James Gallagher, Sea and Sage Audubon

Population:

The Tricolored Blackbird is largely endemic to California and has been listed as a state Species of Special Concern. Surveys indicate that populations have been rapidly declining for decades, probably due to water diversion, land conversion and heavy predation by mammals, corvids and Black-crowned Night Herons (Beedy and Hamilton 1997, Hamilton et al. 1999). Tricolors are colonial breeders, nesting mainly in wetlands or in dense vegetation near open water. No population targets have been established for this species.

Management:

Hamilton et al. (1999) outlines many specific recommendations for conserving Tricolored Blackbird populations in California. Included are:

Protect existing colonies: Managers must seek to protect existing tricolor colonies and nesting sites (Figure 5-18). Adequate tricolor habitat needs to be designated in Habitat Conservation Plans (HCPs). Managers also need to reduce predation pressure to allow populations to expand. Problem species such as ravens, night herons, and coyotes should be properly managed whenever possible (Hamilton *in press*).

Proper water management can enhance their natural nesting habitat and reduce depredation rates (nest predation by mammals increases when water levels around nesting sites drop). If feasible, a simple water level management strategy is to maintain the level present when initial tricolor settlement occurred.

Consider disturbance effects: Private landowners must be encouraged to consider the needs of tricolors and to avoid harvesting, pesticide application and other disturbances to the species during the breeding season.

Provide suitable nesting habitat: Tricolors will often use exotic plants, such as Himalaya blackberry, as nesting substrates. Efforts that remove shrubs used by tricolors should include plans to replant a suitable alternative. Restoration efforts should emphasize native plants.

Public education: Conservation efforts must educate the public about the species' status and needs (Beedy and Hamilton 1997). Managers should encourage development of colonies in conspicuous urban environments where their educational value will be useful (Hamilton *in press*).

Research and Monitoring: Further research will indicate the variables affecting their reproductive success, outline the threats posed to colonies and monitor population changes over time. For a more extensive review of monitoring needs, see Beedy and Hamilton (1997) and Hamilton et al. (1999).

Chapter 7. Bioregional Conservation Objectives

California harbors more naturally occurring species of plants, insects, vertebrates, and other life forms than any comparable area north of the subtropics (Biosystems Analysis 1994). Isolation by the Sierra Nevada mountain range and southern deserts fostered the evolution of more endemics than any other state in the United States except Hawaii. The great diversity of plants and animals renders conservation planning for the entire state more difficult.

Numerous authorities have divided the state into discrete geographical sections, or bioregions, based on natural communities, climate, topography, and soils. The California Biodiversity Council (RAC 1998) divided the state into 10 bioregions (Figure 7-1) while others, including Biosystems Analysis (1994) and Sawyer and Keeler-Wolf (1995) recognize 11 discrete regions. California Partners in Flight followed the Biodiversity Council's 10-region scheme for the purposes of the bird conservation plans.

Figure 7-1. Bioregions of California. From the Biodiversity Council (2003).

Many organizations have embraced planning on a bioregional basis because bioregions facilitate an adaptable, site-specific focus for projects. Setting and achieving conservation goals by bioregion will:

- Ensure that a suite of ecological communities representative of California's diversity will be conserved.
- Ensure the broadest range of biodiversity and locally adapted races of species will be conserved.
- Facilitate action at the local level.

This chapter introduces each of the 10 bioregions considered in this plan (the Sacramento and San Joaquin are discussed together). These descriptions are offered as an overview; the issues and needs vary depending on particular sites within a bioregion. For more information on each, consult the Resource Agency of California's (1998) *Preserving California's Natural Heritage*.

Portfolio Sites

For each bioregion, we list regional Portfolio Sites. These sites stand out for their significance and contribution to conservation, either through management practices or their value as a reference site. CalPIF and the RHJV are constantly seeking to expand this list of portfolio sites in California. Inquiries concerning the suitability of an area for recognition as a portfolio site should be directed to the RHJV coordinator (http://www.prbo.org/calpif/htmldocs/rhjv/). A specific project, geographic area, or discrete patch of habitat may be designated as a Portfolio Site if:

- It has been recognized as a "flagship project" by the RHJV for outstanding riparian habitat management and restoration activities.

- It implements adaptive management strategies by "closing the feedback loop," i.e., gathering data that provides information about wildlife responses to management practices, then incorporating such data into future management decisions.

- RHJV science partners recognize that the site merits long-term monitoring of avian populations. Long-term data collection provides an important baseline against which to measure short-term changes in regional bird populations and reproductive success. Such projects can serve as reference sites when comparing avian response to management or restoration in other areas with similar habitat and climate. Only through long-term data collection will conservation biologists and ecologists avoid the ongoing pitfall of "shifting baselines," i.e., the phenomenon whereby slowly deteriorating conditions over time can become the norm or standard against which to measure healthy ecological systems.

Sacramento and San Joaquin Valleys

California's Great Central Valley provides breeding, migratory stopover and wintering grounds to millions of birds annually. Though seriously degraded due to human disturbance, the Valley still contains vital riparian habitat, freshwater wetlands and seasonally flooded agriculture, vernal pools, and naturalized annual grasslands. Most think of the Central Valley only in terms of its robust agricultural industry. Yet, the Valley once hosted an extensive network of riparian forests with a rich shrub and herbaceous understory, wetlands, and adjacent upland habitats. However, development pressure from a rapidly expanding population and an increasing demand for water threaten the remnants of the once vast riparian system. Without prompt action, the opportunity to restore critical habitat may be lost.

Portfolio Sites

Lower Clear Creek supports the largest breeding population of Yellow Warbler and Song Sparrow in the region. Priority should be given to ensuring a continuous riparian corridor from Clear Creek to the main stem of the Sacramento River and improving habitat quality through restoration and restoring natural processes.

The Lower Feather River, which includes the Audubon Bobelaine Sanctuary, provides important breeding and migratory stopover habitat for numerous songbird species and has high potential for range expansion of riparian birds.

The Sacramento River continues to provide nesting habitat for many species, including Bank Swallow, Swainson's Hawk and Western Yellow-billed Cuckoo. Many species once common in the area, including the Least Bell's Vireo, have been extirpated while the Yellow Warbler, Song Sparrow, Yellow-breasted Chat, and Blue Grosbeak are missing locally (Nur et al. 1996). Protection efforts include the extensive Sacramento River National Wildlife Refuge Complex. The largest river system in the state, the Sacramento has great potential to support vast expanses of riparian habitat. We recommend focusing restoration efforts in areas where dynamic fluvial processes are still intact, and where connectivity can be established with adjacent intact habitat. Examples of ongoing riparian restoration projects include the Rio Vista Unit owned by the USFWS and CDFG's Pine Creek Unit. These sites can be found at the following web sites: http://www.sacramentoriver.org; http://www.riverpartners.org.

Cottonwood Creek is the largest undammed tributary to the Sacramento River in the Central Valley. The hydrology of Cottonwood Creek still resembles a historical flow regime with high stream flows during rainy winter months and very low flows during dry summer months. With natural flow regimes fairly intact, extensive wildlands in the upper watershed, and intact adjacent upland habitat, it is likely that Cottonwood Creek provides valuable habitat to numerous riparian associated bird species. Current threats to riparian habitat on Cottonwood Creek include subdivision of large properties into ranchettes resulting in an increased intensity of land use within and adjacent to riparian habitat, increased demand for water from a growing population, and the encroachment of exotic invasive plant species.

The Tuolumne River has recently garnered conservation attention primarily through the restoration efforts of agencies and groups such as the Friends of the Tuolumne. Though mining, dredging, water diversion and development continue along its reach, the river continues to support breeding Song Sparrows, Common Yellowthroats, Blue Grosbeaks, and Swainson's Hawks. Fairly large habitat patches remain, especially in the river's upper reach.

The Mokelumne River's riparian habitat is currently restricted to linear patches directly along the river corridor due to agriculture and development as well as upstream dams that limit flows. However, a developing partnership between private landowners and the East Bay Municipal Utility District is pursuing riparian restoration along the river to increase the amount of habitat for the benefit of both farmers and wildlife.

Riparian habitat near the Sacramento River.

The San Joaquin River's water flows and habitat have been seriously diminished by the development of agriculture or mining along nearly every mile of its reach and the construction of Friant Dam. The demand for water from the river is immense. It irrigates the world's largest agricultural industry and can run nearly dry in parts of its reach during the summer. The river continues to host a number of riparian species, including Song Sparrow, Blue Grosbeak, Black-headed Grosbeak, and Swainson's Hawk. For the past two years Yellow Warblers have been documented breeding at the San Joaquin River National Wildlife Refuge (PRBO unpublished data). This hopeful sign that an extirpated breeder has returned to the valley floor is the result of protection and restoration efforts along the river, including the establishment of open space reserves near Friant Dam and a growing network of wildlife areas and refuges along its middle reach. These efforts include the San Luis National Wildlife Refuge Complex, Great Valley Grasslands State Recreation Area, and the San Joaquin River Parkway (Conservation) Trust.

Modoc

Of the California bioregions, perhaps the Modoc most resembles its historic state. It is characterized by hot, dry summers and cold, wet winters, extensive stands of conifers and oaks, and high elevation desert conditions in its northeast portion (RAC 1998). It has the smallest population of the states 10 bioregions, though it is expected to grow as California's population expands. A major effort to restore aspen stands has been taking place in the Eagle Lake Ranger District of the Lassen National Forest since 1999. Here they have employed an aggressive strategy of clear-cutting conifers and fencing the boundaries of aspen stands where livestock grazing is an issue. Preliminary results have been positive with extensive resprouting of aspen stems and associated herbaceous species. In 2004, a monitoring component will be added to this project in order to determine the effects aspen release treatments have on songbirds.

Portfolio Sites

Humbug Valley, totaling over 500 hectares, is the largest meadow in the Northern Sierra Nevada. Fed by two perennial streams, willows, alders, sedges and other wet meadow associated vegetation undoubtedly dominated the valley historically. Overgrazing and subsequent stream erosion has resulted in a drying out of this site over the past 180 years. Fencing off the riparian habitat in the mid-1980's, followed by the complete removal of grazing in 2001, has resulted in a dramatic recovery of this site. New willow and herbaceous vegetation has returned to large portions of the valley. The population of Willow Flycatcher has increased from two singing males in 2002 to at least 13 singing males in 2003 (Humple and Burnett 2004). With full recovery of this site, the valley could potentially sustain over 50 pairs of breeding Willow Flycatcher. Other focal species that breed in the valley that should benefit from the recovery of riparian habitat include Spotted Sandpiper, Tree Swallow, Warbling Vireo, Yellow Warbler, Wilson's Warbler, and Song Sparrow. Current conservation efforts are focused on providing permanent protective status for this biologically important mountain meadow.

Warner Valley, a CDFG wildlife area adjacent to the Lassen National Forest and Lassen Volcanic National Park, is one of the most significant breeding areas for Willow Flycatchers in the state. Approximately 10-15% of the Sierra Nevada population of this species breed at this one location (King and King 2003, Humple and Burnett 2004). Substantial numbers of Wilson's Warbler, Yellow Warbler, and a small population of the regionally rare Swainson's Thrush breed here as well. The Willow Flycatcher population here is now being intensively studied as part of a demographic study of the Willow Flycatcher in the Sierra Nevada.

Bear Creek Meadow, located on private property adjacent to the headwaters of the Fall River, is the site of an extensive meadow restoration project. The meadow already contains numerous Yellow Warblers and several other focal species, including Wilson's Warbler and Warbling Vireo. With the maturation of re-vegetation and natural regeneration following the restoration of a hydrologically functional stream, this site has the potential to provide significant breeding habitat for Willow Flycatcher and other riparian focal species.

The Modoc region now appears to be the only area in the Sierra Nevada where the Willow Flycatcher population is stable or increasing (Humple and Burnett 2004, Green et al. 2003, R. Siegel pers. comm.). This population increase in the Lassen area can be attributed primarily to recolonization of former breeding sites on Pacific Gas and Electric (PG&E) lands. The only restoration action taken on these lands has been the complete cessation of cattle grazing. While grazing remains a highly debated subject in the Sierra Nevada, this evidence suggests that restoring mountain meadows to an ecologically healthier state may be accomplished with minimal active restoration in this region. A rigorous study examining the effects of cattle grazing and the recovery of meadows where it has been removed is vital for ensuring the long-term sustainability of many meadow dependent Sierra bird species.

Photo by Steve Zack, WCS

Willow Flycatcher abundance is increasing in the Lassen

Klamath

The Klamath/North Coast bioregion consists of rocky, steep shorelines, rich conifer forests, and lush riparian corridors. The region is one of the wettest in California, with cool, foggy summers along the coast and rainy winters throughout. Though vast tracts of habitat remain, logging, cattle ranching and agriculture have degraded much of the historic riparian habitat. While the old growth redwoods garner much of the attention of conservationists, riparian habitat merits significant attention as well, providing habitat for salmon, mammals and numerous birds, including the Pacific-slope Flycatcher, Bank Swallow and Willow Flycatcher (RAC 1998).

Portfolio Sites

The Trinity River supports important breeding habitat for half of the focal species. It is also used by large numbers of Willow Flycatchers during the pre-migration and migratory periods (Ralph and Hollinger 2003). Congressional legislation has provided the directive for the restoration efforts by the USDI Bureau of Reclamation Trinity River Restoration Program. Proposed bank rehabilitation and flow manipulation projects are aimed at recreating historic aquatic and riparian habitat conditions primarily in the upper reach of the system. Ongoing bird monitoring within the restoration sites will provide population and habitat use information for effective adaptive management.

Central Coast

The Central Coast Bioregion is characterized by a mild climate, a wide variety of habitat types, and numerous small mountain ranges that roughly parallel the coastline. The region supports a robust agricultural industry, which includes cattle grazing, row crops and vineyards. In recent years, the Central Coast has experienced a dramatic population increase fueled largely by prosperous industries, including the booming computer industry in the Santa Clara "Silicon Valley." This expansive growth seriously threatens riparian habitats in the region because of land conversion, water diversion, resource extraction, intensive grazing, habitat clearing and the introduction of invasive plant species. These changes have rendered the Central Coast one of the three most threatened ecoregions in California, along with the Central Valley and Southwest Ecoregions (TNC 1997), and merits immediate attention for conservation and protection efforts.

Valley areas in the Central Coast once supported large floodplain forests of deciduous riparian trees and shrubs. These areas, dominated by sycamore, willows and cottonwoods, were considered the most productive riparian habitat in terms of biodiversity (Roberson and Tenney 1993). Because of land use practices such as grazing and agriculture and associated flood control and groundwater extraction, valley riparian habitat is rare (TNC 1997). Riparian patches on the Salinas, Nacimiento, and Carmel Rivers and a few other localities in the region are important remnants for native wildlife.

Portfolio Sites

The Big Sur River is one of the most intact free-flowing rivers in the Central Coast region. The majority of the upper portion flows through the Ventana Wilderness and the Los Padres National Forest; the lower portion runs through both state and private lands. The riparian corridor is dominated by dense stands of willow, alder, and cottonwood accompanied by mature sycamore alluvial woodlands. The river provides important breeding habitat for a variety of riparian focal species including Warbling Vireo, Swainson's Thrush, Wilson's Warbler, Black-headed Grosbeak, and Song Sparrow. Data collected from long-term monitoring in the lower Big Sur River valley suggest that the breeding population of Warbling Vireos is significantly declining on a local level (VWS unpublished data). This coastal riparian corridor also provides critical stopover habitat during both spring and fall migration. Monitoring along the lower Big Sur River continues, making this a valuable reference site.

Photo by BSOL.

Riparian habitat along the Big Sur River.

The Carmel River flows northwest out of the Carmel Valley between the Santa Lucia Mountains on the South and the Sierra del Salinas Mountains to the north and east, draining approximately 255 square miles. Following the establishment of two dams and intensified floodplain development over the past 80 years, the river and its riparian corridor has shrunk dramatically. The watershed recently has become the focus of multiple restoration programs in an attempt to restore critical coastal riparian habitat and hydrologic function. The primary objective of songbird monitoring at these sites is to study avian responses to habitat restoration efforts, with particular attention given to riparian focal species. Currently, seven riparian focal species breed within the watershed. Although water diversion and intensive development continue, the river still provides important breeding, migratory-stopover, and overwintering habitat.

The Salinas River is the Central Coast bioregion's largest river, flowing through the longest inter-mountain valley in the state. Remnant habitat patches on the Salinas are important for the restoration and recolonization potential they provide for lowland forests and associated species, and include some of the last known potential breeding areas of the Least Bell's Vireo. Over 75% of the riparian habitat along the Salinas is considered disturbed or degraded (Roberson and Tenney 1993), underscoring the need for restoration and Brown-headed Cowbird management.

Priority streams and rivers were identified by TNC after it conducted a biological assessment of the Central Coast Bioregion. Priorities were determined based on factors such as landscape integrity, species richness of targeted species, and the presence of sycamore alluvial woodlands (TNC 1997). Highest priority sites include Pescadero Creek, Scott Creek, Uvas Creek, lower Salinas River, Arroyo Seco, Nacimiento River, upper San Benito River, Big Sur River, Arroyo de la Cruz, San Simeon Creek, San Antonio Creek, and Santa Ynez River.

Vandenberg Air Force Base supports some of the most extensive riparian habitat along the Central Coast (Farmer 1999). The base has high avian diversity and productivity and should be a conservation priority (Gallo et al. 2000).

Bay Delta

The Bay Area Delta Bioregion includes the San Francisco Bay area and spreads eastward to encompass the sprawling Sacramento San Joaquin River Delta. The climate is generally mild, with regular fog on the coast, wet winters, and warm summers inland. Historically, it supported a lush interconnected system of marshes, wetlands and riparian habitat. Though much has been lost to water projects and land conversion, the region continues to provide vital breeding habitat to riparian associated species.

Portfolio Sites

The Point Reyes National Seashore supports significant amounts of riparian habitat in the form of many small willow-alder dominated creeks. The National Park Service in collaboration with PRBO Conservation Science has conducted extensive bird monitoring at three riparian sites: Muddy Hollow, Redwood Creek and Lagunitas Creek. Currently, seven riparian focal species breed within these watersheds; most of which occur here in densities far higher than any other bioregion (Table 6-1). In addition to breeding habitat, these sites also provide critical stopover habitat during spring and fall migration.

The Cosumnes River Preserve, located at the eastern tip of the bioregion, is focused around the only undammed river on the west slope of the Sierras and encompasses over 5,670 hectares of riparian and upland habitats. The Preserve protects the largest remaining tracts of valley oak riparian forest. Management of the Preserve is an excellent example of a working partnership between BLM, The Nature Conservancy, California Dept. of Fish and Game, Ducks Unlimited, Sacramento County and the Wildlife Conservation Board. The Preserve is also an ideal site for studies assessing landbird response to natural recruitment restoration. Managers there have breached levees to capitalize upon natural flooding events and allow natural recruitment of riparian habitat within the Cosumnes bottomlands. The mosaic of different aged patches of habitat resulting from regeneration demonstrates the dynamic processes that result from a river being reconnected to its floodplain. However, low productivity of Song Sparrows and other species in some of these habitats along the Cosumnes indicates that these populations may be in danger of local extirpation, as seems to already have occurred locally in portions of the lower Sacramento River Valley (PRBO unpublished data).

South Coast

The South Coast bioregion includes miles of sandy beaches and steep cliffs along the Pacific, small mountain ranges, and extensive riparian, scrub and conifer habitats. The human population continues to expand rapidly, converting and fragmenting native landscapes at an alarming rate. The climate is arid and warm year round, increasing the importance of the few remaining riparian areas. The South Coast serves as the last refuge for the Least Bell's Vireo in California. Though the species once bred in riparian habitat throughout the state (Grinnell and Miller 1944), years of habitat reduction, nest predation and parasitism by the Brown-headed Cowbird have severely reduced the species' range (USFWS 1998).

Portfolio Sites

The Santa Clara River, is the largest unchannelized river in southern California. The Santa Clara River Enhancement and Management Plan, developed by the USFWS, the California Coastal Commission, and several southern counties, seeks to protect the natural resources and wildlife along the river and proactively avoid the listing or extirpation of any new species. However, current efforts to develop areas along the river's reach may further jeopardize the habitat.

Mojave and Colorado Deserts

While the desert regions have yet to be adequately assessed in this plan, desert oases and associated riparian habitat clearly represent critical bird breeding grounds that also serve as important migratory stopover and wintering sites for many species (Grinnell and Miller 1944, Massey and Evans 1994, Flannery et al. 2004). Water diversion, grazing, exotic plant species and recreational activities threaten riparian habitat in desert oases. The Colorado River hosts an impressive suite of resident and Neotropical migratory breeders (Rosenberg et al. 1991). Efforts along the Colorado River seek to restore some of the native habitat after over a century of degradation due to human disturbance, water diversion and exotic plant invasions. Riparian habitats in the Mojave and Colorado Desert bioregions will be covered more extensively in the CalPIF Desert Bird Conservation Plan (CalPIF *in prep*.).

Portfolio Sites

The Colorado River has recently become the focus of a multi species conservation plan that includes provisions for fish, birds and plants. Restoration efforts include protection and restoration of riparian vegetation and exotic plant control (specifically for tamarisk). Management of flows and reconnection of the river to historic backwater areas will benefit native fish, recreational fishing and riparian habitat.

Sierra

The Sierra Bioregion has faced over a century of land and water conversion, resource exploitation, invasive plant species and rural sprawl. The Sierra Nevada range is considered to be one of 233 sites of globally important biodiversity. Of those sites, it is one of 110 considered critically threatened or endangered (Olson and Dinerstein 1998). While riparian montane meadows historically provided ample habitat for species such as the Yellow Warbler and Willow Flycatcher, they have been degraded or destroyed by grazing and water diversion. Siegel and DeSante (1999) and the Sierra Nevada Ecosystem Project (Davis and Stoms 1996) provide an extensive review of conservation needs and recommendations for the Sierra Nevada region.

The Sierra Bioregion, as distinguished by the Biodiversity Council (RAC 1998), includes a portion of the eastern Sierra escarpment and the western Great Basin. Desert riparian habitats of the Owens Valley alluvial fan zone provide spring and fall migration and dispersal habitat not only for riparian associated species, but also upland species breeding in adjacent sagebrush habitats (Heath et al. 2001, Heath and Ballard 2003). Higher elevation riparian aspen habitats harbor the most diverse breeding songbird communities in the region (Heath and Ballard 2003[a]).

The Los Angeles Department of Water and Power (LADWP), the primary water rights and landowner of lands adjacent to the Owens River and Mono Basin feeder streams, has begun restoration efforts of riparian habitats in the eastern Sierra. Restoration plans for both the Mono Basin feeder streams and the lower Owens River rely primarily on returning water to these diverted systems. A majority of the Sierra Bioregion lands are managed by public agencies. Resource managers and landowners appear willing to invest time and money into finding more ecologically sound management practices and are incorporating conservation recommendations into work plans and project goals (LORP 1999, Siegel and DeSante 1999, Heath et al. 2001).

Portfolio Sites

Sierran mountain meadows are critically important for breeding and post breeding dispersal of Neotropical migrants and resident landbirds (Siegel and DeSante 1999, Burnett and Geupel 2001). These meadows also provide important stopover habitat for many migrating species. Examples of important Sierran meadows include Perazzo, Humbug Valley, Little Truckee River, and Sage Hen.

The South Fork Kern River supports high species diversity and an intensively managed program to support the reproductive success of riparian birds. It remains a high conservation priority, as it provides one of the most important breeding grounds for Yellow-billed Cuckoos and Willow Flycatchers in the West and continues to host a richly diverse bird community (including most of the 17 focal species considered in this Conservation Plan).

The Mono Lake tributaries, compromised for decades by water diversions to the Los Angeles aqueduct, are currently undergoing restoration and have been void of livestock grazing since the 1991 removal of cattle and sheep (LADWP 1996). The streams have been rewatered since 1989 and now harbor abundant breeding populations of many of the riparian focal species (Heath et al. 2002[b]). Rush Creek harbors the densest breeding population of Yellow Warblers currently recorded in the state, and a small population of Willow Flycatchers has recently been discovered breeding among Rush Creek's wild rose patches (Heath et al. 2002[c], McCreedy and Heath *in review*). Court mandated restoration monitoring efforts in the Mono Basin focus on hydrological functions, fish populations and plant regeneration. Songbird monitoring of Mono Basin streams continues to investigate songbird community response to passive riparian regeneration.

The Owens River and its riparian habitat, though compromised due to water diversions since the early 1900's, harbors remnant breeding populations of the Southwest Willow Flycatcher and perhaps the Western Yellow-billed Cuckoo (Laymon and Williams 1994). Once, this river system provided breeding or migratory habitat for nearly all of the 17 riparian focal species, including the Least Bell's Vireo (Fisher 1893, Laymon and Williams 1994, MacMillen et al 1996). As part of the Lower Owens River Project, water is scheduled to be released into over 60 miles of the River system by 2005. Restoration efforts will be primarily passive, relying on the reintroduction of water into the decades long dry channel (LORP 1999). Extensive baseline songbird monitoring on the Lower Owens River began in 2002 and will continue for several years after initial rewatering (Heath and Gates 2002).

Chapter 8. Conservation Recommendations

This chapter provides specific recommendations for riparian habitat activities throughout the state. They consider habitat protection and restoration, land management, research and monitoring, and policy action. Conservation organizations, agencies, scientific researchers and the public provided the information used in developing this chapter and most recommendations were derived from the most recent scientific data and analyses available. Unless otherwise referenced, most information from this section is derived from the focal species accounts (see http://www.prbo.org/calpif/htmldocs/riparian.html). Some, however, rely upon well-informed assumptions that require more scientific investigation. Standardized monitoring and adaptive management will test and develop these assumptions, continually improving our knowledge of conservation and restoration science.

These recommendations seek to reverse the current declines of many riparian-associated bird populations. By restoring healthy, stable populations, we will avoid the expensive and intrusive last resort of listing more species as threatened and endangered. We hope that these recommendations will galvanize and guide conservation organizations, project funding, and the actions of land managers and owners across the state. All of the following objectives and recommendations seek to fulfill the RHJV's central mission, which is to promote conservation and restoration of riparian habitat sufficient to support the long-term viability and recovery of native bird populations.

Habitat Protection Recommendations

Objective 1

Prioritize riparian sites for protection and restoration.

Recommendations

1.1. Prioritize potential riparian protection sites according to current indicators of avian population health.

Conservation efforts should use the most recent information regarding the quality of existing habitat and wildlife populations to prioritize the acquisition and protection of sites. Reproductive success, in particular, is an important demographic parameter that provides a foundation around which to build riparian conservation programs. After a four-year study of passive riparian restoration, Dobkin et al. (1998) suggested that the presence of "key" species in areas undergoing restoration during their third and fourth years signaled the beginning of avian restoration.

Key or "rapid-indicator" species are those that:

- Are still locally abundant in riparian habitats throughout the state.
- Can rapidly colonize an area.
- Depend upon early successional riparian shrub habitats.

1.2. Prioritize restoration sites according to their proximity to existing high-quality sites.

Restoration sites near existing high-quality sites and population sources have a higher probability of being recolonized by extirpated species. Along the San Luis Rey and San Diego Rivers in San Diego County, Kus (1998) documented Least Bell's Vireos' occupation of restored sites more rapidly in habitats adjacent to mature and intact riparian habitat. Tewksbury et al. (2002) found, for the Sacramento River basin and four other western study areas, that sites surrounded by more riparian habitat at the regional scale (5 km) tended to have more long-distance migrants, as well as resident birds.

1.3. Protect and restore riparian areas with intact adjacent upland habitats.

Riparian-associated birds make use of grass, shrub and woodland habitats adjacent to riparian zones throughout their lives. Upland zones provide migratory stopover grounds, foraging habitat, and dispersal corridors for non-breeding adults and juveniles. The Western Yellow-billed Cuckoo, Common Yellowthroat, and Least Bell's Vireo are among the many riparian species that commonly use upland habitats adjacent to riparian nesting sites. These areas act as both flood refugia and supplemental foraging areas. For example, the Common Yellowthroat will not nest over water and therefore must have access to alternative upland nest sites during late spring floods. The Western Yellow-billed Cuckoo's prey base, largely katydid and sphinx moth larvae, winters underground. In wet years, cuckoos must forage in upland areas until the prey base in the lower floodplain recovers. Because most extant riparian habitat is in the primary floodplain, floods may regularly reduce the cuckoo's prey-base and contribute to the decline of cuckoos in the West. Several riparian bird species, including the Warbling Vireo and Black-headed Grosbeak, commonly nest in upland habitats adjacent to riparian zones.

Riparian areas can also support primarily upland nesting bird species. For example, narrow riparian strips in the Owens Valley alluvial fan of the eastern Sierra Nevada provided perching sites, nesting material, foraging and watering areas for predominantly sagebrush nesting species. Additionally, these water birch drainages received an influx of Sage Sparrow families in late summer, suggesting the importance of riparian habitat for post-fledgling dispersal of sagebrush-associated juveniles (Heath and Ballard 2003[b]).

The importance of adjacent intact habitats can be illustrated by taxa other than birds. The Arroyo Southwestern Toad is another example of an animal that uses both riparian and upland habitats, and continuity between the two habitat types may be essential for species survival. This federally listed endangered species uses common riparian types in southern California for foraging and dispersal, even though dense, tall vegetation structures are least preferred for burrows. Females and breeding season males prefer channel and terrace habitats to campground, agricultural or upland habitats, but males use uplands after breeding season commences (Griffin and Case 2001).

A study on riparian lizards on the South Fork of the Eel River concluded that "rivers can feed the forests" and demonstrated that strong links between rivers and surrounding watersheds has implications for resource management. Riparian systems provide food and prey for riparian and upland lizard species alike. Land uses (e.g., river impoundments) that alter downstream productivity and diversity of insects may influence not only downstream river biota, but adjacent terrestrial biota as well (Sabo and Power 2002).

1.4. Prioritize sites with an intact natural hydrology or the potential to restore the natural processes of the system.

Of the 11 focal riparian bird species that have suffered population declines, seven prefer to nest in early successional riparian habitat, particularly willow/alder shrub habitats with dense understory cover. To flourish, early successional habitats depend upon natural hydrology, including flooding, soil deposition, and point bar formation, for establishment (Sacramento River Advisory Council 1998). Seed dispersal and natural tree regeneration and growth also are sometimes compromised due to the absence of high peak flows or seasonal fluctuations in water levels (Smith et al. 1991, Stromberg and Patten 1992). Restoring or mimicking natural hydrology contributes to recreating the structural diversity found in natural riparian systems, increasing the habitat quality for native wildlife. Sites with intact natural hydrology or the potential to return to one should receive special consideration.

For the long-term conservation of the federally endangered Arroyo Southwestern Toad, management of natural disturbance regimes such as flooding, fires, and successional dynamics that promote continuous availability of preferred channel and terrace breeding sites is essential. Reservoirs, low water tables, paving, sediment mining, and exotic flora introduction have all negatively impacted habitats vital for Arroyo Toad breeding and larval development (Griffin and Case 2001).

1.5. Prioritize sites according to surrounding land use.

Management of riparian areas at a watershed-level is the best method for conserving bird populations. Landscape scale land use patterns may significantly affect the sustainability of riparian bird populations over the long term (Petit et al. 1995). Surrounding land uses influence the population sizes of Brown-headed Cowbirds and predators such as domestic cats, jays, skunks, raccoons, ravens, and crows. More research is needed regarding habitat buffers and their influence on predation and parasitism rates. It is known that Brown-headed Cowbirds may commute more than 12 kilometers between foraging grounds and the nest sites of their hosts (Mathews and Goguen 1997). For more information, refer to Recommendation 6-3.

The Swainson's Hawk demonstrates the need for protected and properly managed habitats surrounding riparian zones. In the Central Valley, Swainson's Hawks prefer to nest in riparian vegetation but typically forage upland. Historically, they hunted small mammals in native perennial grasslands. Today, they seek prey in grazed grasslands and certain forms of agricultural land (Table 8-1). Landscape-scale variables determine habitat suitability for these hawks: nest placement not only depends on vegetation characteristics around the nest site, but the suitability of surrounding habitat for foraging. In this case, protecting or restoring a pristine riparian forest is insufficient for the conservation of this species.

Table 8-1. Ranking of various habitats as foraging habitat for Swainson's Hawks in California[1]

Vegetation Type	Rank [2]	Access to Prey [3]	Prey Abundance [4] (Prey Population size and availability)
Perennial Grassland	1, 2	Consistently high	High prey and high availability
Alfalfa	1, 2	Consistently high	High prey and high availability
Fallow Fields	3, 5	Consistently moderate	Moderate prey and high availability
Dryland Pasture	4	Consistently moderate	Low prey, but high availability
Beets	4, 5	Usually low, high at harvest	Moderate prey, only highly available at harvest
Tomatoes	5, 6	Normally low, high at harvest	Moderate prey, only highly available at harvest
Weedy/Ruderal Field	5-11	Highly variable	Moderate prey with variable availability
Irrigated Pasture	7	Consistently low	Very low prey, but high availability
Shrub/Sage	7-12	Highly variable	Low prey and moderate availability
Grains	8	Consistently low	Low prey and low availability
Other Row Crops	9-12	Consistently low	Low prey and low availability
Orchard/Vineyard	10-12	Consistently low	Low prey and low availability

1. Table based on studies in the Central Valley (Estep 1989) and Great Basin (Woodbridge 1991).
2. Ranked from 1 to 12, highest to lowest value as foraging habitat, depending on prey abundance and availability.
3. Different foraging habitats provide varying amounts of prey throughout the year. Tilling and harvest activities strongly affected the availability of prey within each crop type (Estep 1989).
4. Ranked as high, moderate or low prey abundance and the degree of availability of the prey. Each crop type supports a different abundance of prey (Estep 1989).

The following land uses within a riparian buffer zone are listed in general order of preference. This list provides only rules of thumb and must be considered in context with many other factors when assessing each unique conservation opportunity. The land uses generally beneficial with sustainable management are:

- Natural habitat not used for commodity production (e.g., wilderness).
- Unimproved parks/open space (provided substantial non-native species problems do not exist).
- Commercially managed habitat (e.g., grazed oak woodlands or timber production forest).

The land uses that can be beneficial, neutral, or detrimental depending on the wide variety of crops, cultivation, and pest control techniques used (Table 8-1) are:

- Horse/cow pasture.
- Campgrounds and picnic areas.
- Row crops.
- Permanent crops (e.g., orchards, vineyards).

The land uses within a riparian corridor or buffer zone that can be detrimental to birds because they support and attract cowbirds and predators are:

- Manicured parks and golf courses.
- Rural homes/ranchettes.
- Dairies and intensive feedlots.
- Intensive development (urban/suburban) and intensive agriculture.

The land surrounding a proposed protection or restoration site should be assessed for its risk of change or conversion and how that may affect bird populations. For example, is the land available for conversion to other uses? Or, is it permanently prohibited from development (e.g., in a floodplain; in public ownership; or protected through an agricultural conservation easement, a habitat conservation plan, local zoning, or an urban limit line)?

Objective 2

Promote riparian ecosystem health (i.e., a self-sustaining, functioning system).

Recommendations

2.1. Ensure that the patch size, configuration, and connectivity of restored riparian habitats adequately support the desired populations of riparian dependent species.

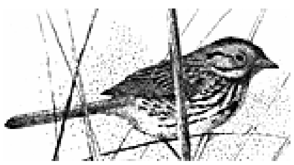
The size and connectivity of riparian habitat patches may be limiting to bird species' occupancy and population size. A habitat patch is a contiguous area of similar vegetation, usually defined by the dominant vegetation (e.g., a cottonwood willow patch within the valley foothill riparian type). Patch sizes must not fall below the minimum necessary to support populations based on:

- Territory size requirements.
- Community dynamics.
- Sensitivity of some species to fragmentation and edge effects (increased predation/parasitism rates).

When determining the minimum acceptable patch size for a site, managers should consider the mean territory size of their target species as a guideline. When considering a suite of species, managers should use the species with largest territory needs (e.g., Western Yellow-billed Cuckoo) to set the minimum patch size requirement, and they should design corridors to connect habitat fragments according to the needs of the species with the highest sensitivity to fragmentation (Bolger et al. 2001).

Western riparian habitats are naturally linear systems with extensive edges. Patch isolation (lack of connectivity) may influence bird communities as much as habitat fragmentation. Small patch size and/or patch isolation may increase predation and brood parasitism rates and limit population dispersal. For example, although a number of riparian areas in California are of sufficient size (41 hectares, Laymon and Halterman 1987, 1989) and structure to support Western Yellow-billed Cuckoos, individuals may not colonize these areas because of their distance from existing populations and the lack of enough potential mates in close proximity. Some studies have suggested that amount of available riparian habitat, at various spatial (e.g., Tewksbury et al. 2002) and temporal (e.g., Greco et al. 2002) scales, is more important than patch size *per se*. Because riparian systems are dynamic, patch sizes may differ from year to year and should be considered on a landscape scale (Greco et al. 2002).

2.2. Restore natural hydrology in riparian systems wherever possible. (see Recommendation 1.4).



Restoration Recommendations

Objective 3

Increase the value of ongoing restoration projects for bird species.

<u>Recommendations</u>

3.1. Restore and manage riparian forests to promote structural diversity and volume of the understory. (See Recommendation 5.2.)

Loss of appropriate microhabitat, such as habitat structure or heterogeneity, may explain a species decline or absence in areas where riparian habitat appears intact. In restored riparian areas, large tree size and high foliage volume promote avian diversity, but diversity of vegetation structure may be even more important (Nur et al. 1996, Holmes et al. 1999). Seven of the ten focal species that have suffered the greatest range reductions and/or are declining tend to depend upon early successional riparian habitat, particularly willow-alder shrub habitats with dense understory cover. These include the Willow Flycatcher, Song Sparrow, Bell's Vireo, Blue Grosbeak, Yellow-breasted Chat, Yellow Warbler, and Common Yellowthroat. Many other species, such as the Wilson's Warbler, Spotted Towhee, and Swainson's Thrush nest on or near the ground and need a healthy understory to successfully reproduce (PRBO unpublished data). The nest success of some species, such as Calliope Hummingbirds, Bushtits and Black-headed Grosbeaks in the eastern Sierra Nevada is positively influenced by herbaceous ground cover or wild rose shrub cover, even though these species tend to nest in the higher layers of the riparian canopy (Heath et al. 2001). Among several bioregions, riparian bird abundance, richness and occurrence is significantly and positively associated with herbaceous or shrub cover as well as tree DBH and tree cover (Gardali et al. 2001, Small et al. 2001, Heath and Ballard 2003a).

In coniferous forest habitats, managers frequently plant conifers in riparian corridors to produce large, woody debris that provides aquatic habitat. This practice should be reassessed, minding that a deciduous component creates the structural diversity needed to support riparian-dependent terrestrial species. For example, in aspen riparian habitats of the eastern Sierra Nevada, breeding bird species richness decreased as conifer cover and white fir cover increased, but was positively influenced by the cover of herbaceous layers, willow shrubs, and snowberry (Heath and Ballard 2003a).

3.2. Restore the width of the riparian corridor.

Most riparian corridors today are much narrower than they were historically, particularly in the Central Valley. Hence, restoration planners should consider increasing corridor width to historic margins when possible. In coastal riparian habitats, for example, the presence of Warbling Vireos, Common Yellowthroats, and Swainson's Thrushes positively correlates with the width of the riparian corridor. The mean riparian corridor width at sites supporting Warbling Vireos was 82 meters, 30 meters greater than the mean width at sites without vireos (Holmes et al. 1999, Gardali et al. 2001). Breeding bird diversity in the eastern Sierra Nevada is positively associated with riparian width at several landscape scales (Heath and Ballard 2003[b]).

Quantifying a specific target width of riparian habitat is extremely complex; the effect of riparian width varies by bird species and riparian type and is only one of many variables affecting species occurrence and reproductive success. For example, while insufficient width of riparian corridors has been shown to negatively affect the breeding success at some locations (Bednarz et al. 1998, Small and Geupel 1998), riparian width had no affect on Yellow Warbler nest success in 50m – 250m wide riparian sites in eastern California (Heath and Ballard 2002[b]). Future research and landscape-level analysis will elucidate the problem. Regardless, wider riparian corridors are likely to provide more and better habitat.

Objective 4

Ensure that large landscape scale management and flood control projects maximize benefits to wildlife while benefiting agriculture and urban populations. Achieving multiple goals simultaneously enhances the overall value of such projects to the people of California.

Recommendations

4.1. Management of new or existing flood bypass areas should consider the benefits of a regenerating riparian habitat against those of other uses.

Recent floods in California, such as the New Year's flood of 1997 or the Napa River flood of 1997-98, demonstrate the need for a new model for flood control and habitat protection. Management of bypass areas as riparian habitat maximizes the public benefits of floodway/bypass projects currently under consideration throughout the state.

The preliminary report of the California governor's Flood Emergency Action Team (1997) stated that new or enlarged flood bypass or levee setback systems should be considered as options for nonstructural flood control. This approach may be particularly useful in areas with little permanent infrastructure or development, such as the San Joaquin River floodplain and the Delta. The Army Corps of Engineers recently assessed the Sacramento and San Joaquin River Valleys for the potential to initiate nonstructural alternatives (NSAs), such as levee setbacks and flood bypass channels, rather than traditional flood control projects (i.e., dams, levees, and channelization).

Cultivated Restoration Recommendations

Restoration and improved management are the best means by which to increase the amount and quality of riparian habitat in the state, thereby increasing the reproductive success and population sizes of riparian-associated birds. California's restoration experts have pioneered the development of riparian habitat restoration techniques over the past few decades.

Scientists are evaluating restoration's effects on threatened or endangered bird populations in California (e.g., Kus 1998, McKernan and Braden 2001), and the Herculean effort of restoring riparian habitat to the Lower Colorado River has been well studied in regards to its benefits to bird populations (e.g., Anderson and Ohmart 1982, Rosenberg et al. 1991). Yet, only recently have scientists evaluated the effects of restoration on more common bird species in other regions of the state (Gardali et al. 2001, Larison et al. 2001, DiGaudio 2003, Haff 2003, Jaramillo and Hudson 2003) and many data remain unpublished or in report form (e.g., Geupel et al. 1997a, b; Small et al. 2000, Burnett and DeStaebler 2001, Small et al. 2001, Heath and Gates 2002, Heath et al. 2002[a]). The results from many of these studies suggest that greater attention should be directed to restoration of the understory to increase cover, particularly forbs (Larison et al. 2001, Burnett and DeStaebler 2002, Recommendation 5.2). Furthermore, primary and secondary cavity nesters greatly benefit when deadwood is maintained at a restoration site (Marzluff and Ewing 2001, Gilchrist et al. 2002).

Objective 5

Design and implement cultivated restoration projects that mimic the diversity and structure of a natural riparian plant community.

<u>Recommendations</u>

5.1. Plant a minimum of two or more species of native shrubs or trees (i.e., avoid monotypic plantings).

Several vegetation features have broad positive effects on bird species diversity, abundance and nesting success (Table 8-2, 8-3). Many non-avian species also respond positively to these vegetation components in riparian habitats. Microhabitat characteristics can also influence nest-site selection by breeding birds. The availability of appropriate nest sites may have a direct effect on the ability of birds to reproduce and maintain a viable population (Martin 1993, Nur et al. 1996, Small et al. 1998). Results from three years of monitoring of restoration sites along the lower Sacramento River indicate that bird diversity in an area increases when two or more shrub species are present and is substantially greater when there are seven or more species (Geupel et al. 1997a). Because many of the "shrubs" detected are actually young trees, high shrub species richness may indicate riparian forests with good structure and regeneration. Studies in coastal Marin County show that bird species diversity in riparian habitats significantly correlates with tree species richness, tree height, and tree girth (Holmes et al. 1999).

5.2. Increase shrub richness, shrub density, and the rate of natural reestablishment by including plantings of understory species in restoration design.

Understory vegetation is critical as nesting substrate for many riparian bird species, especially in newly restored habitats (Larison et al. 2001, Twedt et al. 2002, DiGaudio 2003). Avian density may increase in a habitat with increased foliage density because of a higher number of potential nest sites (Martin 1988). The greater the number of potential nest sites within a given habitat patch, the greater the effort required for predators to locate prey (nest sites). Thus, nests may possess a higher probability of fledging young.

Many revegetation projects enhance growth of tree plantings by mowing the restoration plots during the first two years. After mowing, restoration managers should plant a second stage to enhance recruitment of a native understory, thereby increasing the quality of the shrub and forb layers.

5.3. Plant native forb and sedge species.

The Common Yellowthroat and Spotted Towhee use native grass and sedge frequently in the Sacramento Valley as nest substrate. An excellent resource detailing type, sources, and techniques for planting and restoring native grasses is provided in *Bring Farm Edges Back to Life!* (YCRCD 1998).

5.4. Cultivate tree species where natural hydrological processes are compromised and natural tree regeneration is limited or absent.

Seed dispersal and natural tree regeneration is sometimes compromised due to the absence of high peak flows or seasonal fluctuations in water levels (Stromberg and Patten 1990, Smith et al. 1991). Cultivating tree species where regeneration is lacking is recommended.

5.5. Plant vegetation in a mosaic design with dense shrub patches interspersed with trees to achieve a semi-open canopy.

Plantings that are concentrated into clumps will create more productive patches of habitat for nesting birds than plantings uniformly spaced over a large area. "Clumped" planting designs more closely mimic the natural establishment of vegetation after scouring or soil deposition from a flood. For example, many willows grow naturally in clumps and can be easily planted this way.

Table 8-2. The following plant species and cover types have been found to positively influence breeding bird diversity or breeding species richness in riparian habitats, by California bioregion.

	Sacramento and San Joaquin Valleys[1]	Modoc	Klamath[2]	Central Coast	Bay-Delta[3]	South Coast	Mojave and Colorado Deserts[5]	Sierra Nevada[4]
Canopy layer	• Large trees • Oregon ash	No data	• Tree cover • Big leaf maple	No data	• Tree DBH • Tree cover • Tree richness	No data	• Freemont cottonwood • Black willow	• Aspen • Black willow • # snags
Shrub layer	• Blue elderberry • Box elder • Willow species • Wild rose • California blackberry • Wild grape • Poison oak • Shrub richness • Mugwort • Shrub cover	No data	• Big leaf maple • Ponderosa pine	No data	• Shrub height diversity	No data	No data	• Willow • Snowberry • Shrub cover
Ground cover	• Mugwort	No data	• Blackberry (Himalayan or California)	No data	No data	No data	No data	• Herbaceous cover • Grass cover • Rush cover

[1] Geupel et al. 1997[a], Small et al. 2001, Burnett and DeStaebler 2001, Burnett et al. *in press.*
[2] Nur et al. 1996.
[3] Gardali et al. 1999; Gardali et al. 2001, Holmes et al. 1999, DiGaudio 2003.
[4] Heath et al. 2001, Heath and Ballard 2003a, Heath and Ballard 2003[b], Heath 2002, Stefani 2000.
[5] Anderson et al. 1983.

5.6. Retain at least some existing trees on restoration sites, planting around them, to promote occupancy of the plot by birds requiring mature trees (e.g., cavity nesters, orioles, etc.). Projects that plan to remove orchards should consider leaving a few trees in small clumps (with the exception of fig or other species with invasive root stocks).

Both primary and secondary cavity nesters are common in natural forests and are excluded from nesting on restoration sites that lack older trees due to lack of nest sites. When possible, restoration managers should leave a few old trees with cavities and snags or girdle younger, healthy, non-native trees. It is essential to provide cavity nesters with habitat until planted trees grow sufficiently to provide nests.

Photo by Eric Preston, ericpreston.com

Consider the needs of cavity nesters at restoration sites.

5.7. Connect patches of existing riparian habitat with strips of dense, continuous vegetation that are at least 3-10 meters wide.

The connection of habitat patches is an important restoration consideration. Relatively sedentary species, such as Song Sparrows, Spotted Towhees, and Wrentits, may be affected most by patch isolation. These birds may disperse more widely and effectively if existing source populations were well connected with unoccupied habitats (such as linking the Butte Sink, which supports Song Sparrows, with the Sacramento National Wildlife Refuge, which does not, despite appearing to have suitable habitat). Even narrow strips may function as dispersal corridors. Song Sparrows, Wrentits, and Spotted Towhees have been observed in strips as narrow as 1 meter, and other species have been observed in strips 10 meters wide (Soulé 1988, PRBO unpublished data). These strips probably do not provide adequate breeding habitat, and nesting individuals may have low reproductive success. However, they may be vital in linking populations that would otherwise be isolated from one another, a benefit which outweighs the low reproductive success of relatively few individuals.

Management Recommendations

Effective management of riparian areas is as crucial as habitat restoration to the survival and recovery of riparian birds. Proper management increases habitat value to wildlife, arrests species declines, and contributes to the recovery of declining bird populations. Landscape-scale patterns of land use are of critical importance, influencing whether riparian bird populations remain stable over the long term.

Objective 6

Implement and time land management activities to increase avian reproductive success and enhance populations.

Recommendations

6.1. Manage riparian and adjacent habitats to maintain a diverse and vigorous understory and herbaceous layer, particularly during the breeding season.

The number of young produced in a bird population (reproductive success) may be the most important factor influencing a species' occurrence and persistence in an ecosystem. When less than 20% of nests survive to fledge young, nest success is considered poor and it probably indicates a nonviable population (Martin 1992, Robinson et al. 1995, Trine 1998, Budnik et al. 2000). Early successional habitats with a dense, shrubby understory and herbaceous groundcover are critical for successful nesting of nine of the 17 focal riparian species. Not surprisingly, shrub cover around the nest is an important variable in nest-site selection for many species (Table 8-3). The following recommendations will promote understory and groundcover quality:

- Use groundcover in orchards and vineyards to discourage foraging by Brown-headed Cowbirds, thereby increasing birds' reproductive success. Use of a native species groundcover is preferable. Managers should either avoid mowing through the nesting season or maintain the layer to 6 inches in height to discourage use by nesting birds.

- Control star thistle and other "weedy" non-native species to promote a diverse herb layer.

- Allow natural disturbance regimes, particularly periodic floods.

Grazing, mowing, and burning are common land management practices that significantly affect the understory. Options for managing these activities include:

- Manage grazing intensity and location to ensure riparian deciduous shrubs are recruiting well and are not "highlined" (i.e., cattle do not destroy all the foliage within their reach).

- Manage grazing intensity and timing to avoid direct impacts to low-nesting birds during breeding season.

- Postpone mowing until after peak breeding season. If mowing must be done during breeding season, maintain a low herbaceous layer of no more than 6 inches to discourage birds from nesting there in the first place.

- If burning must be used as a management technique, burn the groundcover in riparian habitats after the end of the breeding season.

The Willow Flycatcher demonstrates how land management activities can affect a breeding population. The subspecies of Willow Flycatcher *E. t. brewsteri* depends upon montane meadows in the Sierra Nevada for nesting. Grazing cattle in mountain meadows during the breeding season has both direct and indirect effects on Willow Flycatchers. Directly, cattle move through meadow willows and destroy Willow Flycatcher nests by bumping against or trampling them. Indirectly, browsing decreases foliage density in willows and other shrubs at heights lower than 1.5 meters, where Willow Flycatcher nests occur. This reduces the number of available nest sites and exposes existing nests to predators.

In desert riparian areas, grazing by wild burros severely affects riparian vegetation and associated bird species. The effects of burros in some areas include (BLM 1998):

- High browse lines and severe hedging of riparian trees and shrubs, which eliminates understory nesting habitat.

- Pulling forage plants out by the roots, possibly contributing to invasion by competitive non-native plants.

- Soil compaction along burro trails, which leads to erosion or inhibits seedling establishment.

These effects combine to destroy the vegetation, and in the harsh desert environment, the habitat recovers more slowly than in other riparian types in California.

Table 8-3. The following plant species and cover types have been found to positively influence select focal species occurrence[a], abundance[b], nest success[c] and nest site selection[d] in riparian habitats, by California bioregion.

	Sacramento and San Joaquin Valleys[1]	Bay-Delta[2]	South Coast[3]	Sierra Nevada[4]
Willow Flycatcher	Species not present	Species not present		• Willow cover[a,b] • Foliage density[a,b]
Warbling Vireo		• Tree richness[a] • Shrub height diversity[a]		• Aspen[a] • Tree height[a]
Least Bell's Vireo	Species not present	Species not present	• Shrub cover[a,b] • Tree cover[a,b] • Tree DBH[c] • Herbaceous cover[d] • Low Aquatic vegetation[d]	Species not present
Swainson's Thrush		• Tree cover[a,d] • Tree height[a] • Hedgenettle[d]		• Canopy closure[a] • Willow patch size[a]
Yellow Warbler	• Himalayan blackberry[b] • Valley oak[b]			• Grass[a] • Wild rose[c] • Willow[a]
Common Yellowthroat	• Shrub richness[a] • Mugwort[a] • Santa Barbara sedge[a]	• Herb cover[a] • Marsh cover[a] • Shrub cover[a]		

Table 8-3 continued

	Sacramento and San Joaquin Valleys[1]	Bay-Delta[2]	South Coast[3]	Sierra Nevada[4]
Wilson's Warbler		• Tree richness[a] • Small trees[a] • California bay[c]		
Yellow-breasted Chat	• Sedge[b] • Black mustard[b] • Sandbar willow[b] • California blackberry[b]			
Black-headed Grosbeak	• Tree richness[a] • California blackberry[a] • Mugwort[a] • Freemont cottonwood[b] • Black mustard[b]	• Tree height[a] • Shrub height diversity[a] • Tree cover[a] • Shrub cover[a] • Tree richness[a]		• Tree species richness[a] • Wild rose[c]
Blue Grosbeak		• Tree richness[a] • Shrub cover[a]		
Song Sparrow	• Valley Oak[b] • Pipevine[b] • Mugwort[b] • Black mustard[b]	• Marsh cover[a] • Shrub height[a] • Herb cover[a] • Red alder[c] • Litter depth[c] • Shrub cover[a,c] • Tree richness[a]		• Willow[a]

[1] Small et al. 2001, Burnett and DeStaebler 2001, Burnett et al. *in press.*
[2] Holmes et al. 1999, PRBO data, Gardali et al. 1999, DiGaudio 2003, Haff 2003.
[3] Salata 1981, Salata 1983, Goldwaser 1981, RECON 1989, Olson and Gray 1989, Kus 1998.
[4] Heath and Ballard 2003, Heath et al. 2001, Heath and Gates 2002, Stefani 2000, Bombay et al. 2003, Bombay 1999, Sanders and Flett 1989.

6.2. Manage or create "soft" edges (through establishment of hedgerows at field margins) appropriate to historical vegetation patterns.

"Soft" edges are gradual boundaries between differing vegetation or land uses where plant succession occurs. Historically, along many of California's rivers, a wetland area graded into scrubby willow that graded into riparian forest. This pattern created a mosaic landscape, where different habitats smoothly merged together into an ecotone. Soft edges are preferable to "hard" edges (abrupt changes in vegetation type) because predation levels along hard edges are higher (Suarez et al. 1997). Creating hedgerows using native plant species along forested riparian zones at the edge of agricultural fields results in "softer" edges. The Yolo County Resource Conservation District publication, *Bring Farm Edges Back to Life!* (YCRCD 1998), details how to create and mange hedgerows.

6.3. Avoid the construction or use of facilities and pastures that attract and provide foraging habitat for Brown-headed Cowbirds.

Management should avoid aggregations of livestock and associated livestock facilities (e.g., corrals, pack stations, salting areas and feedlots) near riparian nest sites during the breeding season whenever possible. Livestock, livestock facilities and human habitation provide foraging areas for cowbirds (Mathews and Goguen 1997, Tewksbury et al. 1998), who feed in short stature vegetation within "commuting distance" of their laying areas. In the eastern Sierra Nevada, weekly point counts at pack stations and adjacent riparian areas revealed significantly more cowbirds at pack stations than in riparian areas in most years and at most sites (Heath et al. 2002[a], 2002[b]). Furthermore, managers should discourage human habitation near riparian areas and bird feeders should be avoided during the breeding season if cowbirds are using them as supplemental food. In the eastern Sierra Nevada, weekly evening area searches in a suburban development near a riparian drainage documented, on average, six cowbirds per visit, with as many as 60 cowbirds observed foraging at one bird feeder on several occasions (PRBO data).

The proximity of active livestock grazing may also determine the feeding distributions of cowbirds and the distances they will commute between foraging and laying areas (Mathews and Goguen 1997). Grazing and human facilities within one kilometer of breeding sites affect reproductive success more negatively than facilities located farther away. Establishing cowbird buffer zones around riparian areas during the avian breeding season may reduce the impact of cowbirds on host species. The creation of such buffers may be difficult, however, since cowbirds may regularly commute up to 12 km between foraging and laying areas (Mathews and Goguen 1997).

In the Bitteroot River Valley of Montana, cowbird abundance declined significantly with increasing distance from agriculture (Tewksbury et al. 1998). Additional feeding areas (i.e., agriculture, livestock) located farther than one km from a laying area have no apparent additional impact on the density of cowbirds or brood parasitism. However, this study did not assess the effect of facilities located at greater than one km from the riparian zone in the absence of facilities located within a one km range. Forest Service management guidelines focused on the Willow Flycatcher recommend avoiding the establishment of new facilities within a two to five km range of important riparian areas. If this is not possible and if landscape features aggregate livestock, then livestock use should be limited during the breeding season (generally, April 1- June 30 for lowland nesting species and May 15 August 15 for nesting areas at high-elevation).

6.4. Brown-headed Cowbird trapping should only be used as an interim/emergency measure. Trapping can save or maintain a threatened population of host species while sustainable, habitat based solutions are developed, but should not be considered a long-term solution.

The consensus of expert opinion indicates that cowbird trapping is at best a temporary stopgap solution (Morrison et al. 1999). Preferably, land managers should focus on restoring riparian habitat and guide land use to lessen the negative impacts of cowbirds. A species will never fully recover as long as they rely upon human intervention for their survival (Kus 1999). The North American Cowbird Advisory Council recently formed to address trapping issues, review trapping programs, and advise land managers and regulatory agencies (http://cowbird.lscf.ucsb.edu/). Cowbird trapping is not an appropriate response to parasitism in many cases because:

- The Brown-headed Cowbird is a native North American breeding species
- It is not a long-term solution.
- It can be expensive and requires constant management
- There are ethical considerations and impacts on non-target species.
- A permanent trapping program may be a factor that weighs against delisting of threatened and endangered species (Kus 1999, Morrison et al. 1999).
- It may be detrimental to host species by removing experienced female cowbirds that are more selective in their host selections and egg laying, creating a void filled by more numerous, younger individuals (Hahn et al. 1999).

Additionally, cowbird trapping in areas such as the lower Sacramento River and the Cosumnes River, where restoration of habitat through large-scale natural recruitment is currently underway, would preclude the ability to monitor wildlife response to restoration efforts in the absence of cowbird trapping. Therefore, we will miss opportunities to learn whether songbird populations can recover simply due to habitat restoration without active cowbird management.

6.5. Manage or influence management at the landscape level (i.e., land surrounding riparian corridors or, preferably, the whole watershed).

Landscape scale land use patterns significantly affect the population levels of Brown-headed Cowbirds and avian predators in an area. With increases in cowbird and predator populations, species often suffer poor reproductive success and, possibly, population declines. Eventually, local extirpation of the species may occur. Managers should discourage certain adjacent land uses that subsidize cowbirds and avian predators, including intensive grazing, golf courses, human habitation and recreation areas, and pack stations. Grazing should be avoided during the breeding season in livestock pastures bordering riparian areas (Goguen and Mathews 1999, Hochachka et al. 1999). Linking and buffering large sections of riparian and associated upland habitat may restore top predators, such as coyotes or bobcats to the riparian system. These predators may, in turn, reduce populations of avian nest predator such as skunks, raccoons and snakes.

When grazing or agriculture constitutes a significant percentage of the landscape near the riparian corridor (particularly within a 1-12 km distance), the following are recommended:

- Use integrated pest management or organic production as an alternative to pesticide use. This prevents damage to nesting birds and increases available foraging habitat, especially in orchards immediately adjacent to healthy riparian areas. Riparian songbirds rely on local insect populations to feed young during the breeding season.

- Use groundcover crops in orchards and vineyards to minimize cowbird foraging habitat. Managers should limit or avoid mowing groundcover during the breeding season (see Recommendation 6-1).

- Eliminate, reduce, or closely manage grazing in spring and during the breeding season (April-July) to maximize the understory habitat value to wildlife and minimize foraging habitat for cowbirds.

- If grazing must occur in riparian zones, establish wide pastures and move cattle often to avoid the devastating impacts of year-round grazing.

6.6. Limit restoration activities and disturbance events such as grazing, disking, herbicide application, and highwater events to the nonbreeding season. When such actions are absolutely necessary during the breeding season, time disturbance to minimize its impacts on nesting birds.

The nesting season is a critical period for the maintenance of bird populations (Martin 1993). Some management activities, such as ground preparation for planting or water impoundment, can have serious consequences for breeding songbirds by destroying nests and nesting habitat or causing nest abandonment. Managers often have a degree of flexibility, allowing them to schedule these activities outside the breeding season while still achieving their management objectives. In general, the breeding season in California may begin as early as March and continue through August, depending on region, habitat type and elevation (Table 8-4).

6.7. Coordinate with management and restoration projects targeted at non-avian taxa to maximize the benefits of conservation of riparian habitats.

Extending riparian habitat restoration and management beyond avian requirements alone is essential. Many non-avian species respond positively to vegetation components and riparian functions that are important for bird populations in riparian habitats of California. The federally endangered riparian brush rabbit is an excellent example of a riparian-dependent species that needs our attention immediately. The riparian brush rabbit, or "brush bunny," is a small cottontail rabbit that is one of eight subspecies of brush rabbits native to California. Like many birds outlined in this document, they depend on a dense understory in riparian oak forests that includes willow thickets, California wild rose, wild grape and Pacific blackberry. In response to their perilous status, the Endangered Species Recovery Program leads a captive breeding program to reintroduce brush rabbits into California riparian areas. The story of the brush bunny illustrates a critical conservation concept: not only do birds benefit from dense riparian understories, but also other species like the endangered brush rabbit. For more information on the riparian brush rabbit, see the following web site: (http://sacramento.fws.gov/es/animal_spp_acct/riparian_brush_rabbit.htm).

Table 8-4. Dates of earliest egg, latest first egg, peak of egg initiation and timing of breeding season for riparian-breeding bird species by study site and bioregion. Derived from nests monitored every four days, all nests for all species combined.

Bioregion and study site	Earliest first egg	Latest first egg	Peak of egg initiation	Breeding Season
Sacramento Valley				
Clear Creek[5]	1st week March	2nd week July	April 30 – June 30	mid March – mid August
San Joaquin Valley				
San Luis NWR	April 12	July 23	April 1 – August 20	
Modoc[1]				
Lassen NF and NP	April 10	----	----	April 5 – August 31
Klamath		No data for this bioregion		
Central Coast		No data for this bioregion		
Bay-Delta				
West Marin county[4]	March 19	July 6	----	mid March – mid August*
South Coast		No data for this bioregion		
Mojave Desert		No data for this bioregion		
Colorado Desert		No data for this bioregion		
Sierra				
Owens Valley alluvial fan[2]	March 29	July 21	May 16 – June 15	Mar 25–August 31
Mono Basin[3]	April 4	July 25	May 16 – June 15	April 1–August 31
> 2500m Mono and Inyo co[3]	April 29	July 26	May 16 – June 15	April 20–August 31

[1] King et al. 1999
[2] Heath et al. 2001
[3] Heath et al. 2002a, Heath et al. 2002b
[4] Gardali et al. 1999
* Hummingbirds can nest year-round in this bioregion.

Objective 7

Protect, enhance or recreate natural riparian processes, particularly hydrology and associated high water events, to promote the natural cycle of channel movement, sediment deposition, and scouring that create a diverse mosaic of riparian vegetation types.

Recommendations

7.1. Avoid impacts on the natural hydrology of meadows, streams, and river channels, particularly in high-priority areas managed for riparian species. (See Recommendation 1.4)

The following options minimize damage to natural hydrology:

- Protect areas where grazing may be drying meadows or streams through soil compaction and gullying; provide alternative water sources for cattle.
- Implement grazing standards that protect natural hydrology; reduce soil compaction, erosion, and water pollution due to grazing.
- Limit or contain recreational use of meadows (e.g., off-road vehicles, horses, camping) that can compact soils and negatively affect hydrology.
- Manage upslope areas (e.g., timber harvest, road building) so that hydrologic function is maintained.
- Implement revegetation projects such as "willow walls" to prevent erosion and provide habitat.

7.2. At sites with dams or other flood control devices, manage flow to allow a near natural hydrograph (i.e., mimic natural flood events) sufficient to support scouring, deposition, and point bar formation. Time managed flood events to avoid detrimental impacts on Bank Swallow nesting colonies.

Managers should modify reservoir storage during wet years to simulate the natural, seasonal pattern of short duration flood peaks. The establishment and succession of native riparian vegetation rely upon a natural hydrology in the river system and provide essential habitat for many riparian-associated birds. Interruptions of these processes, including dams, levees, and water diversion, have significantly contributed to the decrease in riparian habitat and the consequent decline in songbird populations. Many non-native plant species are flood-intolerant, and the loss of regular scouring floods has abetted their invasion of the Central Valley. As invasive plants increasingly dominate a habitat, many native birds lose essential nesting and foraging habitat. For more information, please see the Sacramento River Conservation Area Handbook (Sacramento River Advisory Council 1998).

Bank Swallows are particularly vulnerable to poorly timed water management. The Bank Swallow nesting season extends from late March through early July, varying with seasonal weather fluctuations. During this period, the swallows nest in sandy banks along rivers. “Pulse flows” or “flushing flows” designed to mimic natural flood events may potentially wipe out entire colonies in a single event. These artificial flows, often used in fish management and restoration projects, should be prohibited (or at least severely curtailed and closely monitored) during the swallow’s breeding season (April through July). Flows that artificially raise levels more than 2-3 feet during the breeding season should be avoided altogether. With 50% of the state’s remaining Bank Swallow population nesting along the Sacramento River from Red Bluff to Colusa, a poorly timed flow event could have dire consequences.

7.3. Control and eradicate non-native plant species. Such control is best planned and implemented on a watershed scale.

The non-native plant species listed in Table 8-5 have invaded riparian habitats to the detriment of native flora and fauna. Their negative effects on bird communities are probably much more widespread than noted in the table. Invasive, introduced plants affect native birds by:

- Competing with native vegetation, thereby eliminating useful foraging and nesting habitat.
- Providing a sub-optimal nesting substrate, in which nest success is reduced
- Reducing several orders of native insects (NPS 1998).
- Enhancing non-native animal populations.

In river systems, these non-native plants often spread very quickly and should be controlled at the first sign of their presence. Managers should be especially concerned with the invasion of tamarisk and giant reed in desert riparian habitats. The species displace native vegetation and disrupt the system by drying perennial streams. Species diversity of resident songbirds was negatively correlated with riparian vegetation dominated by saltcedar at the Salton Sea and several bird species were negatively associated with saltcedar dominance (Holmes et al. 2003). Removal of these species can restore the flow of these seasonal streams (BLM 1998), allow native vegetation growth, and subsequently provide more and better habitat for birds.

Control of non-native species is much less expensive and more effective if conducted before the species has spread into extensive monotypic stands. This is particularly true in a riparian system where seeds, rhizomes and vegetation easily spread downstream. Control efforts, therefore, must be planned and undertaken on a watershed scale, preferably beginning with the removal of the invasive species which is furthest upstream.

In many areas, California black walnut is planted as a native; however, some botanists believe this plant was introduced early during the colonization of California. Black walnuts exude a sap that is a natural herbicide (juglans) that can result in a sparse understory beneath a black walnut canopy. Black walnut is detrimental to the nesting success of Yellow-billed Cuckoo and shows no positive influence on nest success of those species that do use it as nest substrate, including the Black-headed Grosbeak, Western Wood-pewee, Western Kingbird, House Wren, and Nuttall’s Woodpecker. Black Walnut negatively influences nest-site selection by Lazuli Bunting, House Wren, and Spotted Towhee and negatively influences nest success of many cavity-nesting birds (Geupel et al. 1997[a]).

7.4. Control and eradicate non-native animal species.

Non-native animals can have a severely negative impact on birds. Invasive bird species such as European Starlings and House Sparrows often out-compete native birds for nest sites and have been known to destroy active nests and even kill nesting adults. Introduced animals, such as domestic cats, kill millions of birds every year. To reduce the effects of non-native animals on native birds:

- Avoid establishing human habitat near riparian zones.
- Do not feed or otherwise encourage populations of feral animals.
- Keep cats indoors.
- Do not put bird feeders in a yard where a cat might ambush feeding birds.
- Humanely control non-native species when necessary.

Table 8-5. Non-native species and their effects in riparian habitat.

Introduced Species	Scientific Name	Effects/Bird Species Affected [1]
Acacia	*Acacia dealbata*	Out-competes and hinders the establishment of willow-alder stands (Danner pers. comm.)
Black locust	*Robinia pseudoacacia*	Displaces native habitat
Black walnut	*Juglans californica*	Western Yellow-billed Cuckoo, Lazuli Bunting, Spotted Towhee, House Wren and other cavity nesters
Cocklebur	*Xanthium strumarium*	Bell's Vireo
Cape-ivy (German ivy)	*Delairea odorata*	Swainson's Thrush. Overtops and out-competes native understory and trees
Edible fig	*Ficus carica*	Western Yellow-billed Cuckoo
English ivy	*Hedera helix*	Chokes riparian trees
Giant reed	*Arundo donax*	Bell's Vireo
Periwinkle	*Vinca major*	Out competes understory plant species (Danner pers. comm.)
Purple loosestrife	*Lythrum salicaria*	Grows in dense stands that support less avian diversity but greater density than some native habitats (Whitt et. al. 1999)
Russian olive	*Elaeagnus augustifolius*	Willow Flycatcher
Sticky eupatorium	*Ageratina adenophora*	Obstructs waterways and forms dense strands on drier uplands (Danner pers. comm.)
Tamarisk	*Tamarix chinensis*	Least Bell's Vireo
Tasmanian blue gum	*Eucalyptus globulus*	Golden-crowned Kinglet, Ruby-crowned Kinglet
Opossum	*Didelphis virginiana*	Predator of many species, particularly those that forage and nest near or on the ground
House cats	*Felis catus*	Predator of many species, particularly those that forage and nest near or on the ground

[1] Unless otherwise noted, sources for the information provided in this table came from the species accounts developed as the first step in producing this conservation guide. Visit http://www.prbo.org/calpif/htmldocs/riparian.html.

Monitoring and Research Recommendations

Objective 8

Provide data on pressing conservation issues affecting birds.

In order to successfully protect and expand native bird populations, managers must have the most recent data available on populations and their habitat needs. Standardized scientific monitoring of populations will provide decision-makers with these essential tools.

Recommendations

8.1. Consider reproductive success and survival rates when monitoring populations, assessing habitat value, and developing conservation plans.

The number of young produced in a bird population (reproductive success) critically influences a population's presence, health and sustainability in an area. Reproductive success is a primary demographic parameter that provides critical information for understanding patterns of population change. Hence, these data can be used to understand trends, focus conservation action and funds, and identify hypotheses for further evaluation. When fewer than 20% of nestlings survive to fledge young, nest success is considered poor and probably indicates a nonviable population. Nur et al. (2004) and Shaffer (*in press*) describe feasible analytical techniques for monitoring nest survival as a function of covariates such as environmental and/or temporal variables. These variables may be quantitative (e.g., vegetation measurements, nest height, date, nest age) or qualitative (e.g., habitat type, management practice). However, to adequately measure annual productivity, investigators should not stop at calculating nest success alone (Thompson et al. 2001, Anders and Marshall *in press*); instead we should also strive to accurately 1) count re-nesting attempts after nest failure, 2) count number of young fledged per successful nest, 3) measure double brooding frequency by following color-marked birds throughout the breeding season.

Monitoring annual adult survival is important in the same way as discussed for reproductive success; population trends can thus be better understood from monitoring the interaction of these demographic parameters. Survival can only be confidently calculated for adults after at least four years of mark/recapture data (such as mist-netting) have been obtained (Nur et al. 1999). Research seeking to determine productivity for a breeding population should include at least four years of nest-searching and/or mist-netting.

8.2. Conduct intensive, long-term monitoring at selected sites. In order to analyze trends, long-term monitoring should continue for more than five years.

Long-term data are vital to deciphering the difference between a true population decline and a natural fluctuation in population size. Because conservation dollars are limited, the best possible data on population trends are needed so as not to squander scarce resources on a species that is not truly in decline. Long-term monitoring should be conducted at reference sites that embody the characteristics restoration efforts strive to recreate. Additionally, long-term monitoring at key experimental sites can test the assumptions that currently drive restoration and management practices. Intensive monitoring includes collecting data on primary demographic processes and associated habitat characteristics and seeks to identify causal connections between habitat variables and species viability. Biologists collect data on reproductive success, breeding densities, reproductive success, parasitism, survival, vegetation data, suitable habitat requirements, and general life-history information. Managers can employ these data to make well-informed, adaptable management plans.

8.3. Investigate the relationship between herbaceous vegetation height and avian productivity and recruitment, especially in wet meadows.

Wet meadows are vital habitats for birds in the Sierra Nevada (Siegel and DeSante 1999). Grazing and other resource-extraction activities compromise these areas and endanger some local avian populations (see Chapter 7: Bioregional Conservation Objectives). More study of the effects of grazing, fire suppression and non-native plant invasion would facilitate the development of grazing prescriptions that are less detrimental to nesting and migrating birds.

8.4. Develop a series of monitoring and research projects that:

1) Determine the habitat attributes that affect migratory stopover use.
2) Assess how migratory stopover habitat may affect species survival.
3) Define conservation priorities and recommendations for stopover habitat.

While vital as breeding grounds, riparian corridors also provide essential stopover habitat for migrating birds. However, little information exists regarding which habitat factors attract and affect migrants. Events at migratory stopover areas may significantly affect certain populations and contribute to declines (Moore et al. 1995, Yong et al. 1998). Monitoring programs should attempt to have a broad geographic scope and seek to collect data on a wide variety of variables, including avian diversity, abundance, stopover duration, fat deposition/physical condition, and vegetation characteristics.

8.5. Conduct selective monitoring at critical sites to determine the effects of cowbird parasitism on the Willow Flycatcher, Bell's Vireo, Warbling Vireo, Common Yellowthroat, Blue Grosbeak, Wilson's Warbler and Yellow Warbler.

Brown-headed Cowbird parasitism has potentially devastating effects on the populations of these and many other species in California. Habitat size, vegetation structure, and adjacent land use all influence the rates of cowbird parasitism. By studying the variables involved, conservationists can better formulate landscape-level management plans to enhance bird populations.

8.6. Conduct selective monitoring at key sites to determine the factors influencing nest success of the Song Sparrow, Lazuli Bunting, Yellow Warbler, Willow Flycatcher and Warbling Vireo.

Relatively recent, local extirpation and declines of these and other western species from their historical breeding range appear to be caused by low productivity (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 1998, Gardali et al. 2000). Local extirpation may signal the early stages of a process of severe population declines. By determining the factors associated with low reproductive success, research may identify which management and restoration actions will help reverse songbird population declines. Land managers, owners and regulatory agencies gain greater freedom in their decision-making if they conserve bird species before special-status listing becomes necessary.

Monitoring the reproductive success of key species provides gauges that allow management changes before it is too late.

Objective 9

Maximize the effectiveness of ongoing monitoring and management efforts.

Recommendations

9.1. Increase communication and coordination between land managers and specialists hired to implement specific projects or conduct monitoring.

Experts, such as those conducting endangered species or biodiversity inventories, should be consulted and included as part of project implementation teams. By doing so, managers can quickly and easily access a wealth of detailed information on local birds and their response to management activities. For example, bird monitoring in restored riparian habitats on the Stony Creek Preserve along the Sacramento River has provided detailed information about breeding birds and their habitat requirements and offered suggestions on how maintenance activities can be implemented with minimal disturbance. Managers on the preserve can quickly incorporate new data into management regimes, honing their project designs to better benefit birds.

9.2. Use standardized monitoring protocols.

By standardizing monitoring techniques, researchers ensure that results can be compared across space and time. The USDA Forest Service published guidelines for standardized monitoring techniques for monitoring birds (Ralph et al. 1993). Please refer to Appendix A for more information.

9.3 The CALFED Bay-Delta Authority should continue to incorporate bird monitoring into all riparian and wetland habitat restoration projects as a way to assess avian response, evaluate projects, and most importantly, adaptively manage.

CALFED is a state agency in California formed to implement the Bay-Delta Accord, signed in 1994. The Accord agreed to develop a Bay-Delta Conservation Plan that would seek to address issues of water quality, water supply, wildlife habitat, and flood control. A major CALFED program is the Ecosystem Restoration Plan, which, when approved, could be implemented with close to $1 billion in state and federal funds over the next 20 years. While the Ecosystem Restoration Plan considers the Central Valley, Delta, and San Francisco Bay riparian and wetland habitats, it historically focused on aquatic species. Realizing the efficacy of bird monitoring programs and their ability to provide information to adaptively manage habitat projects, most new CALFED projects now contain a bird monitoring element. Furthermore, if mistakes are made and practices are harming bird populations, managers can alter their methods and avoid similar mistakes in the future. With additional monitoring, a steady feedback loop of management, monitoring, and revision of practices is established.

9.4. Maximize the cost effectiveness and value of existing specialized monitoring programs for listed species (e.g., those oriented toward Western Yellow-billed Cuckoo and Willow Flycatcher) by collecting standardized data on multiple species (such as point counts) in addition to any specialized protocols aimed at one species.

Many state and federally sponsored surveys only monitor special-status species. By adding a standard protocol that provides information on multiple species while conducting special-status species surveys, researchers could rapidly expand their knowledge of California's birds. Such data could be shared and analyzed and results would be added to conservation plans and incorporated into management regimes. Even if resources are not immediately available for analysis, the information will provide a baseline or historical perspective on bird distribution and abundance.

9.5. Determine what habitat and population characteristics are necessary to successfully wean a songbird population from cowbird trapping.

Most experts agree that cowbird trapping is only a temporary measure for relieving parasitism pressure on landbirds (Morrison et al. 1999). Furthermore, intense cowbird trapping has proven ineffective for certain local populations on the edge of extirpation. Willow Flycatcher populations at both the Kern River Valley and Camp Pendleton failed to increase after extensive cowbird control efforts. It is likely that there are other factors negatively influencing these populations. Although some species experience marked population growth following cowbird trapping (i.e., Least Bell's Vireo), often times little attempt is made to assess the extent to which other management actions, such as improved and expanded habitat, have contributed to the increases (USFWS 2002).

9.6. Coordinate with monitoring and research projects targeted at non-avian taxa to maximize the benefits of the protection, management and restoration of riparian habitats.
Stream amphibians also provide another means of measuring environmental stress, and like birds, amphibians can be good indicators of different niches within riparian habitats (Welsh and Olliver 1998). Like birds, widespread declines of amphibians are well documented (Blaustein and Wake 1990, Wake 1991 and 1998, Pechmann and Wilbur 1994) and amphibians use diverse riparian habitats throughout California. The federally listed endangered Arroyo Southwestern Toad uses most common riparian types in southern California for foraging and dispersal, and females and breeding season males prefer channel and terrace habitats to campground, agricultural or upland habitats. The natural flooding disturbance regimes that encourage understory vegetation growth and provide habitat for declining bird species also promote continuous availability of preferred breeding habitat for the Arroyo Toad (Griffin and Case 2001).

Objective 10

Expand research and monitoring of selected special-status species to address pressing conservation issues.

<u>Recommendations</u>

10.1. Identify and implement research relevant to management of Tricolored Blackbirds, which continue to decline in California.

The most recent surveys of Tricolored Blackbirds in California show a continued population decline in Central Valley wetland habitats. This is likely due to a lack of management for this species. Tricolored Blackbirds require acceptable nesting substrates and adequate water levels throughout the breeding season to discourage mammalian predators. Harvesting of silage and plowing of weedy fields currently are the most common reasons for destruction of nesting colonies (Beedy and Hamilton 1999). Therefore, managers must make thoughtful, well-informed decisions to protect these populations.

10.2. Identify winter range, habitat, and possible overwintering conservation issues for as many Neotropical migrants as possible, including the Western Yellow-billed Cuckoo, Least Bell's Vireo, and Swainson's Hawk.

Wintering grounds play a significant role in the life cycles of Neotropical migratory birds. If a population is declining primarily due to low overwinter survival, no amount of effort to restore or protect breeding grounds will suffice to conserve the species. Additionally, recent research implies that declines in habitat quality on wintering or migratory stopover grounds may lead to lower productivity on breeding grounds (Marra 1998).

For many species, little information is available on overwintering habitat requirements and survival. Least Bell's Vireos overwinters in unknown locations in Baja California. Western Yellow-billed Cuckoos show a very distinct sex ratio in their breeding populations (8 males to every 1 female); if the sexes have different wintering grounds, and the females' has been destroyed or compromised, the ratio could skew further in the future, further imperiling the population. Preliminary radio telemetry data indicate that the Central Valley Swainson's Hawk overwinters in Mexico and Colombia, while Swainson's Hawks from other regions winter in the pampas of Argentina. Conservationists would learn much from solving such questions regarding overwintering habitats.

10.3. Inventory the Central Valley for Swainson's Hawk territories and map distributions of nesting and foraging habitat to develop a target population size. Plan management strategies for protecting priority habitats.

Swainson's Hawks in the Central Valley are more closely associated with riparian habitats than populations in other bioregions. Migratory patterns, overwintering areas, and relative isolation of breeding grounds suggest that this area may support a distinct metapopulation, which should therefore be managed as such.

10.4. Conduct statewide surveys to establish current population and range sizes every five years for the Swainson's Hawk and Bank Swallow, and every 10 years for the Western Yellow-billed Cuckoo.

Such surveys will provide a comprehensive picture of the state of these species and monitor long-term population trends in California. They would alert managers to population declines or expansions. As recommended in 8-2, these surveys should include the collection of as much data as possible on all other riparian birds.

Objective 11

Use information gathered from avian monitoring and research programs to improve the effects of agricultural and land management techniques on birds.

Recommendations

11.1. Work cooperatively with agricultural researchers to assess the potential of agriculture adjacent to existing riparian areas to be more "bird friendly."

Researchers could explore:

- Techniques for minimizing or eliminating cowbird foraging habitat.
- The relative utility to wildlife of row crops versus permanent crops (e.g., orchards, vineyards) as buffers.
- Creating habitat within a farming system through the use of hedgerows, tailwater ponds, hill ponds, irrigation canal and levee revegetation, and roadside buffer strips (YCRCD 1998).
- USFWS records describe Swainson's Hawk mortality events involving from one to 40 birds killed by applications of organophosphate and carbamate insecticides in agricultural fields, particularly in autumn, when flocks fed on insects in harvested fields. Goldstein et al. (1999) attributed high hawk mortality in the pampas of Argentina to poisoning by the organophosphate insecticides monocrotophos and dimethoate, used to control grasshoppers.

11.2. Devise an urgently needed method for controlling giant reed.

Giant reed, often referred to as Arundo, has spread throughout riparian zones in southern and central California, wreaking havoc with native plant communities and the natural hydrology of the area (see Recommendation 7.3). Current control efforts, which primarily employ physical removal and herbicides, appear inadequate to halt the invasion of this species. More effective measures, including biocontrol, must be sought.

Policy Recommendations

Conservation efforts will make little headway without effective policy development. The future of habitat conservation in the West lies not only in the activity of scientists and restoration experts in the field, but also within the walls of statehouses and the pages of law. Policy makers need to examine and appropriately amend statutory and regulatory programs that endanger native habitats or that unnecessarily impede restoration actions. Whenever possible, policy should encourage governmental support of innovative local conservation and sustainable-growth projects.

To achieve conservation and management goals, diverse interests must effectively combine their skills and financial resources. Partners in Flight and the Riparian Habitat Joint Venture embody this kind of cooperative effort. In these groups, scientists, governmental agencies, nonprofit organizations and private citizens share information and concerns and collaborate on solutions. The biological recommendations in this Conservation Plan are readily available to policy-makers, public land managers and private landowners. Furthermore, the findings described here will be relevant to the Partners in Flight North American Landbird Conservation Plan, enhancing conservation efforts throughout the country.

Funding from the National Fish and Wildlife Foundation, derived from the Neotropical Migratory Bird Conservation Initiative, and the USDA Forest Service Partners in Flight awards continue to catalyze conservation activity across the country. Government agencies participating in the RHJV intend to use this Conservation Plan to guide their riparian conservation projects. These agencies include the California Wildlife Conservation Board, the U.S. Bureau of Reclamation, the U.S. Fish & Wildlife Service, the USDA Forest Service, and recent efforts by the Bureau of Land Management.

The following recommendations seek to assist policy advocates and decision-makers as they shape the regulations and procedures that affect avian conservation in the West.

Objective 12

Encourage regulatory and land management agencies to recognize that avian productivity is a prime criterion for determining protected status of specific habitats, mitigation requirements for environmental impacts, and preferred land management practices.

Recommendations

12.1. Land managers should consider avian population parameters, such as reproductive success, as important criteria when designating priority or special-status sites, such as Areas of Critical Environmental Concern (BLM), Research Natural Areas (BLM, USFS) and other publicly owned areas specially managed for biodiversity.

Until recently, few data regarding avian reproductive success at many important riparian sites have been available. Government land managers should consider reproductive success data when designating and managing areas in support of biodiversity, including state wildlife areas and ecological reserves. This information complements ongoing efforts by agencies to evaluate and restore riparian areas, such as efforts by the BLM, USFS, and NRCS to assess proper functioning condition of riparian areas on public lands throughout the West.

12.2. When developing management practices for natural areas, government agencies, such as the USFWS and CDFG, should consider environmental impacts on local bird populations. Such evaluations should also occur when developing plans for habitat mitigation, habitat conservation, multi-species conservation, and natural community conservation.

The California Department of Fish & Game estimates that more than 89 habitat conservation plans, natural community conservation plans, and resource management plans were ongoing in California in 1998. Of these, 33 addressed the needs of one or more bird species. Additionally, the U.S. Fish & Wildlife Service constantly makes decisions regarding mitigation requirements for private and federally sponsored projects that affect the habitats of threatened or endangered species. By incorporating the conservation, restoration, management and monitoring recommendations of this Conservation Plan into their regulatory plans, agencies can implement the most effective conservation actions.

12.3. Land managers should consider the impacts of horses and burros on riparian vegetation and associated birds when designating acceptable numbers of wild horses and burros on public land.

Public Law 92-195, the Wild Free-roaming Horse and Burro Act of December 1971, mandates that the Bureau of Land Management and USFS manage and control wild horses and burros on public lands. Horse and burro population levels are to be maintained at an "optimum number" that results in a thriving ecological balance and avoids deterioration of the range (BLM 1998). Because browsing animals can significantly degrade riparian habitats, land managers must consider the requirements of breeding and migrating birds and monitor habitat quality when establishing acceptable ungulate population sizes.

12.4. Incorporate the costs of limited-term (two–five years) or long-term bird monitoring into management endowments prescribed for conservation projects, including mitigation banks, habitat conservation plans and natural community conservation reserves.

The size of management endowments for preserves in Southern California, for example, varies substantially with management needs and staffing levels. In 1998, they varied from $70,000 at Dos Palmas (covering coordination meetings and management support to the BLM) to $2.5-$3 million at the Coachella Preserve (providing for 1.5 to 2 staff positions, buildings, vehicles, management activities and monitoring). Most endowments for unstaffed preserves are less than $1 million (usually less than $500,000). Most endowments for staffed preserves are greater than $2 million, depending upon the level of management, staffing, and partnerships at the site. Endowments of up to $510 million are common for sites requiring several staff, building maintenance, and active management, and that lack partners with whom to share costs.

Incorporating the long-term cost of bird monitoring into the management endowments of large-scale reserves is an efficient way to ensure that monitoring occurs. In 2000, a monitoring program costing $35,000 per year could provide extensive data from point count routes, mist-netting and two nest monitoring plots (see Appendix A for more information regarding methods). Using progressive investment strategies and a 5% capitalization rate, an endowment of approximately $700,000 would support this level of monitoring. Under these assumptions, one can calculate the cost for endowing monitoring at a site. A good rule of thumb is to add $150,000 to an endowment for every additional $7,500.00/year cost added to the long-term management (i.e., take the additional annual cost, e.g., $7,500, and divide by 5%) (Teresa, pers. comm. 1998).

12.5. Local governments should establish locally-relevant riparian buffer zones to protect riparian habitat and associated surrounding uplands from development and disturbance, through zoning ordinances and/or general plan provisions.

Many California cities and counties have adopted some type of riparian development setback requirements, prohibiting various types of construction activities within a given distance from a stream. Typical development setbacks range from 15 to 30 m from the stream centerline, depending on stream type (perennial vs. intermittent) or land use type (urban vs. rural). In many areas, this small setback distance may not even extend outside the riparian zone. Although some local governments have adopted setbacks that start at the edge of the riparian zone, this is still not general practice. In addition, most zoning ordinances address the construction of a "structure," but often do not require setbacks for other activities that could disturb riparian areas, including roads, corrals/pens, pools, and other types of impervious surfaces that are not "structures" (Clark, pers. comm.).

Existing development setback distances are generally adopted from forestry standards, which are based primarily on the height of the highest tree and are generally focused on protecting water quality and habitat for anadromous fish (Erman et al. 1977, Peterjohn and Cornell 1984). While many have advocated the protection of larger, variable-width riparian buffer zones that incorporate variations in local hydrology and vegetation (Moyle et al. 1996), the emphasis has largely been on aquatic, rather than terrestrial resources. While more research is needed to identify appropriate riparian buffer widths for different terrestrial species, the value of preserving at least the width of a species' home range is well recognized (Warner and Hendrix 1984, Granholm 1987, Chapel 1992). For many, if not most, riparian-associated species, home ranges extend well outside the riparian zone, including adjacent upland vegetation such as grassland, shrub, oak woodland, or coniferous forest. Much of the research to date on effects and appropriate sizes of riparian buffer zones have been conducted in forested landscapes, where the nearby disturbance is timber extraction (e.g., Hagar 1999, Pearsono and Manuwal 2001, Robichaud et al. 2002). Little research on the topic has been done in urban and suburban areas, where the level of disturbance is arguably much greater.

Local ordinances and general plan provisions on riparian development setbacks should be expanded to include a wide range of riparian disturbances, and should start from the edge of the riparian zone, providing an additional upland buffer zone for species whose home ranges extend outside the riparian zone. A review of reptile and amphibian minimum habitat requirements found that a buffer of up to 290 m from the stream edge would be necessary to protect the core habitat of these taxa (Semlitsch and Bodie 2003). While a similar review of home range sizes should be conducted for riparian-associated bird species, territory sizes of locally breeding species (see Table 5-2) may be used as a minimum guideline.

Objective 13

Increase protection and management actions to benefit severely declining or locally extirpated bird species in California.

Recommendations

13.1. Establish a committee to review management and research objectives and progress for Tricolored Blackbirds, seeking to incorporate the efforts and viewpoints of those actively involved in wetland management for waterfowl and shorebirds.

As Tricolored Blackbirds continue to decline, a concerted effort is required to address the needs of this species within the context of overall wetland and waterbird management within the Central Valley. This committee should review and amplify protection, management and research recommendations developed by researchers and agencies. The committee should maximize coordination of conservation efforts with conservation groups and land managers that are focused primarily on waterfowl or shorebird management. Distribution, abundance and reproductive success of Tricolored Blackbirds should be monitored annually.

13.2. Develop GIS layers representing the extent of riparian zone habitats throughout the state at a resolution fine enough for the analysis of territory-level bird data in association with the occurrence of various habitat types. Resulting maps should be field-verified and may be used to identify suitable habitat for riparian birds, including Western Yellow-billed Cuckoos and habitats for other declining or sensitive species.

Riparian habitat covers a small area relative to its importance and value to wildlife. Because most regional landcover maps are based on satellite imagery with 30-m pixel resolution, they generally do not adequately represent riparian habitats, which are often (a) smaller than the minimum mapping unit and/or (b) not easily distinguishable from surrounding uplands in forested areas. Although riparian vegetation may be mapped at a more local scale using high-resolution aerial photos, the quality and composition of the understory is not easily mapped without extensive ground-truthing (as is true for any forest vegetation type). Thus, existing riparian GIS layers are variable in spatial resolution, floristic detail and quality, as well as inconsistent in vegetation and hydrologic classification standards. The dynamic nature of riparian systems, as well as on-going restoration efforts also make this habitat particularly difficult to represent in map form.

Through the California Legacy Project, with the California Department of Forestry and Fire Protection (CDF) and the U.S. Forest Service, efforts are currently underway to develop an intermediate-scale statewide riparian vegetation map/GIS layer for the State of California. In addition, the Riparian Habitat Joint Venture (RHJV) is coordinating efforts to map smaller areas at a higher spatial resolution. Finally, a list of riparian GIS layers can be found at the California Partners in Flight website at: http://www.prbo.org/calpif/htmldocs/riparian.html.

Objective 14

Promote federal, state, and local government flood control policies that will benefit wildlife in tandem with community safety.

The Army Corps of Engineers' mandate to develop non-structural flood control alternatives for the state of California in the aftermath of the 1996-97 floods is a positive step in floodplain management. The importance of flood events has been discussed throughout this document. For specific examples, please see Recommendations 1.4, 4.1, 6.1, 7.1, and 7.2.

Chapter 9. Implementation of Conservation Plan Recommendations

The Riparian Habitat Joint Venture (RHJV) has developed a Strategic Plan and an Annual Operating Plan to achieve the habitat protection/restoration goals set forth in this Conservation Plan. The Strategic Plan articulates the vision, mission, and goals of the Riparian Habitat Joint Venture. It also provides a framework for understanding the long-term goals of the RHJV, and direction for the Operating Plan. The Operating Plan will detail the specific tasks the RHJV will undertake during each year to meet their mission, as well as identify tasks planned for the next three-five years. The Operating Plan will identify measures of success for each identified task, will document achievements, and will be updated annually. The RHJV anticipates working closely with other statewide conservation efforts with overlapping goals during the implementation phase, particularly the Biodiversity Council, Sacramento River Advisory Council (SB1086), and the Coordinated Resource Management Plan Council. Some of the tasks in the Operating Plan include:

- Develop a riparian map and data layer to identify the extent and condition of riparian habitat
- Develop conservation/restoration acreage objectives and a system to prioritize areas for conservation efforts.
- Conduct local workshops to familiarize constituents with the RHJV and the Conservation Plan and to identify partners and initiatives to collaborate with in implementing riparian conservation.
- Provide guidance for a statewide riparian policy to fully protect riparian habitat.

In areas that already have a thriving conservation process in place, such as the SB1086 program along the lower Sacramento River (from Keswick Dam to Verona), the process will provide support and technical assistance for ongoing efforts.

The North American All Bird Initiative

In 1998, participants at a meeting of the International Association of Fish and Wildlife Agencies developed a vision to link all of the major bird conservation initiatives in Canada, the U.S. and Mexico (CEC 1998). The participants represented each of the four major bird conservation initiatives already underway on the continent: the North American Waterfowl Management Plan, Partners in Flight, the Shorebird Conservation Plan, and the Colonial Waterbird Conservation Plan. This new, overarching program, known as the North American All Bird Conservation Initiative (NABCI), seeks to synthesize the efforts of all of these groups by creating "regionally based, biologically driven, landscape-oriented partnerships delivering the full spectrum of bird conservation across the entirety of the North American continent, including simultaneous, on-the-ground delivery of conservation for both game and nongame birds." NABCI aims to ensure that populations and habitats of North America's birds are protected, restored, and enhanced through coordinated efforts at international, national, regional and local levels guided by sound science and effective management. It is designed to increase the effectiveness of new and existing initiatives through:

- Effective coordination;
- Building on existing regional partnerships such as joint ventures; and
- Fostering greater cooperation among the nations and the peoples of the continent.

State, provincial, federal and non-governmental representatives from Canada, Mexico and the U.S. adopted an ecological framework that facilitates coordinated conservation planning, implementation, and evaluation among major bird initiatives. These Bird Conservation Regions (BCR) were defined by adopting the hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC). Existing Joint Ventures as formed under the North American Waterfowl Management Plan (NAWMP) are recognized as important vehicles for local and regional delivery of bird conservation goals. Joint venture focus areas do not always correspond with BCR boundaries, but joint ventures are coordinating with the BCRs encompassed within their boundaries. Many joint ventures in North America have embraced the concept of "all-bird" conservation.

Photo by Eric Preston, ericapreston.com.

Joint Ventures, originally created to protect North America's waterfowl such as this Ring-necked Duck, are now embracing the conservation of all birds.

California is encompassed within five BCRs: the Northwestern Pacific Rainforest region, the Sierra Nevada region, the Coastal California region (which includes the Central Valley), the Great Basin region, and the Sonoran and Mojave Desert region. The state currently hosts five official joint ventures: the Central Valley Habitat Joint Venture, the San Francisco Bay Joint Venture, the Intermountain West Joint Venture, the Pacific Coast Joint Venture, and the Riparian Habitat Joint Venture (Chapter 1). Future bird conservation in California priority habitats will be achieved by encouraging adoption of the all-bird conservation concept within existing joint ventures or by creating new joint ventures, organized regionally around specific habitats and habitat conservation goals.

Chapter 10. Outreach and Education

Scientific efforts for conservation have little impact without the support of local communities, including private landowners, government land managers, and the public of all ages. To gain crucial support, research, management, and conservation programs must share their findings and involve community groups and partners in conservation through education and outreach. For the purposes of this chapter, outreach refers to communication with land managers, agencies, planners, business interests, nonprofit organizations, academia, and volunteers. Outreach activities include, but are not limited to, conferences and workshops that facilitate communication among experts, participation in land use planning, volunteer restoration and monitoring programs, field trips, and ecotourism. Education, an important component of outreach, refers to the range of activities that educate and involve students and adults. Education activities include visits for classes and groups to field sites, interpretive displays, specialized curricula, and participation in festivals.

This chapter will:

- outline key concepts to be disseminated through riparian focused outreach programs;
- identify user groups to address through outreach programs;
- summarize existing resources for use by educators and outreach groups; and
- highlight examples of educational opportunities and successful programs.

Key Concepts

The following list of *Key Concepts for Bird Conservation* should be incorporated into education and outreach programs. These concepts are important to include in any program concerning conservation, and are indispensable in programs focusing on birds and riparian habitats.

- **Reproductive success may be the most important factor influencing bird population health.** It contributes directly to a population's size and viability in an area. A number of factors influence reproductive success, including predation, nest parasitism (ex. Brown-headed Cowbird), nest site availability, and food availability.

- **Nesting habitat requirements vary among species.** Different bird species place their nests in different locations, from directly on the ground to the tops of trees. Most birds nest within five meters of the ground. Managers must consider that habitat needs for different species vary and manage for this diversity accordingly. This can be accomplished by managing grass and forbs to a height greater than 6 inches for ground nesters, retaining a structurally diverse shrub and tree layer for low to mid-height nesters, and leaving dead trees and snags for cavity nesters. Additionally, older tall trees should be retained for birds that build their nests in the canopy (Figure 5-1).

- **The breeding season is a vital period in birds' lives.** Birds nest during the spring and early summer of each year (generally mid-March-August). Nestlings are particularly sensitive to changes in the environment and are indicators of ecosystem health. Disturbances during the breeding season, such as vegetation clearing, habitat restoration, and recreation, may result in nest abandonment, remove potential nest sites, directly destroy nests, expose nests to predators, and decrease food sources such as insects. Predators, such as domestic cats, skunks, and jays, can decimate breeding populations, thus land managers should avoid subsidizing their populations through human food and garbage.

- **Understory (the weedy, shrubby growth underneath trees) is crucial to birds.** A healthy and diverse understory with lots of ground cover offers well-concealed nest and foraging sites. Manicured parks and mowed lawns provide poor nesting conditions for all but a few bird species.

- **Native plants are important to birds.** Native bird populations evolved with the regional vegetation, learning to forage and nest in certain species. Introduced plant species may not provide the same nutrition, host sites for insects, or nest site quality. Introduced plants can also quickly dominate an area, reducing the diversity of vegetation. Less diverse vegetation can lower the productivity and viability of a bird population.

- **Natural predator-prey relationships are balanced, but human disturbance creates an imbalanced system.** Interactions with predators are a natural and essential part of an ecosystem. However, a preponderance of non-native predators or a sustained surplus of natural predators severely affects the health and persistence of bird populations. Feeding wildlife, especially foxes, raccoons, and skunks, should be discouraged. Feeders that are frequented by jays, crows and cowbirds should not be maintained during the breeding season (most songbirds feed their young insects). Domestic and feral cats are responsible for an estimated 4.4 million birds killed each day (Stallcup 1991). It is not true that a well-fed cat will not hunt! In fact, a healthy cat is a more effective predator.

- **Natural processes, such as flood and fire, are integral to a healthy ecosystem.** They provide the natural disturbance needed in an area to keep the vegetative diversity high, an important factor for birds.

"Did you know" and "How you can help" facts about Riparian Habitat

Did you know facts are a great way to teach the public of all ages about riparian habitats? Here are a few to include in educational programs, signs, curriculum, flyers, and presentations:

Did you know…

Cats kill approximately 4 million birds a day in this country alone.

How you can help….

- If you own a cat, help reduce the impact of cats on bird populations. Domestic cats kill hundreds of millions of native birds, reptiles and small mammals every year. This unnecessary impact can easily be reduced if cat owners would keep their cats indoors, and if broad education on the impact of cats on wildlife is conducted.

- The American Bird Conservancy's (ABC) Cats Indoors! campaign seeks to educate the public on the facts of cat predation on birds and other wildlife, and the hazards to free roaming cats. This information is available at the American Bird Conservancy's web site at http://www.abcbirds.org.

- Educate your community about outdoor cats as a conservation threat to birds and other wildlife and distribute brochures and information from ABC's website broadly.

- Attend town hall meeting to raise awareness, especially in problem areas where there are large concentrations of feral or stray cats.

Other actions that cat owners can take to help birds:

- Keep cats as indoor pets.
- Don't abandon unwanted cats; rather, give them to the local SPCA or Humane Society.
- Spay and neuter your cats.
- Cats on ranches or farms, kept to control rodent populations, should be kept to a minimum. Spayed females tend not to stray or wander from the barn area. Keeping feed in closed containers also helps reduce rodent populations (Coleman et al. 1997). Trapping rodents can also be more effective than relying on cats to do the job.
- Don't feed stray or feral cat populations. A more humane alternative for cats and wildlife is to reduce the unwanted cat population by limiting reproduction and facilitating adoption by responsible pet owners.
- Support local efforts to remove feral cats.

Did you know…

Predation is the main cause of nest failure for songbirds. Humans can contribute to an unbalanced predator-prey relationship of both native and non-native predators. Increased numbers of these predators can depress bird populations.

How you can help…

- Eliminate outdoor sources of food including pet food dishes, garbage, and open compost piles that may attract stray cats, jays, raccoons, rats, opossums.
- Avoid indiscriminate open tray bird feeders or seed scattered on the ground that may attract jays, cowbirds, ravens, rats, squirrels, etc. and support unhealthy predator numbers (see the Feeding Birds Safely handout in the resource table).
- Keep cats indoors
- Construct safe bird boxes that are predator proof (see the Keeping your nest box safe Table 10-1).
- Do not feed wildlife or allow wildlife access to your trash when hiking or camping. If you feed birds, avoid doing more harm than good.

Did you know…

Feeding birds can be beneficial if properly done, but it always carries the potential for upsetting the natural balance between native predators and prey species. Improper feeding can help to spread disease, support predator populations that prey on birds and other organisms, or increase non-native populations that displace the natives.

How you can help…

- Feeder placement should be away from shrubs or bushes that provide places for cats to ambush birds (Coleman et al. 1997).

- Avoid feeding birds in the spring and summer. Feeding birds supplements their natural diet, but springtime feeding may encourage a lower quality diet for nestlings that need high-protein insects, which are naturally abundant throughout the breeding season.

- Do not supplement the diet of avian nest predators such as jays, magpies, crows and ravens by feeding them during the breeding season. These predators tend to benefit disproportionately from human habitation, and as their populations expand they are negatively affecting the health of other bird populations. The National Audubon Society produces bird feeders that discourage use by avian predators.

- Avoid supplementing the diet of Brown-headed Cowbirds, which parasitize songbird nests. If cowbirds come to your feeder, try eliminating millet from the birdseed you provide. Evidence indicates that Brown-headed Cowbirds are attracted to bird feeders primarily for millet. Sunflower seeds and other types of birdseed attract many songbird species, but may not attract cowbirds. In addition, do not use open tray feeders or scattered seed on the ground to feed birds; this attracts cowbirds as well as predators.

- When feeding birds in winter, change birdseed if it gets wet from rain as the moisture may promote mildew or sprouting, which can cause birds to become ill.

- In feeding hummingbirds, use a solution of four parts water to one part sugar. Do not use brown sugar, artificial sweeteners, or red dye. Place the feeders in the shade and change the feeder solution every two to three days to avoid cultivating pathogens that can cause hummingbirds to become ill. In freezing weather, bring feeders indoors at dusk and return them with lukewarm fluid at dawn. Clean feeders every 10 days using a few drops of bleach in the wash water, and let stand before rinsing. Rinse thoroughly many times.

Did you know…

Baby birds will often leave, or fledge, the nest before they look fully-grown. Newly fledged birds are often mistaken for "abandoned." Their parents, however, can find them on the ground and will feed them. Most fledglings will continue to be fed by their parents even after leaving the nest.

How you can help…

Leave young uninjured birds alone, as it is likely their parents are nearby. It is not true that parents will avoid young after humans have handled them, but it is still best to leave nests and young undisturbed. Fledglings should not generally be returned to their nest, as this may disturb the nest site. Trampled vegetation and human activity can alert predators to the presence of the nest. Allowing baby birds to remain in the care of their parents provides them their best opportunity for survival. Be aware that it is against federal law to collect wild birds, nests, or their eggs without a permit.

Did you know…

Bird watching is one of the fastest growing hobbies in this country. According to the US Fish and Wildlife Service, about one-fifth of the American population, more than 50 million people, watch birds each year. This outnumbers hunters and anglers combined. Bird watchers are excellent observers and can contribute to the conservation process.

How you can help…

If you are a bird watcher, volunteer for a bird monitoring program. There are increasing opportunities for bird watchers of all skill levels to gain training and experience in various bird monitoring techniques. Participants gain knowledge in a subject area of interest, learn new skills, and can directly contribute to the science of conservation while enjoying birds in the outdoors. There are increasing opportunities to contribute to bird monitoring projects in riparian habitats throughout the state. Subscribe to the Birder Conservationist, an online newsletter of the American Birding Association at http://www.americanbirding.org/programs/constbc.htm.

Key Audiences for Outreach

When designing and implementing education and outreach programs on riparian habitat in your region, you should ensure your program is addressing one or more of the target groups. The four key user groups that need to be targeted through riparian education and outreach programs are:

- Stakeholders (farmers, ranchers)
- Community Members (families, outdoor recreators, homeowners)
- Educators (school teachers and educators)
- Land managers (government agencies, private landowners, homeowners)

Each of the user groups is outlined here with suggestions of the types of outreach activities that are appropriate for each group.

Stakeholders: Stakeholders are people who rely on the habitat for their livelihood, ranching, farming, recreation companies, etc. These are often the group of people that have the highest potential for protecting riparian birds yet they may be the most difficult to reach. In order to effectively communicate with them, conservationists and educators need to find a common ground and build a relationship of trust. Often times highlighting the economic value of songbirds is a great way to reach these groups, e.g., highlighting the role of songbirds as natural pest control at farms.

There is a wide assortment of government funded agricultural/wildlife conservation programs for farmers (http://www.nrcs.usda.gov/programs/farmbill/2002/products.html). Effective programs that target stakeholders include restoration programs that provide incentives to landowners for restoration and conservation. Private landowners can be reached through flyers, brochures, posters, talks at local growers clubs, county fairs, farmers associations, Natural Resource Conservation Service (NRCS) groups, Resource Conservation Districts (RCD's), etc. Tours that take stakeholders into the field to observe the wildlife that depend and co-exist with their agricultural practices are another effective tool. Incorporating articles about riparian songbirds into stakeholder newsletters is a great way to communicate key messages for songbirds in your region. Perhaps most important is person-to-person contact.

Private landowner conservation programs on agricultural lands work best when there is a person getting to know the farmer and showing them the birds. For example, in the years 2001-2002, the Marin County Resource Conservation District (MRCD), in partnership with PRBO, hired a Riparian Habitat Conservationist. The purpose of this position was to link landowners with the riparian songbirds and habitat on their land through monitoring, newsletter articles, presence at MRCD meetings, and person-to-person contact. As a result, farmers who may not have otherwise thought about the songbirds on their land began allowing a biologist to monitor their creeks, agreeing to initiate restoration projects, and looking for ways to protect their creeks while still supporting their cattle operation. This project was an effective way of bridging the gap between a stakeholder group and wildlife conservation. For more information please contact the MRCD (415) 663-1170 or visit http://www.sonomamarinrcds.org/district-mc/.

Community Members: Community members include the public, birders, local businesses, homeowners, families, and outdoor recreation groups. Economically, this group has a lot of influence especially in terms of access to recreation areas. In addition, community members can participate in conservation indirectly through creating favorable public sentiment, promoting legislation to protect riparian habitat and voting on measures to protect and enhance riparian habitat. As a result it is important that education and outreach programs be targeted to these users.

Appropriate programs for this group include general awareness building programs such as informational flyers, birding trips, mist-netting demonstrations, presentations within the community, outreach at local fairs, articles in newspapers and newsletters, and educational materials on the web. In this broad audience there will be users that are receptive to messages about riparian songbird conservation such as birders or conservationists. Other users, such as homeowners, or equestrians, may be more difficult to reach because conservation measures may limit their activities. In this case, continued outreach is needed to build a trusting relationship. It is essential to provide conservation messages to the bilingual or multilingual communities. To improve communication in diverse communities it is important to work with partners in the community to build conservation connections.

Educators: Educating educators expands the potential to reach larger numbers of people with fewer direct staff. Training educators such as schoolteachers, naturalists, bird tour leaders, and docents in the key messages for riparian songbird conservation for each region is essential. Identifying existing education programs in schools, nature centers, and visitor centers and partnering to infuse conservation messages into their existing programs is a cost effective way to reach a broader audience.

To accomplish this, teacher trainings through existing networks and partnerships are an excellent way to train teachers. Providing them with materials in the form of activities, posters, and bird identification guides are well received. Aligning educational programs with state science standards also makes the teachers more receptive to the messages presented through our materials. When trying to reach educators at nature centers or other docent groups, it is best to offer training for staff and provide them with outreach materials to distribute (informational flyers, posters) (Table 10-1).

Land managers: Land managers are user groups that require more technical information to make informed decisions about changing land management practices to benefit songbirds. In addition, land managers are often charged with managing their preserve or refuge for a variety of resources and are often understaffed for the amount of work they are expected to accomplish. As a result, connecting land managers with riparian songbirds becomes extremely important. Getting land managers into the field with biologists, connecting them to their resource, and showing them the direct benefit their actions can produce for songbirds is critical. Clear, concise messages advising managers on how to alter practices are needed. Slide presentations are also effective in reaching this group.

Educational Opportunities and Successful Programs

We now understand that the majority of plant and wildlife population declines are intimately tied with habitat loss and degradation. Diverse flora and fauna depend on riparian habitats in California during some or all phases of their life cycles; however, with less than 5% of riparian habitat left from historical ranges, these species are under pressure. With these facts in mind, we must act now to turn the tide.

Certain educational programs teach hands-on activities, such as ecological restoration.

Targeted education and outreach programs are effective tools to heighten awareness about the biological wealth of riparian habitats. Thankfully, in California there are a number of innovative and inspirational education programs focused on riparian habitats and the surrounding watersheds, some of which are outlined in this section. The success of these educational programs is largely built around meaningful learning experiences that inspire appreciation, generate inquiry, and encourage action in the learner; moreover, the programs involve many regional partners in conservation.

Education programs engage participants most effectively when they involve hands-on activities. Conservation education has the whole of the outdoors as a classroom - what better way to elicit the interest and enthusiasm of students and the public! Teaching ecosystem connections between plants, birds, fish, invertebrates, amphibians, mammals, hydrology, etc. enriches riparian habitat education programs. There are, in fact, many commonalities between riparian-dependent species that lend themselves to excellent 'teachable topics'; for example, the endangered riparian brush rabbit and many nesting songbirds all need a dense understory of diverse plants in the riparian forest to successfully complete some part of their life cycle (see Recommendation 6.7). Seizing educational opportunities, building alliances among educators, and sharing your program's successes and challenges with other others (e.g., California Partners in Flight Education and Outreach Committee) will help ensure well-informed decision-making in California communities into the future.

Table 10-1. Outreach and education resources for schools, educators, and community groups.

Title	Description	Grade and language	Geographic Range	How to Order
International Migratory Bird Day	Celebration information on IMBD. Activities include bird walks, displays, videos	All grades, Spanish and English	Throughout the Americas	http://www.fs.fed.us/dxnf/IMBD.html
PRBO Teacher Resource Packets	11 activities teaching students about birds and conservation	Adaptable for all grades, English	All of CA	PRBO Education Program 4990 Shoreline Hwy. Stinson Beach, CA 94970 (415) 868-1221 or on the web: www.prbo.org/education
Where Do Birds Nest Poster	11 X 17 black and white poster showing where riparian focal species nest in riparian habitat	All grades, English	All of CA	PRBO Education Program Address previously listed
Helping Birds at Bird Feeders	Handout on safe tips for feeding songbirds	All grades, English	All of CA	PRBO Education Program Address previously listed
The Birders Handbook: A Field Guide to the Natural History of North American Birds	Book gives detailed life history information for all birds in North America	High-school, adult, teacher resource	All of CA	Ehrlich et al. 1988
The Sibley Guide to North American Birds by David Sibley.	Resource field guide	High-school, adult, teacher resource	All of CA	Sibley 2000
Bird Study Guide, Tiburon Audubon Society	On-line study guide for students with information about birds and habitats in Marin County.	Grades 4-12	Marin Co. CA	www.tiburonaudubon.org/jrbird/background.html
Bird Songs of California	Cornell's latest audio guide, "Bird Songs of California" - a 3-CD set featuring the voices of 220 bird species from across the Golden State.	All grades	All of CA	http://birds.cornell.edu/

Table 10-1 continued

Title	Description	Grade and language	Geographic Range	How to Order
Birds Beyond Borders	An international environmental education program linking students in the western US with western Mexico through birds.	Grades 3-6	All of the western US	Rocky Mountain Bird Observatory 14500 Lark Bunting Lane Brighton, CO 80601 303-659-4348 education@rmbo.org
The Songbird Blues	A trunk of materials and resources exploring neotropical birds	Grades K-5	All of the Americas	Montana Natural History Center 1617 Roland Ave. Missoula, MT 59801 406 543-6886
Birds in Hand and Field	An activity booklet that makes a great accompaniment to a visit to a mist-netting or bird banding demonstration	K-7	Throughout the West.	Rocky Mountain Bird Observatory 14500 Lark Bunting Lane Brighton, CO 80601 303-659-4348 education@rmbo.org
Keeping Your Nest Box Safe for Songbirds in the West	Handout on how to safely use nest boxes	All grades, English	All of CA	PRBO Education Program Address previously listed
Helping Birds At Home	Handout on how to landscape your yard to help songbirds	All grades, English	All of CA	PRBO Education Program Address previously listed

Table 10-2. Outreach and education resources for wildlife managers and stakeholders (farmers, ranchers).

Title	Description	Geographic Range	How to Order
Riparian Bird Conservation Plan	Science-based bird conservation plan containing recommendations for land managers on enhancing riparian habitat for birds	All of CA	California Partners In Flight 4990 Shoreline Hwy. Stinson Beach, CA 94970 (415) 868-0655 or on the web: www.prbo.org/calpif
Recommendations for Improving Riparian Bird Habitat on Private Lands in Marin County	Handout on how private landowners can enhance their Riparian habitat for birds	Marin County	PRBO Education Program 4990 Shoreline Hwy. Stinson Beach, CA 94970 (415) 868-1221 or on the web: www.prbo.org/education
Improving Songbird Habitat on Your Horse Ranch	Handout on how to improve songbird Habitat on Your Horse Ranch	All of CA	PRBO Education Program Address previously listed
Decreasing Crows and Ravens on Ranches and Dairies	Handout on how to decrease the number of crows and ravens associated with livestock.	All of CA	PRBO Education Program Address previously listed
Horse Keeping: A guide to Land Management for Clean Water	A guidebook prepared by the Bay Area Resource Conservation Districts outlining land management for clean water on horse facilities.	Designed for the Bay Area but could be used throughout CA.	PRBO Education Program Address previously listed

Educational Opportunities

The concepts and guidelines outlined in this chapter can be presented to the public and to students through a variety of media. Following is a list of common education opportunities and some suggestions for content:

Classroom Education

Programs in the classroom should focus on communicating key concepts to students through hands-on activities. Lessons should stress studying birds in the field - whether in the backyard, on school grounds, or in a nearby natural area - and include keeping field notes and observing natural behaviors of birds. Field trips to riparian areas with groups conducting bird conservation and monitoring projects fosters interest and enthusiasm for wildlife and teaches students the importance of conserving birds.

One method of educational outreach, called project-based learning, allows an open-ended approach to solving a conservation problem. Students identify a local conservation issue in their community and through library and field research plan and implement a project from idea conception to project completion. Teachers and students work co-operatively to make important decisions, while working with biologists, land managers, business people, private landowners and others in the community. Because of this investment and emphasis on self-direction, students take ownership of their work, and the lessons learned are profound and long lasting (Rogers, pers. comm.).

A great way to get students interested in birds is through bird observation in the field. While access to binoculars is sometimes limited, you can contact your local Audubon Society, nature center or other local wildlife education group to see if sets are available for check out. If you feel uncertain of your birding skills, contact your local Audubon Society or Nature Center to see if there are any docents or naturalists who will can join your class for a day of birding. An invaluable experience that catches students' interest immediately is to visit a mist-netting site where students have the opportunity to examine birds up close and interact with biologists.

There are many excellent sources for curriculum and hands-on bird activities for the classroom. Many can be found in the table of educational resources listed on pages 100-101. Another useful source is *A Guide to Bird Education Resources* produced by Partners in Flight and the National Fish and Wildlife Foundation. Copies of this book are available from American Birding Association Sales, PO Box 6599, Colorado Springs, CO 80934, phone 1-800-850-2473, member@aba.org. In addition, the California Partners in Flight Education Committee is working on producing educational tools, kits, and resource guides for educators in California. Contact the CalPIF Education Coordinator through the website at http://www.prbo.org/calpif/education.html to find out more.

Volunteer Involvement

Using volunteers to aid in data collection and restoration is an excellent way to gain additional help and to teach people about conservation. Increasingly, families and school groups have opportunities to participate in habitat restoration projects at local parks or nature preserves. Volunteers that participate in counting and studying birds quickly develop a connection to them, which intimately involves the volunteer in the conservation effort. Furthermore, volunteers provide additional support and resources that make long-term monitoring of songbirds viable. To ensure reliable data collection, supervisors must match monitoring techniques with the skill level of the volunteer.

Interpretation at Natural Areas

Interpretation is an excellent way to disseminate key concepts about bird conservation to the public. Displays at preserves, public parks, nature trails, picnic areas, and other natural areas should highlight the birds using the habitats and show the specific features of the habitat that are critical to bird reproduction and survival, including assemblages of native plants. Displays can effectively illustrate how individuals can make a difference at home (e.g., planting native plants in their yards or restraining cats from killing birds). These displays should be aimed at the general public, emphasizing the causes of the decline of songbirds. Again, integrating people as part of the solution encourages their support for conservation issues.

Participation in Birding Festivals and Environmental Fairs

Birding festivals are becoming a popular means of enhancing local economies through ecotourism, which can help to promote local support for conservation of natural areas–a requirement for long-term sustainability of conservation actions. Festivals also present an excellent opportunity to further educate people already familiar with birds about the scientific reasons behind bird conservation. Birders already recognize and love birds and can easily be taught the reasons for bird conservation and what a healthy bird population needs to survive. Birders also constitute a pool of experienced observers who may volunteer for monitoring programs.

Representation of bird conservation at environmental fairs is another way to reach large numbers of people, convey the key concepts behind bird conservation, and build conservation partnerships in the region. Booths that convey the key conservation messages and provide information on how individuals can help through interactive games or activities for children engage families and visitors in bird conservation topics. The National Fish and Wildlife Foundation has published Bridges to Birding, an interactive program for introducing birds, bird watching, and bird conservation to your community. It contains step-by-step instructions on how to put on a festival or fair focusing on birds. To obtain a copy contact IMBD Information Center at (703) 358-2318 or IMBD@fws.gov.

Conducting an International Migratory Bird Day celebration is another excellent way to get local recognition of birds through this international program of the National Fish and Wildlife Foundation. International Migratory Bird Day celebrates the incredible journeys of migratory birds between their breeding grounds in North America and their wintering grounds in Mexico, Central, and South America. The event, which takes place on the second Saturday in May each year, encourages bird conservation and increases awareness of birds through hikes, bird watching, information about birds and migration, public events, and a variety of other education programs. Schedule an IMBD celebration near you. For more information visit www.birdday.org.

Examples of Successful Programs

Mono Basin Birding Chautauqua

The Mono Basin Bird Chautauqua is a birding festival with a mission to enhance the appreciation and understanding of the Mono Basin's diverse and abundant bird life and to educate the public about the area's value to birds and people. The Chautauqua takes place annually over the summer solstice weekend when bird activity in the Basin is at its height. Through field trips, evening presentations by Mono Basin expert biologists, seminars, and special kids' activities, many levels of bird enthusiasts can find something of interest. The event is both volunteer operated and cooperatively organized by several agency and nonprofit partners including Inyo National Forest, Mono Lake Tufa State Reserve, Mono Lake Committee, PRBO Conservation Science, and the Eastern Sierra Audubon Society. Interest and attendance has dramatically increased in the first two years of the Chautauqua, and enthusiasm for the event continues to grow. In 2002 and 2003, 150 and 250 people participated, respectively. The Mono Basin Bird Chautauqua is an excellent example of a bird-focused event that targets a diverse audience and provides a powerfully informative and affective experience for visitors. For more information about the event please visit the website: http://www.birdchautauqua.org/. A similar type of festival is held annually at the Kern River Preserve celebrating the wildlife of the Kern River Valley. For more information visit http://www.valleywild.org/bioregion.htm.

STRAW Bird Project

The STRAW Project coordinates and sustains a network of teachers, students, restoration specialists and other community members as they plan and implement watershed studies and restoration projects in Marin and Sonoma counties. STRAW provides teachers and students with the scientific, educational and technical resources to prepare them for hands-on, outdoor watershed studies, including ecological restoration of riparian corridors. STRAW's overarching goals are to empower students, support teachers, restore the environment, and reconnect communities. STRAW's educational programs include restoration, birds, water quality, and plants. For more information visit www.bay.org/watershed_education.htm.

Mist-netting demonstrations for the public

Providing opportunities for the public to observe mist netting and bird banding demonstrations is an excellent way to connect people with birds and bird conservation science. The following organizations and bird observatories offer public and/or school programs: Big Sur Ornithology Lab www.ventanaws.org/lab.htm, Klamath Bird Observatory www.kbo.org, Humboldt Bay Bird Observatory (a subsidiary of Klamath Bird Observatory), PRBO Conservation Science www.prbo.org, San Francisco Bay Bird Observatory www.sfbbo.org, and Wright Wildlife Refuge.

Chapter 11. Literature Cited

Anders, A. D. and M. R. Marshall. In press. Increasing the accuracy of productivity and survival estimates in assessing landbird population status. Conservation Biology.

Anderson, B. W. and R. D. Ohmart. 1982. Revegetation and wildlife enhancement along the lower Colorado River. U.S. Dept. of the Interior, Bureau of Reclamation. Contract 7-07-30-V0009. 215 pp.

Anderson, B. W., R. D. Ohmart, and J. Rice. 1983. Avian and vegetation community structure and their seasonal relationship in the lower Colorado River Valley. Condor 85(4):392-405.

Andren, H. 1992. Corvid density and nest predation in relation to forest fragmentation: a landscape perspective. Ecology 73:794-804.

Andren, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71:355-366.

Ballard, G. 2003. Tools for songbird monitoring. PRBO's terrestrial program protocols, data structures, field data forms, and computer programs for data management and analysis. www.prbo.org/tools/. Point Reyes Bird Observatory, Stinson Beach, CA.

Ballard, G., G. R. Geupel, D. Barton, and D. Moody. 2003a. California Partners In Flight study areas database: an interactive geographic interface to California's landbird monitoring data: http://cain.nbii.gov/prbo/calpifmap/livemaps/. Point Reyes Bird Observatory. Stinson Beach, CA.

Ballard, G., G. R. Geupel, N. Nur, & T. Gardali. 2003b. Long-term declines and decadal patterns in population trends of songbirds in western North America. Condor 105:737-755.

Bednarz, J. C., J. C. Hovis, and D. M. Evans. 1998. Ongoing changes in Swainson's Thrush population related to landscape fragmentation and forest management. Paper presented at the North American Ornithological Conference, April 1998. St. Louis, MO.

Beedy, E. and W. J. Hamilton III. 1997. Tricolored Blackbird status update and management guidelines. Report prepared for the U.S. Fish and Wildlife Service, Portland, OR and the California Department of Fish and Game.

Beedy, E. C. and W. J. Hamilton III. 1999. Tricolored Blackbird (*Agelaius tricolor). In* The Birds of North America, No. 423 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Biodiversity Council. 2003. http://ceres.ca.gov/biodiversity/

Biosystems Analysis, Inc. 1994. Life on the Edge: a Guide to California's Endangered Natural Resources. Heyday Books, Berkeley, CA and BioSystems Books, Santa Cruz, CA.

Blaustein, A. R. and D. B. Wake. 1990. Declining amphibian populations: a global phenomenon? Trends in Ecology and evolution 5:203-204.

BLM (U.S. Bureau of Land Management). 1998. Northern and eastern Colorado Desert coordinated management plan (NECO Plan). Bureau of Land Management. Riverside, CA.

Bolger, D. T., A. C. Alberts, and M. E. Soulé. 1991. Occurrence patterns of bird species in habitat fragments - sampling, extinction, and nested species subsets. American Naturalist 137:155-166.

Bolger, D. T., T. A. Scott, and J. T. Rotenberry. 2001. Use of corridor-like landscape structures by bird and small mammal species. Biological Conservation 102:213-224.

Bombay, H. L. 1999. Scale perspectives in habitat selection and reproductive success for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. M.S. Thesis, California State University, Sacramento, CA.

Bombay, H. L., M. L. Morrison, and L. S. Hall. 2003. Scale perspectives in habitat selection and animal performance for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. Studies in Avian Biology 26:60-72.

Bonney, R., D. N. Pashley, R. J. Cooper, and L. Niles (eds.). 2000. Strategies for bird conservation: The Partners in Flight planning process; Proceedings of the 3rd Partners in Flight Workshop; 1995 October 1-5; Cape May, N.J. Proceedings RMRS-P-16. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 281 pp.

Bryce, S. A., R. M. Hughes, and P. R. Kaufmann. 2002. Development of a bird integrity index: using bird assemblages as indicators of riparian condition. Environmental Management 30(2):294-310.

Budnik, J. M., M. R. Ryan, and F. R. Thompson. 2000. Demography of Bell's Vireo in Missouri grassland-shrub habitats. Auk 117(4):925-935.

Burnett, R. D. and J. DeStaebler. 2001. Songbird monitoring in the Lower Clear Creek Floodway Restoration Project, 2001. PRBO contribution # 1005.

Burnett, R. D. and J. DeStaebler. 2002. Songbird monitoring in the Lower Clear Creek Floodway Restoration Project, 2002. PRBO contribution # 1098.

Burnett, R. D. and G. R. Geupel. 2001. Songbird monitoring in the Lassen National Forest: results from the 2001 field season. PRBO contribution # 1003.

Burnett, R. D., T. Gardali and G. R. Geupel. In press. Using songbird monitoring to guide and evaluate riparian restoration in salmonid focused stream rehabilitation projects. *In* C. J. Ralph and T. D. Rich (eds.). Proceedings of the Third International Partners in Flight conference. USDA Forest Service Publication. Asilomar, CA.

Cain, J. W. III., M. L. Morrison, and H. L. Bombay. 2003. Predator activity and nest success of Willow Flycatchers and Yellow Warblers. Journal of Wildlife Management 67:600-610.

CalPIF (California Partners in Flight). In prep. The Desert Bird Conservation Plan.

Callicott, J. B. 1986. On the Intrinsic Value of Nonhuman Species in the Preservation of Species: the value of biological diversity. Bryan G. Norton (ed.). Princeton University Press, pp. 138-172.

Cardiff, E. A. 1996. Breeding bird census 1995: desert riparian freshwater marsh. Journal of Field Ornithology. 67:75.

Carter, M. F., W. C. Hunter, D. N. Pashley, and K. V. Rosenberg. 2000. Setting conservation priorities for landbirds in the United States: the Partners in Flight approach. Auk 117:541-548.

CDF (California Department of Forestry and Fire Protection). 2002. Multi-source Land Cover Data (2002 V2). http://www.fire.ca.gov/php/

CDFG and PRBO. 2001. California Bird Species of Special Concern: Draft List and Solicitation of Input. http://www.prbo.org

CEC (Commission for Environmental Cooperation). 1998. A Proposed framework for delineating ecologically-based planning, implementation, and evaluation units for cooperative bird conservation in the U.S.

Chalfoun, A. D., F. R. Thompson, and M. J. Ratnaswamy. 2002. Nest predators and fragmentation: a review and meta-analysis. Conservation Biology 16:306-318.

Chapel, M. Z. 1992. Recommendations for managing late-seral stage forest and riparian habitats on the Tahoe. U.S. Forest Service. Region 5.

Chase, M. K., N. Nur, and G. Geupel. 1997. Survival, productivity, and abundance in a Wilson's Warbler Population. Auk 114:354-366.

Chase, M. K., W. B. Kristan III, A. J. Lynam, M. V. Price, J. T. Rotenberry. 2000. Single species as indicators of species richness and composition in California coastal sage scrub birds and small mammals. Conservation Biology 14:474-487.

Chase, M. K. and G. R. Geupel. In press. The use of avian focal species for conservation planning in California. *In* C. J. Ralph and T. D. Rich (eds.). Proceedings of the Third International Partners In Flight conference. USDA Forest Service Publication. Asilomar, CA.

Cogswell, H. L. 1962. Operation recovery begun in California's Central Valley. Western Bird Bander 37:5254.

Coleman, J. S., S. A. Temple, and S. R. Craven. 1997. Cats and wildlife: A conservation dilemma. Cooperative Extension Publications, Room 170, 630 W. Mifflin Street, Madison, WI 53703, 608-262-3346. http://www.wisc.edu/wildlife/e-pubs.html.

Cooper, C. B. and J. R. Walters. 2002. Experimental evidence of disrupted dispersal causing decline of an Australian passerine in fragmented habitat. Conservation Biology 16:471-478.

Crooks, K. R. and M. E. Soulé. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

Crooks, K. R., A. V. Suarez, D. T. Bolger, and M. E. Soulé. 2001. Extinction and colonization of birds on habitat islands. Conservation Biology 15:159-172.

Davidson, C. 1995. Determining habitat conservation priorities for Neotropical migrant birds in California. Draft report. USDA. Forest Service, Pacific Southwest Research Station and Pacific Southwest Region. San Francisco, CA.

Davis, F. W. and D. M. Stoms. 1996. Sierran vegetation; a gap analysis. Sierra Nevada Ecosystem Project, Final Report to Congress, vol II, Assessments and Scientific Basis for Management Options. University of California, Davis.

Dawdy, D. R. 1989. Feasibility of mapping riparian forests under natural conditions in California. Pp. 63-68 *in* Proceedings of the California Riparian Systems Conference. GTR PSW-110, Davis, CA.

DeSante, D. F. 1992. Monitoring Avian Productivity and Survivorship (MAPS): a sharp, rather than blunt, tool for monitoring and assessing landbird populations. Pp. 511-521 *in* D. R. McCullough and R. H. Barrett (eds.). Wildlife 2001: Populations. Elsevier Applied Science, London, U.K.

DeSante, D. F. 1995. Suggestions for future directions for studies of marked migratory landbirds from the perspective of a practitioner in population management and conservation. Journal of Applied Statistics 22:949-965.

DeSante, D. F. and G. R. Geupel. 1987. Landbird productivity in central coastal California: the relationship to annual rainfall and a reproductive failure in 1986. Condor 89:636-653.

DeSante, D. F. and T. L. George. 1994. Population trends in the landbirds of western North America. Pp. 173-190 *in* J. R. Jehl, Jr. and N. K. Johnson (eds.). A century of avifaunal change in western North America. Studies in Avian Biology No. 15. The Cooper Ornithological Society, Lawrence, KS.

DeSante, D. F. and D. K. Rosenberg. 1998. What do we need to monitor in order to manage landbirds? Pp. 93-110 *in* J. M. Marzluff and R. Sallabanks (eds.). Avian Conservation: Research and Management, Island Press, Washington, D.C.

DeSante, D. F., K. M. Burton, J. F. Saracco, and B. L. Walker. 1995. Productivity indices and survival rate estimates from MAPS, a continent-wide program of constant-effort mist-netting in North America. Journal of Applied Statistics 22:935-947.

DeSante, D. F., K. M. Burton, P. Velez, and D. Froehlich. 1999[a]. MAPS Manual: 1999 Protocol. The Institute for Bird Populations, Point Reyes Station, CA.

DeSante, D. F., D. R. O'Grady, and P. Pyle. 1999[b]. Measures of productivity and survival derived from standardized mist netting are consistent with observed population trends. Bird Study 46 (suppl.): s178-s188.

DiGaudio, R. T. 2003. Songbird richness, diversity and abundance in mature and early successional stage riparian habitat on the Cosumnes River. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Dobkin, D. S. 1994. Conservation and management of Neotropical migrant landbirds in the Northern Rockies and Great Plains. University of Idaho Press, Moscow.

Dobkin, D. S., A. C. Rich, and W. H. Pyle. 1998. Habitat and avifaunal recovery from livestock grazing in a riparian meadow system of the northwest Great Basin. Conservation Biology 12:209-221.

Donovan, T. M., P. W. Jones, E. M. Annand, and F. R. Thompson, III. 1997. Variation in local-scale edge effects: mechanisms and landscape context. Ecology 78: 2064-2075.

Donovan, T. M., C. J. Beardmore, D. N. Bonter, J. D. Brawn, R. J. Cooper, J. A. Fitzgerald, R. Ford, S. A. Gauthreaux, T. L. George, W. C. Hunter, T. E. Martin, J. Price, K. V. Rosenberg, P. D. Vickery, and T. B. Wigley. 2002. Priority research needs for the conservation of Neotropical migrant landbirds. Journal of Field Ornithology 73(4):329-339.

Eckerle, K. P., and C. F. Thompson. 2001. Yellow-breasted Chat (*Icteria virens*). *In* The Birds of North America, No. 575 (A. Poole ad F, Gukkm eds.). The Birds of North America, Inc., Philadelphia, PA.

Erlich, P., Dobkin, D., and Wheye, D. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon and Schuster, Inc.

Erman, D.C., J.D. Newbold, and K.B. Roby. 1977. Evaluation of streamside bufferstrips for protecting aquatic organisms. Univ. of California, California Water Resources Center, Davis. 48pp.

Estep, J. A. 1989. Biology, movements and habitat relationships of the Swainson's Hawk in the Central Valley of California. California Department of Fish and Game. Project Number: CA W-064-4-02.

Faaborg, J. 2002. Saving migrant songbirds: developing strategies for the future. University of Texas Press.

Faber, P.M. (ed.) 2003. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Farmer, C. 1999. The density and distribution of Brown-headed Cowbirds: the central coast enigma. Studies in Avian Biology No. 18:62-67.

Flood Emergency Action Team (FEAT) 1997. Final Report of the Flood Emergency Action Team. http://rubicon.water.ca.gov/FEATReport120.fdr/featindex.html

Fisher, A. K. 1893. The Death Valley Expedition: a biological survey of parts of California, Nevada, Arizona, and Utah (Part II). North American Fauna 7:1-393. USDA, Div. Ornith. and Mammal., Washington D.C.

Flannery, M. E., S. L. Guers, T. Gardali, N. Nur, and G. R. Geupel. 2004. Landbird migration at the Salton Sea: the importance of desert riparian habitat. Studies in Avian Biology: 27:106-115.

Forman, R. T. T. 1995. Some general principles of landscape and regional ecology. Landscape Ecology, 10(3):133-142.

Forman, R. T. T. and M. Godron. 1986. Landscape Ecology. John Wiley & Sons, New York.

Franzreb, K. E. 1989. Ecology and conservation of the endangered Least Bell's Vireo. U.S. Fish and Wildlife Service, Biol. Rep. 89(1). 17pp.

Freemark, K. E., J. B. Dunning, S. J. Hejl, and J. R. Probst. 1995. A landscape ecology perspective for research, conservation and management. Pp. 381-427 *in* T. Martin and D. Finch (eds.). Ecology and Management of Neotropical Migratory Birds. Oxford University Press, New York.

Gaines, D. 1974. The nesting riparian avifauna of the Sacramento Valley, California and the status of the Yellow-billed Cuckoo. MS Thesis. University of California. Davis, CA.

Gaines, D. F. 1977. The valley riparian forests of California: their importance to bird populations. *In* A. Sands (ed.). Riparian forests in California: their ecology and conservation. Institute of Ecology Publication 15. University of California. Davis, CA.

Gallo, J. A., J. A. Scheeter, M. A. Holmgren, and S. I. Rothstein. 2000. Initiation of a long term ecological monitoring project: Avian point counts and habitat assessment in riparian communities in 1998 at Vandenberg Air Force Base, California. University of California, Santa Barbara, Museum of Systematics and Ecology. Environmental Report No. 13.

Gardali, T., A. King, and G. Geupel. 1998. Cowbird parasitism and nest success of the Lazuli Bunting in the Sacramento Valley. Western Birds 29:174-179.

Gardali, T., S. E. Scoggin, G. R. Geupel. 1999. Songbird use of Redwood and Lagunitas Creeks: management and restoration recommendations. Report to the Golden Gate National Recreation Area. PRBO contribution # 903.

Gardali, T., G. Ballard, N. Nur, and G. R. Geupel. 2000. Demography of a declining population of Warbling Vireo in coastal California. Condor 102:601-609.

Gardali, T., C. Shoulders, D. Hatch, A. L., S. E. Scoggin, and G. R. Geupel. 2001. Songbird monitoring in the Golden Gate National Recreation Area: a multifaceted tool for guiding restoration of Redwood Creek. Park Science 21(1):28-32.

Geupel, G. R., G. Ballard, N. Nur, and A. King. 1997[a]. Population status and habitat associations of songbirds along riparian corridors of the lower Sacramento River: results from 1995 field season and summary of results 1993 to 1995. Point Reyes Bird Observatory report to the U.S. Fish and Wildlife Service and The Nature Conservancy. Stinson Beach, CA.

Geupel, G. R., G. Ballard, and A. King. 1997[b]. Songbird monitoring on the Cosumnes River Preserve: results from the 1995 field season. Point Reyes Bird Observatory report to The Nature Conservancy. Stinson Beach, CA.

Geupel, G. R., G. Ballard, L. Pomara, D. Stralberg, N. Nur, and S. Scoggin. 2003. Developing population objectives for California landbirds. Paper presented at the 72nd annual meeting of the Cooper Ornithological Society, April 2003. Flagstaff, AZ.

Gilchrist, J., P. Pintz, and S. L. Small. 2002. Riparian bird communities in the Sacramento Valley: a report of the 2001 field season. A report of the Point Reyes Bird Observatory to The Nature Conservancy California, U.S. Fish and Wildlife Service, California Department of Parks and Recreation, and Sacramento River Partners. PRBO contribution # 1041.

Golet, G. H. 2001. The Riparian Bird Conservation Plan: Book Review. Western Birds 32:182.

Goguen, C. B. and N. E. Mathews. 1999. Review of the causes and implications of the association between cowbirds and livestock. Studies in Avian Biology No. 18:10-17.

Goldstein, M. I., T. E. Lacher, B. Woodbridge, M. J. Bechard, S. B. Canavelli, M. E. Zaccagnini, G. P. Cobb, E. J. Scollon, R. Tribolet, and M. J. Hooper. 1999. Monocrotophos-induced mass mortality of Swainson's Hawks in Argentina, 1995-96. Ecotoxicology 8(3):201-204.

Goldwasser, S. 1978. Distribution, reproductive success and impact of nest parasitism by Brown-headed Cowbirds of Least Bell's Vireos. State of Calif., The Resources Agency, Calif. Dept. of fish and Game. Fed. Aid. Wildl. Rest. W-54-R-10, Nongame Wildl. Prog. Job W 1.5.1, Final Rept.

Goldwasser, S., D. Gaines, and S. Wilbur. 1980. The Least Bell's Vireo in California: a de facto endangered race. Am. Birds 34:742-745.

Granholm, S. L. 1987. Wildlife Handbook for Tuolumne County Wildife Inventory and Evaluation Project. Holton Associates, Berkeley, CA 94706.

Greco, S. E., R. E. Plant, and R. H. Barrett. 2002. Geographic modeling of temporal variability in habitat quality of the Yellow-billed Cuckoo on the Sacramento River, miles 196-219, California. *In* J. M. Scott, P. J. Heglund, M. L. Morrison, J. G. Haufler, M. G. Raphael, W. A. Wall, and F. B. Samson (eds.). Predicting Species Occurrences: Issues of Accuracy and Scale. Island Press, Washington, D.C.

Griffin, P. C. and T. J. Case. 2001. Terrestrial habitat preferences of adult arroyo southwestern toads. Journal of Wildlife Management 65(4):633-644.

Griffith Wildlife Biology. 1999. The status of the Least Bell's vireo at Marine Corps Base Camp Pendleton in 1999. Unpublished report prepared for AC/S, Camp Pendleton by Jane C. Griffith and John T. Griffith, Griffith Wildlife Biology, Calumet, Michigan.

Grinnell, J. and A. H. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna 27. Cooper Ornithological Club. Berkeley, CA.

Haff, T. M., R. T. DiGaudio, G.R. Geupel. 2001. Songbird Monitoring on the Consumnes River Preserve: a progress report of the 2000 field season.

Haff, T. M. 2003. Riparian restoration and nest success. What can we learn from the Modesto Song Sparrow? California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Hagar, J. C. 1999. Influence of riparian buffer width on bird assemblages in western Oregon. Journal of Wildlife Management 63:484-496.

Hahn, D. C., J. Sedgwick, I. Painter, and N. J. Carna. 1999. A spatial and genetic analysis of cowbird host selection. Studies in Avian Biology No. 18:204-217.

Haig, S. M., D. W. Mehlman, and L. W. Oring. 1998. Avian Movements and wetland connectivity in landscape conservation. Conservation Biology 12:749-758.

Halterman, M. D., D. S. Gilmer, S. A. Laymon, and G. A. Falxa. 2001. Status of the Yellow-billed Cuckoo in California: 1999-2000. Report to the USGS-BRD Dixon Field Station, 6924 Tremont Rd, Dixon, CA 95620.

Hamilton, W. J., III. In press. Current policies and programs affecting Tricolored Blackbird (*Agelaius tricolor*) restoration.

Hamilton, B., L. Cook, and K. Hunting 1999. Tricolored Blackbirds 1999 Status Report. Unpublished report to California Department of Fish and Game.

Hammond, J. and G.R. Geupel. 2000. Songbird monitoring on the San Joaquin River National Wildlife Refuge: a progress report for the 2000 field season.

Hanski, I. A. and M. E. Gilpin. 1997. Metapopulation Biology: ecology, genetics, and evolution. Academic Press, San Diego.

Harris, C. 1991. The Avocet, Feb. 1991. Santa Clara Valley Audubon Society. Palo Alto, CA.

Heath, S. K. 2002. Bird monitoring, habitat assessment and visitor education in montane meadow and riparian habitats of Devil's Postpile National Monument: Results from the 2002 field season. PRBO contribution #1064.

Heath, S. K. and G. Ballard. 1999. Songbird monitoring of riparian communities in the eastern Sierra Nevada and western Great Basin region: Results of the 1998 field season. PRBO contribution # 849.

Heath, S. K. and G. Ballard. 2002[a]. Riparian monitoring and habitat assessment in the East and West Walker River watersheds, Bridgeport Ranger District, Humboldt-Toiyabe National Forest: results from the 2001 field season.

Heath, S.K. and G. Ballard. 2002[b]. How viable are Yellow Warbler populations in eastern California and what habitat features affect their nesting success? Poster presented at the 3rd International Partners in Flight Conference. Asilomar, CA.

Heath, S. K. and G. Ballard. 2003[a]. Breeding bird species richness and occurrence in riparian aspen habitats of the eastern Sierra Nevada: are all aspen groves the same? Poster presented at Aspen Management Workshop. May 2003.

Heath, S. K. and G. Ballard. 2003[b]. Bird species composition, phenology, nesting substrate and productivity for the Owens Valley alluvial fan, eastern Sierra Nevada, California 1998-2002. Great Basin Birds 6(1):18-36.

Heath, S. K. and G. Ballard. 2003. Patterns of breeding songbird diversity and occurrence in riparian habitats of the eastern Sierra Nevada. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.. PRBO contribution # 767.

Heath, S. K. and H. R. Gates. 2002. Riparian bird monitoring and habitat assessment in riverine/riparian habitats of the Lower Owens River Project: baseline results from the 2002 field season. PRBO contribution # 809.

Heath, S. K., C. McCreedy, and G. Ballard. 2001. Eastern Sierra Riparian Songbird Conservation. 1998-2000 final report and Mono Basin 2000 progress report. PRBO contribution # 1002.

Heath, S. K., C. McCreedy, and G. Ballard. 2002[a]. Eastern Sierra Riparian Songbird Conservation. 2001 progress report. PRBO contribution # 1010.

Heath, S. K., C. McCreedy, H. R. Gates, and Q. Latif. 2002[b] . Eastern Sierra Riparian Songbird Conservation. Results of the 2002 field season. PRBO contribution # 1066.

Heath, S. K., G. Ballard, and C. McCreedy. 2002[c]. How viable are Yellow Warbler populations in eastern California and what habitat features affect their nesting success? Poster presented at the 3rd International Partners in Flight Conference. Asilomar, CA.

Hochachka, W. M., T. E. Martin, V. Artman, C. R. Smith, S. J. Hejl, D. E. Andersen, D. Curson, L. Petit, N. Mathews, T. Donovan, E. E. Klaas, P. B. Wood, J. C. Manolis, K. P. McFarland, J. V. Nichols, J. C. Berdnarz, D. M. Evans, J. P. Duguay, S. Garner, J. Tewksbury, K. L. Purcell, J. Faaborg, C. B. Goguen, C. Rimmer, R. Dettmers, M. Knutson, J. A. Collazo, L. Garner, D. Whitehead, and G. Geupel. 1999. Scale dependence in the effects of forest cover on parasitization by Brown-headed Cowbirds. Studies in Avian Biology No. 18:80-88.

Holmes, A., D. L. Humple, T. Gardali, and G. R. Geupel. 1999. Songbird habitat associations and response to disturbance in the Point Reyes National Seashore and the Golden Gate National Recreation Area. Point Reyes Bird Observatory, Stinson Beach, CA.

Holmes A. L., M. E. Flannery, and G. R. Geupel. 2003. The effects of saltcedar (Tamarix spp.) on resident songbirds in riparian habitats of the Salton Sea. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Humple, D. L. and G. R. Geupel. 2002. Autumn populations of birds in riparian habitat of California's central valley. Western Birds 33:34-50.

Humple, D. L. and R. D. Burnett. 2004. Songbird monitoring in meadow and shrub habitats within the Lassen National Forest: Results from the 2003 field season. A progress report to the U.S. Forest Service. PRBO contribution # 1173.

Humple, D. L., A. L. Holmes, K. Lindquist, and A. Campomizzi. 2002. Monitoring shrubsteppe and riparian bird communities in northeastern California and northwestern Nevada. A progress report to BLM. PRBO contribution # 1062.

Hunter, J. C., K. B. Willett, M. C. McCoy, J. G. Quinn, and K. E. Keller. 1999. Prospects for preservation and restoration of riparian forests in the Sacramento Valley, California, USA. Environmental Management 24:65-75.

Jaramillo, A. and S. E. Hudson. 2003. Long terms trends and habitat associations of birds using a riparian restoration site. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Jensen, D., S. Torn, and J. Harte. 1993. In our hands: a strategy for conserving California's biological diversity. University of California Press. Berkeley, CA.

Johnson, J. and F. McCormick, Technical Coordinators. 1979. Strategies for protection and management of floodplain wetlands and other riparian ecosystems. General Tech. Report WO12. U.S. Forest Service.

Johnson, M. and G. Geupel. 1996. The importance of productivity to the dynamics of a Swainson's Thrush population. Condor 98:133-141.

Johnson, R. R., C. D. Ziebell, D. R. Patton, P. F. Ffolliot, and R. H. Hamre, Technical coordinators. 1985. Riparian ecosystems and their management: reconciling conflicting uses. Gen. Tech. Report GM-120. U.S. Forest Service. Fort Collins, CO.

Kareiva, P. and M. Andersen. 1988. Spatial aspects of species interactions. Pp. 35-50 *in* A. Hastings (ed.). Community Ecology: Workshop held at Davis, California, April 1986. Springer-Verlag, New York, New York.

Katibah, E. F. 1984. A brief history of riparian forests in the Central Valley of California. *In* R. E. Warner and K. M. Hendrix (eds). California Riparian Systems: Ecology, Conservation, and Productive Management. University of California Press Ltd. London, England.

King, A., J. R. King, and G. R. Geupel. 1999. Songbird monitoring in the Lassen National Forest and Lassen Volcanic National Park: Progress report of the 1998 field season.

King, A. M., J. R. King, A. L. Holmes, and N. Nur. 2001. Songbird monitoring in Almanor Ranger District (Lassen National Forest) and Lassen Volcanic National Park: 1997-1999. PRBO contribution #949.

King, A. M. and J. R. King. 2003. Willow Flycatchers in Warner Valley, Plumas County, California. *In* M. K. Sogge, B. E. Kus, S. J. Sferra, and M. J. Whitfield (eds). Ecology and Conservation of the Willow Flycatcher. Studies in Avian Biology No. 26. Pp. 56-59.

Knopf, F. L., R. R. Johnson, T. Rich, F. B. Samson, and R. C. Szaro. 1988. Conservation of riparian ecosystems in the United States. Wilson Bulletin 100:272-284.

Kus, B. E. 1998. Use of restored riparian habitat by the endangered Least Bell's Vireo (*Vireo bellii pusillus*). Restoration Ecology 6:1.

Kus, B. 1999. Impacts of Brown-headed Cowbird parasitism on productivity of the endangered Least Bell's Vireo. Studies in Avian Biology 18:160-166.

Kus, B.E. 2002. Fitness consequences of nest desertion in an endangered host, the Least Bell's Vireo. Condor 104(4):795-802.

LADWP (Los Angeles Department of Water and Power). 1996. Mono Basin stream and stream channel restoration plan. Prepared for the State Water Resources Control board in response to the Mono Lake Basin Water Rights Decision 1631. Los Angeles, CA.

Lambeck, R. J. 1997. Focal species: a multispecies umbrella for nature conservation. Conservation Biology 11:849-856.

Larison, B., S. A. Laymon, P. L. Williams, and T. B. Smith. 1998. Song Sparrows vs. cowbird brood parasites: impacts of forest structure and nest-site selection. Condor 100:93-101.

Larison, B., S. A. Laymon, P. L. Williams, and T. B. Smith. 2001. Avian responses to restoration: nest-site selection and reproductive success in Song Sparrows. Auk 118(2):432-442.

Laymon S. A. 1987. Brown-headed Cowbirds in California: historical perspectives and management opportunities in riparian habitats. Western Birds 18:63-70.

Laymon, S. A and M. D. Halterman. 1985. Yellow-billed Cuckoos in the Kern River Valley: 1985 population, habitat use, and management recommendations. California Department of Fish and Game. Prepared for The Nature Conservancy, Kern River Preserve. 64pp.

Laymon, S. A., and M. Halterman. 1987. Can the western subspecies of the Yellow-billed Cuckoo be saved from extinction? Western Birds 18:19–25.

Laymon, S. A. and M. D. Halterman. 1989. A proposed habitat management plan for Yellow-billed Cuckoos in California. USDA Forest Service General Technical Report PSW-110 pp. 272-277.

Laymon, S.A. and P. L. Williams. 1994. Riparian and wetland breeding bird surveys, Inyo County, California, with emphasis on the Yellow-billed Cuckoo and the Snowy Plover. Final Report to the California Department of Fish and Game.

Laymon, S. A., and P. A. Williams. 1997. Avifauna in California riparian systems. A report to National Fish and Wildlife Foundation. Kern River Research Center. Weldon, CA.

Leopold, A. 1949. A Sand County Almanac. Oxford University Press, Inc.

LORP (Lower Owens River Project). 1999. Inyo/Los Angeles Water Agreement, technical memoranda, action plan and memorandum or understanding concerning the Lower Owens River Project. Available on the Inyo County Water Department web site: http://www.inyowater.org/LORP/.

Lowther, P. E. 1993. Brown-headed Cowbird (*Molothrus ater*). *In* the Birds of North America No. 47 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington D.C.: The American Ornithologists' Union.

MacArthur, R. H., and E. O. Wilson. 1967. The Theory of Island Biogeography. Princeton University Press, Princeton, NJ.

MacMillan, R .E., D. W. Sada, and M. DeDecker. 1996. Owens Basin sensitive wetland and aquatic species management guidelines plan Inyo and Mono Counties, California. Draft report to the California Department of Fish and Game. Sacramento, CA.

Manley, P. and C. Davidson. 1993. A risk analysis of Neotropical migrant birds in California, U.S. Forest Service report, Region 5. San Francisco, CA.

Marra, P. P., K. A. Hobson, and R. T. Holmes. 1998. Linking winter and summer events in a migratory bird by using stable-carbon isotopes. Science 282:1884-1886.

Martin, T. E. 1988. Habitat and area effects on forest bird assemblages: is nest predation an influence? Ecology 69:74-84.

Martin, T. E. 1992. Breeding productivity considerations: What are the appropriate habitat features for management? *In* J. M. Hagan and D. W. Johnson (eds.). Ecology and Conservation of Neotropical Migrant Birds. Smithsonian Institute Press, Washington, D.C.

Martin, T. E. 1993. Nest predation and nest sites: new perspectives on old patterns. BioScience 43(8):523-532.

Martin, T. E. 1995. Summary: model organisms for advancing and understanding of ecology and land management. Pp. 477-484 *in* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds: a synthesis and review of critical issues. Oxford University Press, New York.

Martin, T. E. and G. R. Geupel. 1993. Nest monitoring plots: methods for locating nests and monitoring success. Journal of Field Ornithology 64:507-519.

Martin, T. E., C. Paine, C. J. Conway, W. M. Hochachka, P. Allen, and W. Jenkins. 1997. BBIRD Field Protocol. Biological Resources Division, University of Montana, Missoula, MT.

Marzluff, J. M. and K. Ewing. 2001. Restoration of fragmented landscapes for the conservation of birds: a general framework and specific recommendations for urbanizing landscapes. Restoration Ecology 9(3):280-292.

Massey, B. W. and M. U. Evans. 1994. An eight-year census of birds of Vallecito Creek, Anzo-Borrego Desert, California. Western Birds 25:178-191.

Mathews, N. and C. Goguen. 1997. Cowbird parasitism and cattle grazing in New Mexico. Quarterly Programmatic Report, April 24, 1998, Project #97-118. National Fish and Wildlife Foundation, Washington, D.C.

Mayer, K. E. and W. F. Laudenslayer, Jr., eds. 1988. A Guide to the Wildlife Habitats of California. California Dept. of Forestry and Fire Protection. Sacramento, CA. 166pp.

Mayfield, H. F. 1975. Suggestions for calculating nest success. Wilson Bulletin 87:456-466.

McKernan, R. L. and G. Braden. 2001. Status, distribution, and habitat affinities of the Southwestern Willow Flycatcher along the Lower Colorado River – Year 5, 2000. Bureau of Reclamation Lower Colorado River office, P.O. Box 61470, Boulder City, NV 89006-1470.

McCreedy, C. L. and S. K. Heath. In review. Atypical Willow Flycatcher nesting sites in a recovering riparian corridor at Mono Lake, CA. Western Birds.

Meffe, G. K. and C. R. Carroll. 1997. Principles of Conservation Biology, 2nd edition. Sinauer Associates, Inc., Sunderland, MA.

Miller, A. H. 1951. An analysis of the distribution of the birds of California. University of California Pub. Zool. 50:531-643.

Moore, F. R., S. A. Gauthreaux, Jr., P. Kerlinger, and T. R. Simmons. 1995. Habitat requirements during migration: important link in conservation. Pp. 121-144 *in* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds: a synthesis and review of the critical issues. Oxford University Press, New York, NY.

Morrison, M. L., L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich. 1999. Research and management of the Brown-headed Cowbird in Western landscapes. Studies in Avian Biology No. 18.

Moyle, P., R. Kattelmann, R. Zomer, and P. J. Randall. 1996. Management of Riparian Areas in the Sierra Nevada. *In* Sierra Nevada Ecosystem Project: Final report to Congress, vol. III, Assessments and scientific basis for management options. University of California Davis, Centers for Water and Wildland Resources.

National Research Council. 2002. Riparian areas : functions and strategies for management. Committee on Riparian Zone Functioning and Strategies for Management, Water Science and

Technology Board, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies, National Research Council. Washington, D.C., 428 pp.

Norris, D. R. and B. J. M. Stutchbury. 2001. Extraterritorial movements of a forest songbird in a fragmented landscape. Conservation Biology 15:729-736.

Noss, R. F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology 4:355-364.

NPS (National Park Service). 1998. Cape-ivy management in the Golden Gate National Recreation Area and Point Reyes National Seashore. GOGA-N-074.

NSRE (National Survey on Recreation and the Environment). 2000-2002. The Interagency National Survey Consortium, Coordinated by the USDA Forest Service, Recreation, Wilderness, and Demographics Trends Research Group, Athens, GA and the Human Dimensions Research Laboratory, University of Tennessee, Knoxville, TN.

Nur, N., C. J. Ralph, S. Laymon, G. Geupel, and D. Evans. 1996. Save Our Songbirds: Songbird conservation in California's riparian habitats: populations assessments and management recommendations. Annual Report, project 94-232. National Fish and Wildlife Foundation, Washington, D.C.

Nur, N., S. L. Jones, and G. R. Geupel. 1999. A statistical guide to data analysis of avian monitoring programs. U.S. Department of the Interior, Fish and Wildlife Service, BTP-R6001-1999, Washington D.C.

Nur, N., G. R. Geupel, and G. Ballard. 2000. The use of constant-effort mist-netting to monitor demographic processes in passerine birds: annual variation in survival, productivity, and floaters. Pp. 185-194 *in* R. Bonney, D.N. Pashley, R.J. Cooper, and L. Niles (eds). Strategies for Bird Conservation; Proceedings of the 3rd Partners in Flight Workshop 1995 October 1-5. USDA Forest Service RMRS-P-16, Ogden, Utah.

Nur, N., A. L. Holmes, and G. R. Geupel. 2004. Use of survival time analysis to analyze nesting success in birds: an example using Loggerhead Shrikes. Condor 106: 457-471.

Ohmart, R. D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 15:273-285.

Olson, D.M. and E. Dinerstein. 1998. The global 200: A representation approach to conserving the Earth's most biological valuable ecoregions. Conservation Biology 12:502-515.

Olson, T. E. and M. V. Gray. 1989. Characteristics of Least Bell's Vireo nest sites along the Santa Ynez River. Pp. 278-284 *in* Dana L. Abell (ed.). Proceedings of the California Riparian Systems Conference: protection, management, and restoration for the 1990's; September 22-24; Davis, CA. Gen. Tech. Rep. PSW-110, Berkeley, CA.

Overmire, T. G. 1962. Nesting of the Bell Vireo in Oklahoma. Condor 64:75.

Pearson, S. F. and D. A. Manuwal. 2001. Breeding bird response to riparian buffer width in managed Pacific Northwest Douglas-fir forests. Ecological Applications 11:840-853.

Pechmann, J. H. K. and H. M. Wilbur. 1994. Putting amphibian declines into perspective: natural fluctuations and human impacts. Herpetologica 50:64-84.

Peterjohn, W. T. and D. L. Cornell. 1984. Nutrient dynamics in an agricultural watershed: observations on the role of a riparian forest. Ecology 65:1466-1475.

Peterjohn, B. G., J. R. Sauer, and C. S. Robbins. 1995. Population trends from the North American Breeding Bird Survey. Pp. 3-39 i*n* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds. Oxford University Press, New York.

Petit, L. J., D. R. Petit, and T. E. Martin. 1995. Landscape-level management of migratory birds: looking past the trees to the forest. Wildlife Society Bulletin 23:420-429.

Pienkowski, M. W. 1991. Using long-term ornithological studies in setting targets for conservation in Britain. Ibis 13 suppl:62-75.

Pietz, P. J. and D. A. Granfors. 2000. Identifying predators and fates of grassland passerine nests using miniature video cameras. Journal of Wildlife Management 64(1):71-86.

Porneluzi, P. A. and J. Faaborg. 1999. Season-long fecundity, survival, and viabilitiy of Ovenbirds in fragmented and unfragmented landscapes. Conservation Biology 13:1151-1161.

Powell, L. A., M. J. Conroy, D. G. Krementz, and J. D. Lang. 1999. A model to predict breeding-season productivity for multibrood songbirds. The Auk 116: 1001-1008.

Pulliam, H. R. 1988. Sources, sinks, and population regulation. The American Naturalist 132:652-661.

RAC (Resources Agency of California). 1998. Preserving California's Natural Heritage. A Bioregional Guide to Land and Water Conservation. Revised edition.

Ralph, C. J. 1998. A comparison of timing, content, and monitoring methods of landbird migration in the Pacific States. Paper presented at the North American Ornithological Conference, April 1998. St. Louis, MO.

Ralph, C. J. and K. Hollinger. 2003. The status of the Willow and Pacific-slope Flycatchers in northwestern California and southern Oregon. Pp. 104-117 i*n* M. Sogge, B. Kus, M. Whitfield, and S. Sferra (eds.). Ecology and Conservation of the Willow Flycatcher. Studies in Avian Biology No. 26.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Field methods for monitoring landbirds. USDA Forest Service Publication, PSW-GTR 144. Albany, CA.

Ralph, C. J., J. R. Sauer, and S. Droege. 1995. Monitoring bird populations by point counts. USDA Forest Service Publication, PSW-GTR 149. Albany, CA.

Rappole, J. H. and M. V. McDonald. 1994. Cause and effect in population declines of migratory birds. Auk 111:652-660.

RECON (Regional Environmental Consultants). 1989. Comprehensive species management plan for the Least Bell's Vireo (*Vireo belli pusillus*). Prepared for San Diego Association of Governments, San Diego.

Rich, T. 1998. Guide for assessing the occurrence of breeding birds in western riparian systems. Draft Report, Fish, Wildlife and Forests Group, Bureau of Land Management. Boise, ID.

Riparian Habitat Joint Venture (RHJV). 2003[a]. Riparian Habitat Joint Venture Strategic Plan.

Riparian Habitat Joint Venture (RHJV). 2003[b]. Riparian Habitat Joint Venture Annual Operating Plan.

Riitters, K. H., R. V. O'Neill, and K. B. Jones. 1997. Assessing habitat suitability at multiple scales: a landscape-level approach. Biological Conservation 81:191-202.

Robbins, C. S. 1970. Recommendations for an international standard for a mapping method in bird census work. Audubon Field Notes 24:723-726.

Roberson, D., and C. Tenney, eds. 1993. Atlas of Breeding Birds of Monterey County. Monterey Peninsula Audubon Society, Carmel, CA.

Robichaud, I., M. A. Villard, and C. S. Machtans. 2002. Effects of forest regeneration on songbird movements in a managed forest landscape of Alberta, Canada. Landscape Ecology 17:247-262.

Robinson, S. K., F. R. Thompson III, T. M. Donovan, D. R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267: 1987-1990.

Rosenberg, K.V. and P.J. Blancher. In press. Setting numerical population objectives for priority landbird species. *In* C. J. Ralph and T. D. Rich (eds.). Proceedings of the Third International Partners in Flight conference. USDA Forest Service Publication. Asilomar, CA.

Rosenberg, K. V., R. D. Ohmart, W. C. Hunter, and B. W. Anderson. 1991. Birds of the lower Colorado River valley. University of Arizona Press. Tucson, AZ.

Rothstein, S. I., J. Verner, and E. Stevens. 1980. Range expansion and diurnal changes in dispersion of the Brown-headed Cowbird in the Sierra Nevada. Auk 97:253-267.

Ruth, J. T., D. R. Petit, J. R. Sauer, M. D. Samuel, F. A. Johnson, M. D. Fornwall, C. E. Korschgen, and J. P. Bennett. 2003. Science for avian conservation: priorities for the new millennium. Auk 120:204-211.

Saab, V. A., C. E. Bock, T. D. Rich, and D. S. Dobkin. 1995. Livestock grazing effects on migratory landbirds in western North America. Pages 311-353 *in* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds: a synthesis and review of critical issues. Oxford University Press, New York.

Saab, V. 1999. Importance of spatial scale to habitat use by breeding birds in riparian forests: a hierarchical analysis. Ecological Applications 9:135-151.

Sabo, J. L. and M. E. Power. 2002. River-watershed exchange: effects of riverine subsidies on riparian lizards and other terrestrial prey. Ecology 83(7):1860-1869.

Sacramento River Advisory Council. 1998. Draft Sacramento River Conservation Area Handbook. Red Bluff, CA.

Salata, L. 1980. Status and distribution of the least Bell's vireo, Camp Pendleton Marine Corps Base, 1980. Unpubl. Rept., U.S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA.

Salata, L. 1981. Least Bell's Vireo research, Camp Pendleton Marine Corps Base, San Diego County, California, 1981. Unpubl. Rept., Natural Resources Office, Camp Pendleton.

Salata, L. 1983. Status of the Least Bell's Vireo on Camp Pendleton, California: report on research done in 1983. Unpubl. Rept., U. S. Fish and Wildlife Service, Laguna Niguel, CA.

Sanders S. D. and M. A. Flett. 1989. Ecology of a Sierra Nevada population of Willow Flycatchers (*Empidonax traillii*), 1986-1987. California Department of Fish and Game, Wildlife Management Division, Nongame Bird and Mammal Section.

Sands, A. (ed.). 1977. Riparian forests in California: their ecology and conservation. Institute of Ecology Publication 15, University of California. Davis, CA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Saunders, D. A., R. J. Hobbs, and C. R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5:18-32.

Sawin, R. S., M. W. Lutman, G. M. Linz, and W. J. Bleier. 2003. Predators on Red-winged Blackbird nests in eastern North Dakota. Journal of Field Ornithology 74(3):288.

Sawyer, J. O. and T. K. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society. Sacramento, California: 471pp.

Sawyer, J. and T. Keeler-Wolf. In prep. A Manual of California Vegetation; Second Edition. See http://www.dfg.ca.gov/whdab/pdfs/natcomlist.pdf for additional information.

Schneider, D. C. 2001. The rise of the concept of scale in ecology. BioScience 51:545-553.

Semlitsch, R. D. and J. R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Conservation Biology 17:1219-1228.

Shaffer, T. L. In press. A unifying approach to analyzing nest success. Auk.

Sherry, T. W., and R. T. Holmes. 1995. Summer versus winter limitation of populations: what are the issues and what is the evidence? Pp. 85-120 *in* T. Martin and D. Finch (eds.). Ecology and management of Neotropical migratory birds: synthesis and review of the critical issues. Oxford University Press, NY.

Sherry. T. W. and R. T. Holmes 2000. Demographic modeling of migratory bird populations: the importance of parameter estimation using marked individuals. Pp. 211-219 *in* R. Bonney, D.N. Pashley, R.J. Cooper, and L. Niles (eds). Strategies for Bird Conservation; Proceedings of the 3rd Partners in Flight Workshop 1995 October 1-5. USDA Forest Service RMRS-P-16, Ogden, Utah.

Sibley, D. A. 2000. The Sibley Guide to North American Birds. Alfred A. Knopf, Inc. 544pp.

Siegel, R. B. and D. F. DeSante. 1999. Version 1.0. The draft avian plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for

Bird Populations report to California Partners in Flight. http://www.prbo.org/calpif/htmldocs/sierra.html.

Sisk, T. D., N. M. Haddad, and P. R. Ehrlich. 1997. Bird assemblages in patchy woodlands: modeling the effects of edge and matrix habitats. Ecological Applications 7:1170-1180.

Small, S. and G. Geupel. 1998. Songbird monitoring in the Point Reyes National Seashore: Results of the 1997 field season. Draft Progress Report to the National Park Service. Point Reyes Bird Observatory. Stinson Beach, CA.

Small, S. L. and T. Gardali. In prep. Regional population growth rates of Black-headed Grosbeaks nesting in California riparian forests. Condor.

Small, S., G. Geupel, N. Nur, A. Holmes, and T. Gardali. 1998. The health of riparian bird populations in central coastal California national parks. Presentation to The Wildlife Society, Western Section, February 1998. Sacramento, CA.

Small, S., J. DeStaebler, G. R. Geupel, and A. King. 1999. Landbird response to riparian restoration on the Sacramento River System: preliminary results of the 1997 and 1998 field season. A report of the Point Reyes Bird Observatory to The Nature Conservancy California and U.S. Fish and Wildlife Service. PRBO contribution # 909.

Small, S. L., N. Nur, A. Black, G. R. Geupel, D. Humple, and G. Ballard. 2000. Riparian bird populations of the Sacramento River system: results from the 1993-1999 field seasons. Point Reyes Bird Observatory, Stinson Beach, CA.

Small, S., T. Gardali, and J. DeStaebler. 2001. Habitat associations and species composition of riparian bird communities in the Sacramento Valley and Lassen Foothill tributaries: a report of the 2000 field season. A report of the Point Reyes Bird Observatory to The Nature Conservancy California, U.S. Fish and Wildlife Service, California Department of Parks and Recreation, and Sacramento River Partners. PRBO contribution # 962.

Smith, F. E. 1977. A survey of riparian forest flora and fauna in California. *In* A. Sands (ed.). Riparian forests in California: their ecology and conservation. Institute of Ecology Publication 15, University of California. Davis, CA.

Smith, D. S., A. B. Wellington, J. L Nachlinger, and C. A. Fox. 1991. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. Ecological Applications (1):89-97.

Sober, E. 1986. Philosophical Problems for Environmentalism in the Preservation of Species: the value of biological diversity. Bryan G. Norton (ed.). Princeton University Press, pp:173-194.

Soulé, M. E., D. T. Bolger, J. Wright, M. Sorice, and S. Hill. 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. Conservation Biology 2(1).

Stallcup, R. 1991. Cats: A heavy toll on songbirds, a reversible catastrophe. The Observer, Number 91, Spring/Summer. Point Reyes Bird Observatory. Stinson Beach, CA.

Stefani, R. A. 2000. The Swainson's Thrush survey in the Sierra Nevada bioregion. Final report for the challenge cost share agreement between University of California, Davis and USDA Forest Service, Tahoe National Forest. February 2000.

Stromberg, J. C. and D. T. Patten. 1990. Riparian vegetation instream flow requirements: a case study from a diverted stream in the eastern Sierra Nevada, California, USA. Environmental Management 14(2):185-194.

Stromberg, J. C. and D. T. Patten. 1992. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. Modroño 39(3):205-223.

Suarez, A. V., K. S. Pfennig, and S. K. Robinson. 1997. Nesting success of a disturbance-dependent songbird on different kinds of edges. Conservation Biology 11(4):928-935.

Szaro, R. C. and M. D. Jakle. 1985. Avian use of desert riparian island and its adjacent scrub habitat. Condor 87:511-519.

Tewksbury, J. J., S. J. Hejl, and T. E. Martin. 1998. Breeding productivity does not decline with increasing fragmentation in a western landscape. Ecology 79:2890-2903.

Tewksbury, J. J., T. E. Martin, S. J. Hejl, T. S. Redman, and F. J. Wheeler. 1999. Cowbirds in a western valley: effects of landscape structure, vegetation, and host density. Studies in Avian Biology 18:23-33.

Tewksbury, J. J., A. E. Black, N. Nur, V. A. Saab, B. D. Logan, and D. S. Dobkin. 2002. Effects of anthropogenic fragmentation and livestock grazing on western riparian bird communities. Studies in Avian Biology 25:158-202.

Temple, S. A. and J. A. Wiens. 1989. Bird Populations and environmental changes: can birds be bio-indicators? American Birds 43:260-270.

The Bay Institute of San Francisco, 1998. The Sierra to the Sea: the ecological history of the San Francisco Bay-Delta Watershed. www.bay.org.

Thompson, B. C., G. E. Knadle, D. L. Brubaker, and K. S. Brubaker. 2001. Nest success is not an adequate comparative estimate of avian reproduction. Journal of Field Ornithology 72:527-536.

Thompson, F. R. and D. E Burhans. 2003. Predation of songbird nests differs by predator and between field and forest habitats. Journal of Wildlife Management 67(2):408.

TNC (The Nature Conservancy). 1997. Central Coast Ecoregional Planning Project. Unpublished report, September 1997.

Trine, C. L. 1998. Wood Thrush population sinks and implications for the scale of regional conservation strategies. Conservation Biology 12(3):576-585.

Twedt, D. J., R. R. Wilson, J. L. Henne-Kerr, and D. A. Grosshuesch. 2002. Avian response to bottomland hardwood reforestation: the first 10 years. Restoration Ecology 10(4):645-655.

Uliczka, H., and P. Angelstam. 2000. Assessing conservation values of forest stands based on specialized lichens and birds. Biological Conservation 95(3):343-351.

USFWS (U.S. Fish and Wildlife Service). 1998. Draft recovery plan for the Least Bell's Vireo. U.S. Fish and Wildlife Service, Portland, OR. 139 pp.

USFWS (U.S. Fish and Wildlife Service). 2002. Southwestern Willow Flycatcher Recovery Plan. Albuquerque, New Mexico. i-ix+210pp., Appendices A-O.

Van Horne, B. 1983. Density as a misleading indicator of habitat quality. Journal of Wildlife Management 47:893–901.

Wake, D. B. 1991. Declining amphibian populations. Science 253:860.

Wake, D. B. 1998. Action on amphibians. Trends in Ecology and Evolution 13:379.

Warner, R. E., and K. M. Hendrix (eds.). 1984. California riparian systems: ecology, conservation, and management. University of California Press. Berkeley, CA.

Welsh, H. H. and L. M. Olliver. 1998. Stream amphibians as indicators of ecosystem stress: a case study from California's redwoods. Ecological Applications 8(4):1118-1132.

Whitt, M. B., H. H. Prince, and R. R. Cox, Jr. 1999. Avian use of purple loosestrife dominated habitat relative to other vegetation types in a Lake Huron wetland complex. Wilson Bulletin, 111(1):105-114.

Wiens, J. A. 1989. Spatial scaling in ecology. Functional Ecology 3:385-397.

Wiens, J. A. 1995. Habitat fragmentation: island v landscape perspectives on bird conservation. Ibis 137:97-104.

Wiens, J. A. 1999. The science and practice of landscape ecology. Pp. 371-383 *in* J. M. Klopatch and R.H. Gardner (eds.). Landscape Ecological Analysis. Springer- Verlag, New York.

Wiens, J. A., N. C. Stenseth, B. Van Horn, and R. A. Ims. 1993. Ecological mechanisms and landscape ecology. Oikos 66:369-380.

Winter, L. 1999. Cat predation on birds and other wildlife and the Cats Indoors! Campaign. Wildlife Rehabilitation 17:175-180.

With, K. A. and A. W. King. 2001. Analysis of landscape sources and sinks: the effect of spatial pattern on avian demography. Biological Conservation 100:75-88.

Wood, J., T. Gardali, and G.R. Geupel. 2001. Neotropical and Resident Songbird Populations in the Lower Creek Floodway Restoration Project: a progress report for the 2000 field season. PRBO contribution #810.

Woodbridge, B. 1991. Habitat selection by nesting Swainson's Hawks: a hierarchical approach. M.S. thesis, Oregon State University, 80 pp.

YCRCD (Yolo County Resource Conservation District). 1998. Bring farm edges back to life! Paul Robins (ed.). Yolo County Resource Conservation District. Woodland, CA.

Yong, W., D. M. Finch, F. R. Moore, and J. F. Kelly. 1998. Stopover ecology and habitat use of migratory Wilson's Warblers. Auk 115:829-842.

Personal Communications

Berry, W. Head of the Wildlife Management Branch of Assistant Chief of Staff/Environmental Security at Marine Corps Base Camp Pendleton, CA. 2003.

Clark, L. E. Placer County Planning Department, Assistant Director. October 31, 2003.

Danner, Sus. Coastal Watershed Council. 1999.

Halterman, Murrelet. University of Nevada, Reno. Cuckoo Project Director. Southern Sierra Research Station. 2003.

King, A. PRBO Conservation Science. 1999.

Rogers, Laurette. 1999.

Siegel, R. The Institute for Bird Populations. 2003.

Teresa, Sherry. Director, Center for Natural Lands Management. 1998.

Appendix A. How to Monitor Riparian Bird Populations

Adaptive management requires the periodic gathering of information to ascertain whether management actions are achieving desired results. The most comprehensive and rigorous way of collecting this information is through a strategic program of monitoring using standardized methods that can be compared between years and between regions. Restoration and land stewardship programs need to build in long-term monitoring programs to assess the effectiveness of their activities. Such data are necessary to determine the need for continued funding.

Research and Monitoring

If habitat restoration or management is undertaken to benefit wildlife species, wildlife monitoring becomes the ultimate measure of success. There are many reasons that bird monitoring should be adopted as a basic component of long-term stewardship in preserves with significant riparian habitats or significant bird populations:

- Birds are highly visible and monitoring is cost effective.
- Birds can show relatively quick response in abundance and diversity to restored habitats (3-5 years).
- Many Neotropical migrants are dependent on early successional development in riparian habitats; therefore, they are good indicators of the success of natural recruitment restoration on an ecosystem scale.
- As secondary consumers (i.e., insectivores), birds are sensitive indicators of environmental change.
- By managing for a diversity of birds, most other elements of biodiversity are conserved.
- Bird monitoring can prevent future listing of declining species by identifying problems and solutions early.
- Because of the increasing popularity of birdwatching, there is great potential for public participation in bird monitoring.
- Birds are tremendously important culturally and economically and their popularity can help raise awareness of land-stewardship needs.

Monitoring Strategically

Monitoring can be conducted at varying levels of intensity, depending on the objectives to be achieved and the resources available. The standardization of protocols is critical to comparing results across space and time. Many recent programs (Ralph et al. 1995, Martin et al. 1997, DeSante et al. 1999a) and publications (Ralph et al. 1993, Geupel and Warkentin 1995, DeSante et al. 1995, 1999b, Nur et al. 2000) have summarized methods, objectives, and implementing results.

Monitoring programs should always include an analysis plan and identification of issues or site-specific projects to be assessed. The primary purpose of site-specific monitoring is to assess the effects on wildlife of natural and anthropogenic stressors or disturbances in the environment. This knowledge is critical in determining the relative priority of identified conservation problems and in developing effective measures to address those problems.

Monitoring across many sites at varying scales can be analyzed to highlight broad changes or trends in species presence, diversity, abundance and productivity. Ideally, a series of reference sites with long-term monitoring, using most if not all protocols below, will be developed for each California bioregion. Other sites will be monitored more opportunistically, depending on the objectives of the landowner.

The following is a list of common monitoring regimes from least to most intensive.

- **Rapid assessment of habitat or designation of Important Bird Areas based on general vegetation characteristics and presence/absence of indicator species.**

Method: area search or point count as little as one census per site per year.

- **Determine breeding status, habitat association, restoration evaluation and/or evaluation of changes in management practices.**

Method: area search or point count two or more times per year for three years. For restoration evaluation every other year, surveys should continue for at least 10 years.

- **Determination of population health or source/sink status.**

Method: census combined with demographic monitoring for a minimum of four years.

- **Reference site.**

Method: point count census, constant effort mist netting and nest monitoring at a minimum of every other year for 10 years.

Long-term Monitoring

Long-term monitoring provides a wealth of useful information about bird populations. Long-term data are vital to deciphering the difference between a true population decline and a natural fluctuation in population size. In addition to parameters that can be determined by both short- and long-term monitoring (such as annual productivity, abundance, and diversity), patterns of variation in reproductive success and trends in abundance and diversity may also be described. Long-term monitoring is also the only method to monitor natural and human-induced changes in bird populations.

Monitoring Protocols

These are listed from least to most intensity of effort. All are described in detail in Handbook of Field Methods for Monitoring Landbirds (Ralph et al. 1993). Online support, field protocols, example data sheets, and data entry and management resources are supplied at http://www.prbo.org/tools (Ballard 2003).

Area Search

The Area Search, adopted from the Australian Bird Count, is a habitat specific, time constraint census method to measure relative abundance and species composition. It may also provide breeding status. While still quantitative, this technique is ideal for volunteers as it mimics the method that a birder would use while searching for birds in a given area, allowing the observer to track down unfamiliar birds.

Point Count

The point count method is used to monitor population changes of breeding landbirds. With this method, it is possible to study the yearly changes of bird populations at fixed points, differences in species composition between habitats, and assess breeding status and abundance patterns of species. The objective of point count vegetation assessment is to relate the changes in bird composition and abundance to differences in vegetation.

Mist Netting

Mist netting provides insight into the health and demographics of the population of birds being studied. Mist nets provide valuable information on productivity, survivorship, and recruitment. With these data, managers will have information on the possible causes of landbird declines or their remedies. This method is currently being used nationwide in the Monitoring Avian Productivity and Survivorship (MAPS) program (DeSante 1992).

Territory Mapping

Also known as "spot mapping," based on the territorial behavior of birds, where locations of birds are marked on a detailed map during several visits (a minimum of eight) in the breeding season. By counting the number of territories in an area, this method estimates the density of birds. Distribution of territories, species richness, and diversity are also documented. This is an excellent method for assessing areas with limited habitat. Standard methods are described by Robbins (1970) and used by The Cornell Laboratory of Ornithology's resident bird counts.

Nest Monitoring

Also called nest searching, this technique measures nesting success in specific habitats and provides information on trends in recruitment; measurement of vegetation associated with nests may identify habitat influences on breeding productivity. Examination of nests also allows collection of life-history data (e.g., clutch size, number of broods, numbers of nesting attempts), which provide important insight into vulnerability of species to decimation or perturbations (Martin and Geupel 1993).

Appendix B. How Birds Respond to Riparian Restoration

In measuring the success of habitat restoration/rehabilitation projects, there are two general levels of evaluation that can be undertaken. Measures of success for cultivated restoration projects include measurements of habitat, particularly survival, size, structure, etc., of regenerating vegetation or plantings. Cultivated measures provide two types of information:

- A picture of how closely restored habitats resemble the "reference-site ideal" for which one is striving.
- A measure of how closely the current restoration site resembles the intended project design.

However, for a measure of the actual benefits to wildlife, as well as the efficacy of a particular restoration design, measurements of wildlife response to restored habitats must be undertaken. Such measures may include all manner of wildlife monitoring techniques. Measuring demographic parameters, particularly reproductive success, are most likely the best measure of success (Martin 1993).

Riparian habitats are perhaps unique in California in that, provided that natural flooding and depositional processes remain, they can often regenerate quickly, providing significant benefits to wildlife in as little as two-three years. Natural recruitment restoration, in which habitat is allowed to regenerate naturally, as in a levee setback or flood bypass project, is probably the most effective and least costly form of restoration possible. However, when natural processes have been eliminated or altered, when non-native plants have become a dominant part of the vegetation, or when restoration outside the active floodplain is sought (i.e., floods occur less than one in four years), cultivated restoration is often employed, wherein intensive site preparation, collection of native-plant stock, and planting and maintenance of riparian vegetation takes place.

Kern River Preserve

Studies have shown that diversity and abundance (or density) can be misleading indicators of bird population health (e.g., Van Horne 1983); therefore, the goal of any restoration project should be ultimately to support populations with high productivity (i.e., high nest success on the breeding grounds). At the Kern River Preserve, 12 years of bird monitoring conducted by the Kern River Research Center in restored habitats suggest predictable patterns of response among bird species as riparian restoration sites regenerate and grow. Species diversity tends to increase significantly with the age of a restoration site; however, the best predictor of total bird species richness is mean tree height, followed by total foliage volume and mean quadratic diameter at breast height. Total foliage volume has been the best predictor of breeding bird density over the life of a riparian restoration site at the Kern River Preserve. In general, the richness and density of riparian obligate bird species increase with the age of the restoration plot. This does not mean, however, that managers should manage their sites or skew natural processes to prefer more mature sites over less mature sites. A mosaic of habitat ages is created naturally.

Patterns of response among individual bird species have also been found at the Kern River Preserve. Five general patterns have been identified: three that involve a positive trend in species population, one that demonstrates no trend, and one that involves a negative trend. A brief description of these patterns follows.

- Species occurring in small numbers before planting which gradually increase (for example, Northern Flicker, Mourning Dove, Nuttall's Woodpecker, Hairy Woodpecker, House Wren, Bushtit, Bewick's Wren, Brown-headed Cowbird, Bullock's Oriole, Spotted Towhee, Song Sparrow, and Lawrence's Goldfinch).

- Species not found before restoration that increase to the breeding population levels of natural forest sites (for example, Anna's Hummingbird, Yellow-billed Cuckoo, Black-chinned Hummingbird, Ash-throated Flycatcher, Western Kingbird, Western Scrub-jay, European Starling, Summer Tanager, and Lesser Goldfinch).

- Species found in low numbers before restoration that show a higher density subsequent to restoration than on natural forest sites (for example, Common Yellowthroat, Black Phoebe, Blue Grosbeak, Lazuli Bunting, and Red-winged Blackbird).

- Species found in small numbers before planting that show no trends as a result of restoration (for example, Downy Woodpecker, Western Wood-pewee, Willow Flycatcher, Tree Swallow, Oak Titmouse, White-breasted Nuthatch, Western Bluebird, American Robin, Yellow Warbler, and Yellow breasted Chat).

- Species that show a negative effect from restoration (for example, Horned Lark, Savannah Sparrow, and Western Meadowlark).

At the Kern River Preserve, restoration sites (with ages up to 12 years) averaged 18 to 22 species per plot, whereas natural forest sites averaged 41 species per plot. Much of the variation results from differences in structural diversity of vegetation. Additionally, natural forest sites show more diversity of habitats, with the interspersion of meadows, patches of mule fat, closed canopies of trees centuries old, and thickets of new growth (Nur et al. 1996).

Sacramento River

At a site restored by The Nature Conservancy, working in partnership with the U.S. Fish and Wildlife Service, PRBO found that in a newly restored riparian site along the Sacramento River bird species diversity increased by 73% from year two to year four of the restoration project. Revegetated sites ranging in age from four to 10 years supported species diversity comparable to mature riparian habitat. Moreover, habitat restoration will also benefit listed species, provided the needs of these species are taken into consideration during project implementation. Nine years after conducting the first riparian restoration at the Kern River Preserve, Yellow-billed Cuckoos nested on a habitat restoration site. Limited foraging use of restored areas began much sooner (after three years), but by the ninth year, restoration sites were used extensively for foraging. Willow Flycatchers began nesting in restored sites seven years after restoration.

Appendix C. Acronyms, Abbreviations, and Species Codes

List of Acronyms and Abbreviations

BBS:	Breeding Bird Survey
BLM:	U.S. Bureau of Land Management
BSOL:	Big Sur Ornithology Lab
CALFED:	CALFED Bay-Delta Program
Conservation Plan:	The California Partners in Flight Riparian Bird Conservation Plan
Corps:	U.S. Army Corps of Engineers
CalPIF:	California Partners in Flight
CDFG:	California Department of Fish and Game
DWR:	California Department of Water Resources
GIS:	Geographic Information Systems
HY:	hatch year
km:	kilometers
m:	meters
MAPS:	Monitoring Avian Productivity and Survivorship
NRCS:	Natural Resource Conservation Service
NSAs:	initiate nonstructural alternatives
PIF:	Partners in Flight
PRBO:	Point Reyes Bird Observatory
RHJV:	Riparian Habitat Joint Venture
USFS:	U.S. Forest Service
USFWS:	U.S. Fish and Wildlife Service
USGS:	U.S. Geological Service
VWS:	Ventana Wilderness Society
WHR:	Wildlife Habitat Relationships

List of Species Codes

BANS:	Bank Swallow
BHGR:	Black-headed Grosbeak
BLGR:	Blue Grosbeak
COYE:	Common Yellowthroat
LBVI:	Least Bell's Vireo
SOSP:	Song Sparrow
SPSA:	Spotted Sandpiper
SWHA:	Swainson's Hawk
SWTH:	Swainson's Thrush
TRES:	Tree Swallow
WAVI:	Warbling Vireo
WIFL:	Willow Flycatcher
WIWA:	Wilson's Warbler
YBCH:	Yellow-breasted Chat
YBCU:	Yellow-billed Cuckoo
YWAR:	Yellow Warbler

Appendix D. Scientific and Common Names

Plants

Common Name	*Latin Name*
Acacia	*Acacia dealbata*
Alder species	*Alnus spp.*
Alkali goldenbush	*Haplopappus acradenius*
Alkali sacaton	*Sporobolus airoides*
Arrowweed	*Pluchea sericea*
Baltic rush	*Juncus balticus*
Bent grass	*Agrostis spp.*
Bigleaf maple	*Acer macrophylum*
Black cottonwood	*Populus balsamifera*
Black locust	*Robinia pseudoacacia*
Black walnut	*Juglans californica*
Blue elderberry	*Sambucus mexicana*
Boxelder	*Acer negundo*
Buttonbush	*Cephalanthus occidentalis*
California Bay	*Umbellularia californica*
California blackberry	*Rubus ursinus*
California fan palm	*Washingtonia filifera*
California sycamore	*Platanus racemosa*
Cape ivy (German ivy)	*Delairea odorata*
Cattail	*Typha spp.*
Chokecherry	*Prunus virginiana*
Cocklebur	*Xanthium strumarium*
Common cattail	*Typha latifolia*
Common reed	*Phragmites australis*
Coyote willow	*Salix exigua*
Date palm	*Phoenix dactilifera*
Desert lavender	*Hyptis emoryi*
Dogwood	*Cornaceae spp.*
Douglas fir	*Pseudotsuga menziesii*
Edible fig	*Ficus carica*
Engelmann spruce	*Picea engelmannii*
English ivy	*Hedera helix*
Fremont cottonwood	*Populus fremontii*
Giant reed	*Arundo donax*
Himalayan blackberry	*Rubus himalaya*
Jeffrey pine	*Pinus jeffreyi*
Lodgepole pine	*Pinus contorta*
Mesquite	*Prosopis spp.*
Mojave seablight	*Suaeda torreyana*
Oatgrass	*Danthonia spp.*
Oregon ash	*Fraxinus latifolia*
Periwinkle	*Vinca major*
Poison oak	*Toxicodendron diversilobum*
Ponderosa pine	*Pinus ponderosa*
Purple loosestrife	*Lythrum salicaria*
Quailbush	*Atriplex lentiformis*
Red Fir	*Albies magnifica*

River bulrush	*Scirpus fluviatilis*
Rose species	*Rosa spp.*
Rush species	*Juncus spp.*
Russian olive	*Elaeagnus augustifolius*
Sagebrush species	*Artemesia spp.*
Sandbar willow	*Salix sessilifolia*
Sedge species	*Carex/Scirpus spp.*
Seep willow	*Baccharis glutinosa*
Serviceberry	*Amelanchier spp.*
Snowberry	*Symphoricarpos spp.*
Squaw waterweed	*Baccharis sergiloides*
Star thistle	*Centaurea spp.*
Sticky euphatorium	*Ageratina adenophora*
Tamarisk, salt cedar	*Tamarix chinensis*
Tasmanian blue gum	*Eucalyptus globulus*
Tule bulrush	*Scirpus acutus*
Valley oak	*Quercus lobata*
Velvet ash	*Fraxinus velutina*
Water Birch	*Betula occidentalis*
Western Juniper	*Juniperus occidentalis*
White alder	*Alnus rhombifolia*
White fir	*Abies concolor*
Wild grape	*Vitis californica*
Wild rose	*Rosa californica*
Willow species	*Salix spp.*
Wiregrass	*Juncus acutus*

Birds

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Anna's Hummingbird	*Calypte anna*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Bank Swallow	*Riparia riparia*
Bewick's Wren	*Thryomanes bewickii*
Black Phoebe	*Sayornis nigricans*
Black-chinned Hummingbird	*Archilochus alexandri*
Black-crowned Night Heron	*Nycticorax nycticorax*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Brown-headed Cowbird	*Molothrus ater*
Bullock's Oriole	*Icterus bullockii*
Bushtit	*Psaltriparus minimus*
Clapper Rail (Light-footed)	*Rallus longirostris levipes*
Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
European Starling	*Sturnus vulgaris*
Golden-crowned Kinglet	*Regulus satrapa*
Hairy Woodpecker	*Picoides villosus*
Horned Lark	*Eremophila alpestris*
House Wren	*Troglodytes aedon*
Lawrence's Goldfinch	*Carduelis lawrencei*

Lazuli Bunting	*Passerina amoena*
Least Bell's Vireo	*Vireo bellii pusillus*
Lesser Goldfinch	*Carduelis psaltria*
Nuttall's Woodpecker	*Picoides nuttallii*
Oak Titmouse	*Baeolophus inornatus*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-necked Duck	*Aythya collaris*
Ruby-crowned Kinglet	*Regulus calendula*
Savannah Sparrow	*Passerculus sandwichensis*
Snowy Plover	*Charadrius alexandrinus*
Song Sparrow	*Melospiza melodia*
Spotted Towhee	*Pipilo maculatus*
Summer Tanager	*Piranga rubra*
Swainson's Hawk	*Buteo swainsoni*
Swainson's Thrush	*Catharus ustulatus*
Swainson's Thrush (Olive-backed)	*Catharus ustulatus swainsoni*
Swainson's Thrush (Russet-backed)	*Catharus ustulatus ustulatus, C. u. oedicus*
Tree Swallow	*Tachycineta bicolor*
Tricolored Blackbird	*Agelaius tricolor*
Warbling Vireo	*Vireo gilvus*
Western Bluebird	*Sialia mexicana*
Western Kingbird	*Tyrannus verticalis*
Western Meadowlark	*Sturnella neglecta*
Western Wood-pewee	*Contopus sordidulus*
White-breasted Nuthatch	*Sitta carolinensis*
Willow Flycatcher	*Empidonax traillii*
Willow Flycatcher (Little)	*Empidonax traillii brewsteri*
Willow Flycatcher (Southwestern)	*Empidonax traillii extimus*
Wilson's Warbler	*Wilsonia pusilla*
Wrentit	*Chamaea fasciata*
Yellow Warbler	*Dendroica petechia*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-billed Magpie	*Pica nuttalli*
Yellow-breasted Chat	*Icteria virens*

Mammals

Bobcat	*Felis rufus*
Coyote	*Canis latrans*
Domestic cat	*Felis catus*
Fox, Gray	*Urocyon cinereoargenteus*
Fox, Red	*Vulpes vulpes*
Opossum, Virginia	*Didelphis virginiana*
Raccoon	*Procyon lotor*
Riparian Brush Rabbit	*Sylvilagus bachmani riparius*
Skunk, Striped	*Mephitis mephitis*

Amphibians

Arroyo Southwestern toad	*Bufo microscaphus californicus*

Invertebrates

Katydid	Family *Tettigoniidae*
Sphinx moth	Family *Sphingidae*

Appendix E. Riparian and Semi-riparian Natural Communities from a Manual of California Vegetation, 2nd Edition (Sawyer and Keeler-Wolf in prep)

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
30.000.00	**SCRUB AND CHAPARRAL**					N	
33.000.00		Sonoran and Mojavean Desert Scrub				N	
33.200.00			Cheesebush Scrub		*Hymenoclea salsola*	N	
33.260.00				Sweetbush Riparian Scrub	*Bebbia juncea*	Y	
40.000.00	**GRASS & HERB DOMINATED COMMUNITIES**					N	
41.000.00		Native Grassland				N	
41.310.00				Knotweed-Echinochloa Riparian Grassland		N	
45.000.00		Meadows and Seeps not dominated by grasses				N	
45.500.00			Alkali Meadow			N	
45.550.00				Cocklebur Riparian Grassland	*Xanthium strumarium*	N	
45.560.00				Rush Riparian Grassland	*Juncus spp.*	N	
45.561.00				Common Rush Riparian Grassland	*Juncus effusus var. brunneus*	N	

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
5.562.00				Baltic Rush Riparian Grassland	*Juncus balticus*	N	
45.563.00				Cooper Rush Riparian Grassland	*Juncus cooperi*	Y	
45.565.00				Mexican Rush Riparian Grassland	*Juncus mexicanus*	N	
60.000.00	**RIPARIAN AND BOTTOMLAND HABITAT**					N	
61.000.00		Riparian Forest and Woodland				N	
61.100.00			Cottonwood and Aspen Woodlands and Forests		*Populus spp.*	N	
61.111.00				Aspen Upland and Riparian Forests and Woodlands		N	ASP
61.120.00				Black Cottonwood Riparian Forests and Woodlands	*Populus balsamifera*	Y	MRI
61.130.00				Fremont Cottonwood Riparian Forests and Woodlands	*Populus fremontii*	Y	VRI, DRI, MRI
61.200.00			Willow Riparian Forests and Woodlands		*Salix spp.*	N	
61.201.00				Arroyo Willow Riparian Forests and Woodlands	*Salix lasiolepis*	Y	DRI, VRI, MRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.202.00				Black Willow Riparian Forests and Woodlands	*Salix gooddingii*	Y	VRI, DRI
61.203.00				Hooker Willow Riparian Forests	*Salix hookeriana*	Y	VRI
61.204.00				Pacific Willow Riparian Forests	*Salix lucida ssp. lasiandra*	Y	DRI, VRI, MRI
61.205.00				Red Willow Riparian Forests	*Salix laevigata*	Y	VRI, DRI, MRI
61.206.00				Sitka Willow Riparian Forests	*Salix sitchensis*	Y	VRI, DRI
61.207.00				Mixed Willow Riparian Forests and Woodlands	*Salix spp.*	Y	
61.208.00				Southern Willow Scrub	*Salix spp.*	Y	
61.209.00				Narrow-leaf Willow Riparian Scrub	*Salix exigua*	N	VRI, DRI, MRI
61.210.00				Yellow Willow Riparian Scrub	*Salix lutea*	N	MRI
61.211.00				Gooding Willow Woodland	*Salix goodingii*	N	
61.300.00			Sycamore		*Platanus spp.*	N	VRI
61.310.00				California Sycamore	*Platanus racemosa*	Y	VRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.311.00				Central CA Sycamore Alluvial Woodland	*Platanus spp.*	Y	VRI
61.312.00				Southern Sycamore - Alder Riparian Woodland	*Platanus spp.-Alnus spp.*	Y	VRI
61.313.00				Foothill Sycamore Riparian Woodland	*Platanus spp.*	Y	VRI
61.314.00				Central Coast Cottonwood - Sycamore Riparian Woodland	*Populus spp.-Platanus spp.*	Y	
61.400.00			Alder Riparian Forest		*Alnus spp.*	N	
61.410.00				Red Alder	*Alnus rubra*	N	RDW, VRI, MRI
61.420.00				White Alder Forest and Woodland	*Alnus rhombifolia*	N	MRI
61.500.00			Desert Wash Riparian Woodland			N	
61.510.00				Mesquite Woodland	*Prosopis spp.*	Y	
61.512.00				Honey Mesquite Scrub	*Prosopis glandulosa*	Y	
61.513.00				Tornillo Scrub	*Prosopis pubescens*	Y	
61.520.00				Fan Palm Woodland	*Washingtonia filifera*	Y	POS
61.530.00				Blue Palo Verde - Ironwood - Smoke Tree Woodland	*Cercidium floridum-Olneya tesota-Psorothamnus spinosus*	Y	

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.540.00				Blue Palo Verde Woodland	*Cercidium floridium*	N	
61.550.00				Desert-willow Woodland	*Chilopsis linearis*	N	
61.560.00				Ironwood Woodland	*Olneya tesota*	N	
61.570.00				Smoke Tree Woodland and Scrub	*Psorothamnus spinosus*	N	
61.580.00				Desert Olive Scrub	*Forestiera pubescens*	Y	
61.800.00			Walnut		*Juglans spp.*	Y	
61.810.00				Hind's Walnut Unique Stands	*Juglans californica var. hindsii*	Y	
61.900.00			Mixed Riparian Forest and Woodland			Y	
61.910.00				Great Valley Mixed Riparian Forest		N	VRI
61.920.00				Southern Mixed Riparian Forest		Y	
61.930.00				Southern Riparian Forest		Y	
61.940.00				Mojave Riparian Forest		Y	DRI
61.950.00				Desert Dry Wash Woodland		N	DSW

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.960.00				Oregon Ash Riparian Forest	*Fraxinus latifolia*	Y	VRI, MRI
63.000.00		Low to High Elevation Riparian Scrub				N	
63.100.00			Scrub Willow		*Salix spp.*	N	
63.110.00				Narrowleaf Willow	*Salix exigua*	Y	VRI, MRI, DRI
61.111.00				Tealeaf Willow Riparian Scrub	*Salix planifolia*	N	
61.112.00				Sierra Willow Riparian Scrub	*Salix eastwoodiae*	N	MRI
61.113.00				Lemmon's Willow Riparian Scrub	*Salix lemmonii*	N	MRI
61.114.00				Dusky Willow Riparian Scrub	*Salix melanopsis*	N	MRI
61.115.00				Grayleaf Sierra Willow Riparian Scrub	*Salix orestera*	N	MRI
61.116.00				Arctic Willow Dwarf Scrub	*Salix arctica*	N	MRI
61.117.00				Snow Willow Dwarf Scrub	*Salix reticulata*	N	MRI
63.120.00				Sandbar Willow	*Salix sessifolia*	N	VRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
63.130.00				Southern Willow	*Salix spp.*	Y	
63.140.00				Great Valley Willow	*Salix spp.*	Y	VRI
63.150.00				Montane Wetland Shrub Habitat		Y	MRI
63.160.00				Subalpine Wetland Shrub Habitat		N	MRI
63.200.00			Alder Scrubs		*Alnus spp.*	N	
63.210.00				Mountain Alder Scrub	*Alnus incana*	Y	MRI
63.220.00				Sitka Alder Scrub	*Alnus viridis*	Y	MRI
63.300.00			Buttonbush Scrub		*Cephalanthus occidentalis*	Y	VRI
63.400.00			Elderberry Scrub and Savanna		*Sambucus spp.*	N	
63.410.00				Mexican Elderberry	*Sambucus mexicana*	N	VRI
63.510.00				Mulefat Scrub	*Baccharis salicifolia*	N	DRI, VRI
63.520.00				Emory Baccharis Scrub	*Baccharis emoryi*	N	DSW, DRI
63.530.00				Broom Baccharis Scrub	*Baccharis sergiloides*	Y	DSW, DRI
63.600.00			Birch Scrub		*Betula spp.*	N	
63.610.00				Water Birch Scrub	*Betula occidentalis*	Y	MRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
63.700.00				Arrow Weed Scrubs	*Pluchea spp.*	N	DSW
63.710.00				Arrow Weed Scrub	*Pluchea sericea*	N	DSW
63.800.00			Vegetation dominated by Tamarisk		*Tamarix spp.*	N	
63.810.00				Tamarisk Scrubs and Woodlands	*Tamarix spp.*	N	DSW, DRI
63.900.00			Southern Riparian Scrub			Y	
63.901.00				North Coast Riparian Scrub		N	MRI
63.902.00				Central Coast Riparian Scrub		N	MRI
63.903.00				Montane Riparian Scrub		N	MRI
63.904.00				Modoc-Great Basin Riparian Scrub		N	
63.905.00				Mojave Desert Wash Scrub		N	DSW
63.906.00				Himalayan Blackberry Scrub	*Rubus discolor*	N	CSC
63.907.00				California Rose Riparian Scrub	*Rosa californica*	N	SEW
63.908.00				Salmonberry Scrub	*Rubus spectabilis*	N	CSC

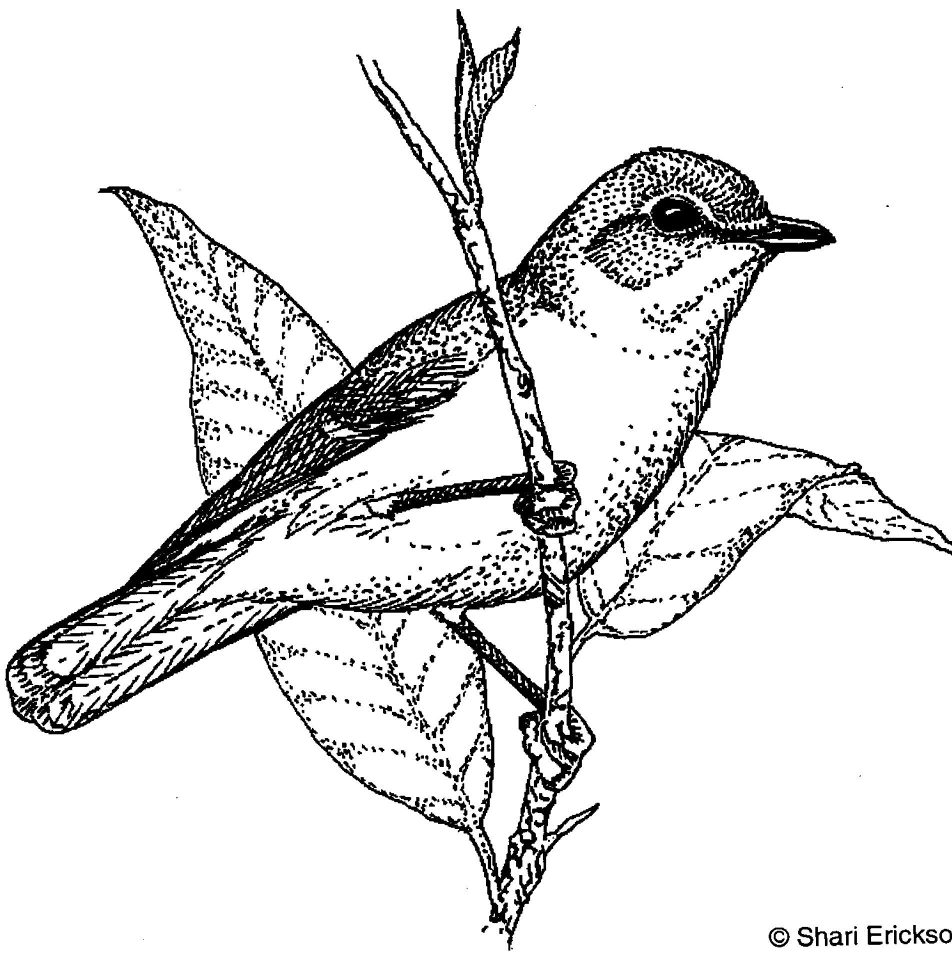
Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
70.000.00	**BROAD LEAFED UPLAND TREE DOMINATED**					N	
71.000.00			Oak Woodlands and Forests			N	
71.040.00				Valley Oak Forests and Woodlands	*Quercus lobata*	Y	VOW, VRI
71.060.00				Coast Live Oak Forest and Woodland	*Quercus agrifolia*	N	COW
80.000.00	**CONIFEROUS UPLAND FOREST AND WOODLAND**					N	
82.000.00			Coastal and Montane Douglas-fir Forests and Woodlands		*Pseudotsuga spp.*	N	
82.500.00				Douglas-fir - Tanoak Forest	*Pseudotsuga menziesii-Lithocarpus densiflora*	N	DFR, COW, MHW, MHC

EXHIBIT 6

U.S. Fish and Wildlife Service

Draft Recovery Plan

For the Least Bell's Vireo
(Vireo bellii pusillus)



DRAFT RECOVERY PLAN

for the

LEAST BELL'S VIREO

(*Vireo bellii pusillus*)

Prepared for

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved: ______________________________
Regional Director, U.S. Fish and Wildlife Service

Date: ______________________________

DISCLAIMER PAGE

Recovery plans delineate reasonable actions required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service (Service), sometimes prepared with the assistance of recovery teams, contractors, State agencies, and other affected and interested parties. Recovery teams serve as independent advisors to the Service. Objectives of the plan will be attained and any necessary funds made available, subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks and may not represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the Service. They represent the official position of the Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citation should read as follows:

Fish and Wildlife Service. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, OR. 139 pp.

ACKNOWLEDGMENTS

This recovery plan was initially prepared by Dr. Barbara Kus of the Department of Biology, San Diego State University, San Diego, California with assistance from D. Ann Kreager, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, Carlsbad, California, and Jill Dye and Gary Waayers also of the Department of Biology, San Diego State University. Jon Avery, U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office, Carlsbad, California, assisted in final revisions and updating of this recovery plan.

Numerous individuals, organizations, jurisdictions, and agencies have contributed significantly to the development of the information contained in this recovery plan, as well as to the improved status of the least Bell's vireo from the time the species was federally listed as endangered. In addition to the individuals who over the years collected, analyzed, and disseminated data, further acknowledgments are extended to the United States Army Corps of Engineers (COE); United States Forest Service; United States Marine Corps, Camp Pendleton; Naval Facilities Engineering Command, Southwest Division; San Diego Association of Governments; California Department of Transportation, District 11; counties of San Diego, Orange, and Riverside; and Orange County Water District, for considerable financial assistance.

EXECUTIVE SUMMARY
OF THE
RECOVERY PLAN FOR THE LEAST BELL'S VIREO
(Vireo bellii pusillus)

Current Species Status:

The breeding distribution of the least Bell's vireo (*Vireo bellii pusillus*) is currently restricted to eight southern counties in California and portions of northern Baja California, Mexico. Available census data indicate that the least Bell's vireo population in southern California increased from an estimated 300 pairs in 1986 to an estimated 1346 pairs in 1996. Least Bell's vireos winter in southern Baja California, Mexico. The least Bell's vireo was listed as endangered on May 2, 1986. Critical habitat for the species was designated on February 2, 1994.

Habitat Requirements and Limiting Factors:

The least Bell's vireo is an obligate riparian species during the breeding season and is characterized as preferring early successional habitat. This species typically inhabits structurally diverse woodlands along watercourses, including cottonwood-willow forests, oak woodlands, and mule fat scrub. Little is known about their winter habitat requirements, but they are not exclusively dependent on willow-dominated riparian woodland habitat on their wintering grounds. Most least Bell's vireos in winter occur in mesquite scrub vegetation in arroyos, but some also use palm groves and hedgerows associated with agricultural fields and rural residential areas.

Extensive breeding habitat loss and degradation and brood parasitism by the brown-headed cowbird (*Molothrus ater*) have resulted in a rangewide decline of the least Bell's vireo. These factors continue to be the most serious threats to the recovery of the least Bell's vireo. Populations occurring in the Owens Valley, Death Valley, Sacramento-San Joaquin Valleys and Sierra Nevada foothills, and Tehama County have been completely extirpated. Vast portions of these areas are no longer available for recolonization or expansion.

Recovery Objective:

The objective of this plan is the reclassification of the least Bell's vireo to threatened and, ultimately, delisting through recovery.

Downlisting Criterion:

Reclassification to threatened may be considered when criterion 1 has been met for a period of 5 consecutive years.

<u>Criterion 1</u>: Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, are protected and managed at the following sites: Tijuana River, Dalzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, San Luis Rey River, Camp Pendleton/Santa Margarita River, Santa Ana River, an Orange County/Los Angeles County metapopulation, Santa Clara River, Santa Ynez River, and an Anza Borrego Desert metapopulation.

Delisting Criteria:

Delisting may be considered when the species meets the criterion for downlisting and the following criteria have been met for 5 consecutive years.

<u>Criterion 2</u>: Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, have become established and are protected and managed at the

following sites: Salinas River, a San Joaquin Valley metapopulation, and a Sacramento Valley metapopulation.

Criterion 3: Threats are reduced or eliminated so that least Bell's vireo populations/metapopulations listed above are capable of persisting without significant human intervention, or perpetual endowments are secured for cowbird trapping and exotic plant control in riparian habitat occupied by least Bell's vireos.

Actions Needed:

The plan describes a strategy for reclassification, recovery, and delisting. Instrumental to this strategy is securing and managing riparian habitat within the historical breeding range of the least Bell's vireo, annual monitoring and rangewide surveys, and research activities necessary to monitor and guide the recovery effort.

Recovery Costs:

Costs of specific recovery actions will be determined as information is obtained and/or final actions are undertaken. These items are designated as "to be determined" (TBD) in the Implementation Schedule.

Total ($1000)	1999	2000	2001	2002	2003
8402 + TBD	1037	2080	2065	1705	1515

Date of Recovery: A delisting target date cannot be projected at this time.

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I. INTRODUCTION

The Ecosystem Approach

This recovery plan for the least Bell's vireo (*Vireo bellii pusillus*), if successfully implemented, will lead not only to the recovery of this species, but also assist in the recovery of one of the most critically endangered ecosystems in the United States: southwestern riparian habitat. Recovery of this ecosystem, through preservation and restoration, will constitute a significant contribution to protection of native North American wildlife.

It is impossible to manage some species in isolation from other species. Species are components of complex ecosystems, influencing and influenced by biotic and abiotic features of their environments. The current emphasis on multiple species protection and management reflects a more accurate recognition of the way organisms interact with their environments, thus enhancing the ability to reverse species' declines and potentially preventing the need for future listings.

The least Bell's vireo was one of the first members of the riparian ecosystem to be recognized as declining to the brink of extinction, partially in response to the decimation of its habitat. The precipitous decline of the least Bell's vireo portends the probable fate of other riparian species in the absence of remedial action to change the status quo of land use in California. Although this recovery plan focuses on the least Bell's vireo, achievement of its recovery will ensure protection to a suite of sensitive species also dependent upon the riparian ecosystem.

The least Bell's vireo is a recoverable species. It has survived extensive modification, degradation, and loss of the habitat, demonstrating its ability to rebound after management preserves or restores the conditions under which the species evolved. It is the goal of this recovery plan to guide such management, leading to the ultimate delisting of the species.

The Riparian Ecosystem. A riparian habitat is a plant community that develops along the margins of freshwater streams, lakes, and rivers where soils are damp and sandy. The structure and composition of riparian plant communities are related to the physiography and hydrology of each watershed and consequently vary throughout the range of the least Bell's vireo. Community types such as southern willow scrub, and mule fat scrub (scrub habitat dominated by *Baccharis glutinosa*), sycamore alluvial woodland, coast live oak riparian forest, arroyo willow riparian forest, and cottonwood bottomland forest (Holland 1986, Faber *et al.* 1989), exemplify least Bell's vireo habitats in California.

Although riparian vegetation comprises a small proportion of the California landscape relative to various other habitat types, the value of this habitat to wildlife is disproportionately high. Riparian habitats support more species of birds than any other habitat type in California; more than 140 species occur in riparian habitat, and 88 of these are obligate riparian species (Faber *et al.* 1989). Birds use riparian habitats for nesting, wintering, or both. The mammalian community is also diverse and consists of several species that are dependent upon riparian woodlands for water, forage, and cover, such as the long-tailed weasel (*Mustela frenata*) and bobcat (*Felis rufus*). Insects are abundant and play important ecological roles as both predators and prey. Many species of fish, reptiles, and amphibians occupy riparian habitats and contribute to its immense diversity. According to the U.S. Council on Environmental Quality (1978, as cited in Faber *et al.* 1989), "no ecosystem is more essential than the riparian system to the survival of the nation's fish and wildlife."

Part of the reason for the high diversity of the riparian community lies in its structural complexity, which allows for "niche partitioning" in which different species seeking food, nest sites, and cover in the same habitat evolve behaviors to use different resources or the same resources in different ways (e.g., different times or space) to avoid competition. The presence of tall trees and a diverse understory creates a microclimate that differs from that of adjacent upland habitats in its high humidity and cooler temperatures. Insects thrive in this environment and are an abundant and dependable food source for many insectivorous animals. Many animals in upland communities are attracted to riparian woodlands for access to water, shelter, and shade, particularly during the rainless southern California summers. The riparian zone also serves as a natural corridor, linking adjacent ecosystems and facilitating movement of animals between them. In these ways, the presence of riparian habitat significantly enriches regional biodiversity beyond what could otherwise be supported.

Not only are many riparian animals and plants listed as rare or endangered, the entire riparian community faces continual threats associated with human activities, including agriculture, flood control projects and channelization, livestock grazing, sand and gravel extraction, road construction, and residential and commercial development. Riparian habitat has been vanishing from the landscape of California at such a pace that today less than 10 percent of the riparian woodlands in existence at the time of the Gold Rush in the 1850's remain (Smith 1977), and those are but fragmented remnants. Faber *et al.* (1989) reported a 95–97 percent loss of naturally vegetated floodplains in southern California. Oberbauer (1990) reported a 61 percent loss of riparian habitat for San Diego County. The relatively higher proportion of riparian habitat remaining in San Diego County corresponds with the largest remaining least Bell's vireo populations, both at the time of listing and currently.

Fortunately, because of the dynamic aspect of riparian vegetation, riparian habitat is resilient and has high restoration potential, as long as the floodplain and fluvial processes (i.e., natural water flow and sedimentation regimes) are restored or intact. However, restoration ecology is in its infancy, and there is much yet to learn about how natural riparian ecosystems function. Until we perfect our ability to restore degraded environments to functioning, self-sustaining ecosystems, protection of existing habitat must be the conservation priority.

A. Brief Overview

The least Bell's vireo is a migratory songbird dependent upon riparian habitat for breeding. Historically, this species was widespread throughout riparian woodlands in the Central Valley and low elevation riverine valleys of California and northern Baja California (Figure 1). The least Bell's vireo was characterized by Grinnell as one of the most abundant birds in the state (Cooper 1861, Anthony 1893, 1895, Fisher 1893, Grinnell and Swarth 1913, Grinnell and Storer 1924, Grinnell and Miller 1944). In the last several decades, the species has undergone a precipitous decline in numbers, a decline attributable to the loss and degradation of riparian habitat throughout its range, as well as to the expansion in range of the brown-headed cowbird (*Molothrus ater*), a nest parasite (Garrett and Dunn 1981). Within California, least Bell's vireos are currently restricted in their distribution to eight southern counties (Figure 1), with the majority of birds occurring in San Diego County (RECON 1989, Appendix A).

In response to the dramatic reduction in numbers and range of the least Bell's vireo in California, the California Fish and Game Commission listed the species as endangered on June 27, 1980, under the California Endangered Species Act of 1970. The U.S. Fish and Wildlife Service proposed the least Bell's vireo for listing on May 3, 1985 (U.S. Fish and Wildlife Service 1985), and the species was subsequently federally listed as endangered on May 3, 1986 (U.S. Fish and Wildlife Service 1986), under the Endangered Species Act of 1973, as amended (Act). Critical habitat for the least Bell's vireo was designated on February 2, 1994 (U.S. Fish and Wildlife Service 1994). These designations afford a procedural process for protection of the least Bell's vireo under State and Federal laws. The species' recovery priority number is 3C, indicating it is a subspecies with a high degree of threat, has a high potential for recovery, and is in conflict with development activities.

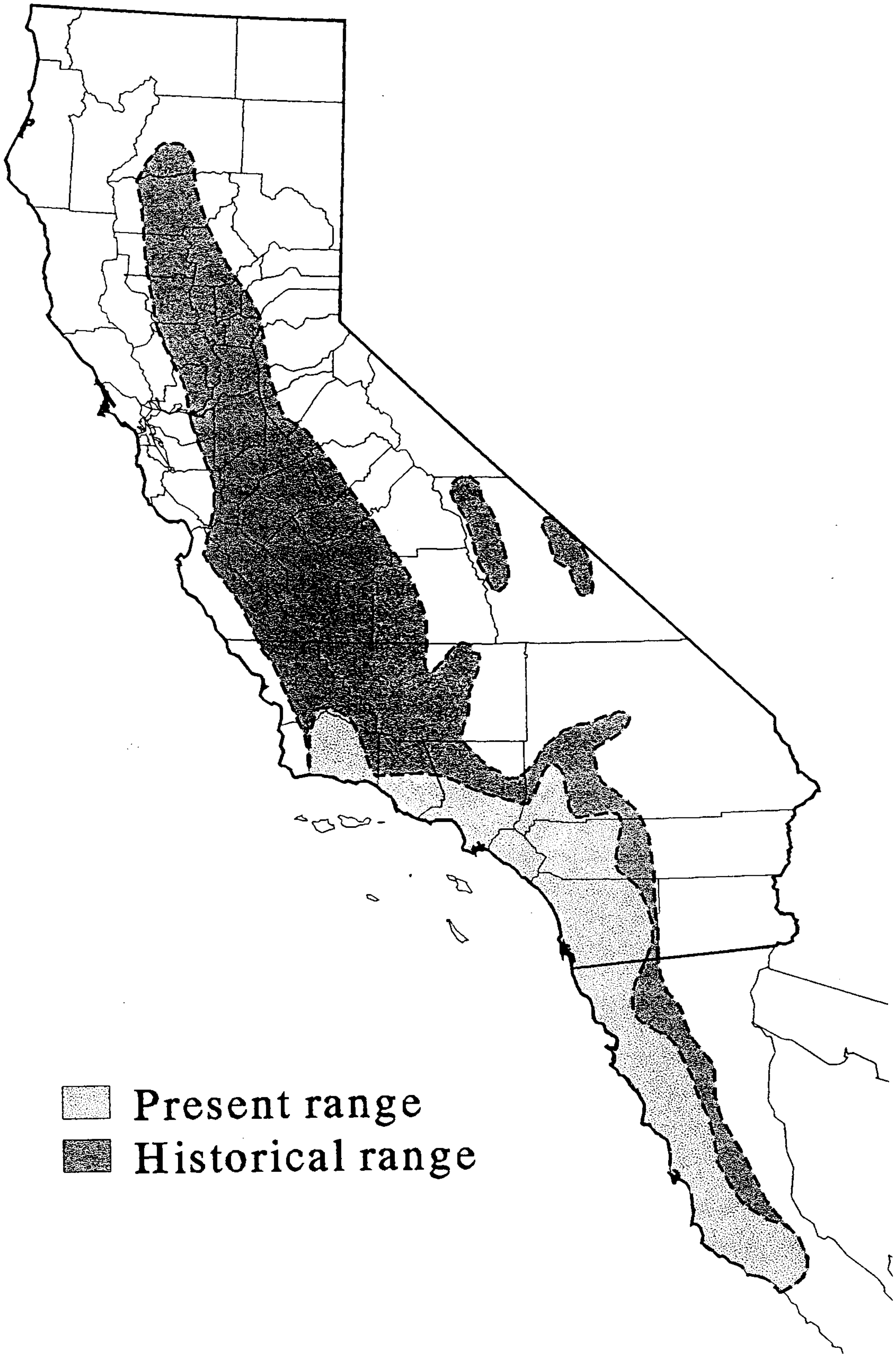

Figure 1. Historical and present ranges of least Bell's vireos.

B. Species Description

Apparently the first account of the least Bell's vireo was written by J. G. Cooper and was based on two specimens he collected in 1861 along the Mojave River near Manix in San Bernardino County, California (Cooper 1861). The original description of the least Bell's vireo (Coues 1866) states:

> The color of the upper parts is a plain dull ashy gray on the head; tinged with grayish olivaceous on the rest of the upper parts. Above grayish ash, becoming more or less ashy olivaceous on the back; not more so on the rump than elsewhere. Below pure white, including under wing coverts; on the breast sometimes a faint suffusion of the lightest possible shade of brownish gray; sides under the wings moderately tinged with sulphur yellow. A narrow short superciliary streak; edges of eyelids, two bands on wings and narrow margins of outer border of wings and tail, dull white; on the latter tinged with olivaceous.

The least Bell's vireo is easily recognized on the breeding grounds by its distinctive song (Coues 1903), characterized by Peterson (1961) as "husky, unmusical phrases at short intervals: cheedle cheedle chee? - cheedle cheedle chew! First phrase ends in rising inflection; second phrase, given more frequently, has downward inflection and sounds as if bird were answering its own question."

Although indistinguishable to the human ear, the least Bell's vireo actually possesses a repertoire of songs, variants of the "question" and "answer" components, through which males rotate (Beck 1996). Males possess individually unique repertoires of from 5 to 15 songs, which are evidently fixed by the first breeding season, providing a "vocal fingerprint" for identifying individual birds. Beck (1996) hypothesizes that the possession of unique repertoires may function in neighbor and/or mate recognition.

C. Taxonomy

Four subspecies of the Bell's vireo (American Ornithologists' Union 1957) have been recognized. Although all subspecies are similar in behavior and life history, they are isolated from one another on both the breeding and wintering grounds (Hamilton 1962) . The least Bell's vireo (*Vireo bellii pusillus*) breeds in California and northwestern Baja California, Mexico, and winters in southern Baja California (Howell and Webb 1995, Unitt 1984). The eastern Bell's vireo (*Vireo bellii bellii*) is found in the central United States from Colorado to Tennessee. The Texas vireo (*Vireo bellii medius*) is distributed in southwestern Texas and eastern Mexico, and the Arizona Bell's vireo (*Vireo bellii arizonae*) occurs in Arizona, Utah, Nevada, California (along the Colorado River), and Sonora, Mexico. The three latter species winter at different longitudes on mainland Mexico and thus, are apparently geographically segregated from one another on the wintering grounds.

D. Distribution

Historically, the least Bell's vireo was widespread and abundant, ranging from interior northern California near Red Bluff (Tehama County), south through the Sacramento-San Joaquin Valleys and Sierra Nevada foothills, and in the Coast Ranges from Santa Clara County south to approximately San Fernando, Baja California, Mexico. Populations also were found in the Owens Valley, Death Valley, and at scattered oases and canyons throughout the Mojave Desert.

No estimates of historical least Bell's vireo numbers were ever made, but workers in the early 19th century and even as late as the 1940's invariably described the subspecies as common to abundant and conspicuous (Cooper 1861, 1874, Anthony 1893 and 1895, Baird *et al.* 1874, Belding 1878, Fisher 1893, Grinnell and Swarth 1913, Grinnell and Storer 1924, Grinnell *et al.* 1930, Grinnell and Miller 1944). These historical accounts indicate that least Bell's vireos were present in considerable numbers wherever suitable habitat occurred.

In the decades following 1940, extensive habitat loss coupled with brood parasitism by the brown-headed cowbird decimated least Bell's vireo populations rangewide, and the decline has been well documented. In 1973, no least Bell's vireos were found during an intensive search in formerly occupied habitat between Red Bluff, Tehama County, and Stockton, San Joaquin County (Gaines 1974). By the early 1980's, the least Bell's vireo had been extirpated from the Sacramento and San Joaquin Valleys, once the center of its breeding range, and the species was restricted to two localities in the Salinas River Valley in Monterey and San Benito Counties (D. Roberson, pers. comm.), one locality along the Amargosa River (Inyo County), and numerous small populations in southern California south of the Tehachapi Mountains and in northwestern Baja California, Mexico (Gaines 1977, Goldwasser 1978, Goldwasser *et al.* 1980, Wilbur 1987, Unitt 1984). By the time the least Bell's vireo was federally listed in 1986, the statewide population was estimated at 300 pairs, with the majority concentrated in San Diego County (RECON 1989, Appendix A).

Breeding populations in northern Baja California apparently underwent similar declines during the same period. During a brief survey in 1980 of Baja California, Mexico, Wilbur (1981, 1987) found 40 pairs of least Bell's vireos distributed in six locations. Although he believed more birds were present than his incomplete survey found, Wilbur observed that habitat was limited and susceptible to many of the same development pressures present in the U.S. Least Bell's vireos were found more recently at five of the eight historical Mexican locations: San Fernando Mission, Valladores, Rancho San Jose (Meling Ranch), Las Cabras, and El Gato. In addition, one new breeding location, Erendira, was described. Subsequent visits to northern Baja California since the late 1980's have revealed that a least Bell's vireo population of 20 to 30 pairs continues to exist at Rancho San Jose (Kus, unpubl. data), and a large (as high as 75 pairs) concentration occurs along the Santo Tomas River (J. and J. Griffith; Kus, unpubl. data). Other sites supporting least Bell's vireo include Catavina, San Telmo Valley, and La Misión. Recent observations suggest that, unlike Wilbur's (1980a) earlier assessment, cowbird parasitism is currently a serious threat to least Bell's vireo breeding populations in Baja California.

Since the least Bell's vireo was federally listed in 1986 and intensive cowbird removal programs initiated, the species has undergone an increase almost as dramatic as its decline. While a few populations surviving the decline have generally stabilized in size (e.g., the Sweetwater, San Diego and Santa Ynez Rivers populations, Appendix A), most have undergone tremendous growth. For example, least Bell's vireos along the Santa Margarita River at Marine Corps Base Camp Pendleton (MCBCP) have increased in number from 15 males in 1980 (Salata 1980) to 523 males in 1996 (Griffith and Griffith 1997). Similar increases have occurred at the Prado Basin on the Santa Ana River, where the least Bell's vireo population grew from 12 males in 1985 (U.S. Fish and Wildlife Service 1986b) to 249 males in 1996 (Pike and Hays 1997) and at the Tijuana River, where the population expanded from 13 males in 1990 (Kus 1990c) to 142 males six years later (Kus 1996). A thorough rangewide survey has not been conducted since the 1986–1987 effort (RECON 1989), but available census data indicate that the least Bell's vireo population in southern California increased from an estimated 300 pairs in 1986 to an estimated 1346 pairs in 1996 (Appendix A).

In addition to population size increases, observations also indicate that least Bell's vireos are also expanding their range and recolonizing sites unoccupied for years or decades. Expansion is occurring both eastward in San Diego County as birds become reestablished in the more inland reaches of the coastal valleys and northward as birds disperse into Riverside and Ventura Counties. Observations of color-banded birds at these sites reveal that dispersal from the more southerly breeding populations is partially responsible for the recolonization (Greaves and Labinger 1997; L. Hays, U. S. Fish and Wildlife Service, pers. comm.; B. Kus, San Diego State University, unpubl. data). As populations continue to grow and least Bell's vireos disperse northward, it is anticipated they could reestablish in the central and northern portions of their historical breeding range.

E. Habitat Requirements

Least Bell's vireos are obligate riparian breeders, typically inhabiting structurally diverse woodlands along watercourses. They occur in a number of riparian habitat types, including cottonwood-willow woodlands/forests, oak woodlands, and mule fat scrub. Several investigators have attempted to identify the habitat requirements of the least Bell's vireo by comparing characteristics of occupied and unoccupied sites and have converged on two features that appear to be essential: (1) the presence of dense cover within 1–2 meters (3–6 feet) of the ground, where nests are typically placed and (2) a dense, stratified canopy for foraging (Goldwasser 1981, Gray and Greaves 1981, Salata 1981, 1983, RECON 1989). Although least Bell's vireos typically nest in willow-dominated areas, plant species composition does not appear to be as important a determinant of nesting site selection as habitat structure.

The selection of breeding sites by least Bell's vireos does not appear to be limited to riparian stands of a specific age, although least Bell's vireos are characterized as preferring early successional habitat. Again, vegetation structure more than simply age, appears to be the important determinant of site use. Early successional riparian habitat typically supports the dense shrub cover required for nesting and also a structurally diverse canopy for foraging. If permitted to persist, willows and other species form dense thickets in approximately 5–10 years and become suitable least Bell's vireo habitat (Goldwasser 1981, Kus in press). As stands mature, the tall canopy tends to shade out the shrub layer, making the sites less suitable for nesting. However, least Bell's vireos will continue to use such areas if patches of understory exist. In mature riparian habitat, the understory vegetation often consists of species such as California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversiloba*), California blackberry (*Rubus ursinus*), grape (*Vitis californica*), and a variety of perennials that provide concealment for least Bell's vireo nests. In addition, least Bell's vireo nest placement tends to occur in openings and along the riparian edge, where exposure to sunlight allows the development of shrubs.

Within suitable riparian habitat, no features have been identified that distinguish least Bell's vireo nest sites from the remainder of the territory (RECON 1989, Hendricks and Rieger 1989, Olsen and Gray 1989). No significant differences have been found between habitat at the nest site and the surrounding habitat with regard to stem density, percent cover, percent open ground, and plant height and density (Hendricks and Rieger 1989). Nest site characteristics are highly variable, and nest success appears to be unrelated to nest height, host species, and amount and arrangement of foliage cover in the vicinity of the nest.

Although least Bell's vireos are tied to riparian habitat for nesting, they have been observed extending their activities into adjacent upland habitats. The arid nature of the southern California landscape typically results in the close proximity of riparian and nonriparian habitats, such as coastal sage scrub. Least Bell's vireos along the edges of riparian corridors maintain territories that incorporate both habitat types. Kus and Miner (1989) found that least Bell's vireos along the Sweetwater River in San Diego County traveled 3–61 meters (9–183 feet) from the riparian edge to reach upland areas. Upland habitat was used primarily by foraging adults and adults foraging with fledglings; however, 35 percent of the pairs whose territories included nonriparian habitat placed at least one nest there. Kus and Miner (1989) speculated that upland vegetation, in particular laurel sumac (*Malosma laurina*) and elderberry (*Sambucus mexicana*), may have provided important supplemental food resources for birds in marginal habitat. Use of upland vegetation has also been observed early in the spring when floodwaters inundate adjacent riparian habitat (J. Wells, TWB Consultants, pers. comm.; P. Ashfield, U.S. Fish and Wildlife Service, pers. comm.; J. and J. Griffith, Griffiths Wildlife Biology, pers. comm.). Under such conditions, least Bell's vireos may nest exclusively in the nonriparian habitat.

Little is known about the least Bell's vireo's wintering habitat requirements. It is known that least Bell's vireos are not exclusively dependent on riparian habitat on the wintering grounds (Kus, unpubl. data). Although wintering least Bell's vireos do occur in willow-dominated riparian woodlands, a greater proportion of the population appears to occur in mesquite scrub vegetation within arroyos (Kus, unpubl. data). During winter, least Bell's vireos also occur in shrubby areas associated with palm groves and along hedgerows associated with agricultural fields and rural residential areas (Kus, unpubl. data). The winter habitat selection of least Bell's vireo in southern Baja California appears more similar to that of breeding Arizona Bell's vireos than to its own breeding-season habitat selection (Kus, unpubl. data).

F. Critical Habitat

Critical habitat was designated for the least Bell's vireo on February 2, 1994 (U.S. Fish and Wildlife Service 1994a). The Service designated critical habitat for the least Bell's vireo at 10 areas encompassing about 15,200 hectares (38,000 acres) in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties. About 49 percent of the least Bell's vireo population in the United States occurred within these 10 areas in 1994 (U.S. Fish and Wildlife Service 1994a).

The Endangered Species Act defines critical habitat as areas containing physical or biological factors "essential to the conservation of the species" and that "may require special management considerations or protection." The Department of the Interior regulations (50 CFR 424.12) describe these features as including areas important for population growth, food and water resources, shelter, breeding and recovery sites, and habitats that "are representative of the historic distribution of the species."

The features or elements of habitat that are essential to the conservation of the least Bell's vireo can be described as riparian woodland vegetation that generally contains both canopy and shrub layers and includes some associated upland habitats. General activities that could cause destruction or adverse modification of least Bell's vireo habitat include the following: (1) removal or destruction of riparian vegetation; (2) thinning of riparian growth, especially near ground level; (3) removal or destruction of adjacent upland habitats used for foraging; and (4) increases in human-associated or human-induced disturbances. Specific actions that could adversely affect least Bell's vireo critical habitat include stream channelization, water impoundment or extraction, water diversion, intensive recreation, and development.

Because of the continued acceleration of these types of activities in remaining least Bell's vireo habitat, limited areas are available for expansion of the current distribution of least Bell's vireos. Nevertheless, these critical habitat areas are expected to support the core populations from which the least Bell's vireo will expand its distribution, particularly to the north. The core populations will have to increase in size to allow population expansion adequate for least Bell's vireo recovery to occur. These critical habitat areas are also expected to perform as refugia during periods of potential population declines following random naturally occurring events.

Protection provided by the critical habitat designation. Critical habitat identifies those areas essential for recovery, including areas currently unoccupied by the listed species. The designation of critical habitat serves to focus conservation activities by identifying areas that contain essential habitat features and may require special management consideration. Critical habitat as addressed under section 7 of the Endangered Species Act applies to actions by Federal agencies only. The Endangered Species Act does not provide any additional protection to lands designated as critical habitat: designating critical habitat does not create a management plan for the identified areas or prescribe specific management actions (inside or outside of critical habitat), establish numerical population goals, or have a direct effect on areas not designated as critical habitat. Specific management recommendations for critical habitat are addressed in recovery plans and management plans, as well as in section 7 consultations.

G. Life History and Ecology

Breeding Biology. Least Bell's vireo breeding biology has been well studied, and the following information summarizes the findings of many investigators, including Barlow (1962). Least Bell's vireos arrive on the southern California breeding grounds in mid-March to early April, with males arriving in advance of females by several days. Observations of banded birds suggest that returning adult breeders may arrive earlier than first-year birds by a few weeks (Kus, unpubl. data). Least Bell's vireos are generally present on the breeding grounds until late September, although they may begin departing by late July (Garrett and Dunn 1981, Salata 1983, Pike and Hays 1992). Stragglers have been noted in October and November (McCaskie and Pugh 1965; McCaskie 1969; K. Miner, California State Parks; J. Newman, U.S. Fish and Wildlife Service, pers. comm.), and occasionally individuals overwinter in California (McCaskie and Banks 1964; McCaskie 1970; L. Hays, pers. comm.).

Males establish and defend territories through counter-singing, chasing, and sometimes physically confronting neighboring males. Territory size ranges from 0.5 to 7.5 acres. Some average territory sizes are shown in Table 1. Newman (1992) investigated the relationship between territory size, vegetation characteristics, and reproductive success for populations of least Bell's vireos at the San Diego and Sweetwater Rivers, but found no significant factors that could account for the variability in territory size observed at his sites.

Spatial differences in riparian habitat structure, patch size, and numerous other factors result in differences in the density of territories within and between drainages such that males have varying numbers of neighbors against whom their territory must be defended. Embree (1992) hypothesized that, because singing is the primary form of territorial advertisement and defense in least Bell's vireos and singing may attract predators to nest sites, least Bell's vireos in dense concentrations might experience lower reproductive success than those with few

Table 1. Average sizes (acres) of least Bell's vireo territories.

Site	1987	1988	1991	1992	1993	Source
Prado Basin (Santa Ana River)	1.9±0.9	1.6±0.9				Hays 1987, 1988
San Diego River	2.1±1.0	1.7±0.9				Kus 1989a
Sweetwater River		1.4±0.8				Kus 1989b
Tijuana River			2.5 ±1.2	2.7 ±1.4	1.8 ±0.8	Kus 1991e, 1992c, 1993d

neighbors. Counter to the subjective impression of field investigators, least Bell's vireos with many (7–13) neighbors did not sing at statistically higher rates than did those with few (1–4) neighbors. Moreover, Embree (1992) did not find significant differences between the singing rates of successful and unsuccessful males. Embree concluded that patch size and crowding did not influence least Bell's vireo reproductive success, at least not through the mechanisms of singing rates and attraction of predators.

Nest building commences a few days after pair formation. The consistency of nest locations of color-banded females supports the supposition that the female selects the nest site (Pitelka and Koestner 1942, Barlow 1962). Both members of the pair construct the nest, a process that usually takes four to five days. The nest is cup-shaped and constructed of leaves, bark, willow catkins, spider webs, and other material (Bent 1950). It is typically constructed in the fork of a tree or shrub branch within 1 meter (3 feet) of the ground. Nests are placed in a wide variety of plant species including willows (*Salix* spp.), mule fat (*Baccharis glutinosa*), California wild rose, poison oak, grape, elderberry (*Sambucus mexicana*), Fremont's cottonwood (*Populus fremontii*), California sycamore (*Platanus* *racemosa*), coast live oak (*Quercus agrifolia*), and several herbaceous species. The majority of nests are placed in willows and mule fat.

Egg-laying begins one to two days after nest completion. Typically three to four eggs are laid, occasionally two, and rarely five. Average clutch sizes of nonparasitized nests observed with complete clutches have ranged from 3.1 to 3.9 during recent years. Long-term average clutch sizes have been determined at the best-studied populations (Table 2). Both parents share in incubation, which takes approximately 14 days. Upon hatching, nestlings are fed by both parents for 10–12 days until fledging.

Adults continue to care for the young for at least two weeks after fledging when territorial boundaries may be relaxed as family groups range over larger areas. Fledglings generally remain in the territory or its vicinity for most of the season, although the behavior of fledglings produced early in the year has not been well studied.

Predation is a major cause of nest failure in areas where brown-headed cowbird nest parasitism is infrequent or has been reduced by cowbird trapping programs (see "Brood Parasitism" under "H. Reasons for Decline"). Most predation occurs during the egg stage. Predators likely include western scrub-jays (*Aphelocoma californica*), Cooper's hawks (*Accipiter cooperii*), gopher snakes (*Pituophis melanoleucus*) and other snake species, raccoons (*Procyon lotor*), opossums (*Didelphis virginiana*), coyotes (*Canis latrans*), long-tailed weasels, dusky-footed woodrats (*Neotoma fuscipes*), deer mice (*Peromyscus maniculatus*), rats (*Rattus* spp.), and domestic cats (*Felis domesticus*) (Franzreb 1989). Other sources of nest failure are human disturbance (trampling of nest or nest site; clearing of vegetation), ant infestations, rainstorms, and unknown factors.

Least Bell's vireo pairs may attempt as many as five nests in a breeding season (B. Kus, pers. comm.), although most fledge young from only one or two nests. The

Table 2. Average reproductive success and productivity of least Bell's vireo.

Site	Average clutch size (# eggs)	Hatch Rate [a] (%)	Fledge Rate [b] (%)	Nests Successful (%)	Fledglings per Nest (#)	Fledglings per Pair (#)	Fledglings per egg (#)
Tijuana River	3.5	83	86	73	2.4	2.8	0.71
Sweetwater River	3.6	70	75	61	1.8	2.5	0.55
	3.7	66	74	51	1.6	2.8	0.49
San Luis Rey River	3.4	53	71	41	1.1	1.8	0.37
West San Luis Rey River	–	75	87	74	1.9	2.6	0.65
Santa Margarita River	3.4	83	91	66	2.1	2.7	0.75
Santa Ana River	3.7	–	–	46	1.8	2.4	–
Santa Ynez River	–	75	79	60	1.9	3.2	0.59

[a] Percent of eggs that hatch.
[b] Percent of nestlings that fledge.

likelihood of renesting depends on the time of season, the pair's previous reproductive effort, the success of previous efforts, and other factors. Few nests are initiated after mid-July.

Reproductive success has been calculated using a variety of different measures. Annual rates of hatching success (the percentage of eggs laid that hatch) have ranged from 38 to 92 percent over the past several years at the major study populations; long-term averages for those sites range from 53 percent at the San Luis Rey River to 83 percent at the Santa Margarita River and Tijuana River (Table 2). Lower hatching rates are characteristic of sites with heavy parasitism and inadequate cowbird control and/or high rates of egg predation. Fledging success (the percentage of nestlings that fledge) is typically higher than hatching success, unless predation on nestlings is high. Annual rates of fledging success during recent years have ranged from 59 to 100 percent, with long-term averages for individual sites falling between 71 and 91 percent (Table 2).

Reproductive success can also be calculated using the nest as the unit of measure. The annual percentage of nests that fledge at least one vireo young has ranged from a low of 33 percent to a high of 89 percent; long-term averages for individual sites show a similarly high degree of variability, ranging from 41 to 74 percent (Table 2). Annual average numbers of young fledged per nest has ranged between 0.7 and 3.3, with long-term averages falling between 1.1 and 2.4 fledged young per nest.

Productivity is a measure of reproductive performance that represents the total production of offspring over all nesting attempts within a season, and is expressed on a per pair basis. The annual average number of fledglings produced per pair has ranged from 0.9 to 4.5, with long-term averages ranging between 1.8 and 3.2.

An even more encompassing measure of productivity is the number of fledglings produced per egg laid. This measure combines the effort of egg production with the probability of hatching and fledging young from those eggs and hence incorporates the number of nesting attempts made by pairs. Annual averages have ranged from 0.31 to 0.85 fledglings per egg at the various sites with long-term averages of 0.37 to 0.75 fledglings per egg, reflecting the differential intensity of pressures such as egg predation, nestling predation, cowbird parasitism, and other sources of nest failure at those sites.

Diet and Foraging Behavior. Bell's vireos are insectivorous, preying on a wide variety of insects, including bugs, beetles, grasshoppers, moths, and particularly caterpillars (Chapin 1925, Bent 1950). They obtain prey primarily by foliage gleaning (picking prey from leaf or bark substrates) and hovering (removing prey from vegetation surfaces while fluttering in the air). Salata (1983) noted foliage gleaning during 93 percent and hovering during 30 percent of his observations of 131 foraging least Bell's vireos. In a study of least Bell's vireo foraging ecology at the Sweetwater River, Miner (1989) observed that 50.4 percent of 413 prey attacks consisted of foliage gleaning and 38.7 percent were hovering. Both Salata (1983) and Miner (1989) observed least Bell's vireos occasionally capturing prey by hawking (pursuit and capture of flying prey). Miner (1989) noted a behavior she called "clinging", which she described as hovering but with the feet in contact with the vegetation.

Foraging occurs at all levels of the canopy, but appears to be concentrated in the lower to mid-strata, particularly when pairs have active nests (Grinnell and Miller, 1944, Goldwasser 1981, Gray and Greaves 1981, Salata 1983, Miner 1989). Salata (1983) found that 69 percent of 131 foraging observations were within 4 meters (12 feet) of the ground. Miner (1989) found a similar peak in foraging activity in vegetation 3–6 meters (9–18 feet) in height. Moreover, she determined that the distribution of least Bell's vireo foraging time across all heights was not simply a function of the availability of vegetation at those heights, but rather represented an actual preference for the 3–6 meter zone.

Foraging occurs most frequently in willows (Salata 1983, Miner 1989). Miner (1989) observed that black willow (*Salix gooddingii*) was used preferentially relative to its cover within least Bell's vireo territories. Arroyo willow (*Salix lasiolepis*) was used preferentially in the 0–3 meter (0–12 feet) height range, possibly reflecting a tendency to forage close to nest sites. No other preferences were noted; other plant species were used proportionately to their availability. Insect sampling revealed that potential least Bell's vireo prey abundances were highest on black willow, arroyo willow, and mule fat.

Least Bell's vireos forage not only on a number of different riparian species, but also on nonriparian plants, particularly later in the season (Gray and Greaves 1981; Salata 1983; Kus and Miner 1989; Miner 1989; T. Keeney, U.S. Navy, pers. comm.). Miner (1989) found that insect abundance on one frequently used nonriparian species, laurel sumac, was lower than that on willows and mule fat. However, the proportion of large prey on this species was greater than on any other plant she studied, suggesting a high return per foraging effort.

Life History, Demography, and Dispersal. The least Bell's vireo is a sub-tropical migrant, traveling some two thousand miles annually between breeding and wintering grounds. Preliminary results of studies of color-banded birds (see Appendix C for sources) indicate that least Bell's vireos have a life span ranging to 7 years. A large proportion of the population dies before reaching the age of 1 year, as is typical of small migratory passerines. Banded bird returns suggest that between 5 and 29 percent of least Bell's vireos survive to their first breeding season, a wide range brought about by probable year-to-year differences in survivorship as well as differences in the effort devoted to reconnaissance for banded birds between sites, years, and observers. Moreover, reconnaissance is for the most part limited to a few well-studied populations; therefore, dispersers to other areas go undetected and are not factored into estimates of first-year survivorship. It is probable that, like other migratory passerines of similar size, roughly 25 percent of juveniles survive to their first breeding season. Resightings of adults suggest that once birds reach the age of 1 year, they exhibit an average annual survivorship of approximately 47 percent (Salata 1983; Kus, unpubl. data).

The average female survivorship appears to be lower than the average documented for males (44 versus 49 percent, respectively [Kus, unpubl. data]), presumably because of the toll that egg production takes on longevity.
While most first-time breeders return to their natal sites to nest, an average of approximately 20 percent disperse to other drainages (Kus, unpubl. data). This figure may be even higher and will require more extensive rangewide surveys to determine. Birds show evidence of an ability to disperse long distances between drainages, moving as far as 130 miles from the natal site (J. Greaves, private consultant, pers. comm., regarding a disperser from the San Luis Rey River to the Santa Clara River in 1994). On average, a greater proportion of males (22 percent) than females (13 percent) disperse from their natal sites (Kus, unpubl. data).

The earliest studies of color-banded least Bell's vireos suggested that they were strongly site tenacious; once birds selected a breeding site, they returned to it year after year (Greaves 1989, Salata 1983). Not only do least Bell's vireos return to the same drainage, they return to the same territory and even the same nest tree or shrub, a remarkable feat considering the terrain covered during the course of migration. More recent data obtained at several additional breeding sites suggest that site tenacity in least Bell's vireos may not be as strong as previously believed. Many banded birds are seen for the first time as 2-year-olds and sometimes older, indicating that they have changed breeding locations during their first few years. The factors promoting a switch in breeding location are not known at this time. Habitat loss, lack of success in obtaining a mate, or even failure to return to the breeding grounds may be possible causes.

Preliminary data analysis of age-specific reproductive activity suggests that first-year females may lay smaller clutches and average fewer young fledged than older females (Kus, unpubl. data). Generating the sample sizes of banded birds necessary for this type of analysis would require long-term effort and could be used for refinement of the population growth models presented in this plan. Expansion of the least Bell's vireo's range at the local and regional scale appears to be dependent on the existence of relatively large core populations that are producing sufficient numbers of juveniles that exploit previously unoccupied areas of their natal drainages or adjacent drainages with suitable habitat. As populations in these areas increase, further expansion occurs. Such expansion can be characterized as a "stepping stone" pattern. These core populations also serve to repopulate adjacent areas where small populations have been extirpated. A core population and the adjacent small populations with which it interacts forms a "metapopulation." This metapopulation concept must be considered in the development of a recovery strategy for the least Bell's vireo.

H. Reasons for Decline

Grinnell and Miller (1944) considered the least Bell's vireo still "common, even locally abundant under favorable conditions of habitat". However, they noted that in the "last fifteen years a noticeable decline has occurred in parts of southern California and in the Sacramento-San Joaquin Valley." That decline continued for four more decades, the combined result of habitat loss and degradation and nest parasitism by the brown-headed cowbird (Garrett and Dunn 1981).

Habitat Loss and Degradation. As human populations increased in California, riparian woodlands were cleared, primarily for agricultural purposes. Rivers were diked to prevent winter flooding of bottomlands. Dams were built to impound water for agricultural, industrial, and domestic use. As a result, large amounts of least Bell's vireo breeding habitat were inundated or removed. Impounding water upstream and diverting water to canals and cropland lowered water tables downstream so that dense vegetation could not grow or was reduced. Flood control projects and channelization of rivers further reduced available least Bell's vireo habitat. Livestock grazing destroyed the choice lower strata of vegetation preferred by the least Bell's vireo (Overmire 1962) and provided foraging areas for brown-headed cowbirds. As the state's human population continues to increase, highway projects and urban, commercial, and recreational developments continue to encroach on what little riparian habitat remains. Similar activities are responsible for the decline of riparian habitat in Baja California (Short and Crossin 1967).

Riparian habitat loss in the Central Valley, estimated at 95 percent of that present during the Gold Rush of the 1850's (Smith 1977), has resulted in the loss of the least Bell's vireos from an area that at one time supported an estimated 60–80 percent of the statewide population based on potentially available habitat. Habitat loss and fragmentation continues to threaten the remaining least Bell's vireo populations in southern California and Baja California. Faber *et al.* (1989) reported a figure of 95–97 percent loss of naturally vegetated floodplains in southern California.

The widespread and precipitous decline of the species left small populations in scattered and widely separated remnants of riparian habitat. These conditions make least Bell's vireo populations particularly vulnerable to local and possibly rangewide extinction (Wilcox 1980). Small populations are susceptible to catastrophic extinction where the entire population could be adversely affected as a result of events such as flooding, as well as demographic failure when the population fails to produce any or enough offspring to survive into the future. Large interpopulation distances reduce the opportunity for dispersal and resultant genetic exchange among populations, thus heightening the risk of deleterious inbreeding (Soulé 1980, Conway 1980, Senner 1980). Lack of available habitat to serve as "refuges" during years when floods and other processes eliminate breeding sites poses a serious threat to the continued survival of the species.

In addition to outright destruction of habitat, riparian woodlands have been degraded in ways that reduce their suitability as least Bell's vireo nesting areas. Many riparian corridors are lined by roads and highways, which generate noise and pollutants and fragment habitats.

Habitat fragmentation results in four major consequences for ecosystems: (1) loss of area-sensitive species whose occurrence and successful reproduction are highly dependent on the size of the habitat patch in which they occur; (2) the larger species (e.g., bobcats) that move widely and occur at low densities are lost as they are more exposed to the dangers of associated with human environments; (3) fragmented and human-subsidized landscapes, providing artificial sources of food and shelter, become dominated by alien (e.g., European starlings) or already common species (e.g., skunks and racoons); (4) inbreeding depression (loss of genetic vigor) is a logical consequence of low densities and isolated populations (Harris and Gallagher 1989).

Habitat fragmentation and roadkills from highways and roads likely change predator-prey relationships in the ecosystems used by breeding least Bell's vireos. Larger predators, such as bobcats, may be lost from the ecosystem. The resulting changes in predator-prey relationships may include an increase in medium-sized predators, such as weasels, raccoons, possums, and foxes, which are nest predators.

Urbanization adjacent to habitat increases human presence in least Bell's vireo nesting sites, raising the potential for inadvertent destruction of nests and disturbance of breeding birds. Free-roaming and feral pets pose a risk of predation to nesting birds, as do increased densities of scrub-jays, racoons, and other predators typically associated with urban landscaping and development. Homeless people living in riparian areas threaten least Bell's vireos through clearing of vegetation for campsites, trampling of nest sites, and their continuous presence in the vicinity of least Bell's vireo territories. Many southern San Diego

County drainages receive enormous foot traffic by persons entering California across the U.S.-Mexico border and following rivers for the safety of their concealment afforded by riparian vegetation.

Loss or degradation of adjacent upland habitat reduces available foraging areas for least Bell's vireos and limits the upland/riparian ecotone (the overlapping of adjoining plant communities). This juxtaposition of different habitats provides increased biological function when compared with the same habitats occurring separately, which is likely important from an ecosystem perspective. Upland areas converted to livestock grazing and agriculture provide foraging areas for brown-headed cowbirds, a brood parasite of least Bell's vireos.

Brood Parasitism. Declines in the least Bell's vireo population brought about by extensive habitat loss and degradation have been exacerbated by parasitism by the brown-headed cowbird (cowbird) (Franzreb 1989, Goldwasser 1978, Goldwasser *et al.* 1980, Garrett and Dunn 1981, Mayfield 1977). Cowbirds are distinguished by their unusual reproductive strategy of laying their eggs in the nests of other species, leaving the "host" to raise the cowbird young, generally at the expense of the host's own young. Cowbirds have been documented using at least 130 avian species as hosts (Friedmann *et al.* 1977).

The least Bell's vireo is a common host (Hanna 1928, Dawson 1923, Rowley 1930, Grinnell and Miller 1944, Goldwasser *et al.* 1980, Salata 1981) and readily accepts cowbird eggs, although it is a relatively poor host and does not fledge many cowbirds (Friedmann 1963). The first reported cowbird eggs in least Bell's vireo nests were discovered in 1907 (Linton 1908). Soon it was difficult to find nests of this species that had not been parasitized (Dawson 1923, Hanna 1928, Rowley 1930). The immediate impact of cowbird parasitism was probably great because the least Bell's vireo population had not previously been exposed to nest parasitism and, therefore, had not evolved defenses as have other species with a long evolutionary history of co-occurrence with nest parasites. The tendency of male least Bell's vireos to sing from the nest no doubt enhances vulnerability to parasitism, although cowbirds evidently locate most nests by observing the pair during nest construction.

At the time of laying, female cowbirds may remove a host egg and replace it with their own, and/or may damage host eggs by pecking them, although it is not known whether this behavior is intentional or coincidental to attempts to remove the egg from the nest. Cowbird eggs hatch sooner than host eggs, and the newly hatched chick may eject host eggs or young from the nest. Cowbird chicks grow more quickly and achieve a larger size than host young, effectively outcompeting them for parental attention and feeding. Few if any host young are fledged from parasitized nests.

Cowbird parasitism reduces least Bell's vireo productivity in several ways, even when nest monitoring is employed to remove cowbird eggs and young from least Bell's vireo nests. Removal of least Bell's vireo eggs from the nest by laying brown-headed cowbird females reduces least Bell's vireo clutch size, limiting potential productivity even if the nest is eventually successful. Some parasitized nests are abandoned outright, reducing overall nest success. The shorter incubation period of cowbird eggs means that some least Bell's vireo eggs may not receive adequate incubation and fail to hatch. Damage to eggs caused by cowbird females and/or chicks also reduces the hatch rate.

Collectively, these factors can lower nesting success (the proportion of nests with eggs that fledge at least one least Bell's vireo young) in heavily parasitized areas where up to four cowbird eggs may be found in least Bell's vireo nests (Salata 1983; B. Jones, Sweetwater Environmental Consultants, pers. comm.). For example, nest monitoring to remove cowbird eggs or young resulted in a 140 percent increase in the number of successful nests at the San Luis Rey site (RECON 1989). Rates of cowbird parasitism at the Santa Margarita and Santa Ynez Rivers during the early 1980's were documented to be between 20 and 47 percent of nests (Salata 1981, 1983, Gray and Greaves 1981). Rates as high as 80 percent of nests were reported for the San Luis Rey, Sweetwater, San Diego, and Santa Ana Rivers in 1984 (Jones 1985, U.S. Fish and Wildlife Service 1986b).

Cowbirds are native to the eastern U.S. and, with the exception of a few winter or vagrant records, were absent from most least Bell's vireo habitat prior to 1900. Subsequent increases in animal husbandry and irrigated agriculture in the West provided new foraging habitat for cowbirds and triggered an increase in cowbird range and numbers that has been described as "remarkable, in fact unparalleled by any of our native birds" (Willett 1933). Cowbirds have not only expanded generally into the western U.S., they achieve particularly high concentrations near least Bell's vireo breeding sites as a result of land-use practices. Dairies, livestock grazing, equestrian centers, and golf courses, all tending to be sited in rural areas along rivers, provide foraging areas for cowbirds in the vicinity of least Bell's vireo breeding habitat.

In one study of black-capped vireos (*Vireo atricapillus*) in Texas, cowbirds were feeding with cattle in 100 percent of the observations; cowbirds were not found in areas without cattle. Cowbird nest parasitism of black-capped vireos went from 35 percent in 1996 to 0 percent in 1997 when cattle were removed from the study area (Cook *et al.* 1997).

The distance to agriculture was the strongest predictor among all variables (landscape or habitat) in a study in Montana and Idaho. This study found landscape factors play a dominant role in predicting the distribution of cowbirds (Young and Hutto 1997). An Idaho study found cowbirds were often associated with horse herds, as well as game animals where salt blocks caused them to congregate. No cowbirds were detected in undeveloped (natural) habitat more than 20 kilometers from horse or mule herds (Wright 1997).

In a Michigan study, the probability that a cowbird would occur at any given site was 3–3.5 times greater when agricultural lands were present within 3 kilometers (2 miles) of the study site. This study found that where agriculture was lacking cowbird occurrence was low, regardless of surrounding habitat characteristics (Stribley and Haufler 1997).

Cowbirds have been documented traveling at least 7 kilometers (4 miles) between foraging and breeding areas (Rothestein *et al.* 1984; E. Berryman, U.S. Fish and Wildlife Service, pers. comm. 1997). A study in New Mexico found cowbirds commuting at least 4 kilometers (2.5 miles) between foraging and breeding areas; female cowbirds were feeding nearly exclusively (more than 98 percent of the time) on grazed sites with livestock (Goguen and Mathews 1997).

I. Conservation Measures

Regulatory Protection

Endangered Species Act. On May 2, 1986, the least Bell's vireo was listed as endangered under the Act. Listing as a federally endangered species includes a prohibition against take and possession, prohibits Federal activities that are likely to jeopardize the continued existence of the species or adversely affect its critical habitat, authorizes land acquisition and other Federal preservation activities, and enables cooperative Federal-State programs for conservation and recovery of the species.

The Endangered Species Act requires the Fish and Wildlife Service to designate critical habitat, to the maximum extent prudent and determinable, concurrently with listing a species as endangered or threatened. Critical habitat was designated for the least Bell's vireo on February 2, 1994 (U.S. Fish and Wildlife Service 1994a) and is discussed previously under "F. Critical Habitat."

Section 9 prohibits the take of any species listed as endangered or threatened under provisions of section 4 of the Endangered Species Act, including the least Bell's vireo. The definition of "take" includes to harass, harm, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct.

"Harm", in the definition of "take", includes significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Sections 10(a)(1)(A) and 10(a)(1)(B) give the Fish and Wildlife Service the authority to issue permits to non-Federal and private entities for the take of least Bell's vireos, as long as such taking is incidental to, and not the purpose of, carrying out otherwise lawful activities.

Section 7(a)(2) requires all Federal agencies consult with the Fish and Wildlife Service on any action they authorize, fund, or carry out that may affect listed endangered or threatened species or critical habitat. Incidental take may also be permitted through the section 7 consultation process. Most take for least Bell's vireos is authorized through the section 7 process.

Section 4 of the Endangered Species Act requires the Department of the Interior and the Department of Commerce to develop and implement recovery plans for animal and plant species listed as endangered or threatened. In 1982, the Fish and Wildlife Service organized the Least Bell's Vireo Working Group, consisting of Federal, State, local government, and university representatives, as well as private individuals knowledgeable about the least Bell's vireo, to promote information exchange and interagency cooperation regarding conservation activities for the least Bell's vireo. While not a regulatory body, the Working Group was appointed to assist in development and implementation of recovery-oriented research and management plans. A draft recovery plan for the least Bell's vireo was prepared in 1988 but was never approved.

Habitat Conservation Plans. Most actions affecting least Bell's vireo habitat directly occur within waters of the U.S. and thus, require a permit from the U.S. Army Corps of Engineers under provisions of the Clean Water Act (discussed below). Activities and projects such as agriculture, dairy farming, flood damage reduction (including herbicidal spraying of riparian vegetation), groundwater pumping, sand and gravel mining, etc., occur with no obvious involvement of a

Federal agency. These actions should be performed in a manner consistent with the ecosystem (wetland and upland) needs of least Bell's vireos rangewide. Non-Federal (private and State) actions affecting least Bell's vireos may be subject to habitat conservation plan requirements of section 10(a)(1)(B) of the Endangered Species Act. Habitat conservation plans can and should effectively intermesh with the recovery goals of this recovery plan by conserving existing and restorable upland habitat, waters, and wetland habitat. Restorable habitat, such as in the Central Valley and along the Salinas River, should be conserved to allow reoccupation of former habitat by expanding least Bell's vireo populations.

Habitat conservation plans can address the problem of habitats that attract and support brown-headed cowbirds. The persistence of brown-headed cowbird foraging areas such as dairies, stables, and livestock grazing operations—and to a lesser extent, agriculture, turf parks and golf-courses, etc.—within 7 kilometers (4 miles) of existing and potential least Bell's vireo habitat reduces the capability of the species to recover and continues the need for cowbird control in perpetuity. Land use changes are needed to minimize the occurrence of cowbirds in riparian areas and allow least Bell's vireos the chance to be self-sustaining without cowbird trapping. Habitat conservation plans should address and, where possible, modify these land uses to reduce adverse effects of brown-headed cowbirds on least Bell's vireos. Draft habitat conservation plans for the least Bell's vireo were initiated on several drainages in San Diego County for the least Bell's vireo in the late 1980's but were later abandoned.

State Laws Protecting the Least Bell's Vireo. The least Bell's vireo is listed as an endangered species under the California Endangered Species Act of 1984. Similar to the Endangered Species Act, this legislation requires State agencies to consult with the California Department of Fish and Game (CDFG) on activities that may affect a State-listed species. The State law also requires State lead agencies as defined in the California Environmental Quality Act to consult with the California Department of Fish and Game regarding any project with potential impacts on State-listed species. Compensation is required by the California Department of Fish and Game for projects that result in least Bell's vireo habitat loss.

Section 2080 of the California Fish and Game Code (Code) prohibits the import, export, take, possession, purchase, or sale of any endangered, threatened, or candidate species listed by the California Fish and Game Commission. As defined in the Code, take means to hunt, pursue, catch, capture, or kill or attempt the same. Exceptions to the take prohibition are as stated in sections 2081 and 2835.

Section 2081 of the Code allows the California Department of Fish and Game to "authorize individuals, public agencies, universities, zoological gardens, and scientific or educational institutions to import, export or possess a listed species for scientific, educational or management purposes," under terms specified in Memoranda of Understanding between any of these groups, agencies, institutions, or individuals and the California Department of Fish and Game.

Clean Water Act Protection. Congress passed the Federal Water Pollution Control Act Amendments of 1972 and the Clean Water Act of 1977 to provide for the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's lakes, rivers, streams, and coastal waters. Section 404 of the Clean Water Act is the principal Federal program that regulates activities affecting the integrity of wetlands. Specifically, section 404 prohibits the discharge of dredged or fill material into jurisdictional waters of the United States, unless permitted by section 404(a) (individual permits), 404(e) (general permits), or unless the discharge is exempt from regulation as designated in 404(f).

In most circumstances, riparian habitat is considered to be in jurisdictional waters of the United States, and disturbance of riparian habitat would be regulated by the Army Corps of Engineers. Additionally, if the affected riparian habitat is occupied by least Bell's vireo, the Army Corps of Engineers would consult with the Fish and Wildlife Service, pursuant to section 7 of the Endangered Species Act.

Migratory Bird Treaty Act. The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 701–711) was implemented in 1918 between the governments of the U.S. and Great Britain (representing Canada) and subsequently Mexico in 1936, Japan in 1972, and in 1976 with the Union of Soviet Socialist Republics, which expanded the definition of migratory birds to include protection for virtually all birds found within the U. S., including the least Bell's vireo. The Migratory Bird Treaty Act establishes provisions regulating take, possession, transport, and import of migratory birds, including nests and eggs. This protection has been of limited importance because the species is not taken commercially or used for sport or food.

Other Regulatory Mechanisms. On July 9, 1986, a Memorandum of Understanding (MOU) was executed between the Fish and Wildlife Service and Marine Corps Base, Camp Pendleton for the purpose and objective of managing and perpetuating the least Bell's vireo on Camp Pendleton. On the basis of the special management considerations afforded the least Bell's vireo under this Memorandum of Understanding, the Fish and Wildlife Service determined that it was not necessary to designate critical habitat on the Base.

The Memorandum of Understanding specifically provides for removal of exotic plant species, annual cowbird trapping, research studies, annual least Bell's vireo censuses, and other management for the benefit of the species. The agreement does not remove the responsibilities of the Marine Corps Base, Camp Pendleton under the Endangered Species Act. The Base is required to consult on any and all activities that may affect the least Bell's vireo.

Conservation Efforts

Santa Clara River Enhancement and Management Plan. The Fish and Wildlife Service, the State Coastal Conservancy, and the counties of Ventura and Los Angeles are guiding the development of a long range conservation plan for the Santa Clara River, the largest unchannelized river in southern California. The plan emphasizes comprehensive planning to protect the substantial natural resources of the river and it will include high priority recovery actions for endangered species (least Bell's vireo and unarmored threespine stickleback) and prelisting recovery actions for numerous candidate species.

Brown-headed Cowbird Control. Probably the most effective management effort undertaken since the time of listing of the least Bell's vireo is cowbird control within least Bell's vireo breeding areas. Continuing cowbird removal programs have been funded by the California Department of Transportation, the Army Corps of Engineers, the International Boundary and Water Commission, the Marine Corps Base, Camp Pendleton, and the Fish and Wildlife Service. With the exception of the latter, most of the funding for cowbird control has been provided within the context of mitigation for projects adversely affecting least Bell's vireos.

Cowbird removal is accomplished through trapping birds in modified Australian crow traps. The traps have a slotted roof that allows birds to easily fly in, but flying out is difficult. These traps, which are large enough for a person to walk in and remove any trapped cowbirds, are baited with seed and live decoy birds and placed within and along the edges of riparian habitat. Traps are strategically placed in areas where cowbirds congregate for foraging, such as dairies and stables.

At Marine Corps Base, Camp Pendleton, the site of the longest continuously run cowbird removal program in the least Bell's vireo's range, nest parasitism dropped from a pretrapping rate of 47 percent of least Bell's vireo nests in the early 1980's to less than 1 percent by 1990 (Griffith and Griffith, in prep.). No cowbird parasitism of least Bell's vireo nests has been observed since 1990, although comprehensive nest monitoring ceased in 1992. As cowbird parasitism declined, least Bell's vireo productivity increased, resulting in the recruitment (increase in the numbers of birds) and expansion of the areas used by the least Bell's vireos observed at the Base since trapping was initiated. There are no cattle on the base, and only limited grazing of sheep and a very small number of bison are currently allowed. Cattle grazing occurs on the adjacent Fallbrook Naval Weapons Station.

Similarly dramatic reductions in the rate of nest parasitism coincidental with implementation of cowbird control programs, and associated increases in productivity, have been documented at the San Luis Rey River, San Diego River, Sweetwater River, and Santa Ana River. Modification and reduction of cowbird foraging areas near riparian zones, as noted above, will concomitantly reduce cowbird numbers (Stribley and Haufler 1997, Tewksbury *et al.* 1997, Young and Hutto 1997) and the need for cowbird trapping.

Monitoring and Research. In addition to cowbird removal, least Bell's vireo nest monitoring was one of the primary management actions called for by the Fish and Wildlife Service at the time of listing. Initially, the principal goal of the nest monitoring was to detect and remove cowbird eggs and/or young from least Bell's vireo nests, supplementing cowbird trapping and removal efforts. Nest monitoring has proven to be an effective backup to cowbird trapping, particularly in areas where trapping has been inadequate in scope and timing, and is useful in evaluating the effectiveness of trapping programs and providing guidance for their improvement. By itself, "rescue" of parasitized nests through removal of cowbird eggs has enhanced annual productivity by as much as 27 percent at the San Diego River (Kus 1992a) and as much as 44 percent at the San Luis Rey River (Kus 1991a,c, 1993b, 1995b).

In addition to its role in reducing nest parasitism, least Bell's vireo nest monitoring has provided an opportunity to collect long-term reproductive data. It has also facilitated color-banding of nestlings and adults for ongoing studies of demography, dispersal, and wintering site selection, which are summarized elsewhere in this plan.

Conservation-oriented research on least Bell's vireo breeding ecology has resulted in the completion of Master's theses describing foraging behavior (Miner 1989), the relationship between habitat patch size and reproductive success (Embree 1992), and the relationships of territory size, habitat quality, and reproductive success (Newman 1992). A fourth study investigated song type diversity and the function of song repertoires in least Bell's vireos (Beck 1996).

Habitat Creation and Restoration. Increasingly, habitat creation and restoration is being pursued as a means of mitigating the loss and degradation of riparian habitat. The majority of the restoration activity in southern California is driven by the requirement to mitigate losses of wetland habitat, which often support least Bell's vireos. Restoration may entail site preparation, including grading and soil amendment when necessary, and planting of either stem cuttings or nursery-grown container stock of a mix of native species selected to mimic the species composition of natural sites. The planted habitat is typically irrigated using overhead sprinklers or a drip system, weeded, and otherwise tended during the first few years of establishment. Other more experimental restoration attempts have used less intensive planting and irrigation efforts, but involved careful grading to restore/create proper hydrology for more passive restoration with an extensive exotics control component.

Considerable advances have occurred over the last ten years in the technical aspects of restoration site design and implementation (Baird 1989, Baird and Rieger 1989, Hendricks and Rieger 1989), and several restoration efforts in San Diego County have been successful both in producing riparian habitat with the structure of natural habitat and in attracting nesting least Bell's vireos (Kus, in press). In a long-term monitoring study of several sites in which restored habitat was quantitatively compared to natural reference habitat, Kus (in press) determined that the structural characteristics defining least Bell's vireo habitat can be achieved in 3–5 years with intensive effort, depending on site conditions and weather conditions, particularly the amount of winter rainfall and associated flooding. Vegetation development proceeds slowly during drought years, which are typical of the southern California climate, making it difficult to predict the time required to achieve certain structural conditions. Least Bell's vireos were observed using restored habitat within a year of planting, but this use was primarily foraging. Least Bell's vireos did not nest in restored habitat until it achieved certain structural conditions, including high cover in the nesting zone between the ground and 2 meters (6 feet) and a well-developed and stratified canopy where foraging is concentrated. Factors promoting the colonization of restoration sites included proximity to occupied natural habitat and adjacency of mature vegetation.

Despite these successes, many attempts at riparian restoration have failed, and there is a considerable need for increased scrutiny of mitigation/restoration plans, including increased monitoring of habitat restoration projects by regulatory agencies. Continued research is needed to develop techniques to improve site selection and site preparation, including grading. Planting techniques should be refined in terms of timing, stock, and subsequent care, including methods of irrigation and providing access to flooding. Other aspects of site maintenance, such as midterm protection from exotic plant invasion, vandalism, and control of pest outbreaks, should be addressed. Also needed is a comprehensive review of the "success" criteria used to evaluate restoration efforts, as well as of the methods used to generate data for such evaluations, particularly in projects where creation of least Bell's vireo nesting habitat is the goal.

Population Viability Analysis

Population viability analyses are important tools for attempting to quantify both the threats to a species and the consequences of conservation actions. Properly used, a population viability analysis incorporates what is known about a species' population dynamics into a model that will facilitate examination and testing of various hypotheses about the viability of small populations. This analysis can help identify critical factors for study, management, and monitoring. The result of the analysis is the determination of a theoretical population number, the minimum viable population; however, the process is instructive only and is not meant to provide an absolute answer. The strengths and weaknesses of population viability analyses have been reviewed (Lacy, in press; U.S. Fish and Wildlife Service 1997a).

When evaluating the results of a population viability analysis, the following should be considered (Lacy, in press):

> Natural systems are too complex for any existing model to accurately predict population dynamics, and our understanding of the extinction process is inadequate.
>
> Most models assume that population changes occur at discrete time steps, which does not accurately reflect all wild populations.
>
> The time span over which data has been collected may not be sufficient to estimate the amplitude of environmental fluctuations and its impact; even less data is available on the frequency and impacts of catastrophes, such as epidemic diseases and severe weather or other environmental phenomena (e.g., fires, drought, El Niño).

Population viability analysis is, by definition, the probability of persistence of a population over defined time frames; however, it may not accurately predict actual outcomes.

Population viability analysis is only as good as the parameter estimates and assumptions upon which it is built. Estimates of necessary parameters are usually incorporated into a population viability analysis; however small changes in these parameters can have profound changes in the estimated time to extinction.

Least Bell's Vireo Population Viability Analysis. Since the early 1980's data has been collected on least Bell's vireo distribution and breeding biology. The database includes information reported by a number of investigators working at least Bell's vireo breeding sites from the U.S.-Mexico border to Santa Barbara County and represents 68 "site-years" of data.

A population viability analysis was performed using data from eight populations (Tijuana, Sweetwater, San Diego, San Luis Rey, West San Luis Rey, and Santa Margarita Rivers in San Diego County; the Santa Ana River in Riverside County, and the Santa Ynez River in Santa Barbara County). These sites were selected for analysis because (1) they supported the few remaining least Bell's vireo populations in 1986 when the species was listed as endangered; (2) they have been monitored and managed annually from 5 to 15 consecutive years; and (3) long-term color-banding studies provided a substantial database. These attributes allow analysis of least Bell's vireo population dynamics, demography, and dispersal over a wide geographic area and a relatively long period of time.

Population data were entered into a statistical model, RAMAS/Space (Akcakaya and Ferson 1992), that simulates the future of the populations given theoretical or empirical values for variables specifying rates of population growth and migration. Questions regarding future population growth and risk of extinction can be addressed with this model. Definitions of terms and a discussion of the population viability analysis are provided in Appendix B.

The results of the computer simulations indicated the least Bell's vireo populations used in the analysis exceeded the minimum viable population size, commonly defined as a population with a less than a five percent probability of extinction over a 100-year period (Soulé 1987), and had a probability of zero of going extinct during the next century assuming the same population growth and dispersal rates. With the exception of one remote population (at the Santa Ynez River), each of the individual populations had an extinction probability of zero during the next 100 years because of the sizes and growth rates of each population, as well as their interconnectedness through dispersal.

The data used for the least Bell's vireo population viability analysis was relatively substantial compared to data available for analysis for many species, but the analysis still required the use of estimates and assumptions. For example, an annual reproductive rate of 2.6 young per pair was assumed, but annual average number of fledglings produced per pair has ranged from 0.9 to 4.5, with long-term averages ranging between 1.8 and 3.2.

The analysis also assumed continued intensive brown-headed cowbird control. It must be stressed that the least Bell's vireo population viability results assume intensive cowbird control, which is inconsistent with the recovery goals of self-sustaining populations. No evidence exists that least Bell's vireos are capable of sustaining their current rate of growth without widespread cowbird trapping. Under current conditions, without land use changes to minimize brown-headed cowbirds, when human intervention is removed it is likely that least Bell's vireo populations will return to the low numbers documented when the species was listed.

RAMAS models logistic growth: populations increase to the limit, or carrying capacity, of their environments and then persist at some equilibrium population size. However, prediction of these equilibrium sizes requires knowledge of the actual carrying capacity of each environment; information about the carrying capacities of least Bell's vireo habitats is not currently available.

Recovery of the least Bell's vireo extends beyond achieving a theoretical minimum viable population in each of the eight populations used in the population viability analysis. Recovery will require protection and management of 14 least Bell's vireo populations/metapopulations and restoration of least Bell's vireos to areas within the historical range. Protection and management actions must include the reduction and elimination of threats and assurances of long-term control of cowbirds, including assurances of modified land uses that contribute to cowbird foraging adjacent to least Bell's vireo breeding areas, and assurance of long-term control of exotic plants in riparian habitats. Completion of monitoring and research tasks will yield additional information regarding carrying capacity, dispersal patterns of birds away from their natal sites and the movements of adults, as well as other life history characteristics for use in refining the population viability analysis.

J. Conservation of Proposed and Candidate Species and Species of Concern

Least Bell's vireos occur with many sensitive species of amphibians, birds, fish, mammals, invertebrates, and plants (Table 3). Virtually all of these species are in peril as a result of the massive loss and degradation of the riparian habitat upon which they depend for survival. Declines in riparian songbirds, including many not listed in Table 3, have been exacerbated by cowbird parasitism. Although the number of sensitive species is, at first glance, intimidating when contemplating recovery of riparian fauna and flora, the fact that so many share the same threats suggests that management to reduce or eliminate those threats will benefit the entire suite of species and go far to restore ecosystem integrity. Cowbird control programs, for example, have already produced observable increases in southern California populations of yellow warblers (*Dendroica petechis*), yellow-breasted

Table 3. Sensitive species that may occur in Californian riparian habitats (California Department of Fish and Game 1996a, 1996b; U.S. Fish and Wildlife Service 1996).

Common Name	Scientific Name	Status [1]
AMPHIBIANS/REPTILES		
Arroyo toad	*Bufo microscaphus californicus*	FE, SC
California tiger salamander	*Ambystoma californiense*	C, SC
Mountain yellow-legged frog	*Rana mucosa*	SC
Yavapai (=lowland) leopard frog	*Rana yavapaiensis*	SC
Two-striped garter snake	*Thamnophis hammondii*	SC
Southwestern pond turtle	*Clemmys marmorata pallida*	SC
California red-legged frog	*Rana aurora draytonii*	FT, SC
BIRDS		
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE
Southwestern willow flycatcher	*Empidonax traillii extimus*	FE, SE
Peregrine falcon	*Falco peregrinus*	FE, SE
Bald eagle	*Haliaeetus leucocephalus*	FT, SE
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	SE
Bank swallow	*Riparia riparia*	ST
Black-crowned night heron	*Nycticorax nycticorax*	SC
Great egret (rookery)	*Casmerodius albus*	SC
Snowy egret (rookery)	*Egretta thula*	SC
Great blue heron (rookery)	*Ardea herodias*	SC
White-faced ibis	*Plegadis chihi*	SC
Black-shouldered kite	*Elanus caeruleus*	SC
Cooper's hawk	*Accipiter cooperii*	SC

Table 3. Sensitive species that may occur in Californian riparian habitats (California Department of Fish and Game 1996a, 1996b; U.S. Fish and Wildlife Service 1996).

Common Name	Scientific Name	Status [1]
Long-eared owl	*Asio otus*	SC
Yellow warbler	*Dendroica petechis brewsteri*	SC
Yellow-breasted chat	*Icteria virens*	SC
<u>FISH</u>		
Owens pupfish	*Cyprinodon radiosus*	FE
Owens tui chub	*Gila bicolor snyderi*	FE
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	FE, SE
Tidewater goby	*Eucyclogobius newberryi*	FE
Santa Ana sucker	*Catastomus santaanae*	SC
Southern steelhead	*Oncorhynchus mykiss*	FT & FE[2], SC
<u>INVERTEBRATES</u>		
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
<u>MAMMALS</u>		
Townsend's big-eared bat	*Plecotus townsendii townsendii*	SC
California leaf-nosed bat	*Macrotus californicus*	SC
Greater western mastiff bat	*Eumops perotis californicus*	SC
Occult little brown bat	*Myotis lucifugus occultus*	SC
Riparian brush rabbit	*Sylvilagus bachmani riparius*	SC

Table 3. Sensitive species that may occur in Californian riparian habitats (U.S. Fish and Wildlife Service 1996).

Common Name	Scientific Name	Status [1]
PLANTS		
Fish slough milk-vetch	*Astragalus lentiginosus* var. *piscinensis*	PE
Nevin's barberry	*Berberis nevinii*	PE
La Graciosa thistle	*Cirsium loncholepis*	C
Surf thistle	*Cirsium rhothophilum*	C
Southern spikeweed	*Hemizonia parryi* ssp. *australis*	1B
Smooth spikeweed	*Hemizonia parryi* ssp. *laevis*	1B
San Diego marsh elder	*Iva hayesiana*	2
Gambel's watercress	*Rorippa gambellii*	FE
Owens Valley checkerbloom	*Sidalcea covillei*	SE
Valley sagittaria	*Sagittaria sandfordii*	1B

[1] FE = federally endangered; FT = federally threatened; PE = federally proposed endangered; SE = State endangered; SC = California species of special concern; C = Federal candidate for listing (taxa for which the Fish and Wildlife Service has substantial information to support listing as threatened or endangered); 1A = California Native Plant Society (CNPS) List (plants presumed extinct in California); 1B = CNPS List (plants rare, threatened, or endangered in California and elsewhere); 2 = CNPS List (plants rare, threatened, or endangered in California but more common elsewhere).

[2] Species was listed by "Evolutionarily Significant Units" (ESU); two ESUs were listed as endangered (including Southern California) and three were listed as threatened (including Central California Coast and South-Central California Coast) (National Marine Fisheries Services 1997).

chats (*Icteria virens*), and southwestern willow flycatchers (*Empidonax trailli extimus*) in some areas. Modifications of land uses that create extensive foraging areas for cowbirds (e.g., minimization of available waste feed-seed and manure at dairies and livestock congregations) should benefit populations of riparian host-bird species in the long term.

K. Recovery Strategy

Recovery efforts will focus on addressing the two major causes of decline of the least Bell's vireo: (1) habitat loss and degradation and (2) brown-headed cowbird nest parasitism. Brown-headed cowbird removal programs, funded by several agencies and through mitigation for projects adversely affecting least Bell's vireos, have been the most effective short-term management effort since the species was listed as endangered. It is essential to continue, and expand where appropriate, brown-headed cowbird removal in least Bell's vireo habitat. Land uses that perpetuate cowbird foraging in the range of the least Bell's vireo should be modified for long-term benefits that reduce the need for human intervention. Establishing perpetual endowments to fund brown-headed cowbird removal, and possibly for exotic plant removal from riparian habitat, will be necessary if self-sustaining populations of least Bell's vireos are not possible without human intervention.

Nest monitoring programs will also be essential to determine levels of brown-headed cowbird parasitism and evaluate the effectiveness of brown-headed cowbird removal and management techniques. In addition to its role in reducing nest parasitism, least Bell's vireo nest monitoring will facilitate color-banding of nestlings and adults for ongoing studies of demography, dispersal, and wintering habitat selection.

The development of management plans for the 14 population/metapopulation units, and for any additional areas identified by completion of recovery tasks, will be supplemented with research on habitat needs and protection of habitat through conservation agreements, conservation easements, habitat conservation plans, and land acquisition. Protection and management of the 14 population/metapopulation units and stable or increasing populations are criteria for downlisting the least Bell's vireo to threatened status. Designation of each of the least Bell's vireo population/metapopulation units is based on drainages with available and restorable habitat within the present and historical ranges and will facilitate development of workable management plans. These population/metapopulation units are not the functional equivalents of recovery units as defined by current Service policy.

To ensure the recovery of the least Bell's vireo, a better understanding of the size, configuration, and location of habitat will be necessary. This information will be used to identify areas to be protected and managed for least Bell's vireos and will be useful in habitat restoration. This information will be particularly useful in identifying potential habitat to allow for recolonization within the historical range as least Bell's vireo populations recover; recolonization is one criterion for delisting least Bell's vireos. A statewide inventory of riparian habitat and rangewide surveys will identify additional and potential least Bell's vireo habitat within the species' historical range.

Although some natural expansion into suitable areas will occur in the least Bell's vireo's presently unoccupied historical range in southern California, it is unlikely that the species can return naturally to the Central Valley, which once supported the majority of the species' population and was the center of the breeding range (Franzreb 1989). The principal recovery strategy for restoring least Bell's vireos to historically occupied areas will focus on natural range expansion as habitat is restored and least Bell's vireo numbers increase under habitat management and restoration and threat management. However, because of the distances between current populations and the Central Valley, as well as the natural site tenacity of least Bell's vireos, reintroduction of the species using translocation of individuals may be necessary to reestablish populations of least Bell's vireos in the Central Valley.

Research tasks will address developing better restoration techniques and monitoring the results as habitat is restored. Research, with international cooperation with Mexico, will determine the extent of the wintering range and identify threats on the wintering grounds that, through their impact on annual survivorship, could threaten the breeding population.

The progress of recovery will be assessed through ongoing evaluations of the success of each of these recovery efforts. As additional information becomes available, management plans will be revised.

Descriptions of the 14 Population/Metapopulation Units

Tijuana River. The Tijuana River originates in the mountains of Baja California, with three-fourths of its watershed in Mexico. The total watershed is 448,323 hectares (1,107,806 acres). Seventy-eight percent of the watershed is behind three dams, two of which are in the U.S. The major portion of the watershed is behind Rodriquez Dam in Mexico. Much of the remaining riparian habitats are on lands managed by the San Diego County Parks Department.

In 1996, the Tijuana River drainage represented 7 percent of the least Bell's vireo pairs recorded in California (Appendix A). Critical habitat for the least Bell's vireo extends approximately 5 kilometers (3 miles) along the Tijuana River, west of Interstate 5 and extending east and west of Dairy Mart Road (Fish and Wildlife Service 1994).

Riparian communities in the Tijuana River are threatened by unauthorized clearing activities and placement of fill materials, off-road vehicle use, exotic species, and flood control projects and channelization. Considerable human foot and horse traffic traverses the riparian habitats of the Tijuana River, and equestrian corrals are common features within the surrounding floodplain and upland areas.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Navy, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, Bureau of Land Management, International Boundary and Water Commission, U.S. Department of Justice/Border Patrol, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, California Coastal Commission, County of San Diego, San Diego County Parks and Recreation Department, San Diego County Vector Control, San Diego Association of Governments, City of San Diego, City of San Ysidro, San Diego Gas and Electric, and Tijuana Valley Water Board.

Dulzura Creek/Jamul Creek/Otay River. The Otay River watershed originates in the coastal foothills near the community of Dulzura and extends west approximately 38 kilometers (24 miles) to San Diego Bay near the community of Palm City. Surface flow is controlled by two dams. Additional flow is added by an aqueduct, which transfers water from Cottonwood Creek (Tijuana River watershed) to Dalzura Creek.

In 1996, the Dulzura Creek/Jamul Creek/Otay River population of least Bell's vireos represented approximately 2 percent of the pairs recorded in California (Appendix A). Critical habitat for the least Bell's vireo has been designated on Jamul-Dulzura Creeks along the drainages approximately 5.5 kilometers (3.5 miles) upstream of the upper end of Lower Otay Reservoir.

Riparian communities in the Otay River watershed are threatened by sand and gravel mining, water supply projects, unauthorized clearing activities and placement of fill materials, exotic species, and flood control projects and channelization.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, Bureau of Land Management, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, California Coastal Commission, County of San Diego, San Diego Association of Governments, San Diego County Parks and Recreation Department, San Diego County Vector Control, City of Chula Vista, San Diego County Water Authority, Otay Water District, and San Diego Gas and Electric.

Sweetwater River. The Sweetwater River watershed extends for about 64 kilometers (40 miles) from the headwaters of the river in Cuyamaca Rancho State Park to San Diego Bay in Chula Vista. Surface flow is controlled by two dams. Within the lower Sweetwater River (downstream of the Cleveland National Forest), San Diego Association of Governments (1991a) identified 371 hectares (917 acres) of existing riparian habitat and 566 hectares (1398 acres) of nonriparian land potentially reclaimable to riparian habitat. The surrounding areas are described as intense urbanization in the lower sections of the river to rapidly urbanizing areas in the middle sections to rural residential and large-scale open spaces in the upper sections of the river.

In 1996, the Sweetwater River population of least Bell's vireos represented approximately 3 percent of the pairs recorded in southern California (Appendix A). Critical habitat for the least Bell's vireo extends from about 1.6 kilometers (1 mile) upstream of Highway 94 downstream to Sweetwater Reservoir.

Threats to the riparian community include agriculture, flood control, sand and gravel mining, recreation, residential/commercial/industrial development, transportation, wastewater treatment, and water supply projects (San Diego Association of Governments 1991b). Equestrian facilities are adjacent to much of the lower Sweetwater River.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, Bureau of Indian Affairs, Sycuan Indian Reservation, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, California Coastal Commission, County of San Diego, San Diego County Parks and Recreation Department, San Diego County Vector Control, San Diego Association of Governments, City of Chula Vista, City of National City, Sweetwater Authority, San Diego County Water Authority, Otay Water District, and San Diego Gas and Electric.

San Diego River. The San Diego River drains a watershed of approximately 1140 square kilometers (440 square miles). The watershed trends westward from the Laguna Mountains down to Mission Bay in San Diego, approximately 64 kilometers (40 miles) away. Five dams control surface flows in the watershed.

Downstream of the Cleveland National Forest and the upper end of El Capitan Reservoir, San Diego Association of Governments (1991b) identified 304 hectares (751 acres) of existing riparian habitat and 380 hectares (940 acres) of land with potential to support riparian habitat, if appropriately reclaimed. The surrounding areas are described as intense urbanization in the lower sections of the river to rapidly urbanizing areas in the middle sections to rural residential and large-scale open spaces in the upper sections (San Diego Association of Governments 1991b).

In 1996, the San Diego River population of least Bell's vireos represented approximately 3 percent of the pairs recorded in California (Appendix A). Critical habitat for the least Bell's vireo along the San Diego River near the City of Santee includes approximately 2.4 kilometers (1.5 miles) upstream and 5 kilometers downstream (3 miles) of the intersection of Big Rock Road and Mission Gorge Road.

Threats to the riparian community include agriculture, flood control, sand and gravel mining, recreation, residential/commercial/industrial development, transportation, wastewater treatment, and water supply projects (San Diego Association of Governments 1991b). Equestrian facilities are adjacent to portions of the San Diego River.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, Bureau of Land Management, Bureau of Indian Affairs, Capitan Grande Indian Reservation, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, California Coastal Commission, San Diego Association of Governments, County of San Diego, San Diego County Parks and Recreation Department, San Diego County Vector Control, City of San Diego, City of Santee, City of Lakeside, City of San Diego Parks and Recreation Department, Metropolitan Transit Development Board, City of San Diego Water Utilities District, Helix Water District, Padre Dam Municipal Water District, San Diego County Water Authority, and San Diego Gas and Electric.

San Luis Rey River. The San Luis Rey River drains a watershed of approximately 1440 square kilometers (556 square miles). The watershed trends westward from the Laguna Mountains down to the Pacific Ocean in Oceanside, approximately 80 kilometers (50 miles) away. One dam exists on the San Luis River at Lake Henshaw. Approximately 14 kilometers (9 miles) downstream of this dam, the Escondido Canal diverts runoff from the San Luis Rey River southwest to Lake Wolford. Under typical conditions, little or no surface flow passes this diversion point.

Eleven kilometers (7 miles) of the downstream end of the San Luis Rey River have been channelized with soft-bottom and concrete levees. West of Lake Henshaw, the San Luis Rey River flows through oak woodlands, chaparral, and coastal sage scrub canyons as it passes through three Indian reservations. The native plant communities have been (and continue to be) gradually replaced by citrus and avocado orchards, cattle and horse ranches, golf courses, and resort condominiums (Faber *et al.* 1989). Farther west and downstream, much of the natural San Luis Rey River floodplain has been turned into truck farms and wheat and barley fields, high- and medium-density residential areas, commercial zones, and industrial parks. Sand mining operations were frequent along the lower reaches of the river in the late 1980's (Faber *et al.* 1989), but most are now inactive. At least one dairy operation, row-crop agriculture, livestock grazing, and horse pasturage are active in the middle portion of the San Luis Rey watershed. However, the San Luis Rey River is considered to be one of the least modified and most easily restorable rivers in urbanized southern California, despite extensive conversion of floodplain riparian habitat to agricultural and other uses (U.S. Army Corps of Engineers 1981).

In 1996, the San Luis Rey River population of least Bell's vireos represented approximately 8 percent of the pairs recorded in California (Appendix A). Critical habitat for the least Bell's vireo extends along the San Luis Rey River from the community of Pala approximately 35 kilometers (22 miles) downstream to Interstate 5 near Oceanside.

Threats to the riparian community include agriculture, flood control, water supply projects, sand and gravel mining, recreation, residential/commercial/industrial development, transportation, wastewater treatment projects (San Diego Association of Governments 1990), and unauthorized placement of fill materials, clearing, and herbiciding activities.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, U.S. Marine Corps, U.S. Navy, Bureau of Land Management, Bureau of Indian Affairs, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, California Coastal Commission, San Diego Association of Governments, County of San Diego, San Diego County Parks and Recreation Department, San Diego County Vector Control, Pauma Indian Reservation, Rincon Indian Reservation, Pala Indian Reservation, La Jolla Indian Reservation, City of Oceanside, Pauma Mutual Water Company, Pauma Valley Community Services District, Rainbow Municipal Water District, San Diego County Water Authority, San Luis Rey Municipal Water District, Valley Center Municipal Water District, Escondido Municipal Water Company, Vista Irrigation District, and San Diego Gas and Electric.

Camp Pendleton/Santa Margarita River. The drainages on Camp Pendleton and Fallbrook Naval Weapons Station are varied and include the Santa Margarita River, Las Pulgas Creek, Fallbrook Creek, French Creek, Las Flores Creek, Pilgrim Creek, De Luz Creek, San Onofre Creek, San Mateo Creek, and others. These drainages have watersheds in Orange, Riverside, and San Diego Counties. Upstream of Camp Pendleton, the Santa Margarita River watershed includes Temecula Creek and Murrieta Creek, which drain from the Black Hills, Aqua Tibia Mountains, Santa Rosa Plateau, and Red Mountain through mostly private lands in Riverside County. Murrieta and Temecula Creeks join near Temecula and form the main stem of the Santa Margarita River, which is bounded within the Santa Rosa Plateau and Santa Rosa Mountains. The western extension of the river flows through Camp Pendleton to the Pacific Ocean at the Santa Margarita estuary (Lee *et al.* 1997). San Mateo Creek, San Onofre Creek, and Las Pulgas Creek watersheds are almost wholly within public ownership on Camp Pendleton and the Cleveland National Forest. The watershed for the Santa Margarita River (including Temecula Creek and Murrieta Creek) is 1927 square kilometers (744 square miles) with a total of 1930 stream kilometers (1200 stream miles) (Lee *et al.* 1997). The Santa Margarita River is the only major water course in southern California south of the Santa Clara River that does not suffer from impoundment or restriction by one or more dams.

Much of the middle and lower elevation watershed on the Santa Margarita River has been adversely affected by either development or agriculture, including farming and grazing (Lee *et al.* 1997). Subdivision of property, fire prevention, land clearing, water management, and urban development are increasingly important land- use trends on the Santa Margarita River (Lee *et al.* 1997). Much of Temecula Creek has been channelized near Temecula. Riparian ecosystems on Camp Pendleton/Fallbrook Naval Weapons Station are adversely affected by fire and fire prevention activities, military training activities, groundwater pumping and wastewater treatment, agriculture, and flood/sediment control projects (J. Avery, U.S. Fish and Wildlife Service, pers. obser.). Exotic species threaten riparian communities throughout the Santa Margarita watershed.

The least Bell's vireo breeding population on Camp Pendleton and Fallbrook Naval Weapons Station is the largest rangewide. In 1996, the Santa Margarita River population of least Bell's vireos represented approximately 34 percent of the pairs recorded in California, and the Camp Pendleton population of least Bell's vireos represented 56 percent of the pairs recorded in California (Appendix A). Critical habitat for the least Bell's vireo on the Santa Margarita River extends approximately 8 kilometers (5 miles) downstream from the Riverside/San Diego

County line to the Camp Pendleton boundary (Santa Margarita y Las Flores Rancho grant boundary). Critical habitat for the least Bell's vireo was not designated on Camp Pendleton under the terms of a Memorandum of Understanding between the U.S. Fish and Wildlife Service and U.S. Marine Corps (see "Other Regulatory Mechanisms" under "I. Conservation Measures").

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, U.S. Marine Corps, U.S. Navy, Bureau of Land Management, Bureau of Indian Affairs, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Parks and Recreation, San Diego Association of Governments, California State Lands Commission, San Diego Association of Governments, County of San Diego, Riverside County, Orange County, Cahuilla Indian Reservation, City of Oceanside, City of San Clemente, City of Temecula, City of Murrieta, Southern California Edison, San Diego County Water Authority, Rainbow Municipal Water District, and Fallbrook Utilities District.

Santa Ana River. The watershed for the Santa Ana River is 6346 square kilometers (2,450 square miles) and comprises the single largest river system in southern California. The headwaters are in the San Bernardino National Forest. Two dams ultimately control surface flow; Seven Oaks Dam is currently under construction, and the Prado Dam is 63 kilometers (39 miles) downstream. The Santa Ana River has been straightened and channelized from Weir Canyon Road near Yorba Linda to the mouth at the Pacific Ocean near the city of Newport Beach.

The Prado Basin proper is actually a reservoir located behind Prado Dam, which was constructed as a flood control measure in 1941. It is located about 70 kilometers (43 miles) east of Los Angeles and 8 kilometers (5 miles) north of the City of Corona in the northwesternmost corner of Riverside County, California. It is estimated that the Prado Basin encompasses some 4500 hectares (11,120 acres), which contains a maximum of 2400 hectares (5930 acres) having elements characteristic of wetland habitats (Zembal *et al.* 1985, Zembal 1986). The riparian woodland in Prado Basin is the largest in areal extent in southern California. Below Prado Dam only one large remnant of perennial stream riparian vegetation remains (Faber *et al.* 1989).

In 1996, the Santa Ana River population of least Bell's vireos represented approximately 15 percent of the pairs recorded in California (Appendix A). Critical habitat for the least Bell's vireo on the Santa Ana River extends from Rubidoux near Riverside downstream through Prado Basin. Much of the current habitat in the watershed for least Bell's vireo is found in Prado Basin.

Although willow woodlands and freshwater marshes and ponds comprise the majority of wetland habitats within the Prado Basin, a significant percentage of the woodland habitats are lacking or devoid of well-developed understories due to the expressed effects of plant community succession or the effects of prolonged inundation. In addition, large tracts of willow woodland habitat have been invaded (and therefore degraded or destroyed) by several nonnative plant species. Water conservation projects have substantially affected low elevation riparian communities within the Prado Basin; however, endowments and other mitigation measures have been established to ensure that revegetation and exotic plant control measures continue in perpetuity within the watershed.

Encroaching and potentially conflicting land uses within the Prado Basin include urban and suburban parks and developments, an airport, livestock grazing and dairy farming, agriculture, oil field operations, and industry. In addition, a large portion of the basin has been leased to hunting club operators and is used for waterfowl, pheasant, and dove hunting, shooting sports, sportsmen's fairs, and dog training.

Riparian communities on the Santa Ana River are threatened by water supply projects, exotic species, flood/sediment control and channelization projects, road projects, and sand and gravel mining. Riparian communities were once extensive along the Santa Ana River (Beattie and Beattie 1939). Because surface flows and ground water are currently heavily managed and diverted, much of the remaining riparian community remnants are now dependent upon wastewater flows and urban runoff.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, Bureau of Land Management, Federal Aeronautics Administration, State of California Department of Conservation Division of Oil, Gas, and Thermal Resources, California Regional Water Quality Control Board, California State Water Resources Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, Riverside County, County of Riverside Parks and Open Space District, Riverside County Flood Control, Orange County, San Bernardino Association of Governments, San Bernardino County, San Bernardino County Flood Control, City of Corona, City of San Bernardino, City of Riverside, City of Redlands, City of Norco, Southern California Edison, Orange County Water District, Western Riverside County Regional Wastewater Authority, Western Municipal Water District, Santa Ana Water Project Authority, Northwest Mosquito Abatement District, West Valley Vector Control District, and Chino Basin Municipal Water District.

Orange County/Los Angeles County. As a direct or indirect result of urbanization, all of the drainages in these two counties have, to varying degrees, been impounded, channelized, or otherwise adversely affected. Most recently, preparations for anticipated El Niño-driven storm events in 1997–1998 have resulted in the clearing of hundreds of acres of stream course vegetation in Los Angeles County and, to a lesser extent, in Orange County. However, patches of suitable, important vireo habitat remain throughout the lower and middle elevations of both counties. Notable among these patches are Arroyo Trabuco, Bonita Canyon/Creek, Canada Gobernadora, Carbon Canyon, Huntington Central Park, Laguna Reservoir, Mason Park/Sand Canyon Wash and Reservoir, Peters Canyon, Rattlesnake Reservoir, San Diego Creek, San Joaquin Marsh, Santa Ana River (task 1.117), and Santiago Creek/Villa Park Flood Control Basin in Orange County, and Big Tujunga Wash/Hansen Dam, Los Angeles River, Santa Fe Dam, San Francisquito, San Gabriel River drainage/Fish Canyon, Big Santa Anita Debris Basin, Santa Clara River drainage/Castaic Creek (task 1.119), Van Norman Dam, and Whittier Narrows in Los Angeles County.

Most or all of these habitat patches were almost certainly occupied historically by vireos (Coues 1903, Hoffman 1927, Grinnell and Miller 1944) prior to the precipitous decline of this once abundant species (Garrett and Dunn 1981). These habitat patches have been selectively and gradually reoccupied by vireos only recently, following sustained and relatively intensive management of the species within its current range. Vireos remain almost entirely absent from the large majority of comparatively expansive riparian habitats to the north within the historic range of the species, and over 95 percent of the entire vireo population is still confined to a small southern portion of the species' documented range despite the recent reoccupation of numerous (southerly) locales. Consequently, the closely spaced habitat patches in Orange and Los Angeles Counties are likely important "stepping stones" to the continuing (northward) expansion and full recovery of the species.

In 1996, the population of least Bell's vireos in Los Angeles and Orange Counties represented approximately 0.5 percent of the pairs recorded in California (Appendix A). Critical habitat includes a portion of the Santa Clara River in Los Angeles County (task 1.119).

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Department of Agriculture

Forest Service, U.S. Environmental Protection Agency, Bureau of Land Management, California Regional Water Quality Control Board, California State Water Resources Control Board, California Regional Water Quality Control Board, California Department of Transportation, California Department of Fish and Game, California State Lands Commission, California Coastal Commission, Los Angeles County, Los Angeles County Department of Public Works, Los Angeles Department of Water and Power, Los Angeles County Department of Health Services, County Sanitation Districts of Los Angeles County, Orange County, Orange County Water District, and Orange County Vector Control District.

Santa Clara River. The watershed of the Santa Clara River covers approximately 4,072 square kilometers (1,629 square miles) with headwaters in the Los Padres and Angeles National Forests. From headwaters in the San Gabriel Mountains, the main stem of the river flows approximately 135 kilometers (84 miles) to the Pacific Ocean. Flows on two principle tributaries of the river, Piru Creek and Castaic Creek, are controlled by dams that serve as both flood control and water supply reservoirs. Although there are no dams on the main stem of the Santa Clara, a large diversion structure on the main stem removes water for recharge of the aquifers underlying the Oxnard Plain. Approximately half of the main stem of the river is now constrained by engineered structures of various descriptions, primarily bank protection to prevent lateral migration of the river (Faber *et al.* 1989). Bank stabilization is particularly evident along the river in the rapidly urbanizing Santa Clarita area of Los Angeles County. The 23-million-liter-per-day (six million gallons) outfall from the Valencia Water Reclamation Plant augments surface flows along the river for several miles downstream of the Santa Clarita area.

Habitat for least Bell's vireos occurs in patches along much of the river, with location and quality varying from year to year as conditions in the river change following winter storm events. An exception is found in several areas along the river where, regardless of rainfall events, extensive riparian habitats persist due to rising groundwater.

In 1996, the Santa Clara River population of least Bell's vireos represented approximately 3 percent of the pairs recorded in southern California (Appendix A). Surveys conducted in 1997 located 60 pairs of least Bell's vireos along this stretch of the river (Jim Greaves, pers. comm. 1997). Critical habitat for the least Bell's vireo extends along Santa Clara River from approximately 2.4 kilometers (1.5 miles) east of its junction with Piru Creek and eastward to the intersection of Old Road and Rye Canyon Road.

The primary threats to native habitats within the river are associated with engineered solutions to flooding of both urbanized and agricultural land, pressure to provide opportunities to mine sand and gravel from the river, and the spread of invasive exotic vegetation, particularly giant reed grass (*Arundo donax*).

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Department of Agriculture Forest Service, U.S. Environmental Protection Agency, Bureau of Land Management, California Department of Conservation Division of Oil, Gas, and Thermal Resources, California Department of Fish and Game, California State Lands Commission, California Department of Transportation, California Regional Water Quality Control Board, Ventura County Flood Control District, Los Angeles County, Los Angeles County Department of Health Services, Los Angeles County Department of Water and Power, Los Angeles County Department of Public Works, California State Water Resources Control Board, United Water Conservation District, County Sanitation Districts of Los Angeles County, and the cities of Santa Clarita, Santa Paula, and Fillmore.

Santa Ynez River. The watershed of the Santa Ynez River covers approximately 1,676 square kilometers (647 square miles) with its headwaters located in the Los

Padres National Forest. From its headwaters, and alternating between narrow canyons and broad valleys, the main stem of the river flows west approximately 158 kilometers (98 miles) between the Santa Ynez and San Rafael Mountain ranges. There are three dams on the main stem of the river: Jamison Dam, Gibralter Dam, and Bradury Dam. The Santa Ynez River empties into the Lompoc coastal plain through the Narrows into the Pacific Ocean

In 1996, the Santa Ynez River population of least Bell's vireos represented approximately 1.5 percent of the pairs recorded in southern California (Appendix A). Surveys conducted in 1997 located an estimated 20 pairs of least Bell's vireos on the river (Jim Greaves, pers. comm. 1997). Habitat for the least Bell's vireo occurs in scattered patches along most of the river, with quality varying from year to year as conditions in the river change following winter storms. Critical habitat for the least Bell's vireo exists along the Santa Ynez River from below Jamison Dam west to a point approximately 1.6 kilometers (1 mile) east of Gibralter Dam. The primary threats to native habitats within the river drainage are associated with dam construction, channelization, water diversions, agricultural and urban development, and wetland draining.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Air Force, U.S. Department of Agriculture Forest Service, U.S. Environmental Protection Agency, Bureau of Land Management, Bureau of Reclamation, California Department of Transportation, California Department of Fish and Game, California Regional Water Quality Control Board, California State Water Resources Board, Santa Barbara County, Santa Barbara County Water Agency, California State Lands Commission, California Department of Water Resources, and the cities of Lompoc and Buelton.

Anza Borrego Desert. The Anza Borrego Desert region includes Coyote Creek, San Felipe Creek, Vallecito Creek, Bow Willow Creek, Carrizo Creek, San Felipe

Creek, Borrego Palm Canyon Wash, Carrizo Marsh, Sheep Canyon Wash, Sentenac Canyon Wash, Tamarisk Grove, Yaqui Well Wash, Aqua Caliente Creek, Windmill Creek, and others. This desert area is approximately 100 kilometers (60 miles) long north-south, and 40 kilometers (25 miles) wide east-west, mostly in eastern San Diego County. Riparian elements in this desert region are rare with considerable distances between sites.

In 1996, the Anza Borrego Desert population of least Bell's vireos represented 0.1 percent of the pairs recorded in California; however, the pairs were minimally surveyed for in this area in 1996 (Appendix A). The number of territorial males documented in the Anza Borrego Desert population, which is likely a better reflection of the current proportional occupation of this area, represented 4 percent of the territorial males recorded in California.

Critical habitat for the least Bell's vireo is designated in the Anza Borrego Desert on approximately 3 kilometers (1.9 miles) of Coyote Creek near the town of Borrego. The largest concentration of least Bell's vireos within this unit is found on private property (Vallecitos Creek). Threats to the riparian community include cattle grazing and equestrian facilities in adjacent areas, exotic species, off-road vehicles, and road projects.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture Forest Service, Bureau of Land Management, Bureau of Indian Affairs, California Regional Water Quality Control Board, Bureau of Land Management, California State Parks and Recreation, California Department of Transportation, California Department of Fish and Game, California State Lands Commission Riverside County, County of San Diego, Imperial County, Los Coyotes Indian Reservation, Santa Rosa Indian Reservation, San Diego and Arizona Eastern Railroad, and San Diego Gas and Electric.

Salinas River. The watershed of the Salinas River, with headwaters located in the coastal mountains of the Los Padres National Forest, drains approximately 11,396 square kilometers (4,400 square miles). From its headwaters the river flows in a northwesterly direction into the Salinas Lagoon and then into the Pacific Ocean at Monterey Bay. The major plant communities of the Salinas River include coniferous forest, oak and foothill (gray) pine woodlands, riparian scrub and woodlands, marshland, valley and foothill grasslands, chaparral, coastal scrub and coastal dunes. One thousand two hundred and ninety five square kilometers (500 square miles) of the watershed is the relatively flat Salinas River Valley. which is primarily agricultural land. Three major reservoirs regulate the flow of the Salinas River: the Nacimiento, San Antonio, and Santa Margarita Lakes.

Habitat for the least Bell's vireo occurs in scattered patches along most of the river; however, the best habitat exists in the upper Salinas Valley, specifically a 6-mile stretch from Bradley to Camp Roberts. The last record of a least Bell's vireo on the Salinas River was a singing male in July of 1993 (Roberson and Tenny 1993). The primary threats to native habitats within the river drainage are associated with dam construction, channelization, water diversions, agricultural development, and grazing.

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Forest Service, U.S. Environmental Protection Agency, California Department of Fish and Game, California State Water Resources Board, U.S. Bureau of Land Management, California State Lands Commission, Monterey County Water Resources Agency, U.S. Bureau of Reclamation, Monterey Peninsula Water Management District, Monterey County Parks Department, Northern Salinas Valley Mosquito Abatement District, California Regional Water Quality Control Board, Central Coast, King City, and City of Salinas.

San Joaquin Valley. The San Joaquin Valley watershed below the 152-meter (500-foot) contour encompasses approximately 3.4 million hectares (8.5 million acres) and extends about 415 kilometers (258 miles) north to south. The San Joaquin River basin is bounded on the west by the Coast Range, on the east by the Sierra Nevada, on the south by the Tehachapi Mountains, and in the north by the Sacramento/San Joaquin River Delta. The Tulare Lake basin to the south is often considered a separate drainage basin, but during wet years it has historically contributed occasional flood overflows and subsurface flows to the San Joaquin River. Numerous dams control surface flows in tributaries to the San Joaquin River, including the Merced, Tuolumne, Stanislaus, and Calaveras Rivers. Dams on the Kings, Kaweah, Kern and Tule Rivers control surface flows draining from the Sierras into the Tulare Lake basin. Agricultural activities and flood control projects are the primary threats to riparian habitats remaining within this basin.

Areas with potential least Bell's vireo habitat include the Kern River Preserve and Caswell Memorial State Park (Stanislaus River).

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture, U.S. Forest Service, Bureau of Reclamation, Bureau of Land Management, Bureau of Indian Affairs, National Marine Fisheries Service, Natural Resources Conservation Service, Federal Energy Regulatory Commission, California Department of Water Resources, The Resources Agency, California Regional Water Quality Control Board, California State Water Resources Board, California Department of Transportation, California Department of Fish and Game, California Fish and Game Commission, California State Lands Commission, State Board of Forestry, California State Parks and Recreation, and numerous cities, counties, mosquito abatement districts, and water districts.

Sacramento Valley. The Sacramento Valley watershed below Shasta Dam encompasses approximately 3.2 million hectares (8 million acres) and extends about 310 kilometers (193 miles) north to south. The Sacramento River basin is bounded on the west by the Coast Range, on the east by the Sierra Nevada, on the north by the Cascade Range, and on the south by the Sacramento/San Joaquin River Delta. Shasta Dam controls flows in the Sacramento River. A number of dams control surface flows in tributaries to the Sacramento River, including the American River, Feather River, Bear River, and Stony Creek. Agricultural activities and flood control projects are the primary threats to riparian habitats remaining within this basin.

Areas of potential least Bell's vireo habitat include Cosumnes River Preserve, Bobelaine Sanctuary (Feather River), Butte Sink, Big Chico Creek to the mouth of Pine Creek, and the Sacramento River (Hanson Island to Parrot Landing, River Miles 170–181; Merrill's Landing at River Miles 212–215; Woodson Bridge-Kopta Slough at River Miles 218–220).

Land use, water, regulatory, and associated agencies include: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Department of Agriculture, U.S. Forest Service, Bureau of Reclamation, Bureau of Land Management, Bureau of Indian Affairs, National Marine Fisheries Service, Natural Resources Conservation Service, Federal Energy Regulatory Commission, California Department of Water Resources, The Resources Agency, California Regional Water Quality Control Board, California State Water Resources Board, California Department of Transportation, California Department of Fish and Game, California Fish and Game Commission, California State Lands Commission, State Board of Forestry, California State Parks and Recreation, and numerous cities, counties, mosquito abatement districts, and water districts.

II. RECOVERY

A. Objective and Criteria

The objective of this recovery plan is to delist the least Bell's vireo when the five listing criteria no longer apply. Before delisting may occur, the Fish and Wildlife Service must determine that the following listing factors are no longer present or continue to adversely affect the least Bell's vireo: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) disease or predation; (3) the inadequacy of existing regulatory mechanisms; and (4) other natural or manmade factors affecting its continued existence (U.S. Fish and Wildlife Service 1985).

Downlisting Criterion:

Reclassification to threatened may be considered when criterion 1 has been met for a period of 5 consecutive years.

Criterion 1: Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, are protected and managed at the following sites: Tijuana River, Dulzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, San Luis Rey River, Camp Pendleton/Santa Margarita River, Santa Ana River, an Orange County/Los Angeles County metapopulation, Santa Clara River, Santa Ynez River, and an Anza Borrego Desert metapopulation.

Delisting Criteria:

Delisting may be considered when the species meets the criterion for downlisting and the following criteria have been met for 5 consecutive years.

Criterion 2: Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, have become established and are protected and managed at the following sites: Salinas River, a San Joaquin Valley metapopulation, and a Sacramento Valley metapopulation.

Criterion 3: Threats are reduced or eliminated so that least Bell's vireo populations/metapopulations listed above are capable of persisting without significant human intervention, or perpetual endowments are secured for cowbird trapping and exotic plant (*Arundo*) control in riparian habitat occupied by least Bell's vireos.

B. Narrative Outline for Recovery Actions

1. Protect and manage riparian and adjacent upland habitats within the least Bell's vireo's historical range.

Continued increases in least Bell's vireo populations and expansion throughout the historical range depend on the availability of suitable nesting habitat. Recent population trends indicate that overall habitat quality/function (predator/prey relationships, foraging and breeding areas, etc.), quantity, and management in southwestern United States portion of the least Bell's vireo's range have been sufficient to promote increases in the least Bell's vireo populations. As discussed in Part I ("D. Life History and Ecology"), expansion of the least Bell's vireo distribution has occurred in a "stepping stone" fashion (i.e., in response to increases in numbers in existing populations, least Bell's vireos expand their range by recolonizing sites that have been unoccupied for years or decades). Existing and restorable habitat within the least Bell's vireo's historic range should be protected. In order to continue progress towards recovery, not only must existing populations be protected and managed but the size, configuration, and location of habitat necessary to sustain new, self-perpetuating least Bell's vireo populations must be determined. These areas must be protected and managed through conservation agreements, habitat conservation plans, multiple species conservation plans, land acquisition and management, conservation easements, and interagency consultations under section 7 of the Endangered Species Act.

1.1 Develop management plans for the 14 population/metapopulation units.

Management plans must be developed and implemented for each of the 14 population/metapopulation units described under the downlisting and delisting criteria. These management plans are essential to the continued viability of the species once the protection afforded by the Endangered Species Act is removed. Moreover, they provide excellent opportunities for multiple species protection, which could preclude the need for Federal listing of other sensitive riparian species. At a minimum, the plans should detail management responsibilities and funding sources to provide for continuing habitat protection, including maintenance of hydrologic regimes necessary to sustain habitat, cowbird control, cowbird foraging area reduction, and control of invasive exotic vegetation. Future proposed projects and activities within the management areas should be designed and regulated in ways compatible with the goals of the management plans.

For each unit, develop a management plan that defines (1) the geographical limits of the habitat unit, (2) the jurisdiction(s) with land-use authority over the unit, (3) what constitutes a viable vireo population for the unit, (4) what is needed to achieve a viable vireo population for the unit, and (5) jurisdictional responsibilities and costs for achieving this objective.

1.111 Tijuana River

Major threats to be addressed include unauthorized clearing activities and placement of fill materials, off-road vehicle use, exotic species, and flood control projects and channelization. Considerable human foot and horse traffic traverses the riparian habitats of the Tijuana River, and equestrian corrals are common features within the surrounding floodplain and upland areas.

1.112 Dulzura Creek/Jamul Creek/Otay River

Major threats to be addressed include sand and gravel mining, water supply projects, unauthorized clearing activities and placement of fill materials, exotic species, and flood control projects and channelization.

1.113 Sweetwater River

Major threats to be addressed include agriculture, flood control, sand and gravel mining, recreation, residential/commercial/industrial development, transportation, wastewater treatment and water supply projects (San Diego Association of Governments 1991b) and equestrian facilities, adjacent to much of the lower Sweetwater River, and their attraction of brown-headed cowbirds.

1.114 San Diego River

Major threats to be addressed include agriculture, flood control, sand and gravel mining, recreation, residential/commercial/industrial development, transportation, wastewater treatment and water supply projects (San Diego Association of Governments 1991b), and equestrian facilities, which may attract brown-headed cowbirds, adjacent to the San Diego River.

1.115 San Luis Rey River

Major threats to be addressed include agriculture, flood control, water supply projects, sand and gravel mining, recreation, residential/commercial/industrial development, transportation, wastewater treatment projects (San Diego Association of Governments 1990), and unauthorized placement of fill materials, clearing, and herbiciding activities.

1.116 Camp Pendleton/Santa Margarita River

Major threats to be addressed include agriculture, fire and fire prevention, land clearing, channelization, water management, urban development, military training activities, groundwater pumping and wastewater treatment, flood/sediment control projects, and exotic species.

1.117 Santa Ana River.

Major threats to be addressed include encroachment and potentially conflicting land uses such as urban and suburban parks, developments, an airport, livestock grazing and dairy farming, agriculture, oil field operations, industry, channelization projects, road projects, sand and gravel mining, and impacts of wastewater flows and urban runoff to riparian communities.

1.118 Orange County/Los Angeles County

Major threats include impoundments, channelization, and removal of stream bank vegetation. Management planning should address the need to maintain the remaining patches of suitable, important least Bell's vireo habitat throughout the lower and middle elevations of both counties, and particulary, the closely spaced habitat patches that are likely important "stepping stones" to the continuing (northward) expansion and full recovery of the species.

1.119 Santa Clara River

Major threats to be addressed are associated with engineered solutions to flooding of both urbanized and agricultural land, pressure to provide opportunities to mine sand and gravel from the river, and the spread of invasive exotic vegetation, particularly giant reed grass (*Arundo donax*).

1.120 Santa Ynez River

Major threats to be addressed include dam construction, channelization, water diversions, agricultural and urban development, and wetland draining.

1.121 Anza Borrego Desert

Major threats to be addressed include cattle grazing and equestrian facilities in adjacent areas, exotic species, off-road vehicles, and road projects.

1.122 Salinas River

Major threats to be addressed include dam construction, channelization, water diversions, agricultural development, and grazing.

1.123 San Joaquin Valley

Major threats to be addressed include agricultural activities and flood control projects.

1.124 Sacramento Valley

Major threats to be addressed include agricultural activities and flood control projects.

1.2 Prepare management plans for least Bell's vireo habitats identified in Task 2.1.

As a result of a statewide inventory of riparian habitat (task 2.11) and statewide surveys (task 2.12) for least Bell's vireos, additional occupied or potential habitat may be found. Management plans should be developed and implemented for these areas to protect existing least Bell's vireos or to manage potential habitat (and adjacent land uses) that may be available for recolonization.

1.3 Establish a protocol for monitoring least Bell's vireo populations and habitat.

These data should provide estimates of population size and trends, demographic parameters, and habitat characteristics. Methods used should be standardized to ensure compatibility of data sets. Monitoring should be an intensive effort to obtain accurate information on population size, number of breeding pairs, nesting success and productivity, annual survivorship (of color-banded birds), dispersal (through resightings of color-banded birds), and rates of cowbird parasitism. Particular emphasis should be placed upon the detection and accurate identification of banded birds, as the linkage between least Bell's vireo populations produced by dispersal is one of the most important factors influencing metapopulation viability, and more data are needed to improve our estimates of this critical parameter. Standardized techniques for measuring vegetation and other habitat characteristics should be developed. Adjacent habitats and land uses should be described at each monitored site.

1.4 **Conduct annual monitoring of the 14 population/metapopulation units.**

Annual monitoring is needed to evaluate progress toward recovery and to identify any problems or threats that arise. Monitoring should follow the protocols established under Task 1.3.

1.411 **Tijuana River**
1.412 **Dulzura Creek/Jamul Creek/Otay River**
1.413 **Sweetwater River**
1.414 **San Diego River**
1.415 **San Luis Rey River**
1.416 **Camp Pendleton/Santa Margarita River**
1.417 **Santa Ana River**
1.418 **Orange County/Los Angeles County**
1.419 **Santa Clara River**
1.420 **Santa Ynez River**
1.421 **Anza Borrego Desert**
1.422 **Salinas River**
1.423 **San Joaquin Valley**
1.424 **Sacramento Valley**

1.5 **Continue cowbird removal.**

Nest parasitism by the brown-headed cowbird has been well-documented as a limiting factor on least Bell's vireo nesting success and productivity.

Extensive and continuous cowbird removal from the least Bell's vireo management areas during the last decade is probably the single most important factor reversing population declines and producing the recent population increases in the southwestern United States portion of the least Bell's vireo range. The recovery criteria outlined in this plan are derived from analysis of the performance of least Bell's vireo populations under a regime of cowbird removal; consequently, it will be necessary to continue such programs until it is determined that active cowbird removal is no longer necessary to maintain current levels of least Bell's vireo productivity, or long-term control measures are assured (task 1.8).

1.6 Develop alternative means of controlling cowbird parasitism.

Presently, cowbird control takes the form of trapping adults and juveniles and monitoring least Bell's vireo nests to remove any cowbird eggs or young. While nest monitoring is limited to least Bell's vireo nests, trapping reduces parasitism of other riparian birds, including the endangered southwestern willow flycatcher and several sensitive species, but also results in losses to nontarget native bird species caught incidentally in traps. The benefits of reducing cowbird numbers, along with the interest of land managers working with endangered species threatened by parasitism elsewhere such as the golden-cheeked warbler (*Dendroica chrysoparia*) and the black-capped vireo (U.S. Fish and Wildlife Service 1991, 1992), justify the need to develop cowbird control measures that are long term, less costly and time intensive, multispecies oriented, and cover a broader geographic area.

Modification of land uses adjacent to least Bell's vireo breeding areas is likely the only long-term method available to reduce cowbird numbers without cowbird removal and nest monitoring. Modification of land uses would involve avoiding or modifying types of land use (e.g., dairies, livestock pens, equestrian centers, and other cowbird feeding areas) within flood plains and adjacent lands that result in concentrations of cowbirds. Additionally, land use management practices (e.g., seasonal alteration of grazing regimes and feed-seed/manure management) can be used to discourage concentrations of cowbirds near riparian habitat during the breeding season. Unless land uses are modified to eliminate or greatly reduce cowbird numbers, trapping may be required in perpetuity.

1.7 **Control nonnative plant species.**

Availability and suitability of riparian habitat for nesting least Bell's vireos and other species is threatened by the invasion of nonnative (exotic) vegetation, including castor bean (*Ricinus communis*), cocklebur (*Xanthium strumarium*), tamarisk (*Tamarix* sp.), and giant reed (*Arundo donax*). *Arundo* is particularly threatening because of its rapid rate of growth and establishment, its ability to be dispersed widely throughout drainages during flooding, and its propensity to spread over large areas, especially following natural or artificial disturbances when it competes effectively against native vegetation. Literally miles of monotypic stands of *Arundo* exist on some southern California drainages, preventing reestablishment of native riparian habitat in those areas and promoting fragmentation of native vegetation stands. Eradication of *Arundo* and other exotic plants is essential to maintain the suitability of riparian habitat for least Bell's vireos, as well as to restore native habitat in areas now dominated by nonnative vegetation.

Current management of nonnative vegetation requires a considerable commitment to thoroughly removing or killing all above- and below-ground parts of the target species and follow-up in subsequent years to control any exotics outbreaks. Eradication of most exotic species currently requires a combination of mechanical and chemical control. Coordination throughout drainages is required to prevent situations where downstream eradication sites are repeatedly colonized by upstream sources of exotic plants.

The Bureau of Reclamation funded biological control research for *Tamarisk* spp., which resulted in the release of *Tamarisk*-specific chrysomelid beetles in the summer of 1997 (Dr. Bernd Blossey, Professor of Biology, Cornell University, pers. comm.). The use of this biocontrol method for *Tamarisk* in California should be implemented, and other methods of biocontrol for *Arundo* and other nonnative plant species should be developed (task 2.5).

1.8 Establish perpetual endowments for brown-headed cowbird control and/or exotic plant control in least Bell's vireo habitat.

Threats must be reduced or eliminated so that least Bell's vireo breeding populations are capable of persisting without significant human intervention. Perpetual endowments must be secured for brown-headed cowbird trapping and/or exotic plant control in riparian habitat occupied by the least Bell's vireo where persistence of least Bell's vireo populations require continuous management of these threats.

2. Conduct research.

2.1 Identify additional and potential least Bell's vireo breeding habitat within its historical range.

The goal of the this recovery plan is to ensure that the 14 least Bell's vireo populations/metapopulations are capable not only of self-perpetuation, but also of producing colonizers that will reestablish viable populations within the historical range. As least Bell's vireo populations recover under protection and management, their increased reproductive success, survivorship, and recruitment of new individuals will require expansion into historically occupied, but currently unoccupied habitat (i.e., the Central Valley). Management plans should be prepared and implemented for protection of areas identified under this task (task 1.2).

2.11 Conduct a statewide inventory of riparian habitat.

Despite wide interest in the current status of California's riparian habitat and its associated wildlife, to date no comprehensive statewide inventory of riparian habitat acreage and distribution has been conducted. Such an effort is needed for effective least Bell's vireo management. Accurate maps, acreages, and habitat type delineations (e.g., cottonwood-willow, mule fat scrub, alder riparian, oak riparian, etc.) would allow projections of the size and geometry of least Bell's vireo populations likely to be established as recovery proceeds. Adjacent land uses should also be examined. Such information would also help to evaluate the contribution of individual sites to the overall habitat base available to the least Bell's vireo. Entry of inventory data into a computer-based Geographic Information System (GIS) would permit retrieval of maps useful for surveys and monitoring. These data would be useful in analyzing the impacts of natural factors, which may vary spatially, and human activities on least Bell's vireo population viability.

2.12 Conduct thorough rangewide surveys.

In addition to annual monitoring of the population/metapopulation units, rangewide surveys of all potential least Bell's vireo habitat are necessary to assess population size and distribution, habitat availability and condition, and to document dispersal. A Fish and Wildlife Service biologist or their designee should assemble, train, and supervise a qualified team large enough to complete an intensive survey. The initial coordinator should identify and delineate survey areas and develop maps, directions, and survey materials for participants. Special effort should be devoted to resighting color-banded birds and obtaining accurate band combinations for contribution to the database on dispersal used in population viability analyses. Surveys should be conducted at least every five years and, preferably, every three years if funding is available.

2.2 Investigate the status of wintering habitat and identify current or potential threats.

A major factor contributing to population declines of neotropical migratory birds is loss of wintering habitat. Although least Bell's vireos are reported to winter throughout the Cape Region of Baja California, Mexico, investigators have had little success in locating specific wintering areas of color-banded least Bell's vireos that breed in California. Continued research is necessary to determine the actual location, extent, and function of the wintering range and to identify threats to birds on the wintering grounds that, through their impact on annual survivorship, could imperil the status of the breeding population.

2.21 Establish a cooperative agreement with Mexico to obtain information on vireo wintering grounds in Baja California, Mexico.

Such an agreement should be coordinated through the Fish and Wildlife Service's International Affairs Office and the Partners in Flight program.

2.3 Collect demographic data on least Bell's vireos.

2.31 Continue color-banding least Bell's vireos and collect data for demographic and dispersal analyses.

Color-banding of nestlings and adults, which has been essential to ongoing studies of demography, dispersal, and wintering site selection, must be continued to facilitate collection of data for additional analyses and to determine the effectiveness of management and recovery actions.

2.32 Determine the relationships between population density and reproductive characteristics.

Variation in demographic parameters as a function of population size is called density-dependent variation. As least Bell's vireos recover and approach the carrying capacity of their habitat, research is needed to determine whether any of their reproductive parameters (i.e., clutch size, hatching rate, fledging rate, predation and parasitism rates, and survival rates) change. Findings of such density-dependence would need to be incorporated into a population viability analysis to reflect its impact on population growth and persistence. Recovery criteria should be revised as necessary in light of any new data.

2.33 Determine the relationships between population density and dispersal.

Dispersal is another life history characteristic that may change as a function of population size, both natal (source) population and target population. As conditions in natal populations become more crowded, proportionately more birds may disperse to new areas. As target populations grow, they may become more attractive to dispersers than smaller populations. There are a number of scenarios possible, and each could produce a different effect on least Bell's vireo metapopulation dynamics. Research in this area will depend on continued intensive color-banding and resighting of color-banded least Bell's vireos.

2.4 Investigate the relationship between habitat characteristics and least Bell's vireo behaviors and access to necessary resources.

Least Bell's vireo habitat needs extend beyond defense of a territory, which can be readily measured in the field and used to quantify "occupied" habitat.

Many other least Bell's behaviors and access to necessary resources are influenced by habitat characteristics such as vegetation structure and species composition, size, age, adjacent land use, and proximity to other riparian habitat. Habitat characteristics can influence mate attraction, nesting and feeding of young, foraging, local post-breeding movements of juveniles, acquisition of territories by first-time breeders both within and outside of the natal drainage, and breeding site shifts prompted by natural disturbance processes. The relationships between these factors and the key components of least Bell's vireo population viability (productivity and dispersal) need to be better understood.

2.5 **Develop biocontrol methods for *Arundo* and other nonnative plant species.**

The development of biological control of *Arundo* and other nonnative plant species through U.S. Department of Agriculture, international, and university programs should be initiated. Biocontrol programs for some plant pest species have been developed, including the use of six insect species to control yellow-star thistle (*Centaurea* sp.), an exotic from southern Europe (Randall 1994); release of a *Tamarisk*-specific chrysomelid beetle in Texas (Dr. Bern Blossey, pers. comm.); and the release of European beetles in New York state for biological control of purple loosestrife (*Lythrum* sp.), an invasive exotic from Europe (U.S. Fish and Wildlife Service 1997). The International Institute of Biological Control headquartered in Switzerland has staff and facilities to perform the international research needed to perform the type of work needed for *Arundo* and other invasive species in the range of the least Bell's vireo (Dr. Bernd Blossey, pers. comm.). Biological control programs hold promise of long-term, self-sustaining, and very wide-range control of invasive plant species with relatively limited costs, but are not without the biological risks associated with releasing additional exotic species.

3. **<u>Develop and evaluate least Bell's vireo habitat restoration techniques</u>**.

Riparian habitat creation and restoration is becoming increasingly popular as a form of mitigation for the destruction or degradation of existing riparian habitat. Results are mixed as to whether suitable habitat is restored and subsequently occupied by nesting least Bell's vireos. While several San Diego County sites are promising examples of successfully colonized restored habitat, many other sites throughout southern California have failed. Long-term monitoring of restoration sites is essential. Existing habitat restoration techniques should be fully evaluated and new methods developed through cooperation between regulatory agencies and academic institutions.

3.1 <u>Implement long-term monitoring of restoration sites and their use by least Bell's vireos and other riparian species</u>.

Long-term monitoring of restoration sites and their use by least Bell's vireos and other riparian species is necessary to determine whether these sites can function as self-sufficient ecosystems and not simply human-tended native plant gardens. Monitoring of restoration sites established under mitigation agreements should be improved.

3.2 <u>Develop less costly methods of creating sites with the vegetation composition and structure required by nesting least Bell's vireos</u>.

Research is also needed on less costly methods of creating sites with the vegetation composition and structure required by nesting least Bell's vireos, such as the use of stem-cuttings rather than nursery stock. Research needs include finding ways to improve site selection and preparation, planting techniques (timing, stock, subsequent care, irrigation methods), and other aspects of site maintenance, such as protection from vandalism and controlling plant pests.

3.3 **Evaluate restoration efforts and effectiveness of methods used.**

Advances in restoration site design and implementation in the last 10 years have resulted in some successful restoration efforts. Riparian habitat with the structure of natural habitat and which attracts nesting least Bell's vireos has been produced. However, despite these successes, many attempts at habitat restoration have failed. The "success" criteria used to evaluate the effectiveness of past restoration efforts, as well as the methods used to generate the data for these evaluations, should be reviewed and revised.

3.4 **Conduct habitat restoration.**

Habitat restoration may be appropriate in areas of potential, or degraded, habitat identified as a result of the statewide inventory of riparian habitat (task 2.11) and rangewide surveys (task 2.12) for additional least Bell's vireos. As information is acquired through monitoring restored habitat and evaluating restoration efforts and techniques (tasks 3.1 and 3.3), and as restoration techniques are improved and costs reduced (task 3.2) habitat restoration should be conducted in such areas.

4. **Reintroduce least Bell's vireos to unoccupied habitat in the historical range through translocation.**

Translocation of least Bell's vireos may be necessary to reestablish populations in areas (i.e., Central Valley) that are too far from existing populations for natural reoccupation to occur. Evaluations of potential sites for reintroductions should include assessing habitat quality and suitability, assessing threats and determining methods of protecting and managing selected sites and reducing or eliminating threats, and assessing the likelihood of least Bell's vireo success in restored or managed areas. Habitat restoration should be completed before reintroductions are initiated, and all reintroduction sites should be protected and managed to maximize long-term survival of least Bell's vireos. A thorough evaluation of reintroduction techniques should include determining the best sources of individuals while considering genetics contributions of selected individuals to a new population. Least Bell vireo behaviors (e.g. song recognition, site fidelity) will also influence selection of individuals. Capture and release of juveniles may be the most feasible approach with the best chance of success. Any translocation efforts should involve public outreach.

5. **Evaluate progress of recovery, effectiveness of management and recovery actions, and revise management plans.**

This adaptive management approach ensures that the best available scientific information is used to guide recovery efforts. As more information becomes available through the completion of recovery tasks, recovery strategies and criteria should be reassessed. Management plans will be updated as management strategies are evaluated and research provides the basis for developing more effective management strategies.

6. **Provide public information and education.**

Public understanding, support, and involvement in the least Bell's vireo recovery efforts are critical to successfully reaching the delisting objective of the recovery plan. An effective public outreach program should be developed and implemented to inform and update local governments and interested members of local communities. An effective outreach program will be particularly essential should translocation of least Bell's vireos become necessary. Outreach activities could include producing brochures about least Bell's vireos, the value of riparian habitat and undeveloped floodplains, wetland functions and values, the effects of channelization, and providing information on the negative impacts of nonnative species. Other outreach activities could include posting signs in public use areas in least Bell's vireo habitat and making presentations to schools and clubs. Outreach activities will benefit the recovery effort and increase public awareness of the reasons for the endangered status of the least Bell's vireo and the value of particular recovery activities.

III. LITERATURE CITED

Akcakaya, H., and S. Ferson. 1992. RAMAS/space. Applied Biomathematics. Setauket, NY.

American Ornithologists' Union. 1957. Check-list of North American birds. Fifth edition. Port City Press, Inc., Baltimore, Md.

Anderson, M., and C. G. Wicklund. 1978. Clumping versus spacing out: experiments on nest predation on field fares (*Turdus pilaris*). Anim. Behav. 26:1207–1212.

Anthony, A. W. 1893. Birds of San Pedro Martir, Lower California. Zoe 4:228–247.

Anthony, A. W. 1895. Birds of San Fernando, lower California. Auk 12:134–143.

Baird, K. 1989. High-quality restoration of riparian ecosystems. Restoration and Management Notes 7:60–64.

Baird K., and J. Rieger. 1989. A restoration design for least Bell's vireo habitat in San Diego County. Pp. 462–467 *in* D.L. Abell, ed. California riparian systems conference: protection, management, and restoration for the 1990's ; 1988 September 22–24, Davis, CA. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA; USDA Forest Service Gen. Tech. Rep. PSW–110. 544 pp.

Baird, S. F., T. M. Brewer, and R. Ridgeway. 1874. A history of North American birds. Vol. 1. Little, Brown, and Co., Boston, Mass.

Barlow, J. C. 1962. Natural history of the Bell vireo, *Vireo bellii*. Audubon. Univ. Kansas Publ. Mus. Nat. Hist. 12:241–296.

Beattie, G.W., and Beattie, H.P. 1939. Heritage of the valley. San Pasqual Press, Pasadena, CA.

Belding, L. 1878. A partial list of the birds of central California. Proc. U. S. Nat. Mus. 1:388–449.

Beck, P. 1996. Song repertoire in the least Bell's vireo, *Vireo bellii pusillus*: relationships between repertoire size and breeding ecology. M.S. Thesis, San Diego State University.

Bent, A. C. 1950. Life histories of North American wagtails, shrikes, vireos, and their allies. U.S. Nat. Mus. Bull. 197.

Breininger, D. 1988. Survey for least Bell's vireo in riparian habitat on Vandenberg Air Force Base, Santa Barbara County, CA. NASA Technical Memorandum 100984.

Brussard, P. 1986. The perils of small populations II: genetic threats to persistence. Pp. 25–32 *in* B.Wilcox, P. Brussard, and B. Marcot, eds. The management of viable populations, theory, applications, and case studies. Center for Conservation Biology, Dept. of Biological Sci., Stanford University.

California Department of Fish and Game. 1996a. Endangered and threatened animals of California. Natural Heritage Division, Natural Diversity Data Base, Sacramento, California.

California Department of Fish and Game. 1996b. Endangered and threatened plants of California. Natural Heritage Division, Plant Conservation Program, Sacramento, California.

Chapin, E. A. 1925. Food habits of the vireos. U. S. Dept. Agr. Bull. 1355.

Collier, G. and B. L. Jones. 1989. Status and management of the least Bell's vireo at the Sweetwater River, San Diego County, California, 1986. Prepared for the State of California Department of Transportation, District 11.

Conway, W. G. 1980. An overview of captive propagation. Pp. 199–208 *in* M. E. Soulé, and B. A.Wilcox, eds. Conservation biology: an evolutionary-ecological perspective. Sinauer Assoc., Sunderland, Mass.

Cook, T.L., J.A. Koloszar, M.D. Goering. 1997. Pp. 2–3 *in* M.L. Morrison and L.S. Hall, co-chairs. Management implications of cowbird behavior and movement relative to the distribution of cattle. Research and management of the brown-headed cowbird in western and eastern landscapes, Partners in Flight program and abstracts, 23-25 October 1997.

Cooper, J. G. 1861. New California animals. Proc. Calif. Acad. Sci. 2:118–123.

Cooper, J. G. 1874. Animal life of the Cuyamaca Mountains. Am. Nat. 8:14–18.

Coues, E. 1866. List of the birds of Fort Whipple, Arizona, with which are incorporated all other species ascertained to inhabit the territory. Proceedings of the Academy of Natural Science of Philadelphia. 18. Pp. 76–77.

Coues, E. 1903. Key to North American birds. Fifth edition. The Page Co., Boston, MA. 1152 pp.

Dawson, W. L. 1923. Birds of California. South Moulton Co., San Diego, CA.

DuBois, A. D. 1940. Nesting habits and behavior of Bell's vireo. Audubon Bull. 35:1–8.

Embree, E. T. 1992. The relationship between population density, singing behavior, and reproductive success in the least Bell's vireo, *Vireo bellii pusillus*. Unpublished Master's thesis, San Diego State University.

Faber, P. A., E. Keller, A. Sands, and B. M. Massey. 1989. The ecology of riparian habitats of the southern California coastal region: a community profile. U.S. Fish and Wildl. Serv. Biol. Rep. 85(7.27). 152 pp.

Fisher, A. K. 1893. Report on the ornithology of the Death Valley Expedition of 1891. North Am. Fauna 7.

Franklin, I. R. 1980. Evolutionary change in small populations. Pp. 135–149 *in* M. E. Soulé and B.A. Wilcox, eds. Conservation biology: an evolutionary-ecological perspective,. Sinauer Assoc., Sunderland, Mass.

Frankel, O. R., and M. E. Soulé. 1981. Conservation and evolution. Cambridge Univ. Press, Cambridge, Mass.

Franzreb, K. E. 1989. Ecology and conservation of the endangered least Bell's vireo. U. S. Fish and Wildlife Service, Biol. Rep. 89(1). 17 pp.

Freel, M. 1984. Habitat management plan least Bell's vireo. U. S. Dept. Agr., Forest Service, Los Padres National Forest.

Friedmann, H. 1963. Host relations of the parasitic cowbirds. U. S. Nat. Mus. Bull. 233. 276 pp.

Friedmann, H., L. F. Kiff, and S. Rothstein. 1977. A further contribution to knowledge of the host relations of the parasitic cowbirds. Smithsonian Contrib. Zool. 235:1–75.

Fusaro, C. 1995. Public trust and the river, a discussion of Santa Ynez River natural resources. 38 pp.

Gaines, D. 1974. A new look at the nesting riparian avifauna of the Sacramento Valley, California. Western Birds 5:61–79.

Gaines, D. 1977. The status of selected riparian forest birds in California. Unpubl. report. to Calif. Dept. Fish and Game. Sacramento, CA.

Garrett, K., and J. Dunn. 1981. The birds of southern California: status and distribution. Los Angeles Audubon Society. 408 pp.

Gochfeld, M. 1978. Begging by nestling shiny cowbirds: adaptive and maladaptive. Living Bird 17:41–50.

Goguen, C.B., and N.E. Mathews. 1997. Cowbird parasitism and behavior in grazed and ungrazed landscape in New Mexico. P. 6 *in* M.L. Morrison and L.S. Hall, co-chairs. Research and management of the brown-headed cowbird in western and eastern landscapes. Partners in Flight program and abstracts, October 23–25, 1997.

Goldwasser, S. 1978. Distribution, reproductive success and impact of nest parasitism by brown-headed cowbirds on least Bell's vireos. State of Calif., The Resources Agency, Calif. Dept. of Fish and Game. Fed. Aid. Wildl. Rest. W-54-R-10, Nongame Wildl. Prog. Job W 1.5.1, Final Rept.

Goldwasser, S. 1981. Habitat requirements of the least Bell's vireo. Calif. Dept. of Fish and Game Final Report., Job IV–38.1.

Goldwasser, S., D. Gaines, and S. Wilbur. 1980. The least Bell's vireo in California: a de facto endangered race. Am. Birds 34:742–745.

Gray, M. V., and J. Greaves. 1981. The riparian forest as habitat for the least Bell's vireo (*Vireo bellii pusillus*). Paper presented at the California Riparian Systems Conference, Univ. of Calif., Davis; September 1981.

Gray, M. V., and J. Greaves. 1984. The riparian forest as habitat for the least Bell's vireo. Pp. 605–611 *in* R. Warner and K. Hendrix, eds. California riparian systems: ecology, conservation and productive management. Univ. Calif. Press, Davis, CA.

Greaves, J. 1989. Maintaining site integrity for breeding least Bell's vireos. Pp. 293–298 *in* D.L. Abell, ed. California riparian systems conference: protection, management, and restoration for the 1990's ; 1988 September 22–24, Davis, CA. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA; USDA Forest Service Gen. Tech. Rep. PSW–110. 544 pp.

Greaves, J. 1991. Least Bell's vireo monitoring and brown-headed cowbird control in the Gibraltar Reservoir area, Santa Barbara County, California, during 1991. Prepared for U. S. Forest Service, U. S. Fish and Wildlife Service, and California Dept. of Fish and Game.

Greaves, J. 1992. Bell's vireo and cowbird management in Gibraltar Reservoir area 1992. Prepared for Los Padres National Forest, U.S. Forest Service, California Dept. of Fish and Game, and U. S. Fish and Wildlife Service.

Greaves, J. 1993. Bell's vireo and cowbird management Gibraltar Reservoir area 1993. Prepared for U.S. Forest Service, California Dept. of Fish and Game, and U. S. Fish and Wildlife Service.

Greaves, J. 1994. Bell's vireo and cowbird management Gibraltar Reservoir area 1994. Prepared for Los Padres National Forest, U. S. Forest Service.

Greaves, J. and Z. Labinger. 1997 [in prep]. Site tenacity and dispersal of least Bell's vireos. *In* Proceedings of The Wildlife Society Conference, Western Section, February 5-8, 1997.

Griffith, J. T., and J. C. Griffith. 1988. 1988 Anza Borrego Desert State Park least Bell's vireo recovery project, brown-headed cowbird trapping program. Anza Borrego Desert State Park least Bell's vireo recovery project, brown-headed cowbird trapping program. Prepared for the California Department of Parks and Recreation.

Griffith, J. T., and J. C. Griffith. 1989. Report on the 1989 Anza Borrego Desert State Park least Bell's vireo recovery project, brown-headed cowbird trapping program. Prepared for the California Department of Parks and Recreation.

Griffith, J. T., and J. C. Griffith. 1990a. The status of the least Bell's vireo on Marine Corps Base, Camp Pendleton, California in 1989. Prepared for U. S. Marine Corps, Natural Resources Office, Camp Pendleton, CA.

Griffith, J. T., and J. C. Griffith. 1990b. The status of the least Bell's vireo on Marine Corps Base, Camp Pendleton, California in 1990. Prepared for U. S. Marine Corps, Environmental and Natural Resources Office, Camp Pendleton, CA.

Griffith, J. T., and J. C. Griffith. 1991. The status of the least Bell's vireo on Marine Corps Base, Camp Pendleton, California in 1991. Prepared for U. S. Marine Corps, Environmental and Natural Resources Office, Camp Pendleton, CA.

Griffith, J. T., and J. C. Griffith. 1995. 1994 Western San Luis Rey River least Bell's vireo monitoring and banding program. Prepared for the Corps of Engineers, Los Angeles District, and Michael Brandman Associates.

Griffith, J. T. and J. C. Griffth (in prep.). Cowbird parasitism and the endangered least Bell's vireo: a management success story.

Griffith, J. T., and J. C. Griffith. 1997. Letter/report dated April 16, 1997, to the Fish and Wildlife Service regarding submittal of 1996 reports and report on 1997 activities.

Grinnell, J., J. Dixon, and J. M. Lindsdale. 1930. Vertebrate natural history of a section of northern California through Lassen Peak. Univ. Calif. Publ. Zool. 35:1–584.

Grinnell, J., and A. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna No. 27. Contribution from the Museum of Zoology of the University of California, Berkeley. Reprinted by Artemisia Press, Lee Vining, CA, 1986. 617 pp.

Grinnell, J., and T. Storer. 1924. Animal life in the Yosemite. Univ. Calif press, Berkeley, CA.

Grinnell, J., and H. S. Swarth. 1913. An account of the birds and mammals of the San Jacinto area of southern California. Univ. Calif. Publ. Zool. 10:197–406.

Hamilton, T. 1962. Species relationships and adaptations for sympatry in the avian genus *Vireo*. Condor 64:40–68.

Hanna, W. C. 1928. Notes on the dwarf cowbird in southern California. Condor 30:161–162.

Harris, L.D., and P.B. Gallager. 1989. Pp. 11–34 *in* Preserving communities and corridors. New initiatives for wildlife conservation: the need for movement corridors. Defenders of Wildlife, Washington D.C.

Hays, L. 1986. The status and management of the least Bell's vireo within the Prado Basin, California, during 1986. Unpubl. report. California State University, Long Beach Foundation, Long Beach, CA.

Hays, L. 1987. The status and management of the least Bell's vireo within the Prado Basin, California, during 1987. Prepared for the California Department of Transportation, District 6.

Hays, L. 1988. Final Report: the status and management of least Bell's vireo within the Prado Basin, California, during 1988. Prepared for the California Department of Transportation, District 8.

Hays, L. 1989. The status and management of the least Bell's vireo in the Prado Basin during 1989. Prepared for the Orange County Water District.

Hays, L. and K. Corey. 1991. The status and management of the least Bell's vireo within the Prado Basin, California, 1986–1990. Prepared for the Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Hendricks, B. J., and J. P. Rieger. 1989. Description of nesting habitat for the least Bell's vireo in San Diego County. Pp. 285–292 *in* D.L. Abell, ed. California riparian systems conference: protection, management, and restoration for the 1990's ; 1988 September 22–24, Davis, CA. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA; USDA Forest Service Gen. Tech. Rep. PSW–110. 544 pp.

Hoffman, R. 1927. Birds of the Pacific states. Houghton Mifflin, Boston, MA. 353 pp.

Holland, R. F. 1986. Preliminary descriptions of the terrestrial natural communities of California. California Dept. of Fish and Game.

Howell, S.N.G., and S. Webb. 1995. A guide to the birds of Mexico and Northern Central America. Oxford Univ. Press, Oxford.

Jones, B. 1985. A report on the status of the least Bell's vireo on the San Diego, Sweetwater, and San Luis Rey Rivers, San Diego County, California. Unpubl. Rept.

Jones, B. 1989a. Status of the least Bell's vireo on Marine Corps Base, Camp Pendleton, San Diego County, California in 1988. Sweetwater Environmental Biologists. Spring Valley, CA.

Jones, B. 1989b. A report on the cowbird removal program for 1989 on the Sweetwater, San Diego, and San Luis Rey Rivers, and Santa Ysabel and Dulzura Creeks, San Diego County, California. Unpubl. report for California Department of Fish and Game.

Jones, B. 1990. A report on the 1990 least Bell's vireo status survey and brown-headed cowbird removal program for Anza Borrego Desert State Park. Prepared for the California Department of Parks and Recreation.

Jorgensen, P. 1994. Least Bell's vireo survey and cowbird trapping report, Anza Borrego Desert, 1994, Borrego Springs, CA. Prepared for California State Parks, Colorado Desert District.

Kus, B. E. 1989a. Status and management of the least Bell's vireo at the San Diego River, San Diego County, California, 1987–88. Prepared for the U.S. Fish and Wildlife Service, Portland, OR.

Kus, B. E. 1989b. Status and management of the least Bell's vireo at the Sweetwater River, San Diego County, California, 1988. Prepared for the U.S. Fish and Wildlife Service, Portland, OR.

Kus, B. E. 1989c. Status and management of the least Bell's vireo at the San Luis Rey River, San Diego County, California, 1988. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1989d. Status of the least Bell's vireo at the San Luis Rey River, San Diego County, California, 1989. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1989e. Status of the least Bell's vireo at the West San Luis Rey River, San Diego County, California, 1989. Prepared for the Army Corps of Engineers, Los Angeles District.

Kus, B. E. 1990a. Status of the least Bell's vireo at the Sweetwater and San Diego Rivers, San Diego County, California, 1989. Prepared for the U.S. Fish and Wildlife Service, Portland, OR.

Kus, B. E. 1990b. Least Bell's vireo studies at the Sweetwater, San Luis Rey, San Diego and Tijuana Rivers, San Diego County, California, 1990. Prepared for the U.S. Fish and Wildlife Service, Portland, OR.

Kus, B. E. 1990c. Status of the least Bell's vireo at the Tijuana River, San Diego County, 1990. Prepared for the Army Corps of Engineers, Los Angeles District.

Kus, B. E. 1991a. Distribution and breeding status of the least Bell's vireo at the San Luis Rey River, San Diego County, California, 1990. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1991b. Status of the least Bell's vireo at the West San Luis Rey River, San Diego County, California, 1990. Prepared for the Army Corps of Engineers, Los Angeles District.

Kus, B. E. 1991c. Distribution and breeding status of the least Bell's vireo at the San Luis Rey River, San Diego County, California, 1991. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1991d. Status of the least Bell's vireo at the West San Luis Rey River, San Diego County, California, 1991. Prepared for the Army Corps of Engineers, Los Angeles District.

Kus, B. E. 1991e. Habitat use and breeding status of the least Bell's vireo at the Tijuana River, California, 1991. Prepared for the International Boundary and Water Commission.

Kus, B. E. 1992a. Distribution and breeding status of the least Bell's vireo at the San Diego River, San Diego County, California, 1990–1991. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1992b. Least Bell's vireo studies at the Sweetwater, San Luis Rey and San Diego Rivers, San Diego County, California, 1991. Prepared for the U.S. Fish and Wildlife Service, Portland, OR.

Kus, B. E. 1992c. Breeding status of the least Bell's vireo at the Tijuana River, California, 1992. Prepared for the International Boundary and Water Commission.

Kus, B. E. 1992d. Monitoring study of least Bell's vireos in Goat Canyon and Smuggler's Gulch, 1992. Prepared for the International Boundary and Water Commission.

Kus, B. E. 1992e. Status of the least Bell's vireo at the West San Luis Rey River, San Diego County, California, 1992. Prepared for the Army Corps of Engineers, Los Angeles District.

Kus, B.E. 1993a. Least Bell's vireo studies at the Sweetwater River, San Diego County, 1992–1993. Prepared for the U.S. Fish and Wildlife Service, Portland, OR.

Kus, B. E. 1993b. Distribution and breeding status of the least Bell's vireo at the San Luis Rey River, San Diego County, California, 1992–1993. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1993c. Breeding activities of the least Bell's vireo at the West San Luis Rey River, San Diego County, California, 1993. Prepared for the Army Corps of Engineers, Los Angeles District.

Kus, B. E. 1993d. Breeding status of the least Bell's vireo in the Tijuana River Valley, California, 1993. Prepared for the International Boundary and Water Commission.

Kus, B. E. 1994a. Distribution and breeding activity of the least Bell's vireo at the San Diego River, 1992–1993. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1994b. Breeding status of the least Bell's vireo in the Tijuana River Valley, California, 1994. Prepared for the International Boundary and Water Commission.

Kus, B. E. 1995a. Distribution and breeding activity of the least Bell's vireo at the San Diego River, 1994. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1995b. Distribution and breeding status of the least Bell's vireo at the San Luis Rey River, San Diego County, California, 1994. Prepared for the California Department of Transportation, District 11.

Kus, B. E. 1996. Breeding status of the least Bell's vireo in the Tijuana River Valley, California, 1996. Prepared for the International Boundary and Water Commission.

Kus, B. E., and G. Collier. 1988. The status and management of the least Bell's vireo at the Sweetwater River, San Diego County, California, 1987. Prepared for the California Department of Transportation, District 11.

Kus, B. E., and K. L. Miner. 1989. The use of non-riparian habitats by least Bell's vireos (*Vireo bellii pusillus*). Pp. 299-303 D.L. Abell, ed. California riparian systems conference: protection, management, and restoration for the 1990's ; 1988 September 22–24, Davis, CA. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA; USDA Forest Service Gen. Tech. Rep. PSW–110. 544 pp.

Kus, B. E. (in press). Use of restored riparian habitat by the endangered least Bell's vireo.

Lacy, R.C. In press. Putting population viability analysis to work in endangered species recovery and small population management. *In* Conserving species dependent on older forests: a population viability workshop. Parks Canada, Fundy National Park, Alma, New Brunswick.

Lane, J. 1976. A birder's guide to southern California. Land Press. Denver, Co.

Lande, R., and G. Barrowclaugh. 1987. Effective population size and its use in population management. Pp. 87–123 *in* M. E. Soulé, ed. Viable populations for conservation. Cambridge Univ. Press, Cambridge.

Lee, L.C., M.C. Rains, J.A. Mason, W.J. Kleindl. 1997. Guidebook to hydrogeomorphic functional assessment of riverine waters/wetlands in the Santa Margarita watershed. Seattle, WA. 298 pp.

Linton, C. B. 1908. Notes from Buena Vista Lake, May 20 to June 16, 1907. Condor 10:196–198.

Lowther, P. E., and R. F. Johnston. 1977. Influences of habitat on cowbird host selection. Kansas Ornithol. Soc. Bull. 28:36–40.

Mayfield, H. F. 1977. Brown-headed cowbird: agent of extermination? American Birds 31:107–113.

McCaskie, G. 1969. Southern Pacific Coast region. Audubon Field Notes 23:106–112.

McCaskie, G. 1970. Southern Pacific Coast region. Audubon Field Notes 24:537–541.

McCaskie, G., and R. Banks. 1964. Occurrence and migration of certain birds in southwestern California. Auk 81:353–361.

McCaskie, G., and E. Pugh. 1965. Southern Pacific Coast region. Audubon Field Notes 19:76–82.

Miner, K. L. 1989. Foraging ecology of the least Bell's vireo, *Vireo bellii pusillus*. Unpublished Master's thesis, San Diego State University.

Mumford, R. 1952. Bell' s vireo in Indiana. Wilson Bull. 64:224–233.

National Marine Fisheries Services. 1997. Endangered and threatened species: listing of several evolutionary significant units (ESUs) of West Coast steelhead. Final Rule. Federal Register 62:43937–43954.

Newman, J. 1992. Relationships between territory size, habitat structure and reproductive success in the least Bell's vireo, *Vireo bellii pusillus*. Unpublished Master's thesis, San Diego State University.

Nice, M. 1929. The fortunes of a pair of Bell vireos. Condor 31:13–18.

Nice, M. 1957. Nesting success in altricial birds. Auk 74:305–321.

Nolan, V., Jr. 1960. Breeding behavior of the Bell vireo in southern Indiana. Condor 62:225–244.

Oberbauer, T.A. 1990. Areas of vegetation communities in San Diego County. Unpubl. rep. County of San Diego, Department of Planning and Land Use, San Diego, California. Cited in Noss, R.F., LaRoe, E.T. III, and Scott, J. M. 1995. Endangered Ecosystems of the United States: A Preliminary Assessment of Loss and Degradation. U.S. Department of Interior. National Biological Service. Washington, D.C.

Olsen, T. E. and M. V. Gray. 1989. Characteristics of least Bell's vireo nest sites along the Santa Ynez River. Pp. 278–284 *in* D.L. Abell, ed. California riparian systems conference: protection, management, and restoration for the 1990's ; 1988 September 22–24, Davis, CA. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA; USDA Forest Service Gen. Tech. Rep. PSW–110. 544 pp.

Overmire, T. G. 1962. Nesting of the Bell vireo in Oklahoma. Condor 64:75.

Peterson, R.T. 1961. A field guide to the western birds. Houghton Mifflin Co., Boston, MA. 309 pp.

Pike, J. 1994. The status and management of the least Bell's vireo within the Prado Basin, California, 1986–1994. Prepared for The Nature Conservancy and Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., and L. Hays. 1992a. Final Report: the status and management of the least Bell's vireo within the Prado Basin, California, 1986–1991. Prepared for the Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., and L. Hays. 1992b. The status and management of the least Bell's vireo within the Prado Basin, California, 1986–1992. Prepared for The Nature Conservancy and Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., and L. Hays. 1993. Status and management of the least Bell's vireo within the Prado Basin, California, 1986–1993. Prepared for The Nature Conservancy and Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., and L. Hays. 1994. The status and management of the least Bell's vireo within the Prado Basin, California, 1986–1994. Unpublished report. California State University, Long Beach Foundation, and U.S. Fish and Wildlife Service.

Pike, J., and L. Hays. 1997. The status and management of the least Bell's vireo and southwestern willow flycatcher within the Prado Basin, California, 1986–1996. Unpublished report. U.S. Fish and Wildlife Service.

Pitelka, F., and E. Koestner. 1942. Breeding behavior of Bell's vireo in Illinois. Wilson Bull. 54:97–106.

Pluff, K. 1991. A report on the 1991 season of the least Bell's vireo recovery project and cowbird trapping program at Anza Borrego Desert State Park. Prepared for U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pluff, K. 1992. A report on the 1992 season of the least Bell's vireo recovery project at Anza Borrego Desert State Park, San Diego County, CA. Prepared for U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pluff, K. 1993. A report on the 1993 season of the least Bell's vireo recovery project at Anza Borrego Desert State Park, San Diego County, CA. Prepared for U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Randall, J.W. 1994. Other invasive non-native plants in California wildlands and natural areas. Pp. 61–67 *in* Arundo donax workshop proceedings, Friday, November 19, 1993. Team Arundo and California Exotic Pest Plant Council.

RECON (Regional Environmental Consultants). 1989. Comprehensive species management plan for the least Bell's vireo (*Vireo bellii pusillus*). Prepared for San Diego Association of Governments, San Diego.

Roberson, D. and C. Tenny. 1993. Atlas of the Breeding Birds of Monterey County California. Monterey Peninsula Audubon Society. 438 pp.

Rothstein, S.I, J. Verner, and E. Stevens. 1984. Radio-tracking confirms a unique diurnal pattern of spatial occurrence in the parasitic brown-headed cowbird. Ecology 65(1):77–88.

Rowley, J. S. 1930. Observations on the dwarf cowbird. Condor 32:130–131.

Salata, L. 1980. Status and distribution of the least Bell's vireo, Camp Pendleton Marine Corps Base, 1980. Unpubl. Rept., U. S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA.

Salata, L. 1981. Least Bell's vireo research, Camp Pendleton Marine Corps Base, San Diego County, California, 1981. Unpubl. Rept., Natural Res. Off., Camp Pendleton.

Salata, L. 1982. Status of the least Bell's vireo on Camp Pendleton, California for 1982. Prepared for U. S. Fish and Wildlife Service, Laguna Niguel, CA.

Salata, L. 1983. Status of the least Bell's vireo on Camp Pendleton, California: report on research done in 1983. Unpubl. Rept., U. S. Fish and Wildlife Service, Laguna Niguel, CA.

Salata, L. 1984. Status of least the Bell's vireo at Camp Pendleton, California: a report on research done in 1984. Unpubl. Rept., U. S. Fish and Wildlife Service, Laguna Niguel, CA.

Salata, L. 1986. Status of the least Bell's vireo on Camp Pendleton in 1985. Unpubl. report prepared for Natural Resources Office, Marine Corps Base Camp Pendleton, CA.

Salata, L. 1987a. Status of the least Bell's vireo on Camp Pendleton in 1986. Unpubl. report prepared for Natural Resources Office, Marine Corps Base Camp Pendleton, CA.

Salata, L. 1987b. Status of the least Bell's vireo on Camp Pendleton in 1987. Unpubl. report prepared for Natural Resources Office, Marine Corps Base Camp Pendleton, CA.

San Diego Association of Governments (SANDAG). 1990. Final draft San Luis Rey River habitat conservation plan. San Diego Association of Governments. December.

San Diego Association of Governments (SANDAG). 1991a. Revised final Sweetwater River habitat conservation plan. San Diego Association of Governments. August.

San Diego Association of Governments (SANDAG). 1991b. Revised final San Diego River habitat conservation plan. San Diego Association of Governments. September.

Shaffer, M.L. 1981. Minimum population sizes for species conservation. Bioscience 31:131–134.

Senner, J. W. 1980. Inbreeding depression and the survival of zoo populations. Pp. 209–224 *in* M. E. Soulé and B. A. Wilcox, eds. Conservation biology: an evolutionary-ecological perspective. Sinauer Assoc., Sunderland, Mass.

Short, L. L., and R. S. Crossin. 1967. Notes of the avifauna of northwestern Baja California. Trans. San Diego Soc. Nat. Hist. 14:283–299.

Smith, F. 1977. A short review of the status of riparian forests in California. Pp. 1–2 *in* A. Sands, ed. Riparian forests in California: their ecology and conservation. Inst. Ecol. Publ. 15.

Soulé, M. E. 1980. Thresholds of survival maintaining fitness and evolutionary potential. Pp. 151–169 *in* M. E. Soulé and B. A. Wilcox, eds. Conservation biology: an evolutionary-ecological perspective. Sinauer Assoc., Sunderland, Mass.

Soulé, M. E. 1987. Viable populations for conservation. Cambridge Univ. Press, Cambridge. 189 pp.

Stribley, J.M., and J.B. Haufler. 1997. Landscape effects on cowbird occurrences in Michigan; implications to research need in forests of the inland West. Pp. 16–17 *in* M.L. Morrison and L.S. Hall, co-chairs. Research and management of the brown-headed cowbird in western and eastern landscapes. Partners in Flight program and abstracts, October 23–25, 1997.

Sweetwater Environmental Biologists. 1991. Report on the least Bell's vireo monitoring and cowbird removal program for 1991. Unpubl. report for California Department of Fish and Game.

Sweetwater Environmental Biologists. 1992a. 1992 status of the least Bell's vireo on Camp Pendleton, CA. Prepared for U. S. Marine Corps, Environmental and Natural Resources Office.

Sweetwater Environmental Biologists. 1992b. Report on the least Bell's vireo monitoring and cowbird removal program for 1992. Unpubl. report for California Department of Fish and Game.

Sweetwater Environmental Biologists. 1993. Report on the least Bell's vireo monitoring and cowbird removal program for 1993. Unpubl. report for California Department of Fish and Game.

Sweetwater Environmental Biologists. 1994. 1994 least Bell's vireo monitoring and cowbird removal program. Prepared for California Department of Fish and Game.

Tate, J., Jr. 1981. The blue list for 1981. Amer. Birds 35:3–10.

Tewksbury, J.J., T.R. Redmond, and J. Wheller. 1997. Landscape context, species habitat relationship, and the effect of parasitism on regional host populations. Pp. 17–18 *in* M.L. Morrison and L.S. Hall, co-chairs. Research and management of the brown-headed cowbird in western and eastern landscapes. Partners in Flight program and abstracts, October 23–25 1997.

Unitt, P. 1984. The birds of San Diego county. Memoir 13. San Diego Society of Natural History.

U.S. Army Corps of Engineers. 1981. San Luis Rey River. GDM main report, supplemental final EIS. 233 pp.

U.S. Fish and Wildlife Service. 1984. California condor recovery plan. U. S. Fish and Wildlife Service, Portland, OR.

U.S. Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants; Proposed endangered status and critical habitat for the least Bell's vireo. Federal Register 50:18968–18975.

U.S. Fish and Wildlife Service. 1986a. Endangered and threatened wildlife and plants; Determination of endangered status for the least Bell's vireo. Final Rule. Federal Register 51:16474–16482.

U.S. Fish and Wildlife Service. 1986b. The least Bell's vireo in the Prado Basin and environs, 1985. Prepared for the Army Corps of Engineers, Los Angeles District.

U.S. Fish and Wildlife Service. 1991. Black-capped vireo (*Vireo atricapillus*) recovery plan. Austin, Texas. pp. vi + 74.

U.S. Fish and Wildlife Service. 1992. Golden-cheeked warbler (*Dendroica chrysoparia*) recovery plan. Albuquerque, New Mexico. 88 pp.

U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants; Designation of critical habitat for the least Bell's vireo. Final rule. Federal Register 59:4845–4867.

U.S. Fish and Wildlife Service. 1994. Status of the least Bell's vireo and southwestern willow flycatcher at Camp Pendleton Marine Corps Base, California in 1993. Prepared for the U.S. Marine Corps, Environmental and Natural Resources Management Office, Camp Pendleton.

U.S. Fish and Wildlife Service. 1997a. Draft recovery plan for the Stephens' kangaroo rat. U. S. Fish and Wildlife Service, Portland, OR. 71 pp.

U.S. Fish and Wildlife Service. 1997b. Fish and Wildlife News, September 1997. U.S. Fish and Wildlife Service, Washington, D.C.

U.S. Forest Service. 1979. Least Bell's vireo (*Vireo bellii pusillus*). Unpubl. Rep.

Wells, J. 1990. Population status of the least Bell's vireo on the Cleveland National Forest Descanso Ranger District. Prepared for the U.S. Forest Service.

Wiens, J. A. 1963. Aspects of cowbird parasitism in southern Oklahoma. Wilson Bull. 75:130–139.

Wier, H. A., and B. Jones. 1987. A survey of the birds of riparian habitats, Anza-Borrego Desert State Park, San Diego County, California, with emphasis on the least Bell's vireo and brown-headed cowbird. Prepared for San Diego Association of Governments, California Department of Transportation, and California Department of Parks and Recreation.

Wilbur, S. 1980a. Least Bell's vireo - draft recovery plan. U. S. Fish and Wildlife Service, Portland, OR.

Wilbur, S. 1980b. Status report on the least Bell's vireo. Unpubl. rept. U. S. Fish and Wildlife Service, Portland, OR.

Wilbur, S. 1981. The least Bell's vireo in Baja California, Mexico. Western Birds 11:129--133.

Wilbur, S. 1987. Bird of Baja California. Univ. of Calif. Press., Berkeley. 253 pp.

Wilcox, B. 1980. Insular ecology and conservation. Pp. 95–118 *in* M. E. Soulé, and B. A. Wilcox, eds. Conservation biology: an evolutionary-ecological approach. Sinauer Assoc., Sunderland, Mass.

Wilcox, B., P. Brussard, and B. Marcot. 1986. The management of viable populations: theory, applications, and case studies. Center for Conservation Biology, Dept. of Bio. Sci., Stanford University.

Willett, G. 1933. A revised list of the birds of southwestern California. Pacific Coast Avifauna 21:1–204.

Wright, A.L. 1997. Distribution and seasonal abundance of brown-headed cowbirds in the Central Idaho Wilderness. P. 20 *in* M.L. Morrison and L.S. Hall, co-chairs. Research and management of the brown-headed cowbird in western and eastern landscapes. Partners in Flight program and abstracts, October 23–25, 1997.

Young, J.S., and R.L. Hutto. Habitat relationships of brown-headed cowbirds in the northern Rockies. Pp. 21 *in* M.L. Morrison and L.S. Hall, co-chairs. Research and management of the brown-headed cowbird in western and eastern landscapes. Partners in Flight program and abstracts, October 23–25 1997.

Zembal, R. 1986. The least Bell's vireo in the Prado Basin and environs, 1985. Unpublished report, U. S. Fish and Wildlife Service, Laguna Niguel, California.

Zembal, R., K. Kramer, and R. Bransfield. 1985. Survey of vegetation and vertebrate fauna in the Prado Basin and the Santa Ana River Canyon, California. Unpublished report, U.S. Fish and Wildlife Service, Laguna Niguel, California.

IV. IMPLEMENTATION SCHEDULE

A summary of scheduled actions and costs associated with this recovery program follows. The scheduling priority for each task and the responsible agency is indicated. Implementation of all tasks listed in the Implementation Schedule will lead to recovery of the least Bell's vireo. Initiation of these actions is subject to availability of funds.

Priorities in column one of the implementation schedule are assigned as follows:

1. **Priority 1:** An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2. **Priority 2:** An action that must be taken to prevent a significant decline in population or habitat quality, or some other significant negative impact short of extinction.

3. **Priority 3:** All other actions necessary to meet the recovery objective.

Acronyms used in the Implementation Schedule

*	Lead Agency
ATSFRR	Atchison Topeka and Santa Fe Railroad
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BR	Bureau of Reclamation
BRD	Biological Resources Division, U.S. Geological Survey
BUEL	City of Buelton
CBMWD	Chino Basin Municipal Water District
CCC	California Coastal Commission
CDC	California Department of Conservation Division of Oil, Gas, and Thermal Resources
CDFG	California Department of Fish and Game
CDSP	California Department of State Parks
CGIR	Capitan Grande Indian Reservation
CIR	Cahuilla Indian Reservation
COE	Army Corps of Engineers
COR	City of Corona
CORNELL	Cornell University

CRWQCB	California Regional Water Quality Control Board
CSDLA	County Sanitation Districts of Los Angeles County
CSLC	California State Lands Commission
CSPR	California State Parks and Recreation
CSWRCB	California State Water Resources Control Board
CV	City of Chula Vista
DOD	Department of Defense
DOJ	Department of Justice/Border Patrol
DOT	California Department of Transportation
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
EMWC	Escondido Municipal Water Company
FAA	Federal Aeronautics Administration
FHWA	Federal Highway Administration
FIL	City of Fillmore
FUD	Fallbrook Utilities District
FWS	U.S. Fish and Wildlife Service
HWD	Helix Water District
IBWC	International Boundary and Water Commission
IIBC	International Institute of Biological Control
ICO	Imperial County
LADHS	Los Angeles County Department of Health Services
LADPW	Los Angeles County Department of Public Works
LACO	Los Angeles County
LADWP	Los Angeles Department of Water and Power
LAK	City of Lakeside
LCIR	Los Coyotes Indian Reservation
LJIR	La Jolla Indian Reservation
LOMPOC	City of Lompoc
MONCO	Monterey County
MTDB	Metropolitan Transit Development Board
MUR	City of Murrieta
NAVY	U.S. Navy
NC	City of National City
NMAD	Northwest Mosquito Abatement District
NORCO	City of Norco
OCO	Orange County
OCVCD	Orange County Vector Control District
OCWD	Orange County Water District

OCN	City of Oceanside
OWD	Otay Water District
PAIR	Pauma Indian Reservation
PDMWD	Padre Dam Municipal Water District
PIR	Pala Indian Reservation
PMWC	Pauma Mutual Water Company
PVCSD	Pauma Valley Community Services District
RCD	Resource Conservation District of Greater San Diego County
RCFC	Riverside County Flood Control
RCP	Riverside County Parks and Open Space District
RED	City of Redlands
RIR	Rincon Indian Reservation
RIV	City of Riverside
RIVCO	Riverside County
RMWD	Rainbow Municipal Water District
SAL	City of Salinas
SANBAG	San Bernardino Association of Governments
SANDAG	San Diego Association of Governments
SANTEE	City of Santee
SAWPA	Santa Ana Water Project Authority
SBACO	Santa Barbara County
SBCO	San Bernardino County
SBCFC	San Bernardino County Flood Control
SBCWA	Santa Barbara County Water Agency
SBECO	San Benito County
SBR	City of San Bernardino
SCE	Southern California Edison
SCL	City of San Clemente
SCLR	City of Santa Clarita
SD	City of San Diego
SDAERR	San Diego and Arizona Eastern Railroad
SDCO	San Diego County
SDCPR	San Diego County Parks and Recreation Department
SDCVC	San Diego County Vector Control
SDCWA	San Diego County Water Authority
SDGE	San Diego Gas and Electric
SDPR	City of San Diego Parks and Recreation Department
SDWUD	City of San Diego Water Utilities District,
SIR	Sycuan Indian Reservation

SLOCO	San Luis Obispo County
SLRMWD	San Luis Rey Municipal Water District
SPA	City of Santa Paula
SPRR	Southern Pacific Railroad
SRIR	Santa Rosa Indian Reservation
SWA	Sweetwater Authority
SYS	City of San Ysidro
TBD	To Be Determined
TEM	City of Temecula
TVWB	Tijuana Valley Water Board
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture-Agronomy and Range Science
USFS	U.S. Forest Service
USMC	U.S. Marine Corps
UWCD	United Water Conservation District
VCFCD	Ventura County Flood Control District
VCMWD	Valley Center Municipal Water District
VID	Vista Irrigation District
WMWD	Western Municipal Water District
WRCRWA	Western Riverside County Regional Wastewater Authority
WVVCD	West Valley Vector Control District

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s) FY 99	FY 00	FY 01	FY 02	FY 03	Comments
1	1.5	Continue cowbird removal	Continuous	FWS*, NAVY, CDSP, USMC, DOD, DOT, FHWA, CDFG, USFS, COE, OCWD	500	100	100	100	100	100	Future costs to be determined if endowments are not established for the permanent monitoring and management of cowbirds
1	1.111	Prepare management plan for the Tijuana River population	1	FWS*, NAVY, COE, EPA, USFS, CSPR, BLM, BRD, IBWC, DOJ, CRWQCB, DOT, CDFG, CSLC, CCC, SDCO, SDCPR, SDCVC, SD, SANDAG, SYS, SDGE, TVWB	20	20					
1	1.112	Prepare management plan for the Dulzura Creek/Jamul Creek/Otay River population	1	FWS*, COE, EPA, USFS, BLM, BRD, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, SDCO, SANDAG, SDCPR, SDCVC, CV, SDCWA, OWD, SDGE	20		20				

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
1	1.113	Prepare management plan for Sweetwater River population	1	FWS*, BLM, COE, EPA, USFS, BRD, BIA, SIR, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, SDCO, SDCPR, SDCVC, SANDAG, CV, NC, SWA, SDCWA, OWD, SDGE	20	20					
1	1.114	Prepare management plan for the San Diego River population	1	FWS*, FHWA, COE, EPA, USFS, BLM, BRD, BIA, CGIR, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, SANDAG, SDCO, SDCPR, SDCVC, SD, SANTEE, LAK, SDPR, MTDB, SDWUD, HWD, PDMWD, SDCWA, SDGE	20		20				

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
1	1.115	Prepare management plan for the San Luis Rey River population	1	FWS*, COE, EPA, FHWA, USFS, USMC, NAVY, BLM, BIA, BRD, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, SANDAG, SDCO, SDCPR, SDCVC, PAIR, RIR, PAL, LJIR, OCN, PMWC, SDCWA, SLRMWD, VCMWD, EMWC, VID, FUD, SDGE	20		20				
1	1.116	Prepare management plan for the Camp Pendleton/Santa Margarita population	1	FWS*, USMC, NAVY, DOD, FAA, BRD, CSPR, COE, FHWA, EPA, USFS, BLM, BIA, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, SANDAG, SDCO, RIVCO, OCO, CIR, OCN, SCL, TEM, MUR, SCE, SDCWA, RMWD, FUD, ATSFRR	20		20				

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
1	1.117	Prepare management plan for Santa Ana River population	1	FWS*, COE, EPA, USFS, BLM, FAA, BRD, CDC, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CSPR, OCWD, RIVCO, RCP, RCFC, OCO, SANBAG, SBCO, SBCFC, COR, SB, RIV, RED, NORCO, SCE, WRCRWA, WMWD, SAWPA, NMAD, WVVCD, CBMWD, ATSFRR, SPRR	20		20				
1	1.118	Prepare management plan for the Orange County/Los Angeles County metapopulation	1	FWS*, COE, EPA, USFS, DOD, BLM, BRD, CDC, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CSPR, OCO, OCWD, OCVCD, LACO, LADPW, LADWP, LADHS, CSDLA, SCE, SPRR	25		25				

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s) FY 99	FY 00	FY 01	FY 02	FY 03	Comments
1	1.119	Prepare management plan for the Santa Clara River population	1	FWS*, DOD, COE, FHWA, EPA, USFS, BLM, BRD, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, CDC, CSPR, DWR, VCFCD, LACO, LADHS, LADWP, LADPW, UWCD, CSDLA, SCLR, SPA, FIL, SPRR	20		20				
1	1.120	Prepare management plan for the Santa Ynez River population	1	FWS*, DOD, COE, USAF, USFS, FHWA, EPA, BLM, BRD, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, CDC, CSPR, DWR, SBACO, SBCWA, LOMPOC, BUEL, SPRR	20			20			
1	1.121	Prepare management plan for the Anza Borrego Desert metapopulation	1	FWS*, DOD, COE, NAVY, USFS, FHWA, EPA, BLM, BRD, BIA, CSPR, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, CDC, RIVCO, SDCO, ICO, LCIR, SRIR, SDAERR, SDGE	30			30			

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s) FY 99	FY 00	FY 01	FY 02	FY 03	Comments
2	1.122	Prepare management plan for the Salinas River population	1	FWS*, DOD, COE, USFS, FHWA, EPA, BLM, BRD, CSPR, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, CDC, SBECO, MONCO, SLOCO, SAL, SPRR	20			20			
2	1.123	Prepare management plan for the San Joaquin Valley population	1	FWS*, DOD, COE, USFS, FHWA, EPA, BLM, BRD, CSPR, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, CDC	20			20			
2	1.124	Prepare management plan for the Sacramento Valley population	1	FWS*, DOD, COE, USFS, FHWA, EPA, BLM, BRD, CSPR, CRWQCB, CSWRCB, DOT, CDFG, CSLC, CCC, CDC	20			20			
2	1.3	Establish monitoring protocol	1	FWS	2	2					
2	1.411	Conduct annual monitoring in the Tijuana River population	5	FWS*, COE, DOJ	250	50	50	50	50	50	monitoring will be required annually and 5 years beyond delisting

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
2	1.412	Conduct annual monitoring in the Dulzura Creek/Jamul Creek/Otay River population	5	FWS*, FHWA, COE, BLM	250	50	50	50	50	50	
2	1.413	Conduct annual monitoring the Sweetwater River population	5	FWS*, FHWA, COE, BLM	250	50	50	50	50	50	
2	1.414	Conduct annual monitoring in the San Diego River population	5	FWS*, FHWA, COE	250	50	50	50	50	50	
2	1.415	Conduct annual monitoring in the San Luis Rey River population	5	FWS*, FHWA, COE, EPA, USFS	250	50	50	50	50	50	
2	1.416	Conduct annual monitoring in the Camp Pendleton/Santa Margarita River population	5	FWS*, DOD, EPA, COE, USFS	375	75	75	75	75	75	

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
2	1.417	Conduct annual monitoring in the Santa Ana River population	5	FWS*, COE, EPA, FHWA, OCWD, DOT	250	50	50	50	50	50	
2	1.418	Conduct annual monitoring in the Orange County/Los Angeles County population	5	FWS, COE, EPA, DOT							
2	1.419	Conduct annual monitoring in the Santa Clara River population	5	FWS*, COE, USFS, EPA	250	50	50	50	50	50	
2	1.420	Conduct annual monitoring in the Santa Ynez River population	5	FWS, DOD, USFS, USAF	100	20	20	20	20	20	
2	1.421	Conduct annual monitoring in the Anza Borrego Desert metapopulation	5	FWS, CSPR, BLM, DOD	250	50	50	50	50	50	
2	1.422	Conduct annual monitoring in the Salinas River population	Continuous	FWS, DOD, BLM, DOT	250	50	50	50	50	50	

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s) FY 99	FY 00	FY 01	FY 02	FY 03	Comments
2	1.423	Conduct annual monitoring in the San Joaquin Valley population	Continuous	FWS, BLM, DOT, COE,	250	50	50	50	50	50	
2	1.424	Conduct annual monitoring in the Sacramento Valley population	Continuous	FWS, BLM, DOT, COE, USAF	250	50	50	50	50	50	
2	1.6	Develop alternative means of controlling cowbird parasitism	3	FWS*, USDA, BLM, USFS, USMC, NAVY, DOT, COE, OCWD, SDCO, SD, RIVCO, SBCO	TBD						
2	2.1	Identify additional and potential habitat in historical range	3	FWS*, COE, CDFG, FHWA, BLM, CDSP, DOD	TBD			TBD	TBD	TBD	
2	1.2	Prepare management plans for areas identified in 2.1	1	TBD	TBD					TBD	
2	1.7	Control nonnative plant species	5	FWS*, USDA, FHWA, USMC, NAVY, COE, CDFG, USFS, CDSP DOT, OCWD, SDCO, RIVCO, RCP	500	100	100	100	100	100	Future costs to be determined if endowments are not established for the permanent monitoring and management of nonnative species

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
2	2.5	Develop biocontrol methods for *Arundo* and other nonnative plant species	4	FWS*, USDA, COE, CORNELL, IIBC, USMC, BR, OCWD	1200		500	300	200	200	
3	1.8	Establish perpetual endowments for cowbird and exotic plant control	Continuous	FWS	TBD						
3	2.11	Conduct a statewide inventory of riparian habitat	2	FWS*, BRD, EPA, COE, USFS, DOD	300		150	150			
3	2.12	Conduct rangewide surveys	5	FWS*, BRD	250	50	50	50	50	50	
3	2.2	Investigate the status of wintering habitat and identify current or potential threats	2	FWS*, BRD	630		30	200	200	200	
3	2.31	Continue color-banding to provide demographic and dispersal data	5	FWS*, BRD	50	10	10	10	10	10	

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s) FY 99	FY 00	FY 01	FY 02	FY 03	Comments
3	2.32	Determine relationships between population density and reproductive characteristics	3	FWS*, BRD	225		75	75	75		
3	2.33	Determine relationships between population density and dispersal	3	FWS*, BRD	225		75	75	75		
3	2.4	Investigate relationship between habitat characteristics and least Bell's vireos behaviors and access to necessary resources	3	FWS*, BRD	120		40	40	40		
3	3.1	Implement long-term monitoring of restored sites	Continuous	FWS, COE, DOD	80		20	20	20	20	
3	3.2	Develop improved restoration techniques	4	FWS, COE, BRD, USFS, BR	200		50	50	50	50	

Recovery Plan Implementation Schedule for the Least Bell's Vireo.

Priority #	Task #	Task Description	Task Duration (Years)	Responsible or Associated Parties	Total Estimated Cost ($1000's)	Costs (1000s)					Comments
						FY 99	FY 00	FY 01	FY 02	FY 03	
3	3.3	Evaluate restoration efforts and effectiveness of methods used	3	FWS*, BRD, CDSP, USFS COE	150			50	50	50	
3	3.4	Conduct habitat restoration	Continuous	FWS, COE, BRD, USFS, BLM, DOD, USMC, NAVY	TBD	TBD	TBD	TBD	TBD	TBD	
3	5	Evaluate progress of recovery, management and recovery actions, and revise management plans	Continuous	FWS	150	30	30	30	30	30	
3	6	Provide public information and education	Continuous	FWS*, BRD, BLM, USFS	50	10	10	10	10	10	

V. APPENDICES

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
San Diego County											
Agua Caliente County Park	- -	- -	- -	- -	- -	- -	- -	- -	- (1)	- -	- (2)
Agua Hedionda Creek	1 (1)	0 (0)	- -	- -	- -	- -	1 (2)	- -	- -	- -	- -
Alder Canyon	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Aliso Creek	- -	- -	- -	- -	- -	2 (2)	2 (2)	2 (5)[b]	- (9)[b]	6 (12)	10 (24)
Angelina Spring	- -	- -	- -	- -	- -	- -	- -	- -	- -	- (0)	- -
Borderfield	- -	- -	- -	- -	- -	- -	0 (1)	- -	- -	- -	- -
Borrego Palm Canyon	5 (7)	1 (2)	3 (6)	2 (4)	2 (4)	4 (4)	0+ (5)	? (5)	? (2)	? (3)	? (1)
Campbell Grade	- -	- -	- -	- -	- -	- -	- -	? (18)	? (12)	? (12)	? (19)
Campo Creek	- -	4 (5)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Canebrake Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (1)
Carmel Valley	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Carrizo Creek	- -	- -	- -	- -	- -	- -	0 (3)	? (1)	0 (0)	- -	? (1)
Carrizo Marsh	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (1)	? (1)
Cockleburr Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)
Cottonwood Creek	0 (0)	- -	- -	- -	3 (8)	- -	- -	- -	- -	- -	- -
Cougar Canyon	0 (0)	- -	- -	- -	0 (0)	- -	- -	0 (0)	0 (0)	- -	- -
Coyote Creek	8 (9)	2 (8)	0+ (8)	10 (11)	7 (10)	12 (13)	? (17)	5 (18)	? (22)	? (14)	? (20)

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Cristianitos Creek	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	0 (1)	4 (5)
Culp Valley	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (0)	? (0)
DeLuz Creek	1 (2)	0 (3)	2 (2)	1 (2)	0 (0)	1 (3)	2 (2)	? (3)	? (9)	17 (24)	24 (26)
Encinitas Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Fallbrook Creek	- -	- -	- -	- -	- -	- -	1 (1)	4 (10)[b]	- (28)	9 (11)	12 (16)
French Creek	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)	- (1)[b]	? (4)	4 (7)	4 (10)
Hauser Creek	- -	- -	- -	- -	2 (3)	- -	- -	- -	- -	- -	- -
Hellhole Canyon	4 (5)	0 (1)	- (1)	1 (1)	2 (2)	0 (0)	0 (0)	- -	- -	? (0)	? (2)
Hidden Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	7 (10)
Horno Creek	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	0 (0)	0 (0)
Horse Canyon	- -	- -	- -	- -	- -	- -	- -	0 (0)	? (1)	? (1)	? (0)
Indian Canyon	1 (1)	- -	- -	- -	0 (0)	- -	- -	0 (0)	? (2)	- -	- -
Jamul/Dulzura Creeks	2 (8)	6 (11)	- -	6 (10)	- -	6 (9)	? (2)	7 (11)	4 (12)	- -	23 (24)
Key's Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Kilo 1/Kilo 2 areas Camp Pendleton	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	2 (3)
Las Flores Creek	0 (0)	2 (4)	2 (3)	3 (4)	8 (8)	15 (19)	5 (9)	9 (59)[b]	? (50)	111 (125)	132 (148)
Lima/Mike/November areas Camp Pendleton	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	6 (6)

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Live Oak Creek	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Los Penasquitos	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Moosa Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Newton Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (3)
Otay River	- -	- -	- -	- -	- -	- -	1 (3)	1 (1)	4 (4)	- -	- -
Peterson Creek	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Piedra de Lumbre Canyon	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	0 (1)	1 (1)
Pilgrim Creek	2 (5)	1 (4)	3 (3)	3 (8)	6 (10)	9 (14)	13 (13)	5 (20)[b]	? (28)	35 (44)	62 (69)[g]
Proctor Valley	- -	- -	- -	- -	- -	- -	- -	- -	1 (1)	- -	- -
Pueblitos Canyon	- -	- -	- -	- -	- -	- -	- -	? (1)	- -	? (1)	2 (2)
Roblar Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
San Diego River											
Mission Valley	0 (0)	0 (0)	? (1)	- -	- -	? (1)	2 (2)	- -	- -	3 (4)	10 (11)
Mission Trails-Padre Dam	0 (0)	? (2)	1 (1)	- -	- -	4+ (5)	1+ (5)	- -	- -	- -	- -
Padre Dam-Carlton Hills Blvd	19 (21)	21 (27)	28 (31)	25 (26)	24 (28)	27 (29)	24 (32)	28 (32)	32 (36)	37 (42)	30 (33+)[h]
Carlton Hills Blvd-Lakeside	? (6)	4 (5)	? (2)	0 (1)	0 (0)[c]	? (1)[c]	? (1)[c]	- -	- -	- -	- -
El Capitan	8 (8)	- -	- -	- -	- -	0 (0)	0 (0)	- -	- -	- -	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
San Felipe Creek	0 (1)	- -	0+ (2+)	1+ (3)	- -	- -	2 (2)	2 (3)	- -	4 (?)	- -
San Luis Rey River											
Interstate 5-College	7 (9)	7 (9)	- -	4 (6)	7 (11)	7 (9)	21 (26)	25 (31)	40 (54)	41 (52)	42 (50)
College-Gird Rd.	19 (19)	26 (32)[d]	38 (44)	25 (32)	27 (43)	35 (39)	54 (59)	62 (76)	68 (89)	75 (104)	70 (90)
Upstream of Gird Rd.	- -	- -	- -	- -	- -	- -	- -	- -	1 (10)	6 (10)	- -
San Marcos Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
San Mateo Creek	0 (0)	2 (3)	1 (1)	0 (0)	1 (1)	1 (1)	1 (2)	1 (4)[b]	? (5)[b]	11 (17)	44 (48)
San Onofre Creek	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)[b]	? (7)	7 (15)	22 (27)
Santa Margarita River											
Camp Pendleton	68 (98)	97 (127)	167 (81)	122 (142)	168 (186)	138+ (212)	? (194)	132 (319)[b]	84 (336)[b]	352 (426)	456 (523)
Fallbrook	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	2 -
Santa Ysabel/ San Dieguito River	3 (13)	5 (18)	- -	4 (6)	10 (11)	9 (13)	17 (25)	21 (48)	31 (47)	- -	- -
Santa Ysabel/ Forest Service	- -	- -	- -	- -	- -	- -	4 (4)	- -	- -	- -	- -
Sentenac Canyon	4 (5)	1 (2)	- -	1 (2)	0 (2)	2 (2)	? (5)	4 (8)	? (4)	? (12)	? (13)
Sheep Canyon	0 (0)	0 (1)	- -	- -	0 (1)	- -	- -	0 (0)	? (1)	- -	- -
Stage Coach Canyon	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	0 (0)	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Sweetwater River											
Downstream of Reservoir	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)	1 (1)	- -	0 (0)
Reservoir-Rancho S. D. Golfcourse	48 (51)	60 (82)	54 (69)	40 (49)	41 (50)	36 (51)	49 (53)	50 (61)	29 + (41)[c]	29 (40)	33+ (51)
Upstream of Golfcourse	(1)	?(5)	- -	- -	- -	- -	? (4+)	- -	- -	- -	3+ (3+)
Talone Lake	- -	- -	- -	1 (2)	- -	1 (1)	1 (3)	- -	- -	- -	3 -
Tamarisk Grove	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (1)	? (0)
Tecolote Canyon	2 (3)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Tijuana River											
West of Dairymart Rd.	3 (5)	0+ (8)	0+ (3+)	3+ (5)	9 (13)	15 (22)	26 (27)	41 (49)	63 (79)	80 (112)	87 (134)
East of Dairymart Rd.	0 (0)	0 (0)	- -	- -	- -	? (2)	- -	- -	- -	2 (2)	2 (5)
Goat Canyon	- -	- -	- -	- -	- -	- -	2 (3)	2 (3)	1 (1)	0 (0)	1 (3)
Tecate Creek (Marron Valley)	- -	- -	- -	- -	- -	- -	0 (1)	- -	- -	- -	- -
Vallecito Creek	0+ (6)	0+ (7)	- -	10 (10)	3+ (10)	3+ (9)	? (18)	? (8)	? (14)	? (23)	? (33)
Windmill Canyon	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	0 (0)	2 (2)
Yaqui Well	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (1)	? (1)
Orange County											

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Anaheim Wetlands	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- (1)
Aliso Creek	0 (1)	0 (0)	- -	- -	- -	- -	- -	- -	- -	0 (1)	- -
Arroyo Trabuco	- -	- -	- -	- -	- -	0 (0)	- -	- -	- -	- -	- -
Bonita Canyon/Creek	- -	- -	- -	- -	0+ (1)	1 (1)	1 (2)	1 (2)	3 (3)	1 (1)	0 (3)
Brea Dam	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (1)
Canada Gobernadora	0 (0)	- -	- -	- -	- -	0 (0)	0 (0)	0 (2)	0 (0)	- -	- -
Carbon Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 (2)
Featherly Park	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- (0)
Green River	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- (0)
Huntington Beach Central Park	0 (1)[e]	- -	- -	- -	0 (2)[e]	0 (0)	0 (0)	0 (0)	0 (1)	0 (1)[g]	0 (0)
Sand Canyon Wash Mason Park/Upstream of Reservoir	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)	1 (1)	1 (1)	0 (4)	2 (7)
Peters Canyon Res.	- -	- -	- -	- -	- -	0 (1)	0 (0)	- -	1 (2)	1 (2)	1 (3)
Rattlesnake Res.	- -	- -	- -	- -	- -	0 (1)	0 (0)	- -	- -	- -	1 (2)
San Diego Creek	- -	- -	- -	- -	- -	- -	- -	- (1)	1 (3)	0 (1)	0 (4)
San Joaquin Marsh	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (2)	0 (2)
San Juan Creek	0 (0)	- -	0 (0)	0 (0)	0 (0)	- -	- -	- -	- -	0 (1)	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Santa Ana River (Gypsum Canyon)	0 (0)	0 (1)	0 (0)	0 (0)	- -	- -	- -	0 (2)	- -	0 (1)	1 (4)
Santiago Creek/Villa Park FCB/above Loma Street	0 (0)	- -	- -	0 (0)	0 (0)	1 (2)	0 (3)	1 (2)	0 (3)	0 (1)	1 (2)
Upper Newport Bay	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)	0 (1)	0 (1)	0 (1)
Riverside County											
Andreas	2 (2)	3 (3)	- -	- -	0 (2)	- -	- -	- -	- -	- -	- -
Auld Valley	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Bautista Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Chino Canyon	4 (4)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
March Air Force Base (unnamed tributary west of Interstate-215)	- -	- -	- -	- -	- -	- -	- -	1 (1)	0 (1)	- -	- -
Murrietta Creek	- -	- -	- -	- -	- -	- -	0 (1)	- -	- -	- -	- -
Murray Canyon	1 (2)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Oasis de los Osos	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Palm Canyon	1 (1)	0 (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Potero Creek? (Beumont/Lockheed)	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
San Jacinto Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
San Jacinto River (Route 74)	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (0)	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Saint John's Canyon	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
San Timoteo	1 (3)	0 (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Santa Ana River											
Prado Basin[a]	19 (21)	20 (26)	30 (37)	31 (36)	42 (47)	64 (70)	99 (112)	123 (138)	149 (188)	164 (217)	195 (249)
Below Prado Dam	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (2+)	1 (4)
Temescal Wash	2 (3)	2 (3)	- -	- -	1 (1)	2 (3)	- -	- -	- -	- -	- -
Hidden Valley	- -	- -	- -	- -	- -	- -	- -	- -	? (2)	1 (3)	2 (4)
Tonner Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
Warm Springs Valley (unnamed tributaries Lake Elsinore)	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 (1)	- -
Whitewater Hole	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Willow Hole	0 (0)	0 (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Wilson Creek	- -	- -	0 (1)	0 (1)	- -	- -	- -	- -	- -	- -	- -
San Bernardino County											
Cajon Creek	- -	- -	- -	- -	0 (1)	- -	- -	- -	- -	- -	- -
Chino Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (1)	- -
City Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Santa Ana River (Gypsum Canyon)	0 (0)	0 (1)	0 (0)	0 (0)	- -	- -	- -	0 (2)	- -	0 (1)	1 (4)
Santiago Creek/Villa Park FCB/above Loma Street	0 (0)	- -	- -	0 (0)	0 (0)	1 (2)	0 (3)	1 (2)	0 (3)	0 (1)	1 (2)
Upper Newport Bay	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)	0 (1)	0 (1)	0 (1)
Riverside County											
Andreas	2 (2)	3 (3)	- -	- -	0 (2)	- -	- -	- -	- -	- -	- -
Auld Valley	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Bautista Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Chino Canyon	4 (4)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
March Air Force Base (unnamed tributary west of Interstate-215)	- -	- -	- -	- -	- -	- -	- -	1 (1)	0 (1)	- -	- -
Murrietta Creek	- -	- -	- -	- -	- -	- -	0 (1)	- -	- -	- -	- -
Murray Canyon	1 (2)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Oasis de los Osos	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Palm Canyon	1 (1)	0 (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Potero Creek? (Beumont/Lockheed)	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
San Jacinto Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
San Jacinto River (Route 74)	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (0)	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Saint John's Canyon	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
San Timoteo	1 (3)	0 (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Santa Ana River											
Prado Basin[a]	19 (21)	20 (26)	30 (37)	31 (36)	42 (47)	64 (70)	99 (112)	123 (138)	149 (188)	164 (217)	195 (249)
Below Prado Dam	- -	- -	- -	- -	- -	- -	- -	- -	- -	? (2+)	1 (4)
Temescal Wash	2 (3)	2 (3)	- -	- -	1 (1)	2 (3)	- -	- -	- -	- -	- -
Hidden Valley	- -	- -	- -	- -	- -	- -	- -	- -	? (2)	1 (3)	2 (4)
Tonner Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
Warm Springs Valley (unnamed tributaries Lake Elsinore)	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 (1)	- -
Whitewater Hole	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Willow Hole	0 (0)	0 (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Wilson Creek	- -	- -	0 (1)	0 (1)	- -	- -	- -	- -	- -	- -	- -
San Bernardino County											
Cajon Creek	- -	- -	- -	- -	0 (1)	- -	- -	- -	- -	- -	- -
Chino Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (1)	- -
City Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
East Etiwanda Creek	- -	- -	- -	- -	- -	- -	1 (2)	- -	- -	- -	- -
Fort Paiute Creek	1 (1)	- -	- -	- -	- -	- -	- -	- (3)	0 (0)	- -	- -
Horsethief Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
Los Serranos Channel	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (1)	- -
Mill Creek	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
Mojave River	0 (0)	- -	- -	0 (1)	- -	- -	- -	- -	- -	0 (0)	0 (1)
Morongo Creek[f]	0 (1)	0 (1)	0 (1)	0 (1)	- -	- -	- -	- -	- -	- -	- -
San Jacinto River	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (0)	- -
Santa Ana River	- -	- -	- -	- -	- -	- -	- -	- -	0 (1)	1 (1)	1 (1)
Wildhorse Canyon	- -	- -	- -	- -	- -	- -	- -	? (2)	- -	- -	- -
Los Angeles County											
Amargosa Creek (W of Palmdale)	- -	- -	- -	- -	- -	- -	- -	- -	- (1)	- (1)	- -
Big Tujunga	- -	- -	- -	- -	- -	- -	0 (1)	- -	- -	0 (2)	- -
Fish Canyon	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Las Brisas Ranch	- -	- -	- -	- -	- -	- -	- -	- -	? (1)	- -	- -
San Francisquito	0 (1)	0 (1)	- -	- -	- -	- -	- -	- -	1 (1)	- -	- -
San Gabriel River	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- (1)	- (1)
Santa Clara River	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	2 (4)

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Van Norman Dam	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
Ventura County											
Arroyo Simi	0 (0)	0 (0)	- -	- -	- -	- -	1 (3)	1 (2)	- (1)	- -	- -
La Jolla Canyon	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Piru Creek	0 (0)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -
San Antonio Creek	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Santa Clara River	0+ (8)	0 (1)	- -	- -	- -	12 (17)	14 (20)	22 (26)	25 (27)	30+ (34+)	40+ (44+)
Santa Paula	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Ventura River	0 (0)	- -	- -	- -	- -	- -	- -	1 (2)	1 (2)	1 (1)	- -
Santa Barbara County											
Cuyama River	0 (0)	- -	- -	- -	- -	- -	- -	- (1)	- -	- -	- -

APPENDIX A. Numbers and Distribution of Least Bell's Vireos, 1986-1996: Number of Pairs (Territorial Males)

Site	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Santa Ynez River											
Upper (Gibralter Res./Mono Creek/Agua Caliente Creek.)	~30 (57)	19 (32)	21 (23)	14 (20)	17 (22)	17 (20)	16 (20)	29 (31)	20+ (20+)	1+ -	2 + -
Lower (Buellton/Lompoc)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 (2)
Inyo County											
Amargosa River	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
China Ranch Wash	1 (2)	2 (2)	- -	- -	- -	- -	- -	- -	? (1)	- -	- -
Scotty's Castle	- -	- -	- -	- -	- -	- -	- -	- -	? (1)	- -	- -
Tecopa	1 (2)	2 (2)	- -	- -	- -	- -	- -	- -	? (3)	- -	- -
Kern County											
South Fork Kern River	- -	- -	- -	- -	- -	- -	- (1)	- -	- (1)	- -	- -
Monterey County											
Salinas River	2 (3)	0 (0)	- -	- -	- -	- -	- -	- -	- -	- -	- -

Legend:

- \- No data.
- \+ Indicates that actual number could have been higher (field surveys were incomplete or noncomprehensive).
- ? Number of pairs unknown.
- ~ Approximately.
- a Prado Basin includes a small portion of San Bernardino County. See Riverside County data. 1970 to 1986 data include areas upstream and downstream from Prado Basin.
- b Territorial male data include the following numbers of males reported as "status unknown."

Year	Site	Number
1993	Aliso Creek	1
1993	Fallbrook Creek	4
1993	French Creek	1
1993	Las Flores Creek	19
1993	Pilgrim Creek	6
1993	San Mateo Creek	2
1993	San Onofre Creek	1
1993	Santa Margarita River	80
1994	Aliso Creek	3
1994	San Mateo Creek	1
1994	Santa Margarita	101

- c Indicates partial survey.
- d College-Gird Rd. and Upstream of Gird data combined in 1987.
- e Because of excellent coverage at this site, birds were known to be either migrants or wintering (winter of 1985-1986). Numbers not included in territorial male totals.
- f Data for Big Morongo Creek and Little Morongo Creek combined after 1986.
- g This data is for on and off Camp Pendleton, whereas most or all data for previous years is for on-base.
- h This survey area is from Padre Dam to Mast Blvd, a smaller survey area then in previous years.

APPENDIX B: POPULATION VIABILITY ANALYSIS FOR THE LEAST BELL'S VIREO

The following discussion uses several terms from population ecology, which are defined here:

***Population*:** a group of interbreeding organisms of a single species in a particular geographical area.

Metapopulation: "a collection of interacting populations of the same species" (Akcakaya and Ferson 1992).

***Viable population*:** a population that "maintains its vigor and its potential for evolutionary adaptation" (Soulé 1987) and that "is self-sustaining with minimal demographic or genetic intervention over the long term" (Wilcox *et al.*1986). Within the context of modeling, a viable population is one that has some probability of surviving (avoiding extinction) over some period of time, where the probability of extinction and the time span are specified. In this plan, "viable population" refers to one with a probability of 5 percent or less of going extinct during a 100-year period.

Minimum viable population size: the minimum size that a population must achieve to avoid extinction and thus remain viable, as defined above.

Recruitment: addition of new members into a breeding population through production of offspring.

Productivity: production of offspring; usually expressed as the number of young produced per pair.

Predicting the future of an endangered species such as the least Bell's vireo requires considerable information on its life history, demography, and current abundance and distribution. At the core of population ecology, the discipline upon which such an exercise draws, are fundamental principles which describe how populations behave over time. Put simply, individuals are added to a population through the production of offspring and immigration into the population from outside, and are lost from the population as a result of mortality (death) and emigration out of the population. The net effect of these processes determines whether populations grow or decline in size over time. Central to any recovery plan is a determination of the population size trend for the species of interest, accompanied by an analysis of which of these processes has been altered to produce the trend. While the first determination is comparatively straightforward, the second is not.

The processes of birth, death, and migration, and consequently population size trends, are influenced by many factors. These have been condensed into four general categories which describe the nature of factors creating a risk of extinction for endangered species (Shaffer 1981). Three of these are applicable to least Bell's vireos (the fourth pertains to species with mating systems not exhibited by the least Bell's vireo). ***Extrinsic forces*** include forces in the environment with which the species cannot contend. With regard to least Bell's vireos these include interactions with other organisms, such as exposure to brood parasitism by brown-headed cowbirds, a species with which the least Bell's vireo has not evolved, and possibly heightened rates of predation by native and non-native predators; random catastrophic events such as floods and droughts; and human-induced habitat loss and degradation. ***Demographic stochasticity*** refers to random events in the survival and reproduction of individuals in small populations, resulting in such problems as a skewed sex ratio leading to difficulty in finding a mate; total reproductive failure one year; death of the entire population, etc. ***Genetic deterioration*** can be both short-and long-term. Short-term genetic deterioration includes inbreeding depression, leading to reduced survival, skewed sex ratios and other problems, particularly in small populations. Long-term deterioration refers to the reduced ability of a population to adapt to environmental changes because of a loss of genetic variability. Both of these processes are linked to the amount of dispersal among populations of a species.

Increasingly, conservation biologists are using a tool called Population Viability Analysis (PVA) to project the future of populations or species. A PVA simulates the population's future given a set of current parameters describing birth, death, and migration, incorporating the complexities of the factors influencing these parameters. With this tool, investigators can ask questions such as "What is the probability that this population will go extinct within 20 years?", or "How long will it take for this population to reach 1000 individuals?", or "What effect on population growth rate would doubling the birth rate have?" A common goal of a PVA is to determine the conditions necessary for maintaining a viable population. A "viable population" is one capable of surviving (avoiding extinction) with some probability over some extended period of time. The term "viability" does not have universal meaning with regard to the time period involved or the acceptable probability of extinction; these must be specified based on the biology of the species of concern, and the context within which the PVA is being used.

Recovery plans are concerned with the management of species, and most species in nature occur in multiple populations. From the perspective of a recovery plan, then, a PVA must address not just the dynamics of individual populations, but the complex interactions among the populations as well. This is achieved by incorporating into the PVA information on the number of different populations, their geographic configuration, and the rate of migration between them.

A PVA was performed for the least Bell's vireo using RAMAS/Space (Akcakaya and Ferson 1992), a widely used modeling environment that allows the user to simulate population performance by inputting empirical and/or theoretical values for demographic parameters. Output of the simulations includes projections for each individual population as well as the network of populations, referred to as the metapopulation. Here, the term "metapopulation" is used for consistency with the terminology of the model, and is not meant to imply anything more than "a collection of interacting populations of the same species" (Akcakaya and Ferson 1992).

Empirical data used in the PVA were obtained from the results of long-term population monitoring conducted at eight major breeding sites in southern California, located at (from south to north) the Tijuana, Sweetwater, San Diego, San Luis Rey, West San Luis Rey, and Santa Margarita Rivers in San Diego County; the Santa Ana River in Riverside County, and the Santa Ynez River in Santa Barbara County (see Appendix C for site descriptions and sources of information). The sites were selected for analysis because (1) they supported the few remaining least Bell's vireo populations by the time the species was listed in 1986 and intensive monitoring and management initiated, (2) they have been monitored annually for from 5-15 consecutive years, and (3) long-term color-banding and resighting studies are being pursued at most sites. These attributes allow for analysis of least Bell's vireo population dynamics, demography and dispersal over a wide geographic area and a relatively long period of time. In 1994, these eight sites supported approximately 70 percent of the known least Bell's vireo population.

Empirical values were entered into the model parameters "R" (average population growth rate), standard deviation of R, density dependence, and migration rates between populations. These are discussed in turn below.

R: R symbolizes the average growth rate of a population, and is the proportion by which the population size changes each year. It is calculated as population size at time t+1/population size at time t. An R equal to 1.0 represents a stable population (neither growing nor declining). R greater than 1.0 represents a growing population, and less than 1.0 a declining population. Populations in which R is chronically less than 1.0 will eventually go extinct.

Most modeling exercises involving endangered species attempt to identify the conditions necessary to achieve an R of 1.0 or greater; that is, the model is used to specify values for demographic parameters needed to reverse an extinction-bound trend and achieve at a minimum a stable population. In simulating the least Bell's vireo metapopulation, this was not done. Analysis of the long-term data available for the eight core populations revealed average R's of greater than 1.0, indicating that reproductive output is currently adequate to maintain at least stable populations (Table 1).

Standard Deviation of R: The standard deviation of R is used to model fluctuations in the population growth rate from year to year, simulating the variability found in nature.

Density Dependence: Density dependence refers to the relationship between population growth and population size, and whether or not population growth is limited by any factors as a function of size. Populations that are density independent grow exponentially and are not limited by resources. Populations such as the least Bell's vireo, however, are eventually limited by habitat availability and resources critical to survival and reproduction. A logistic model of density dependent growth was used in the simulations. By this model, as populations grow and approach the limit, or carrying capacity, of their environment, their rate of growth slows and approximates 1.0. At this point, the population is in a stable equilibrium unless disrupted by a change in the environment or some demographic parameter.

Simulation of density dependent growth requires specification of K, the carrying capacity, for each population. The value of K is not known for least Bell's vireo populations. A crude estimate can be obtained by dividing the total habitat base by the average least Bell's vireo territory size, but this assumes the habitat to be homogenous in quality and considers only one potentially limiting resource (space). Moreover, average territory size at the breeding areas it has been studied at has declined over the years as least Bell's vireo abundance has increased, indicating that the minimum threshold in territory size has not yet been achieved. As a conservative estimate, the population sizes at each site in 1994 were used as values for K to simulate density dependent growth. This allowed an assessment of the metapopulation's future under the assumption that all suitable habitat is currently occupied and no further population growth at these sites is possible (a worst case scenario). These values were then increased by 50 percent in a separate simulation to determine the sensitivity of the results to K.

Migration Rates: Migration, which includes dispersal of birds away from their natal sites and movement between populations by adults, was modeled using data from color-banded birds of known origin. Return rates to the natal site, as well as observations of birds at sites other than their natal sites, allowed calculation of the proportion a given population that migrated to each of the other populations in the metapopulation, and vice versa. Migration between populations was not symmetrical; that is, the migration rate from Population A to Population B was not equivalent to the migration rate from Population B to Population A. Rather, a northward bias was detected, with birds more likely to change drainages by moving north than by moving south.

Migration rates are probably underestimated, because they rely on thorough examination of all individuals in a population to detect banded birds, and then depend on accurate determination of the band combination of any banded birds located. Canvassing an entire population for banded birds is more feasible in small populations than in large ones, and even then, obtaining clear views of females can be challenging. The opportunity for resighting banded birds was beyond the scope of some projects, given the person-power and funding available for such an effort.

Table 1. Empirical values used in least Bell's vireo PVA

Site	Average Growth Rate (R)	Standard Deviation of R	1994 Population Size (# males)
Tijuana River	1.60	0.33	80
Sweetwater River	1.05	0.25	61
San Diego River	1.08	0.13	36
San Luis Rey River	1.16	0.29	89
West San Luis Rey River	1.68	0.91	31[a]
Santa Margarita River	1.29	0.32	348
Santa Ana River	1.37	0.19	188
Santa Ynez River	1.02	0.27	31[a]

[a]*1993 data most recent available.*

To initiate the simulations, geographic coordinates are input for each site to establish spatial relationships, and initial population sizes specified. Population sizes during the first year of monitoring were used for these values, creating an opportunity to compare the results of the simulations with the past ten or so years of history. One hundred replications of each simulation were run, using a time frame of 100 years. Three questions were asked of the model:

1. What is the probability of extinction of the least Bell's vireo during the next 100 years?

The results of the simulations predict that the least Bell's vireo metapopulation as defined by the eight core sites has an extinction probability of zero during the next 100 years. Moreover, seven of the eight individual populations have extinction probabilities of zero over the same time period, indicating that they are unlikely to "blink out" and require re-colonization by migrants from another population. One population (at the Santa Ynez River), is at risk of extinction, however, as a result of small population size, a low rate of growth, and isolation from dispersers from other of the core populations, at least to the extent that such migration could be detected by observations of color-banded birds. The Santa Ynez population may in fact persist longer than predicted if it is experiencing immigration from other unknown or unbanded populations.

2. How long will it take for the least Bell's vireo population to reach carrying capacity?

The time required to reach carrying capacity, at which time the population becomes stable (R = 1.0) depended on the value of K input into the model. The metapopulation reached equilibrium within approximately 20 years when 1994 population sizes were used to estimate K; note that nearly half of this time has actually passed since the starting point of the simulations reflected population conditions during the mid-1980's. The time to achieve equilibrium for each of the seven individual populations that grew to carrying capacity ranged between 15 and 30 years, with a modal time of 20 years. One population, the Santa Margarita River, failed to reach the carrying capacity input into the model (348 pairs) and instead leveled off at approximately 220 pairs. This may be the result of overestimating migration away from the Santa Margarita by failing to detect birds remaining at their natal site, and of underestimating migration into the Santa Margarita population by a similar failure to detect color-banded immigrants.

When K is increased by 50 percent, the time to achieve equilibrium for the metapopulation increased from 20 years to 28 years, or by 40 percent (Figure 2). The differences for the individual populations ranged from zero to 30 percent (Figure 2).

3. What is the effect of migration rate on the time required to reach carrying capacity?

Migration rate was varied holding K constant at the larger of the two estimates, producing the result that time to achieve equilibrium under higher migration was virtually unchanged for those populations currently experiencing low migration rates, and increased for those with high rates, particularly those with emigration (migration out of the population) rates higher than immigration (migration into the populations), such as the San Diego and San Luis Rey Rivers (Figure 3). An exception to this was the Santa Margarita River, for which the simulations predicted a reduction in the time to achieve stability. This may be because the simulations also predicted a lower equilibrium population size at the Santa Margarita under conditions of higher migration.

Conclusions

The following conclusions are drawn from this modeling exercise:

1. Under current conditions, the least Bell's vireo is not at risk of extinction.

2. One population at the Santa Ynez River is at risk of extinction as a result of a low reproductive rate and no detectable migration into the population. However, this population should continue to be managed to preserve it as a "stepping stone" for future colonization to the north, and because establishment of breeding populations in the vicinity of the Santa Ynez River, such as those at the Ventura and Santa Clara Rivers, may facilitate migration into the population and provide a "rescue effect" from local extinction.

3. Although carrying capacity and hence potential maximum population size for the least Bell's vireo is not known at this time, at current rates of growth, least Bell's vireo populations have the capacity to achieve conservative estimates of carrying capacity within 20 years. In fact, least Bell's vireo at some sites, such as the Santa Margarita River, appear to be "out-performing" the simulations in actual population growth, achieving the predicted maxima rather than the averages.

4. Migration rates among populations influence the time required to achieve carrying capacity for those populations with a comparatively high rate of emigration. However, for a 50 percent increase in migration rate, time to reach equilibrium increases by less than ten years, a remarkably short period of time within the context of endangered species management. Further study is needed to improve estimates of migration among the eight core populations as well as other populations throughout the range of the least Bell's vireo.

APPENDIX C: SOURCES OF INFORMATION FOR THE POPULATION VIABILITY MODEL

Tijuana River:	RECON 1989; Kus 1990c; 1991e; 1992c,d; 1993d;1994b.
Sweetwater River:	Jones 1985b; Collier and Jones 1989; Kus and Collier 1988; Kus 1989b;Kus 1990b; Kus 1992b; Kus 1993b.
San Diego River:	Jones 1985; RECON 1989; Kus 1989a; Kus 1990a,b; Kus 1992a; Kus 1994a; Kus 1995a.
San Luis Rey River:	Jones 1985; RECON 1989; Kus 1989c,d; Kus 1991a; Kus 1993b; Kus 1995b.
West San Luis Rey River:	Jones 1985; RECON 1989; Kus 1989e; Kus 1991b,d; Kus 1992e; Kus 1993c; Griffith and Griffith 1995.
Santa Margarita River:	Salata 1980; Salata 1981; Salata 1982; Salata 1983; Salata 1984; Salata 1986; Salata 1987; Jones 1989a; Griffith and Griffith 1990a,b; Griffith and Griffith 1991; Sweetwater Environmental Biologists 1992a; USFWS 1994; USFWS 1995.
Santa Ana River:	USFWS 1986; Hays 1986; Hays 1987; Hays 1988; Hays 1989; Hays and Corey 1991; Pike and Hays 1992a,b; Pike and Hays 1993; Pike 1994.
Santa Ynez River:	RECON 1989; Greaves 1991; Greaves 1992; Greaves 1993; Greaves 1994.

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Ecological Services
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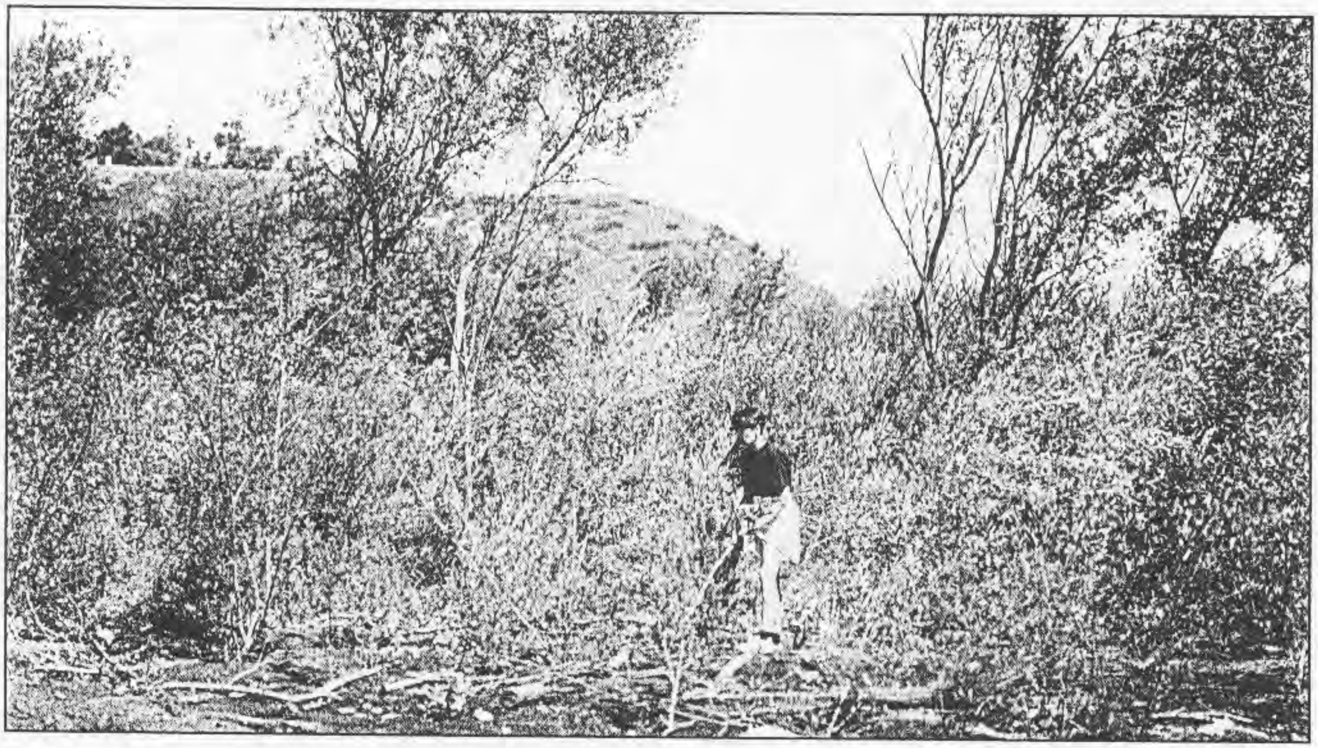
Portland, Oregon 97232-4181

March 1998

EXHIBIT 7



Details of community structure are a critical factor in the development of habitat for birds such as the least Bell's vireo in riparian areas of southern California. Structure may be controlled to some extent by the choice of species and placement of plants, but it also depends on soil mycorrhizae, which influence the uptake of water and minerals. Here author Kathryn Baird spreads litter to introduce mycorrhizae at a restoration site.

High Quality Restoration of Riparian Ecosystems

The attempt to create habitat for rare bird species is leading to the refinement of techniques for creating authentic replicas of these environmentally critical systems.

by Kathryn Baird

Despite the legal and grassroots efforts to preserve riparian ecosystems during the past three decades, today the few remaining areas are being threatened by intensified development accompanied by growing political pressure. As a result these areas are often the objects of efforts to preserve natural areas or to mitigate their loss through restoration. Work of this kind is sometimes associated with highway development, and staff biologists at the California Department of Transportation in San Diego County have been involved in the restoration of numerous riparian systems during the past eight years.

In the course of constructing a number of these systems and reviewing many more we have begun to identify some of the factors that are critical for successful restoration of these systems. In general what we have found is that, while properly installed plantings may be successful on riparian sites, the composition and structure of the resulting community is frequently quite different from that of the natural or model community. This may not be critical if one is concerned only with establishing vegetative cover. It becomes critical, however, in projects designed to provide habitat for a particular species, or when the goal is creating functioning, self-sustaining ecosystems. As a result we have paid special attention to structure and dynamics as well as species composition in our projects. This has led to a number of refinements in technique, and the results, though still incomplete, do suggest an improvement in our ability to create habitat for particular target species.

This article summarizes what we feel are the most important lessons we have learned in the course of this work. These should be of value to others attempting to create habitat for native species. They may also be of value to those restoring native ecosystems under comparable conditions, in which rainfall is low and seasonal, and water is drawn directly from the water table a meter or so beneath the soil surface or is supplied by periodic flooding.

Design Aspects

The use of an ecosystem model has been a key feature of our attempts to create habitat for the least Bell's vireo (*Vireo bellii pusillus*) at sites along the San Luis Rey River and the San Diego River in San Diego County. Admittedly,

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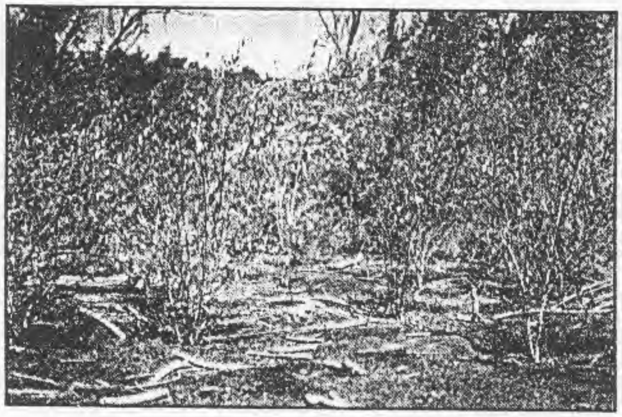

The same site about two months after work was completed in May, 1989.

understanding an ecosystem is difficult at best, but an ecosystem approach appears to be the surest way to create a functioning habitat. The goal of any habitat creation project should encompass both long and short term objectives. The short term objective for these projects is to provide suitable least Bell's vireo habitat. The long term objective is to create a framework within which natural selective forces can operate to create a self-sustaining, functioning riparian habitat that not only provides habitat for a complete assemblage of riparian species, including the vireo, but which is also capable of long-term regeneration and recovery following natural disturbances.

Vireo Habitat Model

Restoration projects aimed at a particular species are not unlike general habitat restoration projects, except that the baseline studies require directed analysis of the target species in addition to habitat studies. We began our projects by analyzing biological data on 30 active vireo nest sites and 10 non-nesting riparian sites (Hendricks and Rieger, in press). We then selected five factors as the basis for the model we used to develop restoration objectives at our various sites. These were: plant density, percent cover, species composition, and community structure and arrangement in the landscape. (A detailed account of the model development process can be found in the 1988 California Riparian Systems Conference Proceedings (Baird and Rieger, in press).)

The first parameters we considered were density and percent cover for each of the plant groups (trees, shrubs and herbs) (Table 1).

Next we developed a list of the native species at project sites on each of the river drainages. Percent abundance for the tree species varied from site to site, but species composition did not. A list of species and their relative abundances on both river drainages is provided in table 2.

These values then became the "target" values for restoration sites in these drainages and the basis for our planting program.

To maximize survivorship and reduce the need for disruptive replanting we used 1-, 5- and 15-gallon container-grown plants from a local native plant nursery. Contrary to popular dogma, we have had lower mortality and better results generally with 5- and 15-gallon than with 1-gallon stock, both in the short and long term. If the nursery has handled the larger plants correctly, and the root systems are healthy the larger plants are simply more vigorous and reliable.

The percent of each size class used was modeled after the height variation and ranges found in the field, taking into consideration the anticipated growth rates for each species. In preparing planting plans we also allowed for field mortality and recruitment for each species, using estimates based on earlier restoration projects and communications with other biologists. We then calculated the actual planting numbers for each species and size according to the following formula:

[(Density)(Species abundance)(% Size class)] +
[(% Mortality)(Density)(Species abundance)] -
[(% Recruitment)(Density)(Species abundance)]=
Planting number.

Planting Pattern

To develop a pattern for setting out plants in the specified age and size categories, we first made scale maps of our original 30 vireo nesting sites. We then chose four of the "best" maps and used them as the basis for the planting layout. On this basis we constructed a 100 X 100 foot (30m X 30m) "cell," checking it against the percent cover and linear edge values calculated from the field studies. What resulted was a mosaic planting design that included areas of trees, shrubs and open space. We then used this cell as a module that can be replicated and joined together to accommodate an area of any size or shape.

Table 1. Percent Cover and Density Values

	San Diego River		San Luis Rey River	
	Percent Cover	Density No./acre	Percent Cover	Density No./acre
Trees	50	1056	47	1000
Shrubs	39	1890	33	3966
Herbs	4	2655	8	2655
Open	7	NA	12	NA

Table 2. Species composition and abundance (as percent of individuals in class)

	San Luis Rey	San Diego
Trees		
Salix gooddingii	37	40
S. lasiolepis	40	37
S. hindsiana	11	6
S. laevigata	10	6
Populus fremontii	1.3	6.5
Platanus racemosa	0.7	4.5
Shrubs		
Baccharis glutinosa	100	100

Following the resulting plan, we then set out the appropriate willow species in monotypic groups of 12-15 of mixed sizes within areas designated as tree cover. To encourage the *Baccharis* shrubs to develop their characteristic, multi-stemmed, fountain-like growth form, we planted some in clusters of two or three. We also developed lists of herbaceous species based on information obtained in the original field studies but excluding exotic species present on the model sites. A local seed specialist developed a planting prescription for these species, specifying the amount and purity of seed to be used on each site, using the method described by Schaff (1988). To help in locating specific areas during construction and later during trouble shooting and monitoring, we superimposed the sprinkler system on the planting plan and numbered the sprinkler heads to establish a convenient system of coordinates on each site.

Site Specifications

The success of any restoration project depends in part on how closely the site you've chosen meets the criteria for the community or ecosystem you are trying to restore. With enough water and work we can force most any group of plants to survive, at least for a time. However, if the conditions on the site differ significantly from those under which the system occurs naturally, its long term survival and regeneration are unlikely. A key criterion for riparian system in the arid West is the elevation or depth-to-groundwater requirements of the habitat in question—in this case riparian willow scrub.

Unfortunately, information on this subject is limited. There is general information on days per year of inundation for specific habitats and species types (Granholm et al, 1988). But this provides only an indirect indication of normal ground water relations. To obtain a more direct reading, we measured elevation profiles across shorelines at several points along the San Luis Rey River to determine the normal depth-to-groundwater range. On the basis of this limited information we designed a surface elevation about 0.9m to 1.2m above the average low water table. So far, our experience makes it clear that there is a real need for more information about the relationship between depth-to- groundwater and community type and dynamics. This underscores the importance of measuring, recording and publishing information about groundwater relationships in carrying out restoration projects on riparian sites, and suggests an area in which restorationists may make an important contribution to the understanding of an ecological system.

We next determined final elevation grades for each of our restoration sites by drilling well holes at various locations and then sketched out the topographic relief and elevations for each site. We specified surfaces ranging between 1m and 1.6m above the water table and included gentle hills throughout the sites. This topographic variation together with a rough surface provided microclimatic variation we think is likely to increase biological diversity in the community developing on the site. On soils containing clay we included networks of channels to facilitate drainage and water movement. Past experience has shown that even small amounts of clay in the soil can cause ponding and loss of plants. Depending upon the amount of clay in the soil other modification may be needed for successful plant establishment. Sandy soils, on the other hand, require little or no channelling, since water moves readily through these soils.

IMPLEMENTATION

Weed Competition

In the six riparian restoration projects we have carried out, competition from exotic weed species has been a major factor in mortality and site failure. If the site is not being graded (assuming that it is already within the acceptable elevation range) a large weed seed bank will usually have accumulated by the time restoration begins, the number and kinds of seeds in the bank depending both upon the current condition and history of the site (See R&MN 7(1) p.24). As a result, in most cases with the addition of water you will find yourself with a field of weeds so vigorous you will be unable to locate anything smaller than a 5- gallon plant.

One way to avoid this is to remove the seed bank by removing the surface soil. This has several obvious disadvantages, including removal of nutrients, mycorrhizal fungi, bacteria, and insect and invertebrate populations critical to a healthy habitat. However, since the majority of areas selected for our restoration sites have been dominated by undesirable exotic species, we have frequently resorted to soil removal to reduce weed problems. To reiterate, our experience shows that weed and weed seed removal by mechanical means, repeat burning or some other method is mandatory in projects such as ours.

We have also used a cover crop of native wildflowers, hand- broadcast over the site to aid in weed control. These species (for example, California poppy (*Eschscholtzia californica*), lupine (*Lupinus bicolor*), and common phacelia (*Placelia parryi*), are not expected to survive in large numbers beyond the first year or two, and we hope they will reduce competition from exotics while contributing organic matter to the soil. The initial results have been mixed. On our drier, sandy sites germination of the wildflowers has been low, limiting their value as a weed deterrent. On the wetter, heavier soils, however, the wildflowers have established better and do seem to be helping to control weeds.

Unfortunately, the only sure way to control weeds during the first growing season is by frequent hand weeding. The important thing here is to weed frequently, keeping ahead of weeds before they get out of control.

Soil Flora

There is considerable evidence that fertilizing a restoration site in southern California favors exotic weeds over native plants (Grime and Hunt, 1975; Grime, 1978; St. John, 1987 and 1988). Many plants native to southern California have evolved under a low nutrient regime and are less capable of utilizing added fertilizer than are many exotics. Rather than fertilize we have chosen to inoculate our sites with mycorrhizal fungi, which enable seedlings of some species to better utilize limited supplies of both water and nutrients (Hayman, 1983; Stribley, 1987; Miller, 1987). By the same token, the rate of establishment of many native species may be reduced by the diminished inoculum levels on a disturbed site, since succession may depend on the establishment of critical mycorrhizal associations (Warner et al, 1987).

Thus introduction of an appropriate inoculum of mycorrhizal fungi may play a key role in the establishment and long-term development of a restoration project. If the plants in question are endomycorrhizal plants we find it is usually easiest to have a nursery inoculate all potted material. Direct inoculation of the soil with endomyrorrhizae is also possible. Most riparian species are ectomycorrhizal, however, and the spores of appropriate species are generally abundant in the leaf litter and duff under mature riparian plants. To inoculate our sites, we simply collected litter from mature communities upstream from our sites and spread it thinly over our sites following planting.

This procedure raises questions about the quality and performance of an inoculum. An assemblage of organisms obtained in this way will include a variety of organisms, including bacteria and actinomycetes in addition to mycorrhizae, which are adapted to field conditions, and may or may not be more effective than inoculation with pure cultures of mycorrhizae (Perry et al., 1987). In any case, this is hardly an option in most instances, since pure-culture inoculum is not readily available for most systems. (This problem is being addressed by at least one native plant nursery in southern California, the Tree of Life Nursery in San Juan Capistrano (Ted St. John, personal communication).)

Table 3. Performance Criteria

Percent Cover	Goal	Range
Tree*	50	40-60
Shrub*	39	30-50
Herbaceous*	4	2-9
Open*	7	3-9
Species Composition	**Goal (percent)**	**Range (percent)**
Salix gooddingii	40	30-50
S. lasiolepis	37	30-50
S. laevigata	6	3-9
S. hindsiana	6	3-9
Populus fremontii	6.5	4-10
Platanus racemosa	4.5	3-7

* The combined cover of trees and shrubs must total at least 82 percent, while the combined total of herbaceous and open is not to exceed 18 percent nor fall below 5 percent.

Soil microbes, bacteria, fungi and invertebrates are critical components of most ecosystems, yet are often overlooked because of the complexity of the underground part of the system and the difficulty of obtaining detailed information about it. This being the case, we have done as restorationists generally do and have relied on the introduction of soil, principally in the form of the rootballs of transplanted stock, to introduce these organisms into the restored community.

In our case, this was introduced in the form of large (1.2m deep by 2.8m wide) rootballs of mature trees brought in from riparian sites to meet Caltrans' tight schedule for restoration projects. Smaller, more economical soil plugs scattered throughout the site can serve the same purpose. The number of soil plugs needed to ensure the establishment of soil flora is directly related to the distance of the restoration site from a similar, mature community.

Criteria for Success

The U.S. Fish and Wildlife Service and Caltrans have jointly developed performance criteria for the riparian projects, and these criteria have become more specific as both parties have progressed in experience and knowledge. For the majority of Caltrans' projects these criteria must be met before initiation of highway construction is permitted. Our San Luis Rey River sites will be considered successful when a pair of least Bell's vireos has nested successfully on the site, or when the vegetation on the site matches that on active breeding sites within specified limits. On the San Diego River, the vegetation must match the values for percent cover and species composition specified in Table 3. Sampling to measure for these goals will be performed by dividing the site into eight cells of approximately 2.6 ha each. Each cell must be sampled at four randomly selected points using the same sampling technique employed in the collection of original vireo habitat data. Prior to construction, seven of the cells must meet the designated criteria, the eighth cell may miss the goals by up to 5 percent, with corrective measures being taken in that area concurrently with final review. A cell will be considered successful regardless of the vegetation condition if a least Bell's vireo, willow flycatcher or yellow-breasted chat nests within that cell.

* The combined cover of trees and shrubs must total at least 82 percent, while the combined total of herbaceous and open is not to exceed 18 percent nor fall below 5 percent.

RESULTS

It is still too early to make definitive statements about any of our least Bell's vireo restoration projects. Investigators are monitoring insect population dynamics and avifauna use. However, by all initial indications they appear healthy and are showing great promise. Within the first season a variety of passerine birds has been spotted foraging within the sites, among them pairs of least Bell's vireos, yellow-breasted chats, black grosbeaks, warbling vireos and common yellow-throats with young, yellow and orange-crowned warblers and western flycatchers. One of the sites even contained a passerine nest with two chicks. Unfortunately, the nest failed before positive identification could be made.

In summary, the most important thing we have learned from our experience so far is the value of imitating the natural habitat closely in designing a restoration site. In visiting sites throughout California we have been troubled by what could best be described as a lack of depth and completeness in the planning and implementation of many projects. While the appropriate dominant plant species may be present, we often cannot shake the feeling of an artificial, landscaped habitat. In some instances, moreover, failure to use an ecosystem approach has resulted in sites permanently dependent upon an artificial water source or lacking critical understory components, and we also have the impression that these sites are less attractive to wildlife as well.

All this underlines the importance of restoration planning based on careful analysis of species composition, density, community structure, arrangement, ground water and soil characteristics. This may be difficult in some situations. But in most cases a little work and perseverance can provide the data required to design a responsible restoration project.

References

Baird, K.J. and J.P. Rieger. In Press. Restoration design for least Bell's vireo habitat in San Diego County. In: Proceeding of the California Riparian Systems Conference, 1988; Davis, California.

Granholm, S., W.P. Henry, W.D. Kanemoto and R.E. Palmer. 1988. Designing riparian plantings to mimic native forests within four hydrologic zones along the Sacramento River. In: J.P. Rieger and B.K. Williams (eds.) Proceedings of the Second Native Plant Revegetation Symposium, San Diego, California. pp. 198-212.

Grime, J.P. 1978. Interpretation of small-scale patterns in the distribution of plant species in space and time. In: A.J.H. Freysen and J.W. Woldendorp (eds.) Structure and Functioning of Plant Populations. Elsevier, North-Holland, Amsterdam, New York, pp.101-104.

Grime, J.P. and R. Hunt. 1975. Relative growth rate: its range and adaptive significance in a local flora. J Ecology 63:393-422.

Hayman, D.S. 1983. The physiology of vesicular-arbuscular endomycorrhizal symbiosis. Can. J. Bot. 61:944-963.

Hendricks, B.J. and J.P. Rieger. In Press. Description of nesting habitat for Least Bell's Vireo in San Diego County. Proceeding of the California Riparian Systems Conference, 1988; Davis, California.

Miller, R.M. 1987. The ecology of vesicular-arbuscular mycorrhizae in grass-and shrublands. In: Gene Safir (ed.) Ecophysiology of V.A. Mycorrhizal Plants. CRC Press, Boca Raton, Florida. pp. 135-170.

Perry, D.A., R. Molina and M.P. Amaranthus. 1987. Mycorrhizae, mycorrhizospheres and reforestation: Current knowledge and research needs. Can. J. Forest Research. 17:929-940.

St. John, T.V. 1987. Mineral acquisition in native plants. In Elias, Thomas S. (ed.) Conservation and Management of Rare and Endangered Plants. Sacramento, Calif.; California Native Plant Society. pp. 529-536.

St. John, T.V. 1988. Soil disturbance and the mineral nutrient of native plants. In: Rieger J.P. and B.K. Williams (eds.) Proceedings of the Second Native Plant Revegetation Symposium; San Diego, California. pp. 34-39.

Schaff, V.W. 1988. Using seeds of native species for revegetation. In: Rieger, J.P., and B.K. Williams (eds.) Proceedings of the Second Native Plant Revegetation Symposium; San Diego, California. pp. 32-33.

Stribley, D.P. 1987. Mineral nutrition. In: Gene Safir (ed.) Ecophysiology of V.A. Mycorrhizal Plants. CRC Press; Boca Raton, Florida. pp. 59-70.

Warner, N.J., M.F. Allen and J.A. MacMahon. 1987. Dispersal agents of vesicular-arbuscular mycorrhizal fungi in a disturbed arid ecosystem. Mycologia 79(5) 721-730.

EXHIBIT 8

The Riparian Bird Conservation Plan

A strategy for reversing the decline of riparian associated birds in California

A project of California Partners in Flight and the Riparian Habitat Joint Venture

The Riparian Bird Conservation Plan

A strategy for reversing the decline of riparian associated birds in California

Version 2.0

2004

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FIGURES

TABLES

Executive Summary

This Riparian Bird Conservation Plan is a collaborative effort of the Riparian Habitat Joint Venture (RHJV, all acronyms are defined in Appendix C on page 144 and California Partners in Flight (CalPIF) and has been developed to guide conservation policy and action on behalf of California's riparian habitats and wildlife. The Conservation Plan focuses on data concerning bird species associated with riparian habitat, but conservation recommendations, if implemented, should benefit many riparian associated species. The plan, which includes both this written document and an associated web site, is intended to provide a source of information on riparian bird conservation for managers, agencies, landowners, academic institutions and non-governmental organizations. This Conservation Plan "takes a heroic step forward in tightening the link between science and on-the-ground management" (Golet 2001). This is not a regulatory document, nor does it represent the policies of any agency or organization.

This Conservation Plan, along with the associated Geographic Information System (GIS) database of riparian monitoring projects maintained by PRBO Conservation Science (PRBO), is the second iteration of a continuing process of updating habitat conservation recommendations based on the latest scientific data. This Conservation Plan, combined with the associated RHJV Strategic Plan, provides the foundation for adaptive conservation planning in California's riparian habitats (RHJV 2003[a]). The plan applies broadly to many of the conservation efforts now underway in the state, including, but not limited to: the California Bay-Delta Program (CALFED); the California Biodiversity Council; California Legacy Project, all habitat-based Joint Ventures (i.e., Central Valley, Intermountain West, Pacific Coast, San Francisco Bay, and Sonoran); the Sacramento and San Joaquin River Basins Comprehensive Study of the U.S. Army Corps of Engineers (Corps); the SB 1086 Program; programs of the Natural Resources Conservation Service; US Fish and Wildlife Service refuges and 'Partners for Wildlife' program; The Nature Conservancy Ecoregion Plans; the California Wildlands Project; and updates to resource management plans (RMPs) and environmental assessments of the USDA Forest Service and Bureau of Land Management.

An important extension of this Conservation Plan is the on-line GIS database of riparian monitoring projects and focal species breeding status available through the CalPIF section of PRBO's website at http://www.prbo.org/calpif/htmldocs/riparian.html (Ballard et al. 2003a). Contributing to and managing data in this database is accomplished through a web interface, to which access is available by request. This database is used for cataloguing new information and new analysis and for updating conservation recommendations and goals. Bird and study site data will be posted on this website, periodically updated, and made available for use by the public. Therefore, this Conservation Plan is a "living" document.

Biological Need

More than 225 species of birds, mammals, reptiles, and amphibians depend on California's riparian habitats. Riparian ecosystems harbor the most diverse bird communities in the arid and semiarid portions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). Riparian vegetation is critical to the quality of in-stream habitat and aids significantly in maintaining aquatic life by providing shade, food, and nutrients that form the basis of the food chain (Jensen et al. 1993). Riparian vegetation also supplies in-stream habitat when downed trees and willow mats scour pools and form logjams important for fish, amphibians, and aquatic insects. The National Research Council (2002) concluded that riparian areas perform a disproportionate number of biological and physical functions on a unit area basis and that the restoration of riparian function along America's waterbodies should be a national goal.

Riparian vegetation in California makes up less than 0.5% of the total land area, an estimated 145,000 hectares (CDF 2002). Yet, studies of riparian habitats indicate that they are important to ecosystem integrity and function across landscapes (Sands 1977, Johnson and McCormick 1979, Katibah 1984, Johnson et al. 1985, Faber 2003). Consequently, they may also be the most important habitat for landbird species in California (Manley and Davidson 1993). Despite its importance, riparian habitat has been decimated over the past 150 years. Today, depending on bioregion, riparian habitat covers 2% to 15% of its historic range in California (Katibah 1984, Dawdy 1989).

Due to their biological wealth and severe degradation, riparian areas are the most critical habitat for conservation of Neotropical migrants and resident birds in the West (Miller 1951, Gaines 1974, Manley and Davidson 1993, Rich 1998, Donovan et al. 2002). California's riparian habitat provides important breeding and over wintering grounds, migration stopover areas, and corridors for dispersal (Cogswell 1962, Gaines 1977, Ralph 1998, Humple and Geupel 2002, Flannery et al. 2004). The loss of riparian habitats may be the most important cause of population decline among landbird species in western North America (DeSante and George 1994).

Photo by Eric Preston, ericpreston.com

Riparian areas provide habitat for numerous birds, including Song Sparrows.

Mission and Objectives

The mission of Partners in Flight (PIF) is to stop the decline of, and maintain or increase, healthy populations of landbirds in North America. This mission translates into identification of habitat conservation and management priorities for bird species at risk in California. By developing the Riparian Bird Conservation Plan, CalPIF seeks to promote conservation and restoration of these habitats to support long-term viability and recovery of both native bird populations and other native species. The goals of the Riparian Bird Conservation Plan are:

- Emphasize what is needed to conserve both populations of species, and species assemblages, which are defined here as groups of naturally co-occurring bird species.

- Synthesize and summarize current scientific knowledge of the requirements of birds in riparian habitats.

- Provide recommendations for habitat protection, restoration, management, monitoring, and policy to ensure the long-term persistence of birds and other wildlife dependent on riparian ecosystems.

- Support and inform efforts to increase the overall acreage and effectiveness of riparian habitat conservation efforts in California by funding, and promoting on-the-ground conservation projects.

This Conservation Plan concentrates on a subset of riparian bird species, with the aim of contributing to the conservation of riparian ecosystems as a whole. By focusing appropriate conservation efforts on well-chosen "focal" riparian bird species, many other animals and plants may also benefit (Lambeck 1997). For example, demographic monitoring of bird species is especially valuable if those species serve as indicators of the presence of a threatened biological community (Chase et al. 2000), or are sensitive to a particular type of environmental change, such as habitat fragmentation (Noss 1990). Other species, especially those with large area requirements, may qualify as "umbrella species;" those whose protection will result in the protection of many other species (Noss 1990).

The RHJV and CalPIF recognize that the subject of land managment and land use, whether on private or public lands, can be contentious. Because many California riparian areas are on private lands, the RHJV and CalPIF supports the need for land managers and landowners to have flexibility to develop systems that accommodate their needs while seeking to achieve the desired habitat characteristics that will maximize benefits to wildlife. CalPIF supports and will seek to maximize the benefits of new and ongoing efforts to ensure a critical level of riparian habitat is protected, monitored, and properly managed for future generations of Californians and wildlife.

Findings and Recommendations

This Conservation Plan has been developed collaboratively by the leading bird researchers in California through a process designed to:

- Capture the conservation needs for the complete range of riparian habitat types throughout the state.
- Develop biological conservation objectives using current data on riparian-associated focal species.

At more than 520 monitoring sites throughout California, researchers have been collecting data on riparian songbirds and are contributing to the CalPIF songbird monitoring database (http://cain.nbii.gov/prbo/calpifmap/index.html). Some of these data have contributed to the focal species accounts and recommendations presented in this plan. This document emphasizes a suite of 17 bird species chosen because of their conservation interest and as focal species representative of riparian habitats in the state. Preliminary analyses of the 17 focal species habitat requirements reveal:

- Eleven of these species have suffered reductions in a significant portion of their former breeding range and eight of 17 continue to decline. Extirpation appears to have resulted primarily from historical loss and fragmentation of riparian habitat throughout the state.

- Loss of appropriate habitat condition also often contributes to the decline or extirpation of a population. Ten of the focal species depend upon shrub cover and early successional habitat for successful nesting. These species particularly rely upon willow/alder shrub habitats with dense understory cover, which in turn require natural hydrological processes for establishment. Four of the focal species depend on late successional high canopy tree species. Cottonwood and willow tree regeneration is often compromised in riparian systems with altered hydrological processes such as peaks and timing of flows. The extensive alteration of California's streams and hydrological processes by humans contributes significantly to this habitat loss and degradation.

- Current restoration and rehabilitation efforts throughout the state need to be assessed with sound research and monitoring techniques (see Appendix B for more information). Many projects aim to increase riparian habitat by restoring natural hydrological processes or by managing dam releases. While these are excellent first steps in riparian restoration, success can only be gauged by observing their effects on wildlife.

- Riparian restoration and protection sites should be prioritized by:

    1. The ability to restore the natural hydrology of the area.

    2. Location of sites within potential dispersal range of existing "source" populations, which will maximize the potential for range expansion.

    3. The ability to protect and manage adjacent upland habitats for foraging, flood refugia, and/or nesting habitat.

    4. The extent to which land use within 7-12 kilometers from the riparian corridor (or even better, throughout the watershed) can be protected, influenced or is likely to remain under management that is beneficial to birds.

- High levels of brood parasitism by Brown-headed Cowbirds and high predation rates by native and nonnative predators significantly reduce the reproductive success of many species of birds. The structure and diversity of riparian vegetation heavily influence both factors. The size and isolation of remnant riparian patches, coupled with landscape-scale factors such as the type and configuration of surrounding land use, further influence avian productivity. Conservation efforts must initiate protection, management, and development of riparian and surrounding upland areas from a landscape-scale perspective. This will include promoting compatible types of agriculture, grazing, and recreation management, as well as comprehensive land use planning by local governments.

- Seven specific recommendations to increase the benefits of cultivated riparian restoration for landbirds are offered. Most of these recommendations will add little to the cost of restoration, but will significantly enhance benefits to songbirds in riparian habitats.

- Numerous specific recommendations concerning land management practices are offered that will benefit birds. Many recommendations can be implemented on farms and rangelands in California either to protect and enhance riparian habitats or to provide a beneficial buffer to riparian zones and reduce the impacts that negatively affect bird populations.

- The cost-effectiveness of many habitat restoration, management, and mitigation projects can be maximized by incorporating elements from this Conservation Plan, even if the project does not expressly aim to restore bird populations.

California Partners in Flight and Riparian Habitat Joint Venture Partners

California Department of Fish and Game
California Department of Water Resources
California State Lands Commission
Ducks Unlimited
Kern River Research Group (now defunct)
Klamath Bird Observatory
National Audubon Society
National Fish and Wildlife Foundation
National Park Service
Natural Resources Conservation Service
PRBO Conservation Science
River Partners
The Nature Conservancy
The Trust for Public Land
The Resources Agency State of California
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S.D.A. Forest Service
Wildlife Conservation Board

Photo by Peter Knapp.

Common Yellowthroat, a riparian focal species.

Chapter 1. Introduction

Updates to Version 2.0

This document represents the second iteration of the Riparian Bird Conservation Plan. A review of the original focal species list revealed the need to add three new species to better capture the diversity of habitat niches found in California riparian systems and to account for species which are experiencing range reductions in the state. Following the same criteria established in the selection of the original 14 focal species, Spotted Sandpiper, Tree Swallow, and Tricolored Blackbird were added. Species accounts for these new additions are currently in preparation and will be available at http://www.prbo.org/calpif/htmldocs/riparian.html. Their summary information has been added to this document. Static range maps of all 17 focal species, with 2004 data incorporated, are included in this version of the Plan (Figures 5-2 through 5-18). As always, the most recent updates for these maps can be viewed on the web site.

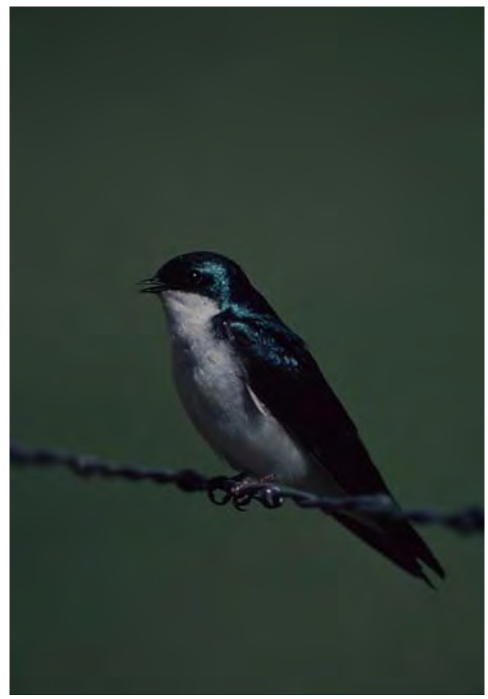


Photo by James Gallagher, Sea and Sage Audubon

Tree Swallow, a new focal species to Version 2.0.

In spring of 2001, the RHJV, the Wildlife Society and sponsors and supporters from numerous state, federal, and private entities hosted the Riparian Habitat and Floodplains Conference in Sacramento, California. This meeting was the largest one-time gathering of wildlife biologists and managers in the western United States in several years. Approximately 400 scientific papers were presented and more than 1,500 people attended. The proceedings derived from this conference were published in 2003 and present results from several projects that have been implemented since Version 1.0 of the Riparian Bird Conservation Plan (Faber 2003). References from these proceedings and other recent scientific publications have been incorporated into this revision of the Plan and added to the already extensive Literature Cited section.

Also new to this version is a description of a process for setting population objectives for select focal species using current monitoring data and GIS data layers (Chapter 6). In this version, examples from Central Valley Basins are used to estimate current and potential population size. Potential populations or "targets" are estimated using GIS data layers based on the historical extent of riparian forests, corrected for permanent habitat loss (urbanization). Densities estimated (using the values for the top 25% of surveyed sites currently available) are extrapolated to provide a target population. Target values for key demographic parameters (primarily nest success and survival) also are provided to evaluate and project a population's viability ('health'). In Chapter 7, we refined the definition of a Portfolio Site, and invited experts from each bioregion to supplement the existing list with new sites. In Chapter 8, we incorporated the most current riparian songbird data from several California bioregions into the Conservation Recommendations section and included the latest topical references from the scientific literature. Tables reflecting bird and habitat associations, estimates of nest success, and riparian songbird nesting seasons by bioregions have been added to better assist land managers with data pertaining to their specific area. In Chapter 9, we provided updates on the North American all-bird initiatives and the recent activities of the RHJV. In Chapter 10, we identified more opportunities for private citizens to be involved in bird conservation and to help enhance bird populations. Finally, we added a new chapter (Chapter 3) with information pertaining to landscape-scale factors that affect riparian birds.

As always, this Plan is a "living document" which will constantly be revised to best fit the needs of the land management, research, education, policy and conservation communities. Perhaps one of the most essential uses of this document is to demonstrate where information gaps exist, or where existing information has been overlooked. For this reason, and with the spirit of the RHJV in mind, we encourage you, the reader, to provide us with your feedback, data, and experiences. Version 3.0 is planned for release in September of 2006.

Riparian Habitat Joint Venture

Following a series of strategic meetings with members of the CalPIF Management Committee in 1993, the Riparian Habitat Joint Venture project was launched in a public ceremony along the American River in Sacramento in September 1994. The RHJV, modeled after the successful Central Valley Habitat Joint Venture project of the North American Waterfowl Management Plan, reinforces other collaborative efforts currently underway that protect biodiversity and enhance natural resources and the human population they support. The RHJV seeks to restore, enhance, and protect a network of functioning riparian habitat across California to support the long-term viability of birds and other species. The RHJV will provide leadership and guidance to promote effective riparian conservation from the local to state level. This will be accomplished by the following goals:

- **Identify and develop technical information for a strategic approach to riparian conservation in California.** To develop a strategic statewide approach to riparian conservation, the initial step is to assess the extent and condition of riparian habitat in California. In addition, the latest riparian management and scientific information must be continually assessed to refine and update RHJV conservation goals.

- **Promote and support riparian conservation on the ground by providing guidance, technical assistance and a forum for collaboration**. Through meetings, workshops, and technical assistance the RHJV provides a forum where members, as well as other organizations, can develop new collaborative opportunities for planning, funding and implementing riparian conservation projects.

- **Guide and promote riparian conservation policy through outreach and education.** The RHJV can raise the awareness of local constituents and state policy makers to the critical importance of riparian habitat for wildlife and plants as well as to the many benefits and services it provides to human society.

Partners in Flight

This Conservation Plan is one of many to be created under the aegis of the national movement known as Partners in Flight (PIF), which seeks to protect North American landbirds throughout their ranges by reversing species declines, stabilizing populations, and "keeping common birds common." PIF is an international cooperative endeavor initiated in 1990 in response to alarming population declines noted among species of Neotropical migratory birds. The program encourages conservation through partnerships before species and their habitats become threatened or endangered and provides a constructive framework for guiding nongame landbird conservation activities throughout the United States, Canada, Mexico, and Central America.

California Partners in Flight (CalPIF) was formed in 1992 with the full participation of the state's land and wildlife managers, scientists and researchers, and private organizations interested in the conservation of nongame landbirds. Noting that the major cause of population declines in California appeared to be habitat loss, CalPIF began identifying critical habitats important to birds and worked cooperatively to protect and enhance remaining habitat fragments. Recognizing their critical importance, CalPIF initially focused on riparian zones throughout the state. However, CalPIF has developed plans for several other ecosystems, including oak woodlands, coastal scrub and chaparral, grasslands, coniferous forests, shrubsteppe, and the Sierra Nevada. Visit http://www.prbo.org/calpif/plans.html for more information and current versions of these plans.

Photo by James Gallagher, Sea and Sage Audubon

The international initiative Partners in Flight strives to keep common birds common, such as this Black-headed Grosbeak.

Justification for the Conservation Plan

The justification for conservation can be articulated from various philosophical perspectives:

- An ecological perspective
- A perspective that emphasizes intrinsic value
- A primarily utilitarian or humanist perspective

Ecological Perspective

"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

-Aldo Leopold, *The Sand County Almanac.*

The ecological arguments for conserving birds as a component of biodiversity emphasize the critical role that birds play in ecological systems. A conservation plan based on the needs of birds makes sense for a number of reasons. Birds are critical components of natural ecosystems, and they occupy an extremely diverse range of niches within riparian systems. A large number of bird species breed in riparian habitat in California; many others use riparian areas during some portion of their life cycle. By managing for a diversity of birds, we will also protect many other elements of biodiversity and the natural processes that are an integral part of the riparian ecosystem (e.g., Bank Swallows depend upon regular high-water events to create exposed riverbank sites that they use for nesting). Also, because of their high metabolic rate, their relatively high position in the food chain and their distribution across a wide variety of habitats, birds are sensitive indicators of environmental conditions (Temple and Wiens 1989, Uliczka and Angelstam 2000, Bryce et al. 2002). Finally, birds are relatively easy and cost effective to monitor and they provide an excellent means by which to track larger changes in natural systems. Our rapidly expanding capacity to monitor demographic processes in birds (reproduction and survivorship) provides us with the ability to proactively address root causes of population declines and increases (Pienkowski 1991, DeSante and Rosenberg 1998).

Intrinsic Perspective

Modern philosophers and environmental leaders have increasingly recognized the intrinsic value of plants, animals, and even the inanimate physical environment (Callicott 1986, Sober 1986). Throughout human history, many cultural belief systems have greatly valued birds and other elements of the natural world for reasons other than materialistic needs. This tradition continues today and is meeting with broader acceptance in political and public life.

Utilitarian or Humanist Perspective

A strictly utilitarian or humanist argument for conservation of bird species focuses on the direct, tangible benefits that people and society derive from their "services." For example, many passerine species (including Neotropical migrants) play an indispensable role in control of forest and agricultural insect pests, saving millions of dollars in the application of deleterious pesticides. Additionally, bird watching is a popular outdoor recreation and is currently enjoyed by an estimated 67.8 million Americans according to the 2000-2002 National Survey on Recreation and the Environment (NSRE 2000-2002). Non-consumptive bird use contributes 16,000 jobs and more than $622 million in retail sales annually to the California economy, which leads the nation in economic benefits derived from "birders." Ecotourism, with bird watching as a primary component, is increasingly seen as the best new source of income that can cushion resource based economies as they transition to a sustainable level of resource use.

Objective of the Riparian Bird Conservation Plan

The Riparian Bird Conservation Plan seeks to synthesize and summarize the current state of scientific knowledge concerning the requirements of birds in riparian habitats. It provides recommendations for habitat protection, restoration, management, research, monitoring, and policy to ensure the long-term persistence of birds dependent on riparian ecosystems. This Conservation Plan is complemented by the RHJV Strategic Plan and the RHJV Annual Operating Plan (RHJV 2003a, 2003b) that will guide the RHJV in accomplishing its objectives. Both the Conservation and Strategic plans are "living" documents; new information and data analysis will be incorporated into the recommendations and conservation targets regularly.

Photo by Steve Zack, WCS

Yellow-breasted Chats nest in early successional riparian habitats.

Chapter 2. Riparian Vegetation in California

Riparian vegetation in California makes up less than 0.5% of the total land area, an estimated 145,000 hectares (CDF 2002, Table 2-1, Figure 2-1). Yet, riparian habitats have long been recognized as important to ecosystem integrity and function across landscapes, and have received much attention at scientific conferences and symposia (Sands 1977, Johnson and McCormick 1979, Warner and Hendrix 1984, Johnson et al. 1985, Faber 2003).

Riparian habitats have been identified as the most important habitats to landbird species in California (Manley and Davidson 1993, Davidson 1995), yet they have been decimated over the past 150 years. Reservoir construction, levee and channelization projects, livestock grazing, timber harvest, water pollution, introduction of non-native species, gravel and gold mining, and clearing for agricultural and domestic uses have all contributed to riparian destruction (see Knopf et al. 1988 for review). While no estimates exist for the total historical extent of riparian habitat in California, there were at least 600,000 miles of streams in the state that were capable of supporting this type of vegetation (Warner and Hendrix 1984). Current estimates of remaining riparian habitat in the state range from 2% to 7% for the Central Valley and desert areas and approximately 15% for the northern coastal streams (Katibah 1984, Dawdy 1989).

Table 2-1. Approximate extant hectares of riparian habitat in each California bioregion. Derived from composite 100-m pixel landcover GIS data compiled by the California Department of Forestry's Fire and Resource Assessment Program, 2002 (CDF 2002). CWHR codes are given in parentheses.

Bioregion	Aspen (ASP)	Montane Riparian (MRI)	Valley Foothill Riparian (VRI)	Desert Riparian (DRI)	Palm Oasis (POS)	Wetland Meadow (WTM)	Freshwater Emergent Wetland (FEW)
North Coast / Klamath	6	15,230	552	0	0	5,162	374
Modoc	1,345	1,609	12	0	0	22,570	93
Sacramento Valley	0	112	8,015	0	0	43	12,585
Bay Area / Delta	0	568	3,102	0	0	20	6,626
San Joaquin Valley	0	2	2,596	0	0	12	11,627
South Central Coast	0	3,454	2,925	0	0	3	83
South Coast	0	2,874	6,496	12	0	1,116	461
Sierra	5,252	10,620	68	0	0	14,884	794
Colorado Desert	0	46	220	826	15	47	55
Mojave	0	210	187	2,827	0	109	5
Total in California	**6,603**	**34,725**	**24,173**	**3,665**	**15**	**43,966**	**32,703**

Riparian Habitat

NRCS photo

The word *riparian* is derived from the Latin word *ripa*, meaning bank or shore (as of a stream), and this meaning remains intact today. Warner and Hendrix (1984) define *riparian* as pertaining to the banks and other adjacent terrestrial environs of freshwater bodies, watercourses, estuaries, and surface emergent aquifers (springs, seeps, and oases). These areas can be perennial, intermittent, or ephemeral, and include estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, providing linkages between waterbodies and adjacent uplands and include portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (NRC 2002). The available water provides soil moisture in excess of that typically available through local precipitation and potentially supports the growth of mesic vegetation. Here, *vegetation* refers to all the plant species in a region and the way they are arranged (i.e., plant assemblages Sawyer and Keeler-Wolf 1995).

The terms *riparian habitat* and *riparian vegetation* represent broad physiographic units and may include areas with few or no plant species in common. This is especially true in California, where differences in species diversity, topography, biogeography, climate, and geology are great. The California Wildlife Habitat Relationships (CWHR) system of classification provides general descriptions of wildlife habitats in California. The following brief descriptions of the major riparian habitats in California offer a window into the diversity of riparian vegetation. CWHR codes are given in parentheses. For complete accounts see Mayer and Laudenslayer (1988), updated periodically by the CA Department of Fish and Game (http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html). For Latin names of species, please refer to Appendix D.

Montane Riparian (MRI)

Montane riparian habitats (elevation = sea level to 2,440 m) are found in the Klamath, Cascade, Coast, Transverse, and Peninsular ranges and in the Sierra Nevada south to Kern and Northern Santa Barbara counties. Associated with lakes, ponds, seeps, bogs, meadows, rivers, streams, and springs, they are structurally diverse with variable vegetation. The composition of montane riparian zones varies widely by region. In northwestern California, west of the Klamath mountains, black cottonwood is the dominant species, sometimes codominant with bigleaf maple, and often associated with dogwood and boxelder. In northeastern California, black cottonwood, white alder and thinleaf alder are dominant, with Oregon ash and willow associates. Characteristic species of Sierra Nevada montane riparian zones include thinleaf alder, aspen, black cottonwood, dogwood, wild azalea, willow and water birch, white alder, and dogwood. Bigleaf maple and California bay are dominant in the southern Coast Ranges, the Transverse Ranges, and the Peninsular Range. Along the immediate coast, from San Luis Obispo to Del Norte counties, red alder is the dominant species in the coastal subtype of montane riparian.

Valley Foothill Riparian (VRI)

Valley foothill riparian habitats (elevation = sea level to 1,000 m) occur in the Central Valley and the lower foothills of the Cascade, Sierra Nevada, and Coast ranges. These habitats are associated with variable flow velocities and topographies, ranging from swift rapids and waterfalls of steep canyons to slow moving water in floodplains of gentle topography. They comprise a complex structure with a canopy, subcanopy, and understory shrub layer (usually impenetrable). Wild grape festoons trees and shrubs and constitutes a high percent of the groundcover. Dominant trees include valley oak, cottonwood, California sycamore, white alder, box elder, and Oregon ash, and California bay. Shrub layer plants include wild grape, wild rose, California blackberry, blue elderberry, poison oak, buttonbush, and willows. The herbaceous layer is diverse.

Desert Riparian (DRI)

Desert riparian habitats (elevation < 900 m) are found in scattered locations throughout the 1.4 million hectares of the Mojave, Colorado, and Great Basin deserts and in the desert canyons of the Peninsular ranges along permanent streams, seeps, and springs. They are often characterized by dense groves of low trees and tall shrubs; other patches are sparser, with medium-sized trees. The dominant canopy species vary but often include velvet ash, mesquite, Fremont cottonwood, willows and tamarisk (an invasive non-native species also known as Salt Cedar). The shrub layer comprises smaller individuals of canopy species as well as quailbush, Mojave seablight, desert lavender, seep willow, and arrowweed. Cattail and common reed are also important components of the understory.

Palm Oasis (POS)

Palm oasis habitats (elevation < 1,066 m) are found around the Salton Sea basin, especially along the San Andreas Fault zone, and are restricted to areas with permanent water of seeps, springs, and streams. Density of vegetation varies from sparse, scattered trees to dense, closely packed vegetation. The California fan palm frequently dominates the vegetation, but the habitat may also include coyote willow, velvet ash, California sycamore, naturalized date palms, Fremont cottonwood, mesquite, and tamarisk. Alkali sacaton and wiregrass dominate the herb layer. The understory also includes young individuals of canopy species and arrowweed, squaw waterweed, and alkali goldenbush.

Freshwater Emergent Wetland (FEW)

Fresh emergent wetland is found throughout California (most prevalent at elevation < 2,270 m) with the bulk of acreage in the Klamath Basin, Sacramento Valley, San Joaquin Valley, Delta, and Imperial Valley/Salton Sea. It primarily occurs at the edges of rivers and lakes. All emergent wetlands are flooded frequently. Dominant plant species include common cattail, tule bulrush, sedge, river bulrush, and baltic rush. Fresh emergent wetlands are an extension of many riparian areas, often grading into land with nonhydric soils.

Wetland Meadow (WTM)

Wet meadows (elevation = 1200-2400 m) usually occur in ecotones between fresh emergent wetlands and perennial grasslands. Where wet meadows merge with fresh emergent wetlands, slight differences in water depth significantly contribute to the animal species composition of the area. At all elevations, wet meadows generally have a simple structure consisting mainly of a layer of herbaceous plants. Trees and shrubs are an important part of the meadow, usually occurring around the edges. Wet meadows occur with a great variety of plant species, but several genera, including bent grass, oat grass, and rushes, occur commonly throughout the state.

Aspen (ASP)

Most aspen habitats (elevation = 2,000-3,000 m) in California are found within 80 km of the Nevada border from Mono County to Modoc County. Aspen habitats are found near seeps and streams on both the eastern and western slopes of the Sierra Nevada and eastern slope of the Cascade Range. East of the Sierra crest, aspens are found in the Carson and Monitor ranges and the Sweetwater and White mountains. Aspen stands tend to become more extensive in the north and east of their range. They comprise relatively open canopies associated with willows, alders, black cottonwoods, lodgepole pines, Jeffrey pine, ponderosa pine, red fir, and white fir. Important understory shrubs include sagebrush, roses, snowberry, chokecherry, and serviceberry with an extremely rich herbaceous layer. Additional aspen habitats are found on upland sites with increased associations with sagebrush and western juniper.

Photo by Eric Preston, ericnpreston.com

Aspens in Mono County, California.

A Standardized California Vegetation Classification

Recognizing the importance of broad, habitat-based classification schemes (e.g., CWHR), a detailed floristic system of California vegetation classification has been developed by Sawyer and Keeler-Wolf (1995). Their Manual of California Vegetation (MCV) provides a system of classification at a more specific level; floristically based on lower units of plant associations (referred to as series). With a standardized classification system one can describe vegetation associated with many aspects of bird biology and conservation across space and time. A single, widely accepted terminology provides land managers, natural resources specialists, and conservationists with a common language that promotes clear communication and hence better-informed decisions. CalPIF has adopted the Sawyer and Keeler-Wolf/MCV system of vegetation classification as the standard used for all CalPIF objectives. The Sawyer and Keeler-Wolf system ties in with continental planning efforts of The Nature Conservancy and is compatible with most previous schemes used in California, such as that of the California Biodiversity Council (see Chapter 7, Bioregional Conservation Objectives). As of 2004, the second edition of the Manual of California Vegetation, a new hierarchical vegetation classification system consistent with the National Vegetation Classification Standard (NVCS), is being developed by Sawyer and Keeler-Wolf, in coordination with a statewide committee (Sawyer and Keeler-Wolf *in prep*). In the NVCS, there are several upper levels of classification (currently six, may be reduced to three) representing growth form, leaf characters, hydrology, and environment and two lower levels, representing floristics (Alliance, Association). Alliances are defined by the dominant one to three species, while Associations are distinguished by secondary associated species, usually in the understory. Appendix E contains descriptions of riparian and semi-riparian alliances identified by the 2004 California Vegetation classification by Sawyer and Keeler-Wolf.

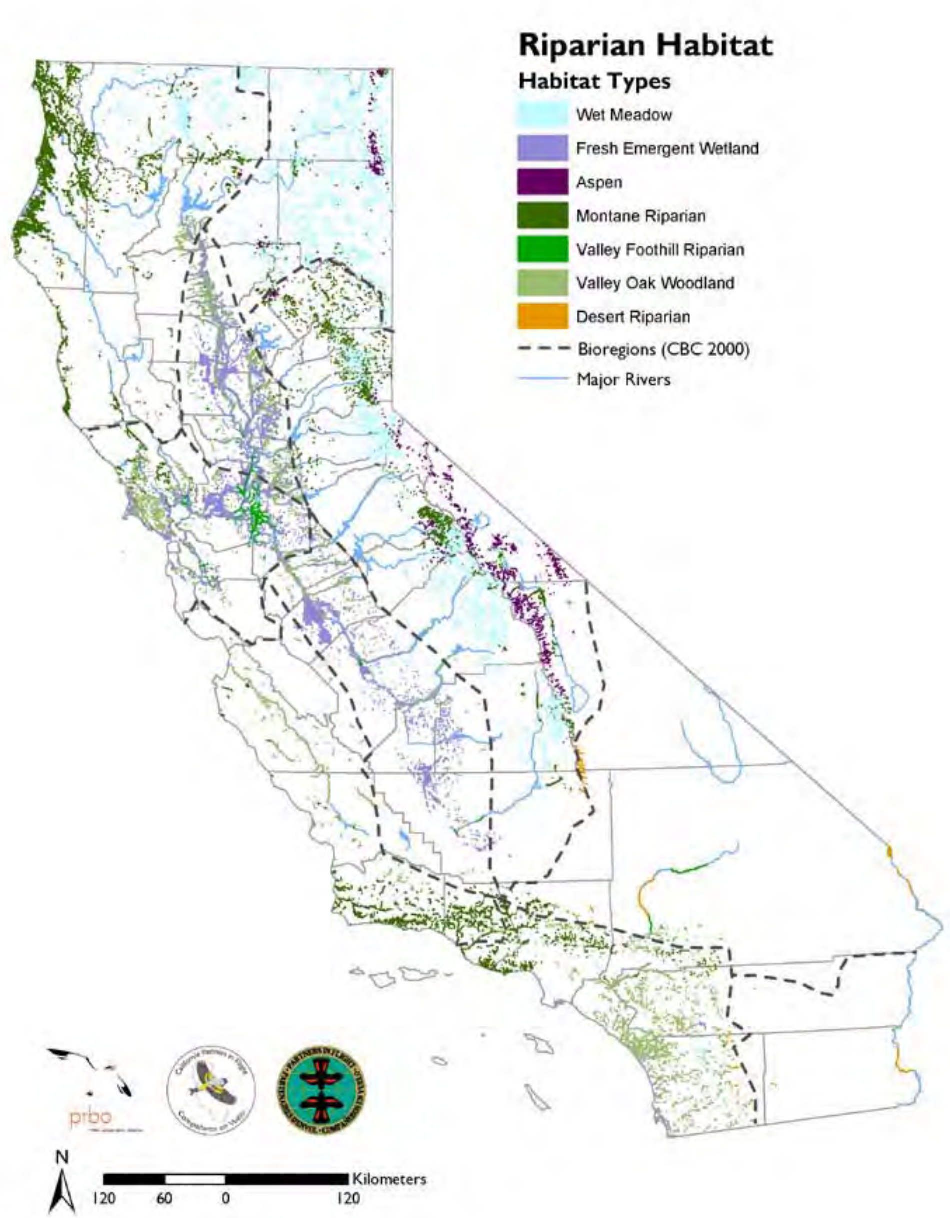


Figure 2-1. Approximate current coverage of riparian habitats throughout California.

Chapter 3. Riparian Habitat Conservation at the Landscape Scale

A number of issues covered in this Conservation Plan are united by the fact that they must be addressed on a relatively large spatial scale. When targets are set for restoring healthy population sizes of a given species (Chapter 6), researchers and land managers have to consider habitat at the scale of many hectares or square kilometers, and prioritizing land parcels for conservation and habitat restoration (Chapter 8) usually occurs at similar scales. Agricultural development in California's Central Valley, for example, has left remnant patches of riparian forest that measure from a few to a few hundred hectares (Hunter et al. 1999), and the conservation and restoration of this habitat involves consideration of the ecology of entire landscapes in which remnants are situated (Figure 3-1). Ecological conditions required for healthy wildlife populations in riparian habitats, such as complex vegetation structure that provides birds with nesting sites, are often measured at the scale of square meters (Kareiva and Andersen 1988); but additional conditions exist at much larger scales, and managers must also provide for these.

Figure 3-1. Point count locations and riparian data layers of the Central Valley basins.

The need for research focused on large-scale issues has been stressed in bird conservation initiatives (Ruth et al. 2003) and other conservation efforts partly because this is the scale at which parcels of land are owned and managed, and partly because many important ecological processes occur, and can only be studied, at large scales. Since the emergence of landscape ecology, research has increasingly been directed toward understanding the consequences for wildlife of alterations to, and the potential restoration of, natural habitats at large scales.

What is Landscape Ecology?

Landscape ecology takes into consideration the large-scale heterogeneity of areas containing species or natural communities that might be targeted for conservation. Although the size of a landscape is not strictly defined and can vary widely, landscapes typically exist at the general scale of a vista that can be seen in all directions around an observer from a single point. Such a landscape is normally a complex mosaic of multiple component areas (landscape elements or *patches*) under varying management practices or natural succession regimes (Forman and Godron 1986). Different patches may have different values for wildlife; some may be largely unoccupied by a given species while other areas are densely occupied, and occupied areas may be sites of largely successful or largely unsuccessful breeding and reproduction (i.e., population sources and sinks—Pulliam 1988, With and King 2001).

Landscape ecology, then, is concerned with interactions among these patches, in terms of the flow of species, materials, and energy among them. It also focuses on the ways that the specific shapes and spatial arrangements of landscape elements affect their interactions. That is, landscape ecology is a spatially explicit science (Forman and Godron 1986, Wiens et al. 1993, Forman 1995). While patches can be defined at nearly any scale, landscape ecology often investigates interactions of biological populations or communities with relatively large-scale environmental features and processes, such as regional topography, the expansion of urban areas into wildlands, and forest fragmentation. The growth of landscape ecology as a discipline has been paralleled by growing recognition that conclusions drawn from ecological investigations can depend upon the scale at which a system is studied (Wiens 1989, Riitters et al. 1997, Saab 1999, Wiens 1999, Schneider 2001). Environmental factors may affect bird populations differently at different scales, may only have important effects at certain scales, and may affect different species at different scales. For example, Hochachka et al. (1999) found for sites across the western U.S. that, while rates of songbird nest parasitization by Brown-headed Cowbirds decreased with increasing forest cover within 10 km of nesting sites, the relationship reversed when forest cover within 50 km was considered. Thus, the explicit consideration of scale has become an important aspect of ecological investigations, with consequences for conservation activities (Schneider 2001).

Landscape-scale factors that affect riparian birds

Many environmental factors can affect riparian bird populations at large scales. We mention here some of the more important ones that are of immediate conservation relevance.

Altered hydrology

Little research has investigated the impacts of California's large-scale alteration of natural hydrologic regimes to bird communities. Artificial flow regulation with local or upstream dams and diversions, as well as channel alteration and containment with levees and channelization, can alter plant communities at watershed scales (Ohmart 1994, Hunter et al. 1999). Vegetation, and therefore vegetation-dependent wildlife, can be dramatically affected by distant upstream water management practices (Ohmart 1994), so that restoration efforts at specific sites may depend ultimately on the cooperation of partners managing water in the wider landscape.

Habitat fragmentation and landscape condition

More attention has been paid to the topic of habitat fragmentation because fragmentation has been perhaps the most apparent human-caused transformation of natural systems, aside from their outright reduction in size (Meffe and Carroll 1997). As riparian forests have been converted to agricultural fields, for example, remnant undeveloped habitat has been left as a disconnected series of fragments of varying size and shape. Such habitat fragments have been likened to islands in a "sea" of inhospitable habitat. The Theory of Island Biogeography (MacArthur and Wilson 1967) maintains that smaller, more isolated islands (or fragments) support fewer species, due to a higher likelihood of local population extirpation. This general property of small populations results from numerous ecological mechanisms working at relatively small scales within islands or fragments, as well as at larger scales around them. For example, small remnant patches of breeding bird habitat in urban areas may contain such low numbers of a particular species that small increases in predation rates can cause extirpation. In such cases, increased densities of cats and other predators subsidized by the surrounding urban landscape can be sufficient to cause the loss of several songbird species (Soulé et al. 1988, Bolger et al. 1991, Crooks and Soulé 1999, Crooks et al. 2001). Donovan et al. (1997) found that in Midwestern forest habitats, nest predation was higher on habitat edges within moderately and highly fragmented landscapes, compared to unfragmented landscapes. Chalfoun et al. (2002) found that edge effects on nest predators were stronger in agricultural landscapes than in more heavily forested landscapes. In western riparian habitats, which are more naturally fragmented than eastern deciduous forests, densities of both nest predators and nest parasites (Brown-headed Cowbird) in forest fragments may depend more on surrounding land use, such as the prevalence of agriculture in the landscape, than on fragment size or amount of edge (Tewksbury et al. 1999). Nest parasitism by Brown-headed Cowbirds can affect the reproductive success of songbirds (Chapter 4), so landscape features that influence cowbird abundance are an important consideration.

Barriers to Movement

In addition to affecting habitat patch quality, surrounding landscape conditions can also affect wildlife movement among habitat patches. In naturally patchy systems such as desert riparian woodland, and possibly in artificially fragmented systems, it may be appropriate to consider bird populations in patches as parts of a metapopulation, or group of interconnected populations (Hanski and Gilpin 1997). In this framework, the probability of a local population's extirpation is reduced by occasional immigration from other patches, so that the long-term stability of the entire metapopulation depends on some minimum level of patch interconnectivity. In other words, a particular habitat fragment may be too small to meet minimum requirements for a stable population of a given species, but effective movement of individuals (such as dispersing juveniles or adults seeking mates) among multiple fragments can render each fragment a functioning component of the whole population. Movement among fragments may be hindered by hostile conditions in developed areas around fragments, and such movement can become increasingly unlikely with increasing distance between fragments (e.g., Norris and Stutchbury 2001, Cooper and Walters 2002).

Conservation Approaches

Clearly, the quality of remnant habitat fragments can depend not only on their size and internal characteristics, but also on their configuration relative to one another and the characteristics of the surrounding landscape (Andren 1992, 1994; Sisk et al. 1997; Tewksbury et al. 1998; Saab 1999; Tewksbury et al. 2002). Prioritization of sites for bird conservation should therefore consider surrounding landscape conditions, such as the proximity and prevalence of other natural areas, urban areas, agricultural areas, or Brown-headed Cowbird foraging areas. Managing for healthy wildlife populations in remnant natural areas may entail developing cooperative relationships with the managers of adjacent lands.


Weaselhead.org photo.

Female Brown-headed Cowbird.

Fragmentation vs. natural patchiness

The fragmentation of formerly contiguous habitat can reduce the usefulness of remaining habitat for wildlife conservation in some cases, so preservation and restoration efforts should in these cases prioritize large contiguous blocks of habitat and connectivity among those blocks. However, many natural systems are patchy or heterogeneous at large scales, and organisms can be adapted to naturally patchy environments. For example, desert riparian gallery forests often occur naturally as discreet patches along river stretches where conditions are favorable. This contrasts with the riparian forests of California's Central Valley, which were historically relatively wide, contiguous stands following river courses for long distances. Natural patchiness generates habitat heterogeneity that single organisms may use, as when bird species nest in one habitat and forage in another. In desert riparian systems, many riparian woodland-dependent species also forage in surrounding scrub habitat (Szaro and Jakle 1985). Thus, efforts to restore natural conditions must be tailored to the needs of specific systems, with consideration for the natural large-scale heterogeneity of many systems. In extreme cases of critical habitats that are very patchy, such as freshwater wetlands, conservation efforts may be best directed towards multiple small reserves where remnant habitat exists (Haig et al. 1998).

The landscape paradigm

It is increasingly recognized that viewing habitat remnants as islands embedded in a sea of unsuitable habitat is an oversimplification of reality, and conservation planning should not necessarily follow this model. Each of the patches that compose a landscape is more accurately seen as falling somewhere along a continuous gradient of habitat quality, and quality varies depending on what particular wildlife species or community one considers as well as the scale at which patches are defined (Wiens 1995). As discussed above, habitat quality is also mediated by landscape composition and interactions among patches.

Advances in landscape ecology have therefore generated a framework for conservation planning within which the structure and function of all elements of a landscape can be considered together in a spatially explicit, scale-explicit manner. Resulting conservation approaches might identify priority areas for strict preservation of remnant and restored natural systems, surrounding areas for less strict forms of mixed-use conservation management, and management applications in permanently degraded areas that will minimize their adverse impacts on the broader landscape.

"Placing the conservation reserves firmly within the context of the surrounding landscape and attempting to develop complementary management strategies seems to be the only way to ensure the long term viability of remnant areas… This has important implications for land managers since it involves a radically new way of viewing management and requires that neighboring land uses, and hence neighboring landowners, interact in a positive way. This is difficult, but not impossible…"(Saunders et al. 1991).

Chapter 4. Problems Affecting Riparian Birds

Riparian areas are the most critical habitat for conservation of Neotropical migrant and resident birds in California (Miller 1951, Gaines 1974, Manley and Davidson 1993) and throughout the west (Rich 1998). Riparian ecosystems harbor the highest number of bird species found in the arid and semiarid portions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). Consequently, the loss of riparian habitats may be the most important cause of population decline among landbird species in western North America (DeSante and George 1994). In addition to providing important breeding grounds, riparian habitat offers vital overwintering and migration stopover areas and corridors for dispersal (Gaines 1977, Ralph 1998, Humple and Geupel 2002).

Habitat loss and degradation are probably the most important factors causing the decline of riparian bird populations. Alteration of riparian landscapes narrows or destroys important population dispersal corridors. Disruption of natural hydrological conditions by dams, levees and diversions, clearing associated with farming and development, overgrazing, and invasion by exotic species have all contributed to degradation of riparian zones. Nest predation and parasitism by the Brown-headed Cowbird may reduce the reproductive success of many riparian birds in California (Gaines 1977, Harris 1991, Geupel et al. 1997[b], Laymon and Williams 1997, Gardali et al. 1998, USFWS 1998). Long-term studies of migrant landbirds in California suggest that reproductive success on the breeding grounds is the primary factor limiting populations (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000). However, the situation is complex and it is likely that many factors, in and across all stages in the annual cycle, are operating to influence population dynamics (Martin 1993, Rappole and McDonald 1994, Sherry and Holmes 1995, Faaborg 2002, Ballard et al. 2003b).

Nest Parasitism

Local habitat features around the nest, such as vegetation composition and structure, as well as habitat configuration and landscape context, have been shown to affect levels of nest parasitism and predation (Freemark et al. 1995, Larison et al. 1998, Hochachka et al. 1999, Tewksbury et al. 2002, Chapter 3). As a result of the conversion of native habitats to farms and pastures, the Brown-headed Cowbird has undergone a population explosion and range expansion during the twentieth century (Rothstein et al. 1980, Laymon 1987, Lowther 1993). Agriculture and livestock grazing near riparian zones provide Brown-headed Cowbirds with ample foraging habitat close to songbird breeding grounds (Mathews and Goguen 1997, Tewksbury et al. 1998). Cowbird parasitism contributes to lowered productivity in host species through direct destruction of host eggs; through competition between cowbird and host chicks, resulting in increased mortality; and through nest abandonment in some species, thus lowering overall fecundity within a season.

Nest Predation

In addition, the expansion of agricultural and urban land conversion tends to enhance favorable conditions for native and non-native predators that can decimate bird communities. The elimination of top predators, such as mountain lions and wolves, often results in an increased population of midlevel predators (Soule et al. 1988, Crooks et al. 1999). Raccoons, skunk and domestic cats, for example, are well-documented avian predators (Winter 1999, Pietz and Granfors 2000, Thompson and Burhans 2003, Sawin et al. 2003). Land conversion can also favor nest predators such as jays, crows and magpies (Andren 1992).

The identification and protection of source populations (production of young exceeds adult mortality) is vital to bird conservation. By recognizing those habitat and landscape factors that exist in these healthy (i.e., source) populations, conservation efforts can increase and enhance favorable conditions for birds (Martin 1995). To identify source populations, scientists must gather specific demographic information on the productivity, survivorship and dispersal rates of the bird community. Determination of these variables for every species breeding in riparian habitat is not currently feasible; however, recent advances in the monitoring demographic parameters of bird populations (Martin and Geupel 1993, DeSante 1995, DeSante and Rosenberg 1998) have allowed biologists to model a population's potential health at specific sites (e.g., Robinson et al. 1995, Tewksbury et al. 1998). In general, nest success rates of 20% or less, for most species, indicate unsustainable or "sink" populations (Martin 1992, Robinson et al. 1995, Trine 1998, Budnik et al. 2000). The number of young produced in a bird community is probably the most important factor influencing many species' occurrence and persistence (Martin 1992, Martin and Geupel 1993) and may be the easiest way to identify a healthy population. Table 4-1 provides an example of how productivity can vary among riparian sites among California's bioregions.

Photo by Ian Tait

Western Scrub-Jay, a common nest predator.

However, nest success alone cannot entirely substitute for an actual measure of annual productivity that takes into account re-nesting attempts after nest failure, double brooding, and the number of young fledged per successful nest (Thompson et al. 2001). Several recent studies have demonstrated that the Mayfield method underestimates population productivity (summarized in Anders and Marshal *in press*). Intensive studies that follow color-marked birds throughout the breeding season are feasible, and yield the most accurate productivity data. Powell et al. (1999) describe a model that may be used to predict breeding-season productivity as a function of adult survival, juvenile survival, nesting success, season length, re-nesting interval, and juvenile care intervals. For species with nests that are difficult to find or monitor, or when logistical constraints prohibit locating every nest on a study plot, nest monitoring may be supplemented by color-marking breeding adults and counting fledglings on breeding territories to measure annual productivity (Porneluzi and Faaborg 1999).

Many of California's riparian birds face potential population declines and local extirpations. Of these, Least Bell's Vireo, Yellow-billed Cuckoo, and Willow Flycatcher have suffered the most drastic reductions in their overall populations and breeding ranges (Laymon and Halterman 1985, USFWS 1998), resulting in state or federal listing for each. Habitat loss, in concert with brood parasitism and nest predation, affects most open cup nesting species throughout the state. Events in California may be illustrated by the demise of Yellow Warbler populations along the Colorado River. There, a combination of massive habitat loss, breeding failure in "replacement" habitats and, finally, high cowbird pressure in remaining habitat patches resulted in near extirpation of the species (Rosenberg et al. 1991).

Table 4-1. Mayfield (1975) estimates of nest success for select species among riparian songbird monitoring sites by California bioregion, using same data collection and analysis methods.

Species	Sacramento Valley	Bay-Delta	Modoc	Sierra Nevada
Black-chinned Hummingbird	0.44[3]	--	--	0.39[6]
Western Wood-Peewee	--	0.64[4]	0.17[5]	0.63[6]
Warbling Vireo	--	0.06[1]	--	0.09[6]
Bushtit	--	0.44[4]	--	0.44[6]
Swainson's Thrush	--	0.29[1]	--	--
American Robin	--	0.21[1]	--	0.49[6]
Yellow Warbler	0.32[2]	--	0.89[5]	0.30[7]
Wilson's Warbler	--	0.05[1]	--	--
Common Yellowthroat	--	0.63[4]	--	--
Spotted Towhee	0.28[3],0.05[2]	0.43[4]	--	0.24[6]
Song Sparrow	0.28[8]	0.58[4],0.24[1]	0.59[5]	0.29[7]
Black-headed Grosbeak	0.27[3], 0.33[2]	0.27[1]	--	0.57[6]

[1] Gardali et al. 1999, [2] Wood et al. 2001, [3] Small et al. 1999, [4] Haff et al. 2001, [5] King et al. 2001, [6] Heath et al. 2001, [7] Heath et al. 2002[b], [8] Hammond and Geupel 2000

Least Bell's Vireo: An Example of Conservation Need and Action

The Least Bell's Vireo provides an excellent example of the problems facing riparian birds in California and how adaptive management and restoration efforts can reverse population declines. Historically, the Least Bell's Vireo was one of the most common breeding birds in riparian habitat in California (Grinnell and Miller 1944). In 1973, extensive searches of their former breeding grounds between Tehama and San Joaquin counties failed to detect any Least Bell's Vireos (Gaines 1974). By 1980, the species was extirpated from the entire Central Valley (USFWS 1998). Once characterized as abundant (for review see USFWS 1998), there remained only about 300 pairs of breeding birds when the species received federal listing as endangered in 1986 (RECON 1989). Today, the Least Bell's Vireo remains absent from the bulk of its historical range and is restricted to eight southern counties, with the majority of birds occurring in San Diego County (Figure 5-7).

Habitat destruction and degradation have severely reduced the range of Least Bell's Vireo in California. Agricultural land uses and water projects have not only actively destroyed riparian habitat, but have reduced water tables to levels that inhibit the growth of the dense vegetation the vireos prefer. The remaining vireo populations cling to small, increasingly isolated patches of habitats; as such, populations are more vulnerable to catastrophic events, demographic failure and loss of dispersal corridors. Dams, levees and other flood control structures hinder riparian reestablishment, creating more "old-growth" conditions (dense canopy and open understory) that are unfavorable to breeding vireos. Finally, habitat degradation encourages nest predation and parasitism.


Photo by Big Sur Ornithology Lab

Cowbird parasitism of Least Bell's Vireo nests further encourages their decline. Livestock grazing has reduced and degraded the lower riparian vegetation favored by the Least Bell's Vireo (Overmire 1962) and provided foraging areas for the Brown-headed Cowbird. Row crops and orchards also provide feeding grounds for the parasite. By as early as 1930, nearly every Least Bell's Vireo nest found in California hosted at least one cowbird egg (USFWS 1998). Since a parasitized nest rarely fledges any vireo young, nest parasitism of Least Bell's Vireo results in drastically reduced nest success (Goldwasser 1978, Goldwasser et al. 1980, Franzreb 1989, Kus 1999, Kus 2002).

Since federal listing and concordant restoration and management activities, the population increased dramatically up until 1998 (USFWS 1998). The Camp Pendelton population increased from 15 males in 1980 (Salata 1980) to 1011 in 1998 (Griffith 1999). In addition to population growth, observations indicate that the species is expanding its range northward. Currently, Least Bell's Vireos are recolonizing areas unoccupied for decades and may potentially reestablish breeding populations in the central and northern portions of their historic range (USFWS 1998). Since the peak in 1998, however, the Camp Pendelton population has declined to 757 in 2002 (W. Berry pers. comm.).

Chapter 5. The Conservation Planning Process

The national Partners in Flight program requested that state working groups define and prioritize the most threatened habitat types in each region, weighted by their importance to birds. In California, riparian habitats were unanimously chosen as the top priority because they provide the richest habitats for both breeding and wintering birds (Miller 1951, Cogswell 1962, Gaines 1977, Manley and Davidson 1993). Thus, California Partners in Flight formed the Riparian Habitat Joint Venture to spearhead the conservation planning process.

Prioritization schemes developed for the state's Neotropical migrants consistently ranked riparian as the most important habitat type (Davidson 1995). California's riparian habitats have many endemic species and subspecies that are known as riparian-obligate species. In addition to high species richness, riparian areas during the breeding season can harbor individuals at densities up to ten times greater than surrounding upland habitats. Although riparian habitat is recognized as extremely important, the magnitude of its destruction and degradation has been greater than for any other habitat in California, with the possible exception of perennial grassland.

The Riparian Bird Conservation Plan has been developed cooperatively by leading bird researchers in California through a process designed to:

- Capture the conservation needs of the complete range of riparian habitat types throughout the state.
- Develop, by consensus, biological conservation objectives for selected riparian bird species.

Photo by Kevin McKereghan

Song Sparrow, a riparian focal species.

Criteria for Selecting Riparian Focal Species

The majority of the PIF planning efforts use the national PIF database (Carter et al. 2000) to prioritize species in need of conservation attention and then select focal species by region for conservation plans. The RHJV elected against this method for the Riparian Bird Conservation Plan for a number of reasons. The national PIF prioritization scheme relies heavily on BBS trend estimates that likely do not adequately monitor riparian birds in California. Additionally, the PIF database does not yet recognize many subspecies including the Western Yellow-billed Cuckoo, a California endangered species. These factors render such a "priority" species list less representative than the RHJV preferred. Instead, the RHJV chose to emphasize the ecological associations of individual species *as well as* those of conservation concern (Chase and Geupel *in press*). In doing so, the RHJV included a suite of focal species whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a "healthy" system (Table 5-2**.** Additionally, the RHJV decided that some of the most useful indicators were those with populations and distributions large enough to be easily monitored and to provide sufficient sample sizes for statistical analysis across sites and/or regions.

The RHJV included species in the conservation planning process based on five factors (although not all species meeting these criteria were selected, and species selected did not necessarily meet all criteria, note: most are not special management species; see Table 5-1). The species considered:

- Use riparian vegetation as their primary breeding habitat in most bioregions of California.
- Warrant special management status—endangered, threatened, or species of special concern on either the federal or state level.
- Have experienced a reduction from their historical breeding range.
- Commonly breed throughout California's riparian areas—allowing adequate sample sizes for statistical comparisons and therefore the ability to rapidly assess responses to changes in management (such as restoration).
- Have breeding requirements that represent the full range of successional stages of riparian ecosystems—to assess the success of restoration efforts.

Because birds occupy a wide diversity of ecological niches in riparian habitat (Figure 5-1), they serve as useful tools in the design of conservation efforts. Birds are relatively easy to monitor in comparison with other taxa and can serve as "focal species," whose requirements define different spatial attributes, habitat characteristics and management regimes representative of a healthy riparian system (Chase and Geupel *in press* for review of CalPIF's strategy of choice and use of focal species). For example, the bird that requires the largest area to survive in a certain habitat will determine the minimum suitable area for that habitat type. Likewise, the requirements of non-migratory birds that disperse short distances to establish new territories will define the attributes of connecting vegetation. The species with the most demanding or exacting requirements for an ecological characteristic, such as stream width or canopy cover, determines its minimum acceptable value. Therefore, the assumption is that a landscape designed and managed to meet the focal species' needs encompasses the requirements of other species (Lambeck 1997).

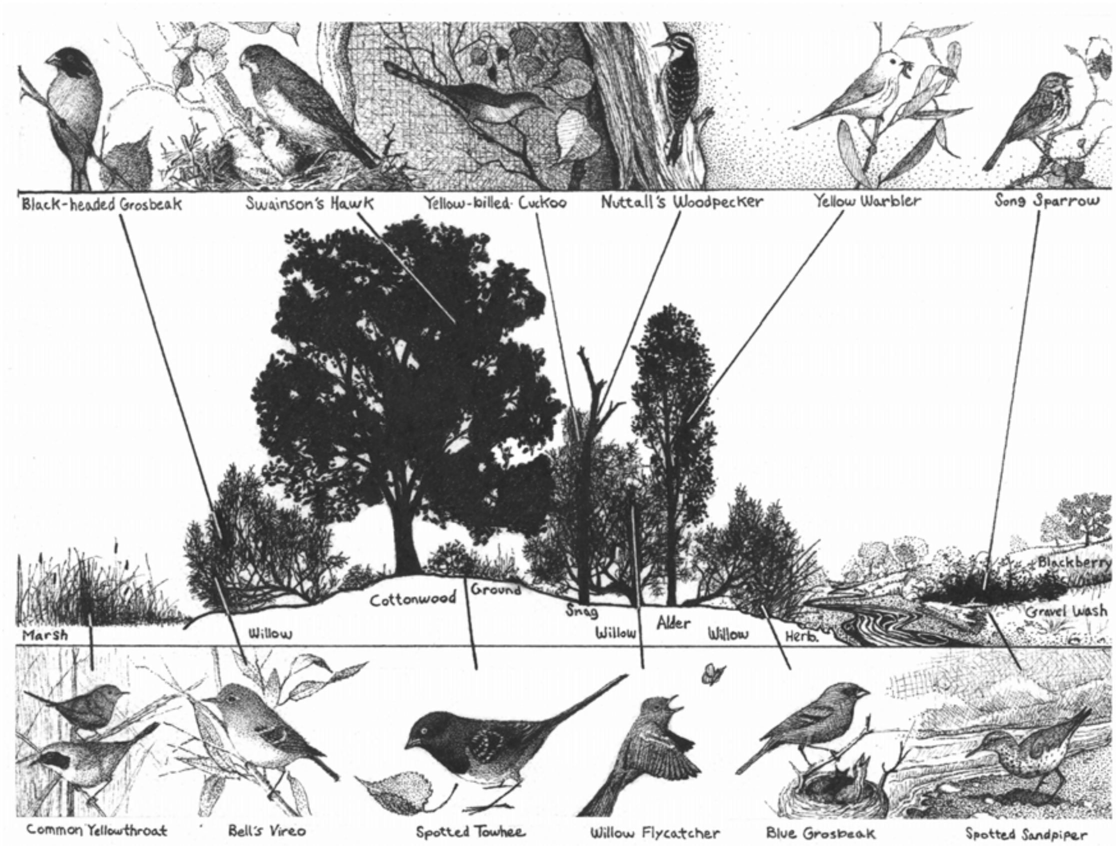


Figure 5-1. A healthy system needs diverse vegetative structure to best support birds. Illustration by Zac Denning.

Focal Species

The following were selected as focal species for preparing the Conservation Plan. They are listed below followed by the species account author and any special-status designations. Latin names are given in Appendix D. New for this version are: Spotted Sandpiper, Tree Swallow, and Tricolored Blackbird.

Swainson's Hawk: California listed as threatened. Brian Woodbridge, U.S. Fish and Wildlife Service

Spotted Sandpiper: Chris McCreedy and Nils Warnock, PRBO Conservation Science

Western Yellow-billed Cuckoo: California listed as endangered. Steve Laymon, Bureau of Land Management

Willow Flycatcher: California listed as endangered, USFS Region 5 sensitive species; the Southwestern Willow Flycatcher subspecies is federally listed as endangered. Mary Whitfield, Southern Sierra Research Station; Diana Craig, USDA Forest Service and Pamela Williams, Kern National Wildlife Refuge

Warbling Vireo: Tom Gardali, PRBO Conservation Science

Least Bell's Vireo: Federally listed as endangered. Barbara Kus, San Diego State University

Bank Swallow: California listed as threatened. Barry Garrison, California Department of Fish & Game

Tree Swallow: David Winkler, Cornell University

Swainson's Thrush: Jennifer White and Stacy Small, University of Missouri, Columbia

Yellow Warbler: California species of special concern for species and Sonoran subspecies. Sacha Heath, PRBO Conservation Science

Common Yellowthroat: California listed as species of special concern for San Francisco subspecies. Tina Menges, U.S. Fish and Wildlife Service

Wilson's Warbler: Chris Otahal, U.S. Fish and Wildlife Service

Yellow-breasted Chat: California species of special concern. Matt Ricketts, LSA Associates and Barbara Kus, San Diego State University

Song Sparrow: Diana Humple and Geoff Geupel, PRBO Conservation Science

Black-headed Grosbeak: Stacy Small, University of Missouri, Columbia and Mike Lynes, Hastings University

Blue Grosbeak: Jeanne Hammond, Humboldt State University

Tricolored Blackbird: Bill Hamilton, UC Davis

Key findings from the species accounts are available at http://www.prbo.org/calpif/htmldocs/riparian.html. These findings and the detailed information found in each species account provide the basis for the conclusions and conservation recommendations presented in this Conservation Plan. Account authors and other conservation and land management experts gathered to discuss and synthesize their results into a summary of concerns, habitat requirements, conservation objectives, and action plans (or recommendations). The species accounts and the results from this meeting form the backbone of this Conservation Plan.

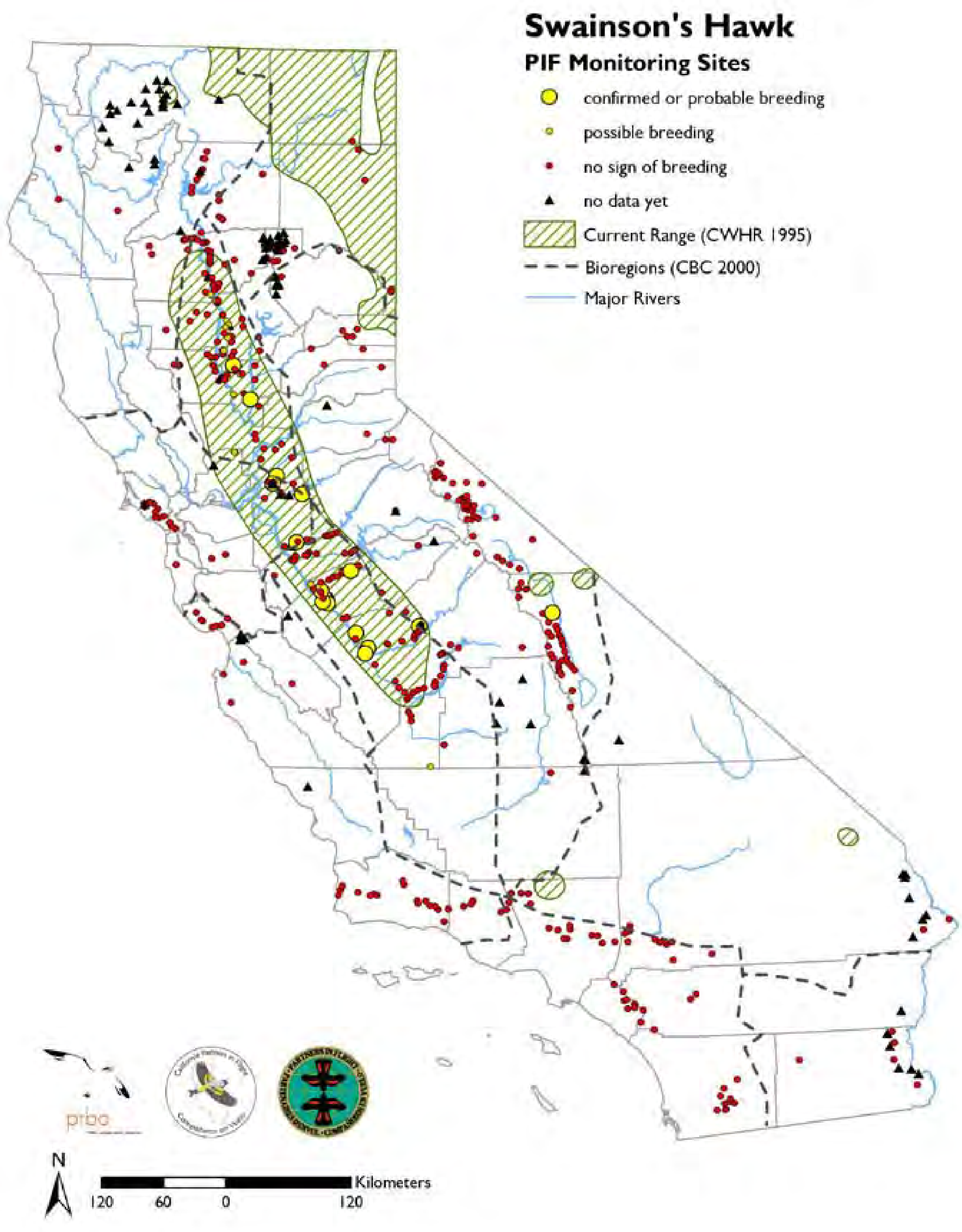


Figure 5-2. CalPIF monitoring sites, breeding status, and current range for the Swainson's Hawk in California.

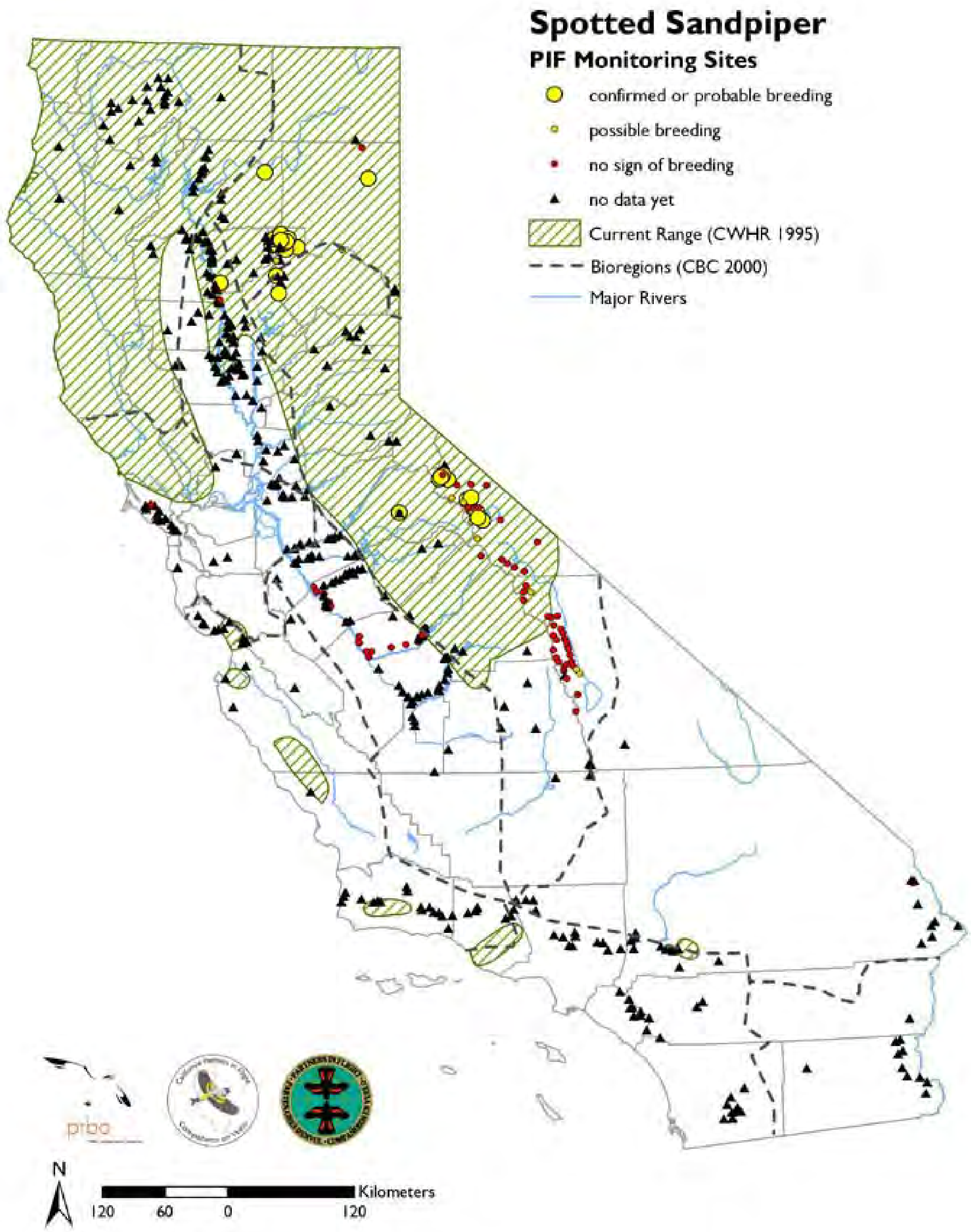


Figure 5-3. CalPIF monitoring sites, breeding status, and current range for the Spotted Sandpiper in California.

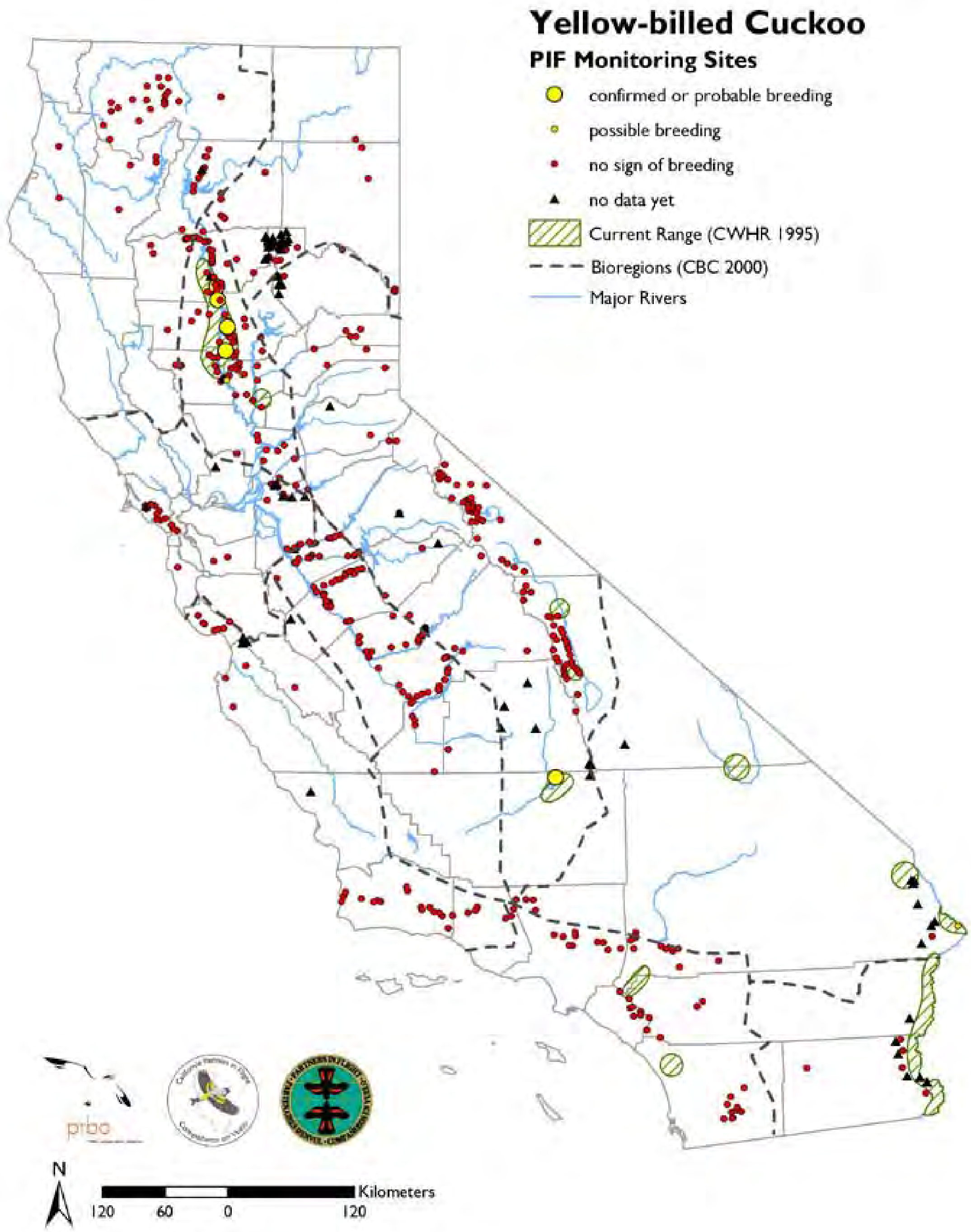


Figure 5-4. CalPIF monitoring sites, breeding status, and current range for the Western Yellow-billed Cuckoo in California.

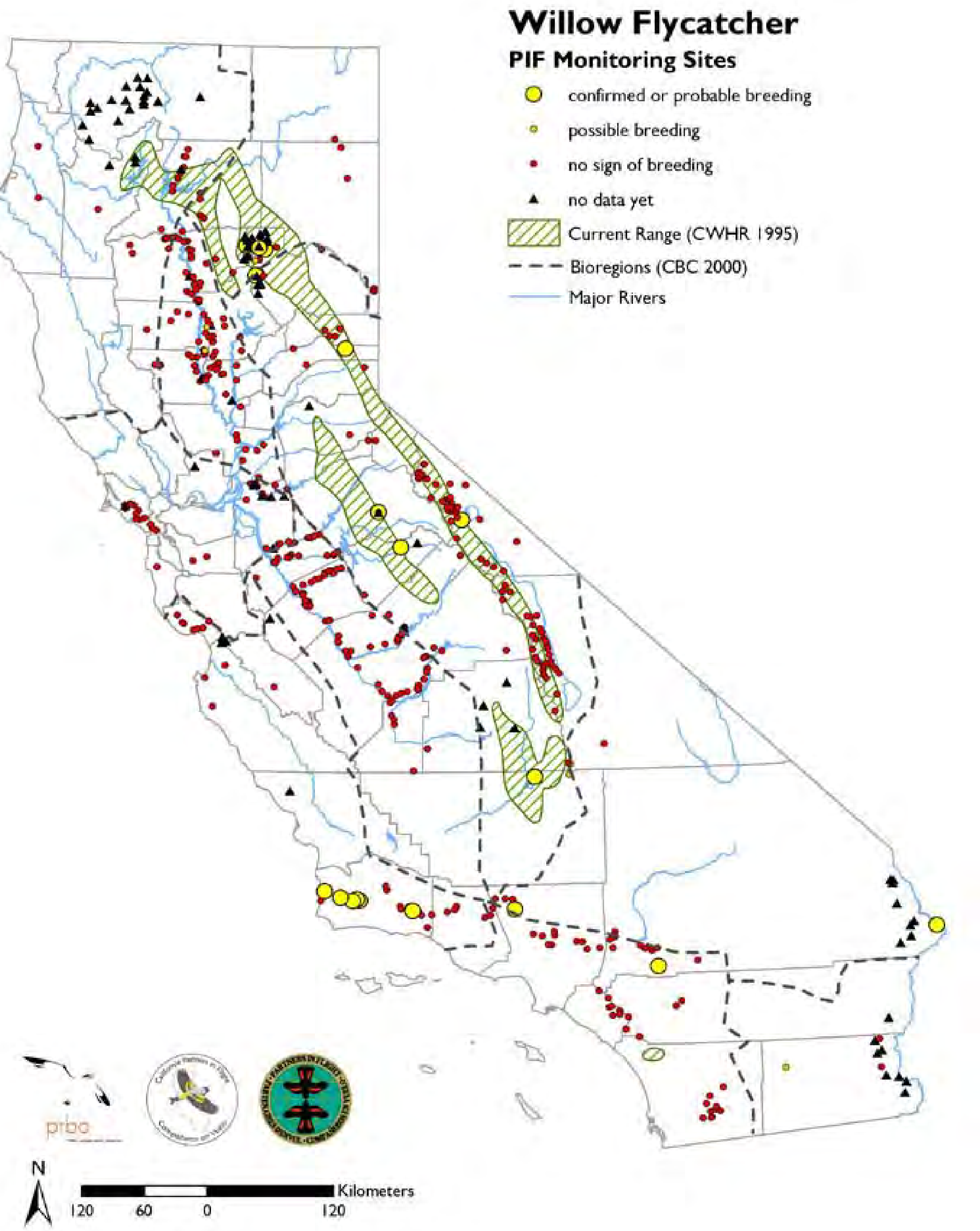


Figure 5-5. CalPIF monitoring sites, breeding status, and current range for the Willow Flycatcher in California.

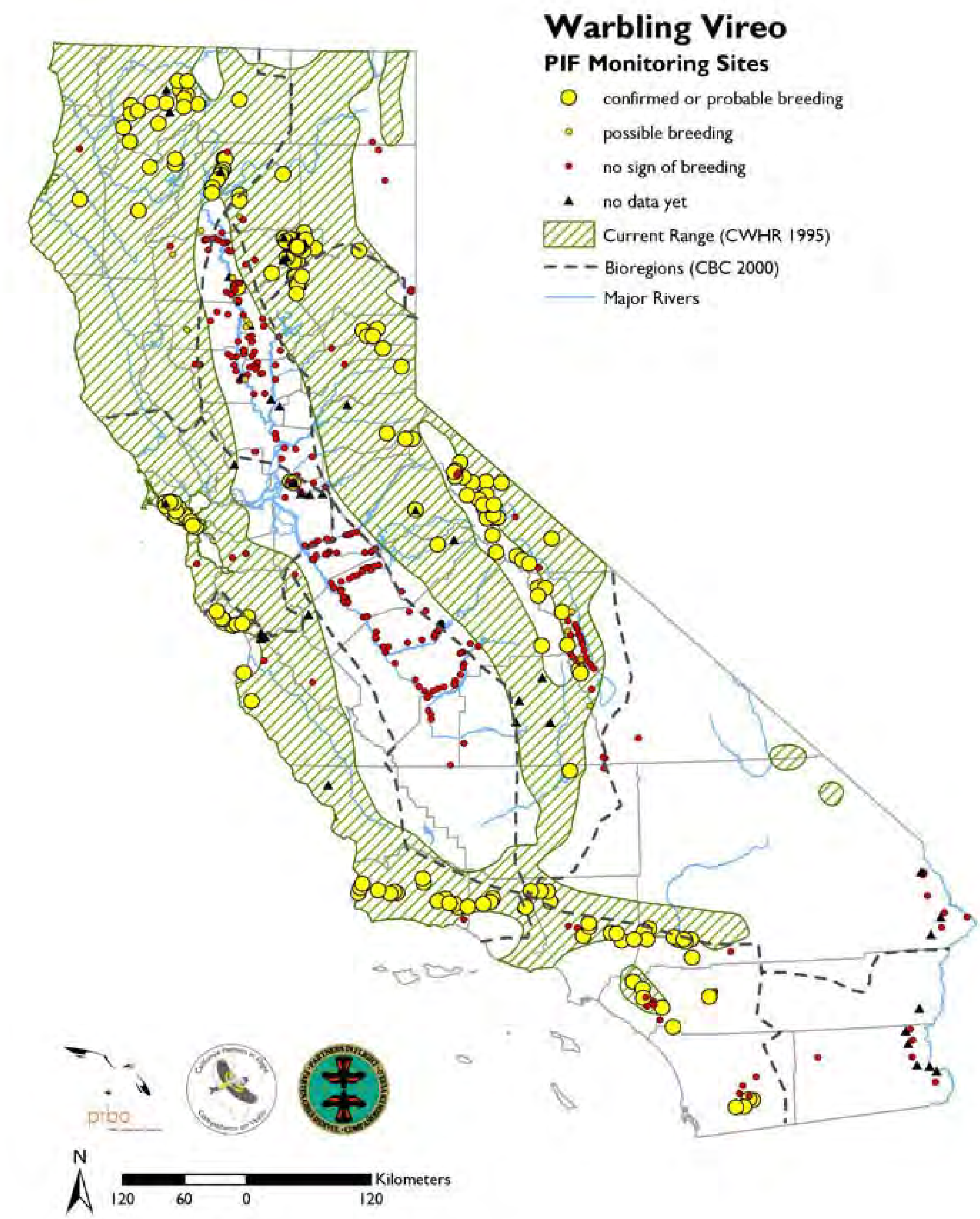


Figure 5-6. CalPIF monitoring sites, breeding status, and current range for the Warbling Vireo in California.

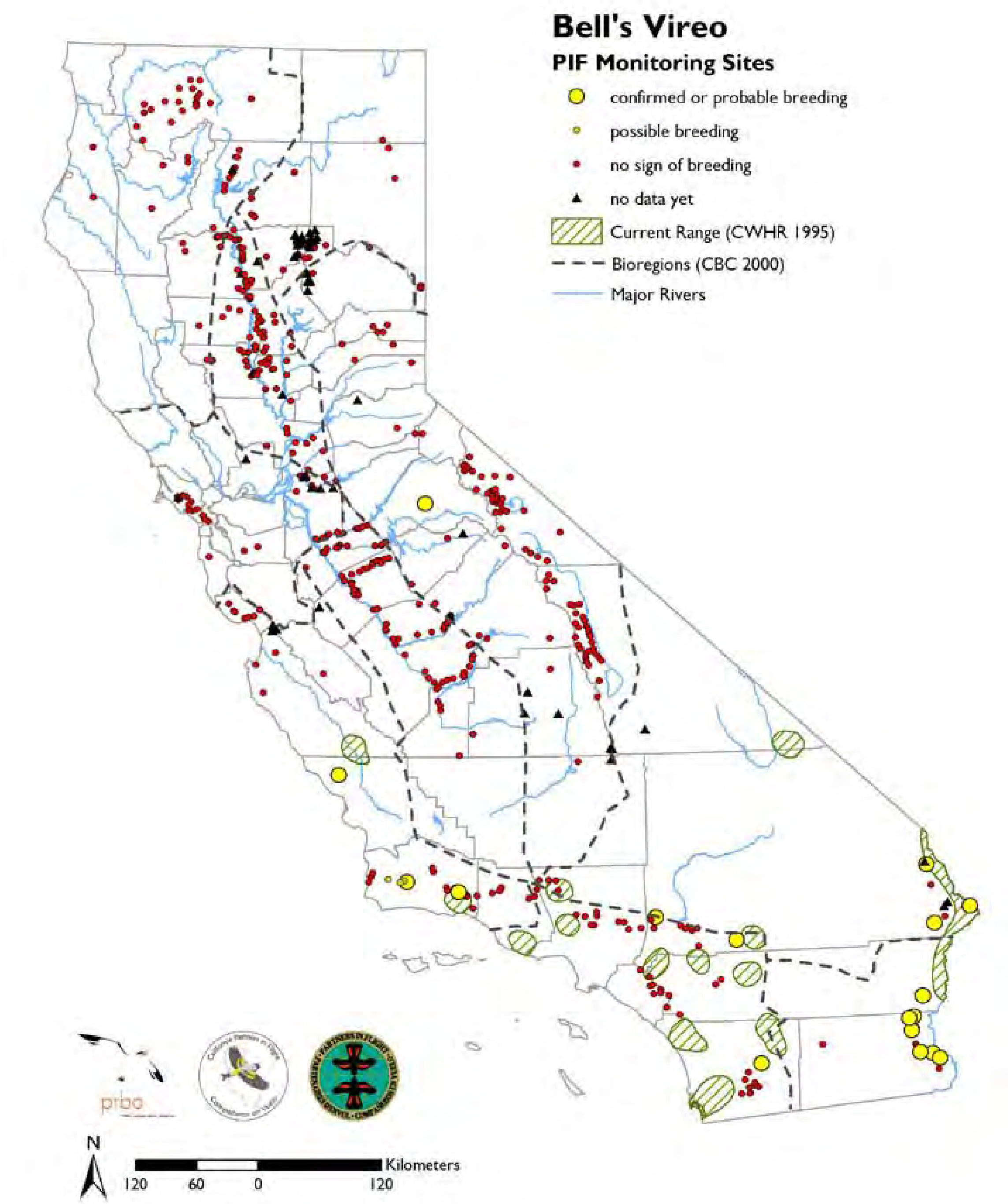


Figure 5-7. CalPIF monitoring sites, breeding status, and current range for the Least Bell's Vireo in California.

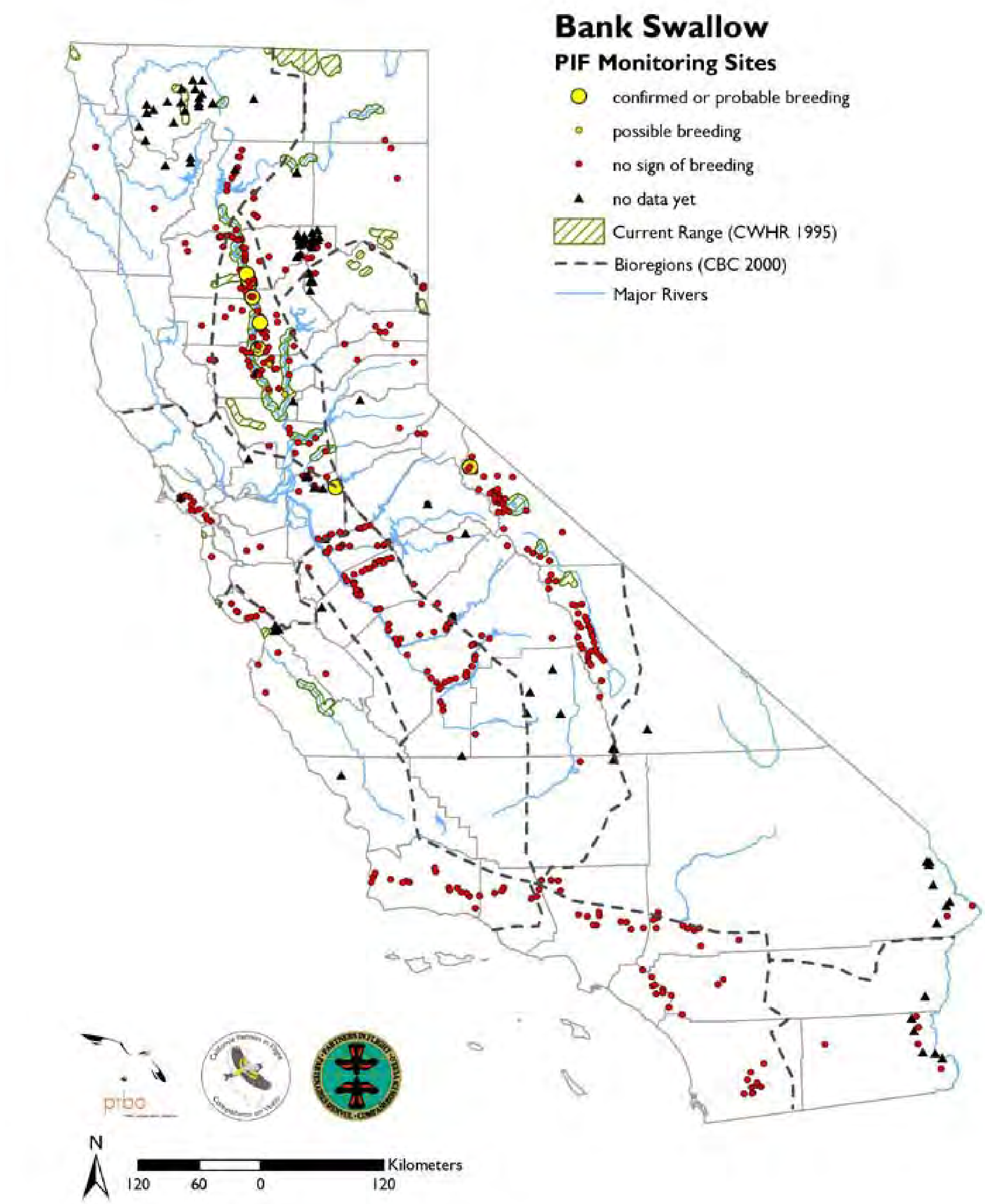


Figure 5-8. CalPIF monitoring sites, breeding status, and current range for the Bank Swallow in California.

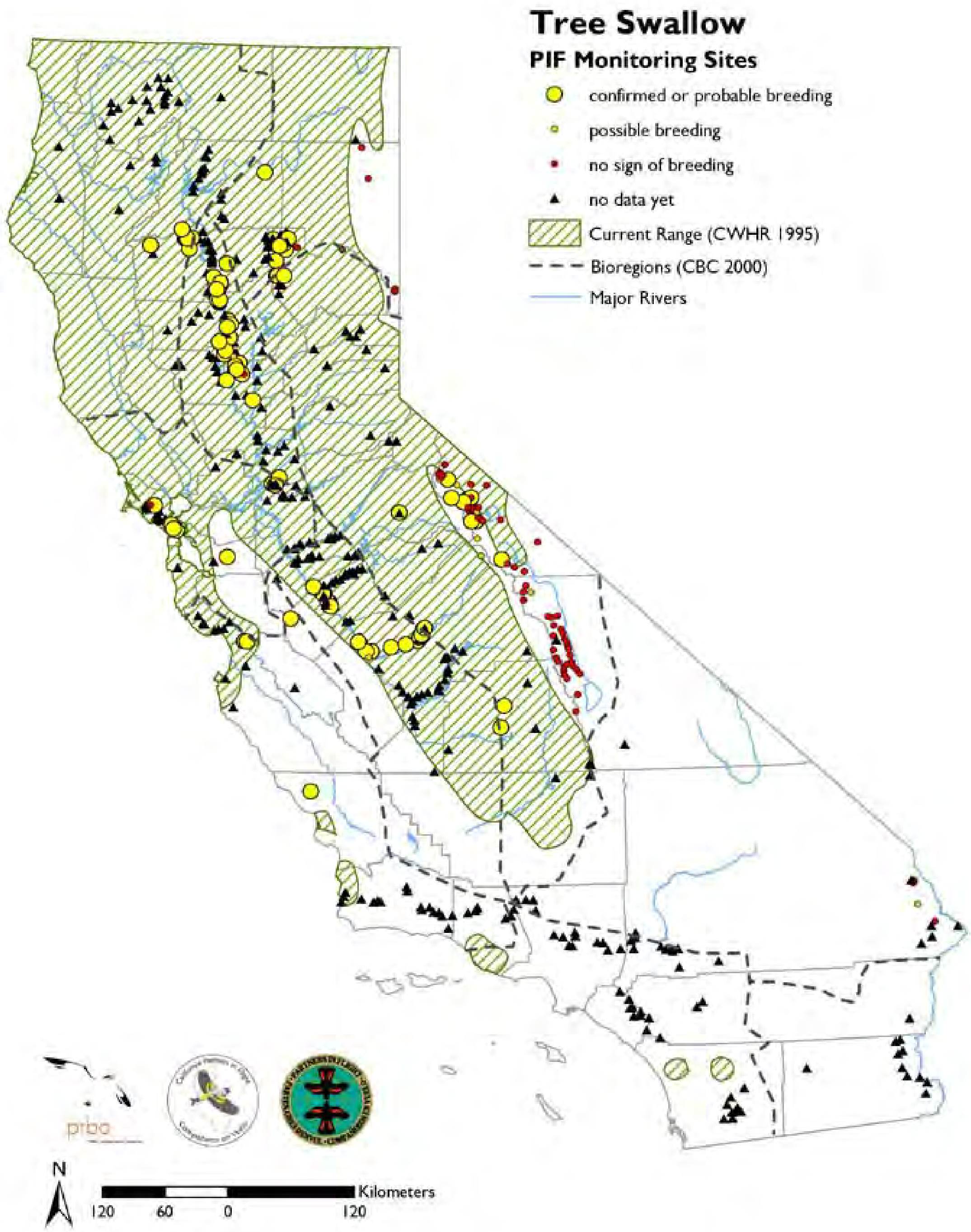


Figure 5-9. CalPIF monitoring sites, breeding status, and current range for the Tree Swallow in California.

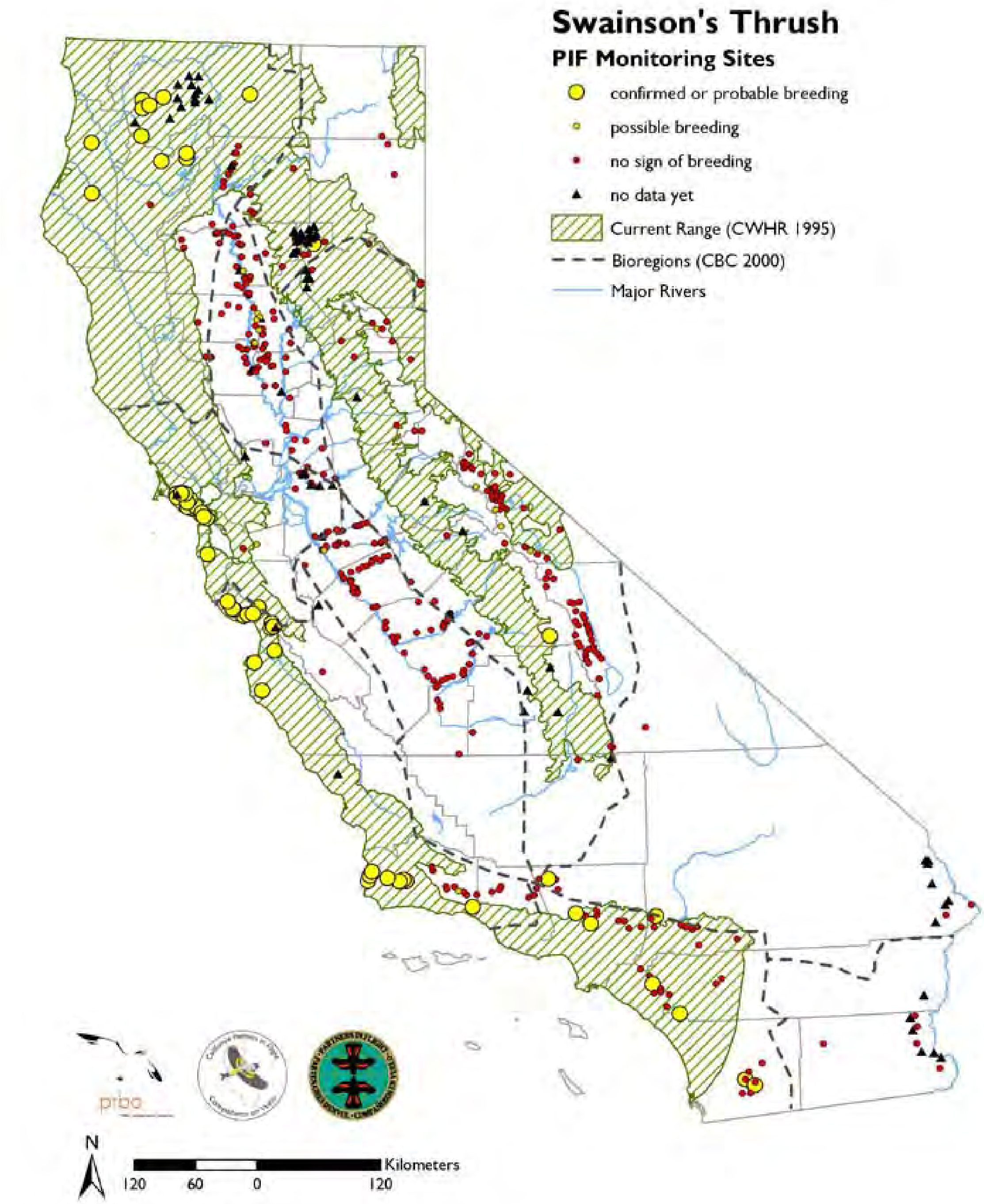


Figure 5-10. CalPIF monitoring sites, breeding status, and current range for the Swainson's Thrush in California.

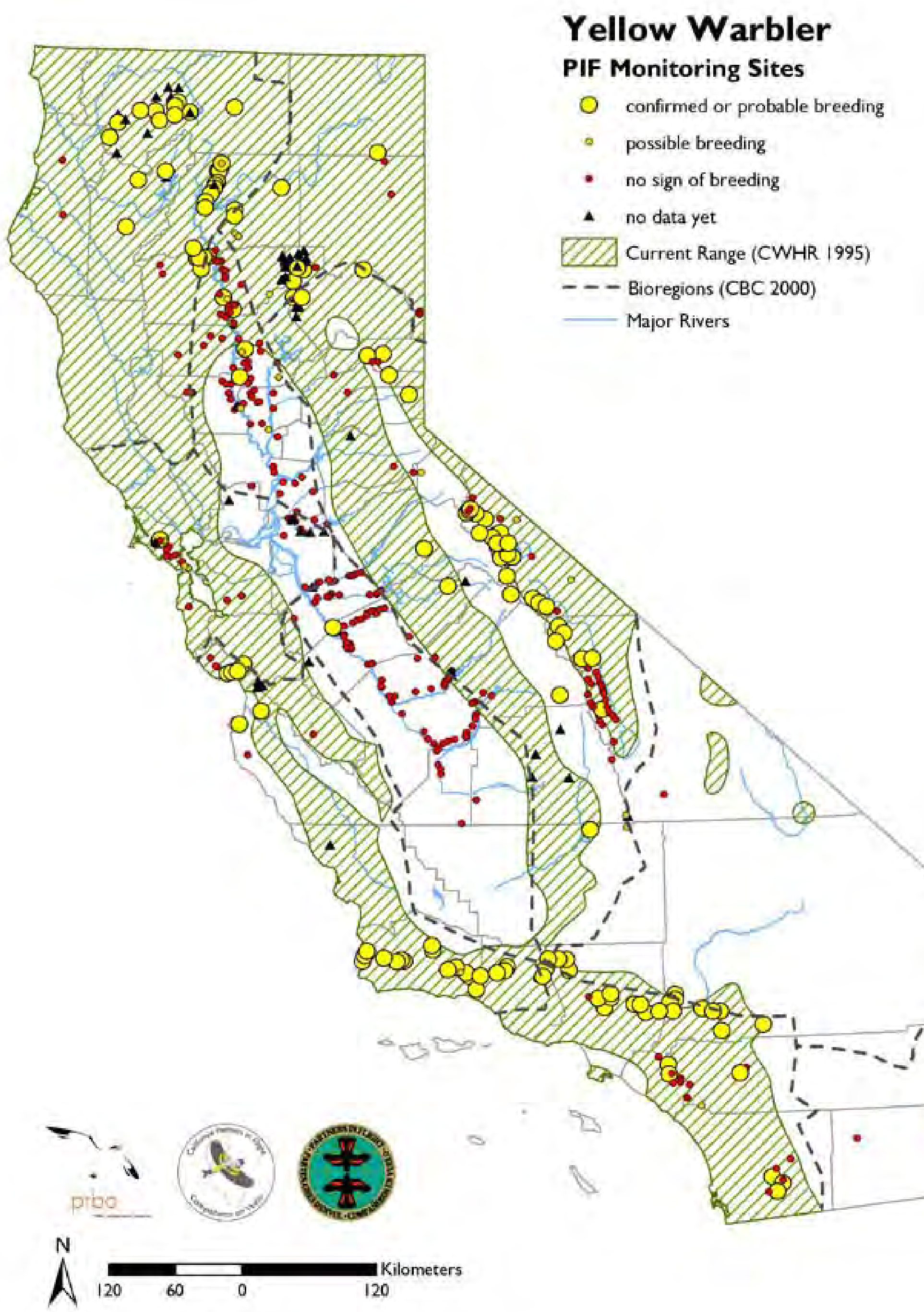


Figure 5-11. CalPIF monitoring sites, breeding status, and current range for the Yellow Warbler in California.

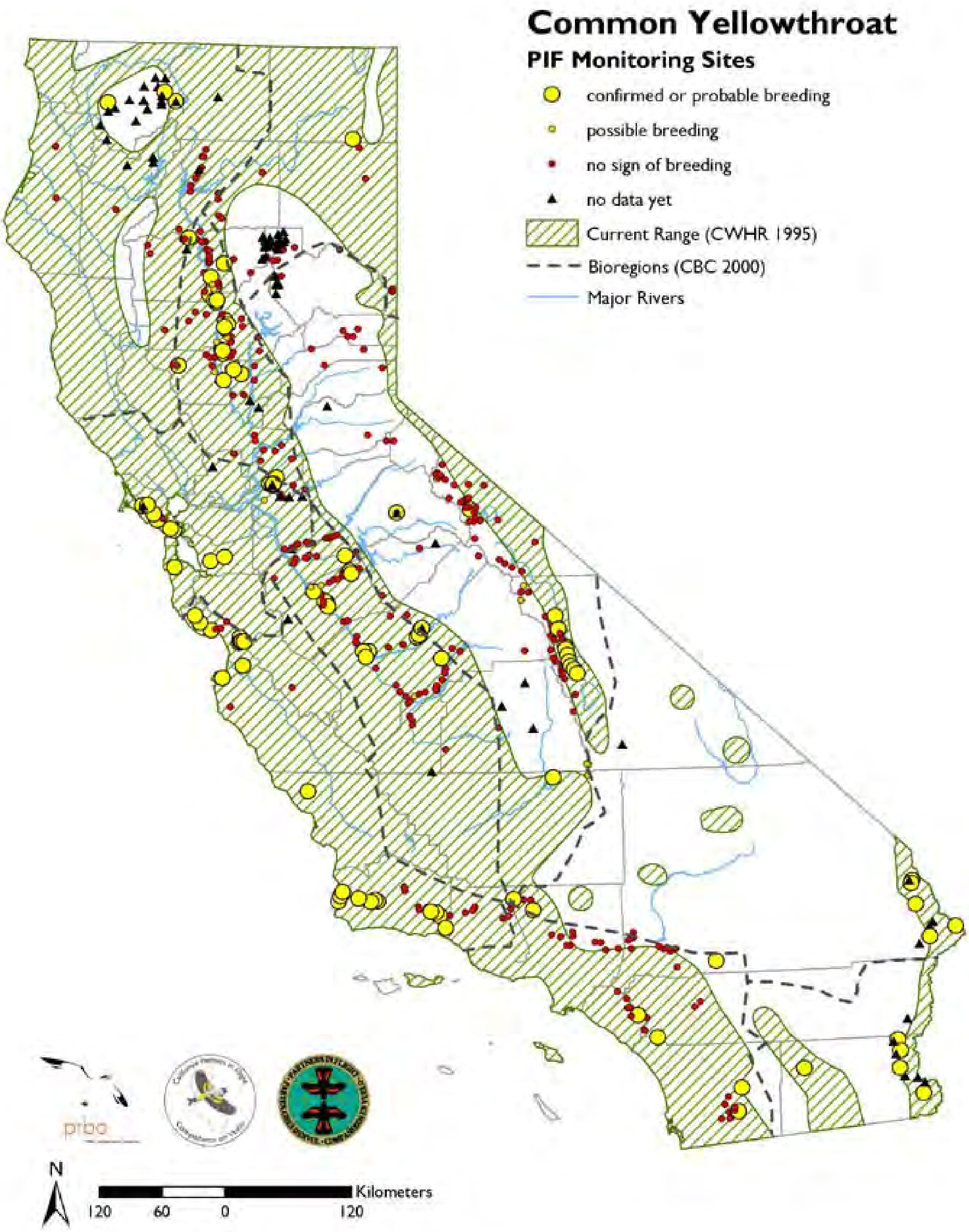


Figure 5-12. CalPIF monitoring sites, breeding status, and current range for the Common Yellowthroat in California.

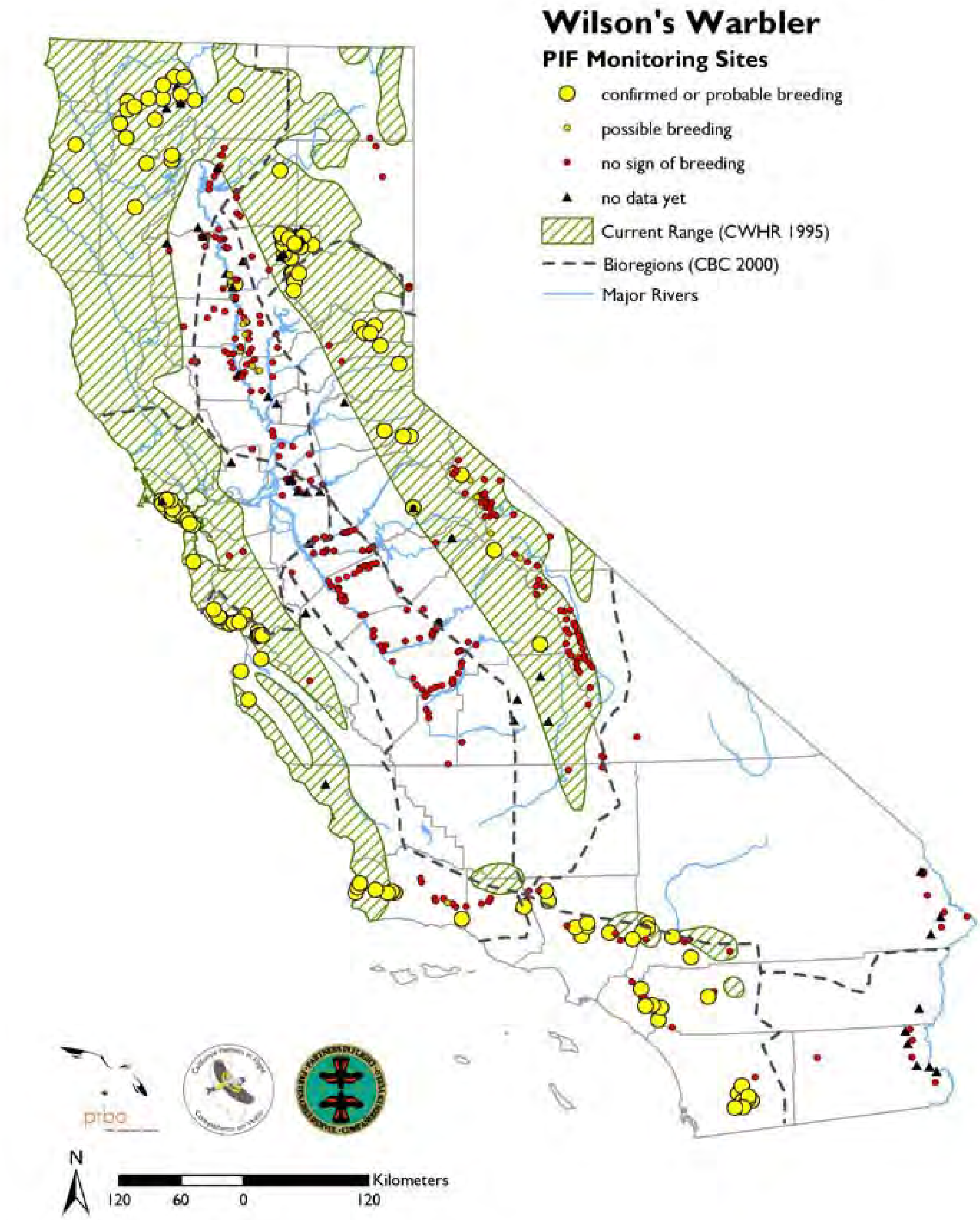


Figure 5-13. CalPIF monitoring sites, breeding status, and current range for the Wilson's Warbler in California.

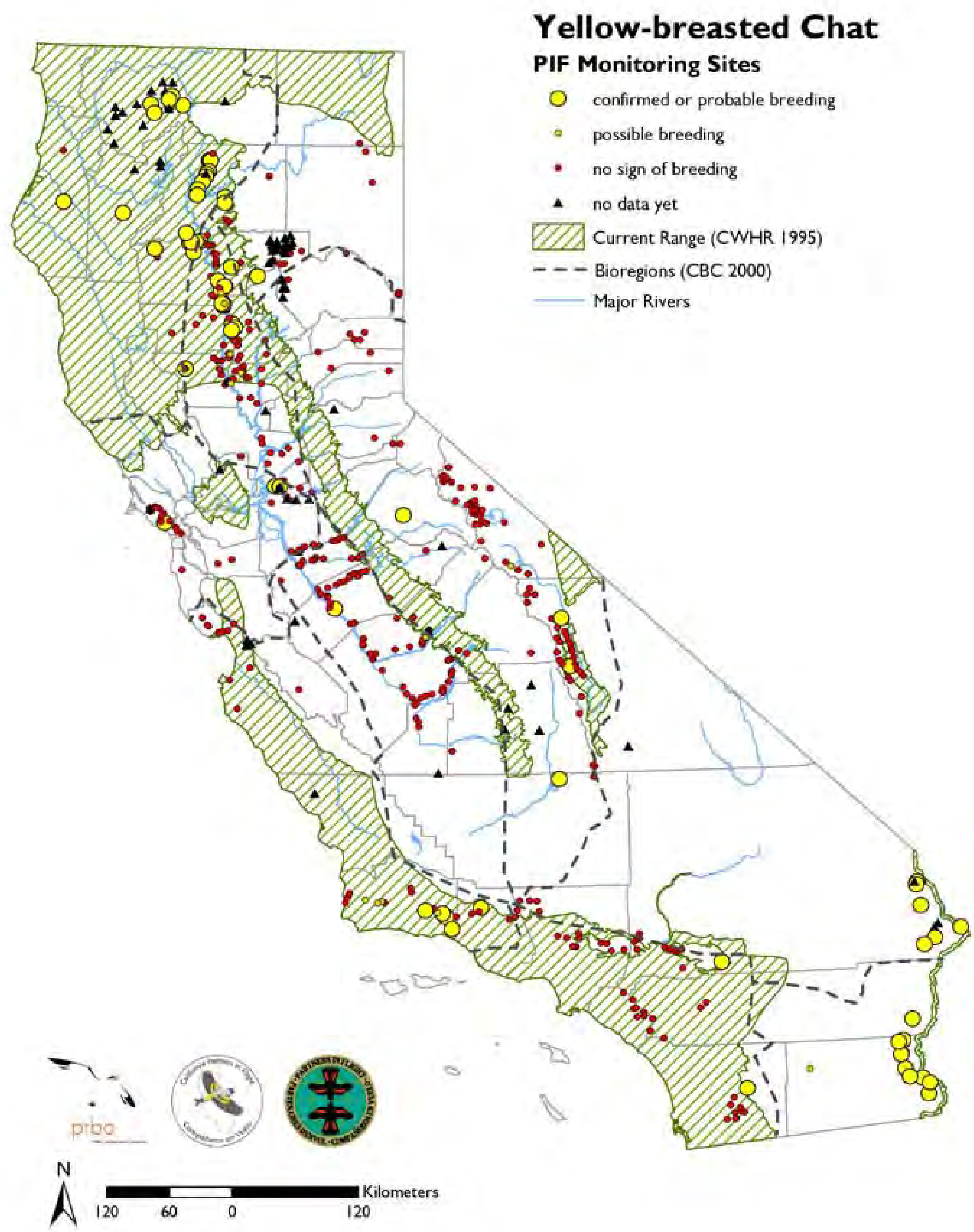


Figure 5-14. CalPIF monitoring sites, breeding status, and current range for the Yellow-breasted Chat in California.

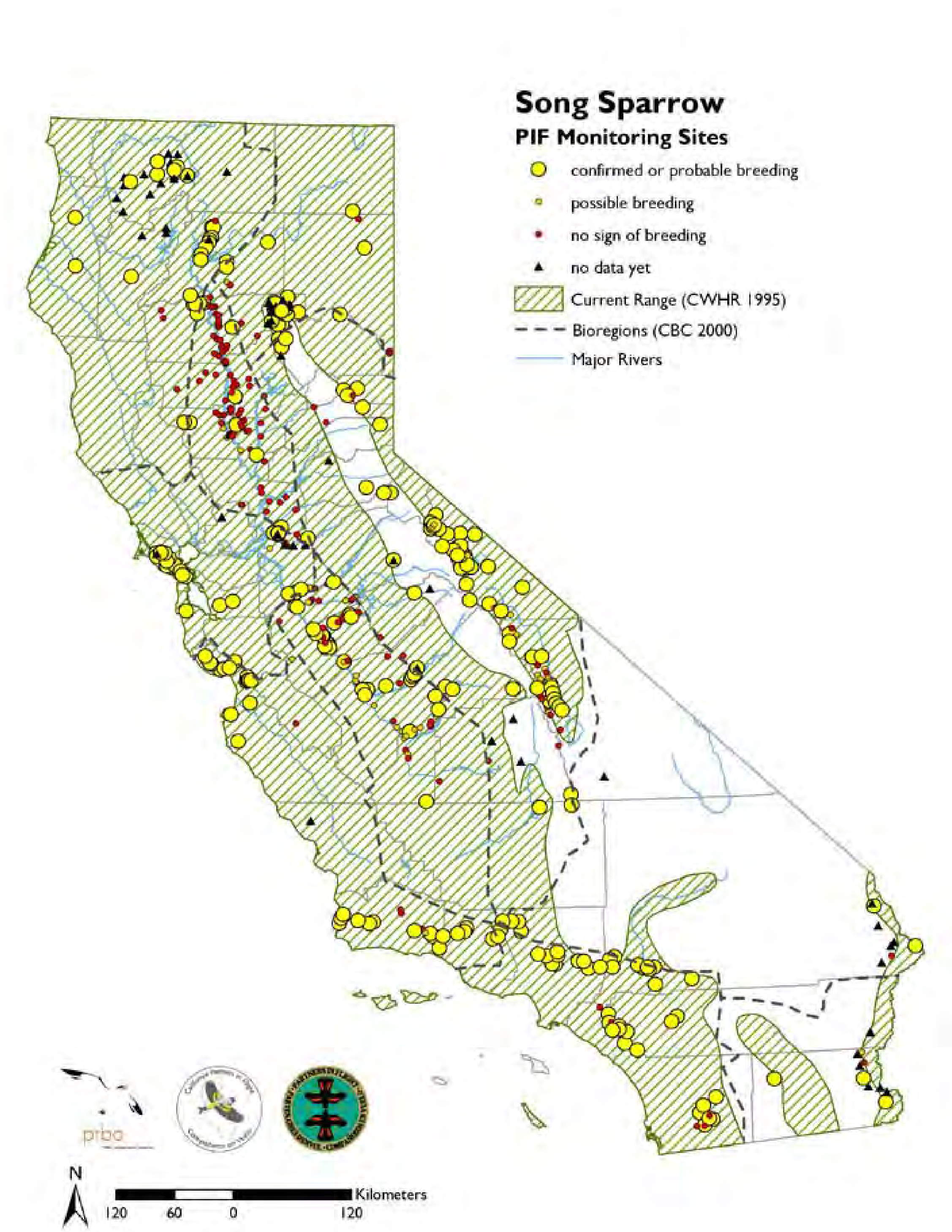


Figure 5-15. CalPIF monitoring sites, breeding status, and current range for the Song Sparrow in California.

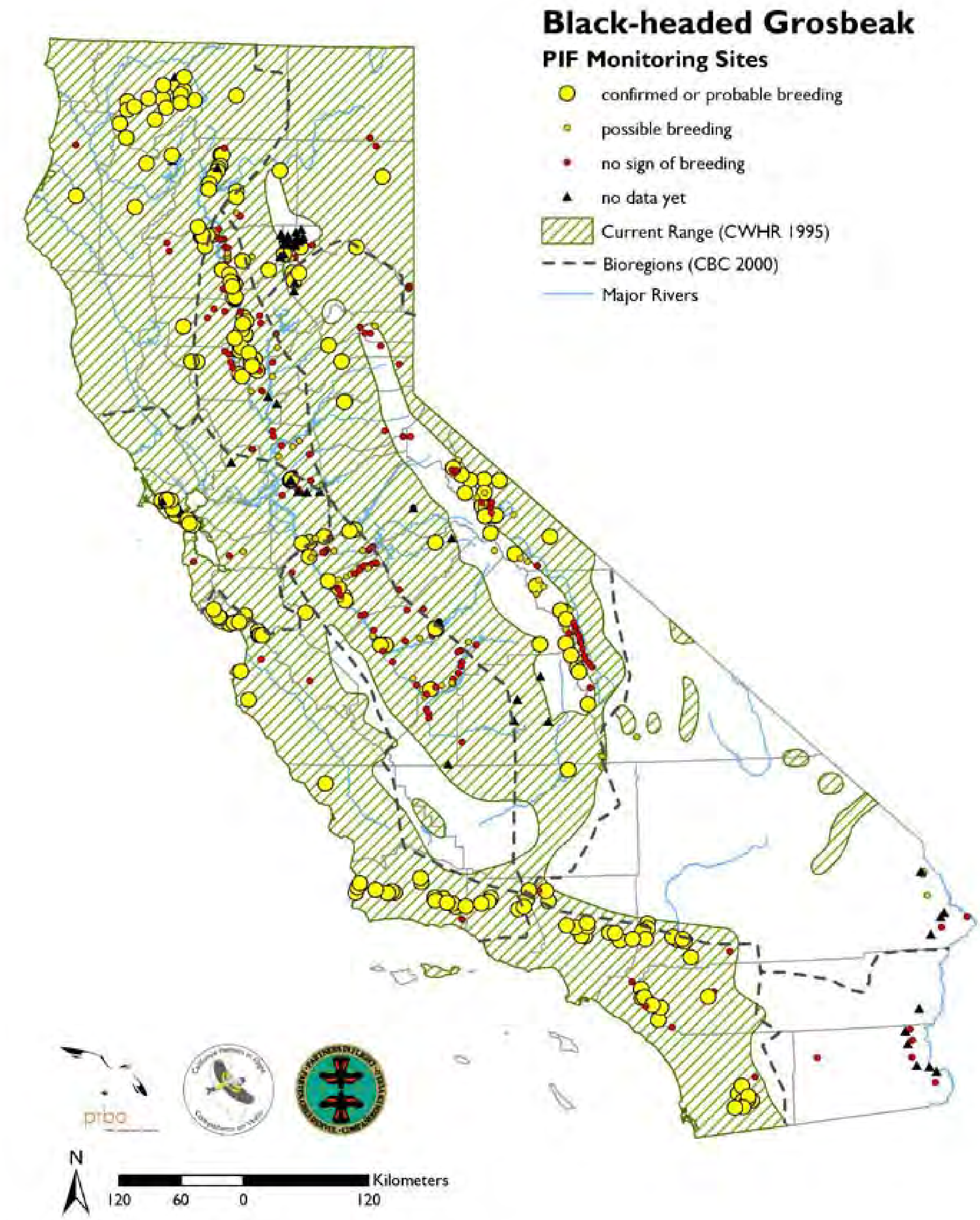


Figure 5-16. CalPIF monitoring sites, breeding status, and current range for the Black-headed Grosbeak in California.

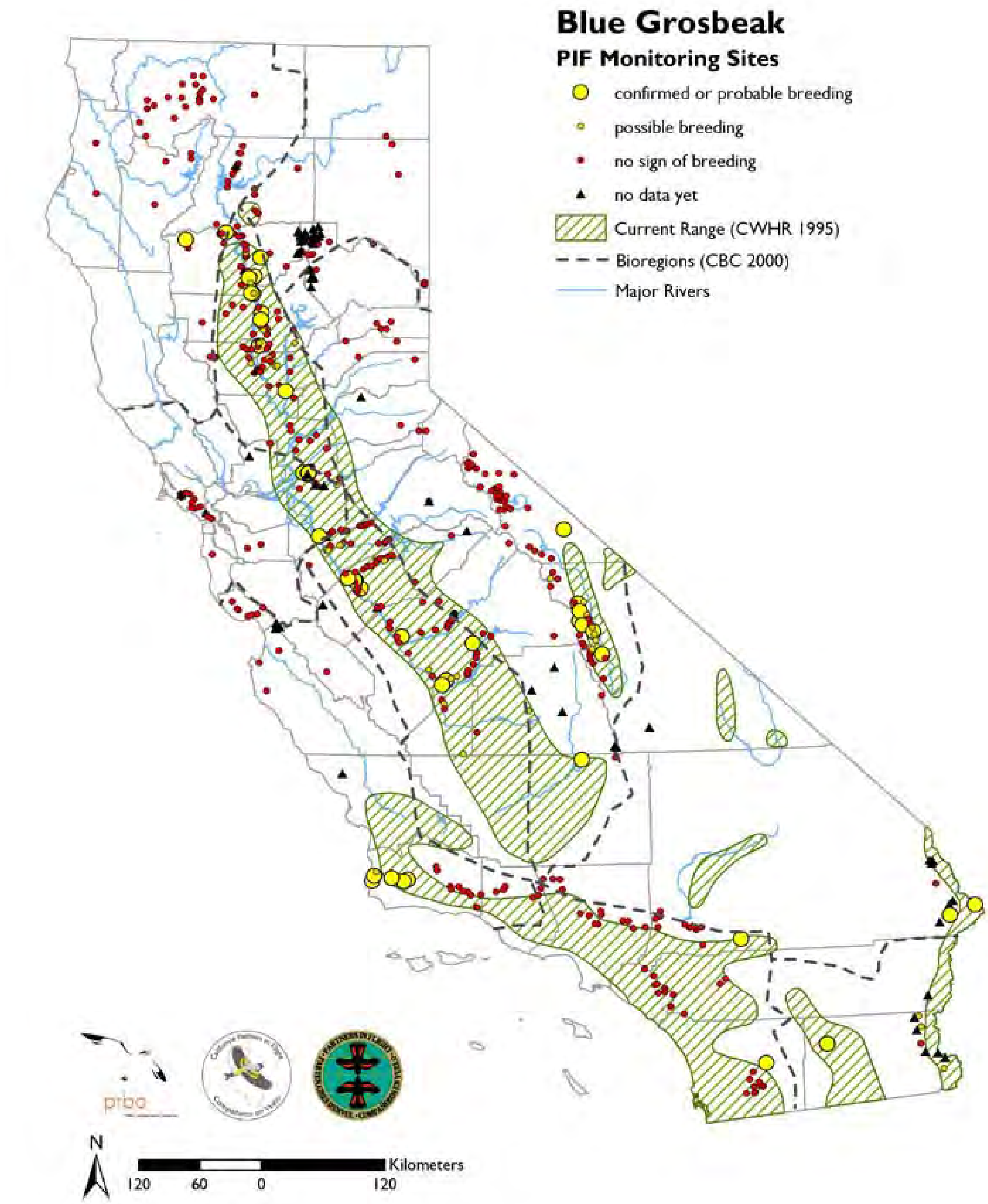


Figure 5-17. CalPIF monitoring sites, breeding status, and current range for the Blue Grosbeak in California.

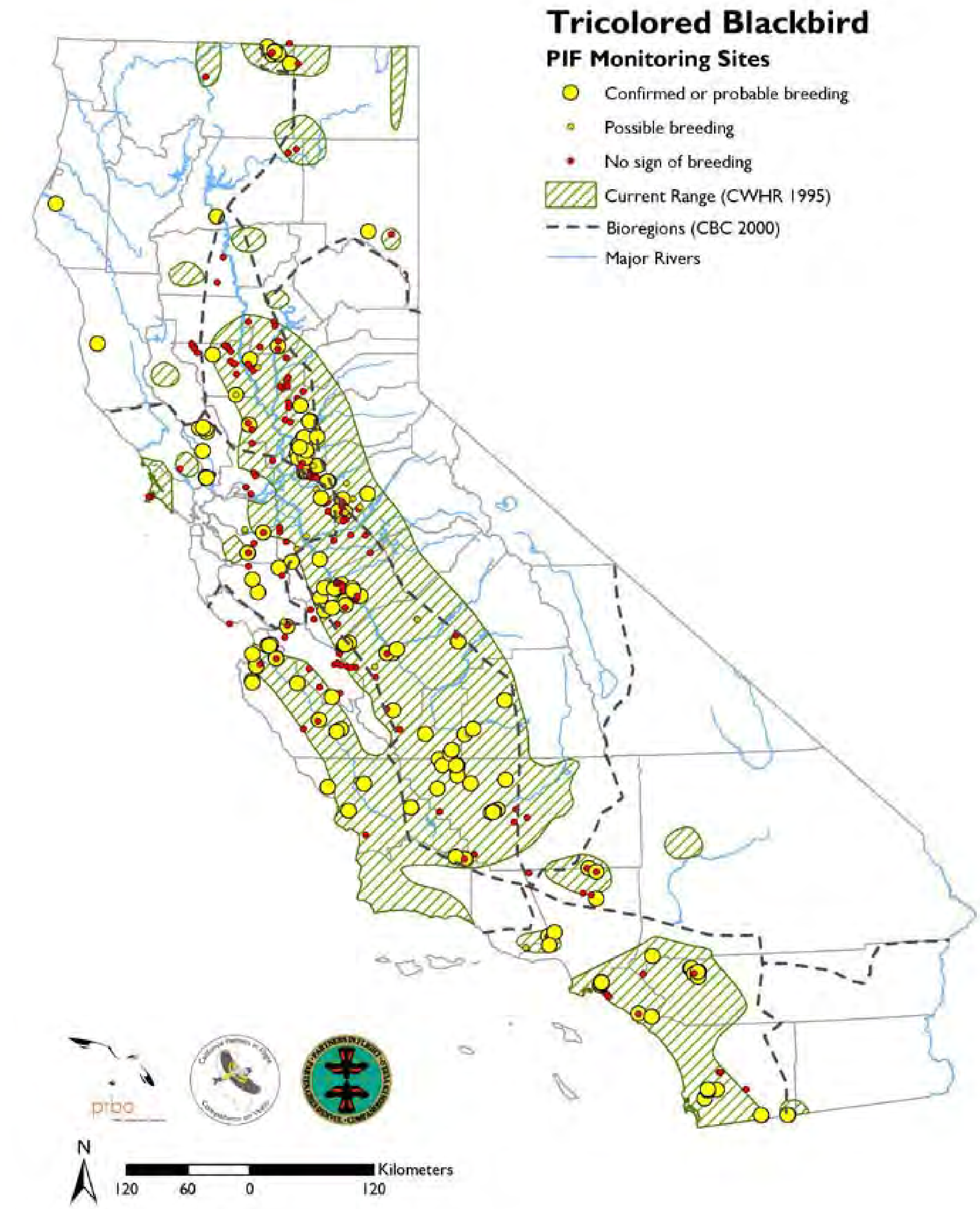


Figure 5-18. CalPIF monitoring sites, breeding status, and current range for the Tricolored Blackbird in California.

Table 5-1. Criteria for selecting the Riparian Bird Conservation Plan focal species.

Focal Species	Riparian Breeder	Special status	Reduction in breeding range	Abundant breeder in CA	Nest Site Location
Swainson's Hawk	X	X	X		Canopy
Spotted Sandpiper	X			X	Gravel Bar
Yellow-billed Cuckoo	X	X	X		Midstory to Canopy
Willow Flycatcher	X	X	X		Understory
Warbling Vireo	X		X	X	Canopy
Bell's Vireo	X	X	X		Understory
Bank Swallow	X	X	X		Sandy banks
Tree Swallow	X			X	2º Cavity
Swainson's Thrush	X		X	X	Understory
Yellow Warbler	X	X	X	X	Midstory
Common Yellowthroat	X	X	X	X	Understory
Wilson's Warbler	X			X	Understory
Yellow-breasted Chat	X	X	X		Understory
Song Sparrow	X		X	X	Understory
Black-headed Grosbeak	X			X	Midstory
Blue Grosbeak	X	X	X		Understory
Tricolored Blackbird	X	X	X		Understory

Data-Gathering Effort

Identifying the causes of population fluctuations requires an understanding of how demographic and physiological processes—annual survival, reproductive success, dispersal, and recruitment—vary across habitats, landscapes, and management practices. This information must be gathered using scientifically sound research and monitoring techniques (see Appendix A for a summary, Ralph et al. 1993, Bonney et al. 2000 for review). The Breeding Bird Survey (BBS), coordinated by the USFWS and the Canadian Wildlife Service, produces most of the available information regarding changes in the sizes and ranges of landbird populations in North America (Sauer 2003). These roadside counts provide an excellent baseline by which to assess long-term population trends, but they do not identify factors contributing to these changes (e.g., habitat and landscape variables) and may fail to adequately monitor bird populations away from roads and human disturbance (Peterjohn et al. 1995). In the West, Breeding Bird Surveys cover riparian habitat poorly because most survey routes occur on public lands and along roads, whereas riparian habitat tends to occur on private lands and/or away from roads. Furthermore, the inability of BBS data to detect trends within certain habitats, particularly patchily distributed habitats such as riparian, contributes to the need for more intensive, site-specific monitoring techniques.

Biologists throughout California have contributed data to this document. They have sent information garnered from constant-effort mist netting, nest searching, point counts and other standardized techniques. The locations of study areas, contact information, types of data collected, and breeding status information for all focal species are stored and updated in real time via an interactive map interface to a relational database system (Ballard et al. 2003a). In some cases, more extensive data will be linked to this interface, allowing for calculations of population estimates and demographic parameters. Figure 5-19 provides a map of riparian bird data showing biodiversity "hotspots" in California riparian habitats as defined by the richness of 16 of the 17 focal species.

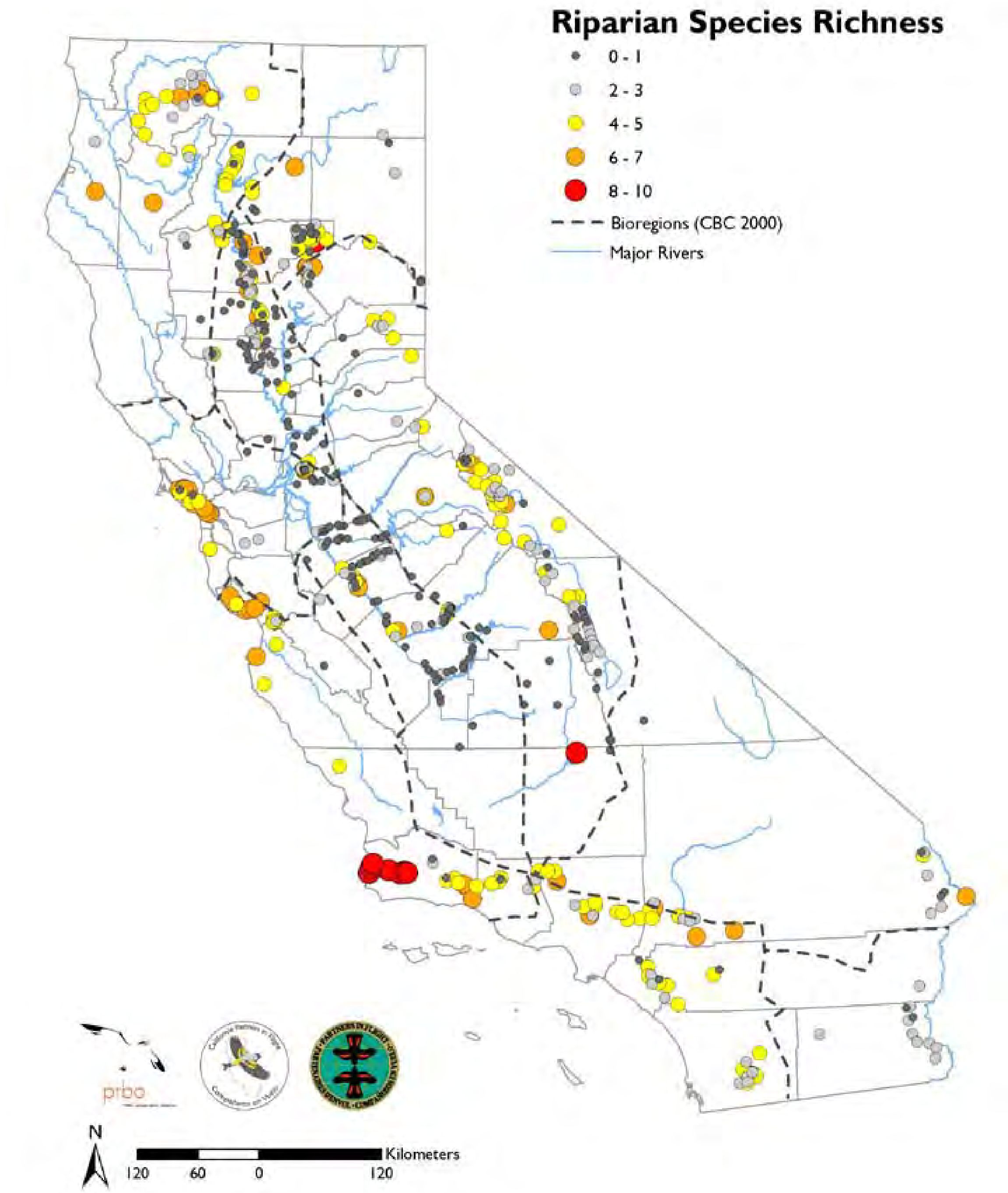


Figure 5-19. Species richness for 16 of the 17 focal riparian species at census sites throughout California. Data were collected and submitted by CalPIF contributors.

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Swainson's Hawk	• CA Threatened species • CA may have declined by as much as 90%.	SACR, BA/DE[2], SAJO, CECO[2], SINE, MOJA[2], COLD[2]	• Disturbance can lead to nest abandonment. • Poisoned by pesticides during migration and over winter.	Varied. Constructs nests in wide variety of trees.	Occupy a wide variety of open habitats with suitable nest trees, typically riparian forest or remnants.	Variable. Home range varies from 69-8,718 ha. Depends on availability of nest trees.
Spotted Sandpiper	• None	KLAM[2], MODO[2], BA/DE[2], SINE, SOCO[2], CECO[2], MOJA[2]	• Loss of nesting habitat from flood control projects and water diversions. • Abrupt changes in water level from human management or recreation during breeding season can cause nest failure. • Responds quickly to restoration efforts. • Benefits from healthy riparian systems in which flooding, and thus early successional vegetation and exposed gravel are prevalent.	Exposed gravel bars along streams, lakes and reservoirs. Often utilizes slight vegetative cover and litter.	Prefers early successional riparian.	Polyandrous. Sierra Nevada: 0.10 – 0.39 nest/ha found and 0.19 – 0.50 females/ha (PRBO data).

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Willow Flycatcher	• All three subspecies in CA listed as State Threatened and USFS Region 5 Sensitive Species. *E.t. extimus* is federally listed as Endangered. • Extirpated from much of historical breeding range.	KLAM[2], MODO, BA/DE[2], SAJO[2], SINE, CECO, SOCO, COLD (AZ).	• Negatively affected by livestock grazing, which changes riparian hydrology and vegetation composition, and damages nests. • Common Brown-headed Cowbird host. Trapping at South Fork Kern River reduced parasitism by 30-50%. • Recreational activities in riparian areas can reduce the quality of habitat for WIFL. • Not adequately monitored by many multispecies census	Generally in willows, alders, and cottonwoods or other riparian deciduous vegetation. Will also nest in non-native vegetation, such as tamarisk.	Varies by subspecies. Please refer to species account. Typically prefers dense patches and early successional riparian areas.	Varies by subspecies and region. *E.t. brewsteri* in eastern Fresno Co.; territories averaged 0.18 ha, and in Sierra Co. averaged 0.34 ha. *E.t. extimus* averaged 0.06-1.5 ha in Arizona and 0.6-1.1 ha on South Fork Kern River.
Warbling Vireo	• Declining in CA.	KLAM, MODO, SACR[2], BA/DE, CECO, SAJO[2], SINE, SOCO	• Common Brown-headed Cowbird host; parasitism in Sierra Nevada may be severe enough to depress population • Sensitive to loss of deciduous trees. • Population size likely limited primarily on breeding grounds from Brown-headed Cowbird parasitism and nest predation.	Nests high in deciduous trees. In Marin County, prefers willows and red alders.	Prefers large deciduous trees associated with streams, semi-open canopy. Shrub layer seems unimportant.	1.2 ha according to only reported account. Density: 1.1 pairs/ha in Bay-Delta. In AZ, densities were 0.52-0.63 pairs/ha in unlogged forests although they were 0.88-1.1 pairs/ha in selectively logged areas
Least Bell's Vireo	• Federal Endangered species. • Extirpated from or reduced in much of historical range.	SACR[2], SOJA[2], BA/DE[2], SINE[2], SOCO, MOJA, COLD, CECO	• Common Brown-headed Cowbird host. • Benefits from Brown-headed Cowbird control efforts.	Nests typically within 1 m of the ground in dense vegetation.	Prefers early successional riparian areas.	Territory size ranges from 0.2-3.0 ha; averages 0.6 (SD=0.3) to 1.1 (SD=0.6) ha.

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Bank Swallow	• California Threatened Species. • Nesting populations appear to be declining.	KLAM, MODO, SACR, CECO, SINE, SOCO[2]	• Loss of nesting habitat from bank protection and flood control projects. • Abrupt changes in water level from human management or recreation during breeding season can cause nest failure.	Burrows in vertical faces of bluffs or banks higher than 1 meter tall. Requires friable soils.	Variable. Requires vertical banks and bluffs, often from flooding and associated erosion events.	NA. Nest burrows are placed 1-59 cm apart. Varies from solitary to 1,500 pairs in a colony.
Tree Swallow	• None	KLAM, MODO, SACR, BA/DE, SAJO[2], SINE, GRBA, CECO, SOCO	• Natural nests require trees of considerable trunk diameter (>13cm), but nest-boxes can provide habitat in the absence of large trees. • Requires open areas for coursing feeding flights. • Eggs are vulnerable in shrubby habitats to puncturing by male House Wrens. • Nests near livestock can be subject to intense nest site competition from House Sparrows, sometimes resulting in the death of the defending swallows.	Uses cavities in the range of heights that are available, but appears to prefer sites 1.5-6.1 meters above the ground. Natural cavities in cis-montane California likely in cottonwoods or sycamore. In mountain and Great Basin habitats, often nests in aspen.	Without nest-boxes, prefers edges of riparian areas with large trees for nesting. Nest-boxes encourage this species to nest in a wide variety of habitats, from upland areas to sewage ponds. All foraging is done in open areas, preferably near water, and not in dense riparian forest.	Territory limited to immediate vicinity of nest-cavity. Fighting over nest-cavities, with own and other species, can be quite intense. Territory is not defended more than a few yards away from the nest. Nest densities depend on availability of nesting cavities, and nearest neighbor distances of 15 meters or less are not uncommon if cavity availability is high.

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Yellow Warbler	• CA Species of Special Concern (both as species and as subspecies *D. p.sonorana*). • Extirpated or declining in much of historical breeding range.	KLAM, MODO, SACR?, BA/DE, SAJO[2], SINE, GRBA, CECO, MOJA, SOCO, COLD	• Common Brown-headed Cowbird host. • Needs more subspecies-specific information in regards to Brown-headed Cowbird parasitism and habitat needs. • More data on productivity needed in CA. • Grazing reduces quality of nesting habitat. • Species seems to respond quickly to management actions such as restoration and Brown-headed Cowbird control.	Varies by bioregion. Often nests in deciduous riparian plant species, such as willows and cottonwoods, but also breeds locally in wild rose and more xeric plant species and habitats.	Generally found in wet areas with early successional riparian communities, or in remnant or regenerating canopy species stands. Will also breed locally in xeric shrub fields.	In early successional restored habitats in the eastern Sierra Nevadas, density ranged from 0.4 – 2.74 territories/ha. Territory sizes ranged from 0.06 – 0.75 ha.
Wilson's Warbler	• Shows significant decline in CA from 1966-1996 according to BBS data.	KLAM, MODO, BA/DE, SINE, GRBA, CECO, SOCO.	• Common Brown-headed Cowbird host. Abundance negatively correlated with abundance of Brown-headed Cowbird. • Loss of herbaceous cover during breeding season may reduce nest success. • Grazing may result in increased frequency of above points. • Loss of nesting habitat and pressure from Brown-headed Cowbird has resulted in reduction of breeding range.	Nests in riparian deciduous plants as well as grass, nettles, and ferns. Nest height from 0.3-3.0 meters, but mostly below 0.9 meters.	Prefers willows, alders, and shrub thickets and areas with tall trees and moderate to thick canopy cover.	In the Bay-Delta region: 0.57/ha (range 0.2-1.3 ha)

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Yellow-breasted Chat	• California Species of Special Concern. • Appears to be reduced in much of historical range.	KLAM, MODO, SACR,COLD BA/DE, SAJO?, SINE[2], CECO, MOJA, SOCO .	• Common Brown-headed Cowbird host[5]. • Any activity, such as grazing, that leads to the disappearance of dense, shrubby areas will be detrimental[5].	Nests in low, dense shrubs 0.3-2.4 meters high.	Prefers riparian habitat and marsh margins[5]. Often found in early successional riparian habitat.	In California riparian habitat, densities ranged from 6.5-27 males/100 ha[5].
Black-headed Grosbeak	• Population appears stable.	KLAM, MODO, SACR, BA/DE, CECO, SINE, SOCO	• Vulnerable to loss of riparian habitat for nesting. • Highest quality territory of males are where densities of Western Scrub-jays are low. • Responds quickly to restoration efforts.	Highly variable. In riparian, nests in willow, alder, and ash with fairly high nest cover.	Prefers semi-open canopy with moderate shrub cover and vertical stratification of vegetation layers. Often nests in early to mid-successional riparian areas.	No data for California. 1.9-3.9/ha in n. Utah.
Blue Grosbeak	• Appears to be reduced in much of historical range.	SACR, BA/DE, CECO, SINE, MOJA, COLD, CECO	• Common Brown-headed Cowbird host, but can raise both parasite and own young. • Benefits from a healthy riparian system where herbaceous annuals and early successional plant species are abundant. • Patch size and fragmentation seem unimportant to this species.	Nests in vertical forbs, young willows and cottonwoods, and herbaceous annuals.	Riparian edge species, preferring the annual forbs, young deciduous plants, and low canopy cover found in early successional riparian habitat.	No data for California. 1.2-6.2/ha in southeast U.S.
Song Sparrow	• *M.m.mailliardi* subspecies is a California Species of Special Concern[4].	KLAM, MODO, SACR, SINE, SAJO,COLD CECO, SOCO	• Common Brown-headed Cowbird host. • Responds quickly in many areas to restoration efforts (PRBO data).	Varies by bioregion.	Varies by bioregion. Breeds in early successional riparian, wetlands, coastal scrub, and marshes (PRBO data).	Bay Delta Coastal Scrub: 0.88 terr./ha. Bay Delta Salt Marsh: 14.9 detected per hectare (PRBO data).

Table 5-2. Status, special factors, and nesting requirements of riparian focal species.

Species	Statewide Status	Historical Breeding Range	Special Factors	Nest Site	Breeding Grounds Description	Territory Size and Breeding Density
Tricolored Blackbird	• California Species of Special Concern.	KLAM, MODO, SACR, BA/DE, SAJO, SINE[2], CECO, SOCO	• Loss of nesting and foraging and habitat due to agricultural and urban development[3]. • Significant reproductive losses annually due to crop harvesting activities[3]. • Failure of entire nesting colonies due to pesticides and other contaminants[3].	Dense patches of cattails and/or bulrushes. Blackberry[3].	Prefers freshwater wetlands and weedy, fallow fields[3].	Male territory size ranges from $1.8m^2$ to $3.25m^2$

1. Bioregions included in historical breeding range as estimated from Grinnell and Miller 1944: KLAM=Klamath; MODO=Modoc; SACR=Sacramento; BA/DE=Bay-Delta; SAJO=San Joaquin; SINE=Sierra Nevada; CECO=Central Coastal; GRBA=Great Basin; MOJA=Mojave; SOCO=South Coastal; COLD=Colorado Desert. See the range maps and species accounts at http://www.prbo.org/calpif/data.html.for more information.

2. Not recently detected and/or extirpated from this bioregion.

3. Beedy and Hamilton 1999.

4. CDFG and PRBO 2001.

5. Eckerle and Thompson 2001.

Chapter 6. Population Targets

California Partners in Flight and the Riparian Habitat Joint Venture seek to develop population targets that will guide avian and habitat conservation efforts and provide them with a gauge of success. Although ambiguous and based on assumptions difficult to test, numerical population targets provide a compelling means of communicating with the public and policy makers. Furthermore they provide: 1) monitoring objectives and an evaluation procedure of project success ('accountability'); 2) ranking criteria for project proposals that allow reviewers to determine which sites or projects will be more advantageous for a particular species or suite of species; 3) current data for scientifically sound biological objectives; and 4) integration and comparison with population objectives of larger regional, national, and international schemes (e.g., Rosenberg and Blancher *in press*).

In this document, two approaches for deriving population targets of riparian focal species are examined. The first approach provides estimates of population size, where data exists, from two avian monitoring techniques (point counts and spot mapping) for the 17 focal species in each bioregion (Table 6-1). These density estimates are to be used with caution and are provided as a reference for comparison when collecting similar data. In general, these estimates are taken from the highest recorded density in regions where populations are believed to be viable as estimated from demographic monitoring (Sherry and Holmes 2000). The second approach is a process still in development that has been completed for six species in the 12 basins of the Central Valley (Figure 3-1). The following six species were used primarily because of data availability and distribution in the Central Valley: Yellow Warbler, Common Yellowthroat, Yellow-breasted Chat, Spotted Towhee, Song Sparrow, and Black-headed Grosbeak. Other species estimates and more detailed descriptions may be found on the CalPIF website. The description as follows has been presented and critiqued at various meetings (Geupel et al. 2003) and incorporated into the Strategic Plan of the RHJV.

Photo by James Gallagher, Sea and Sage Audubon

Population targets will help guide avian and habitat conservation efforts.

Table 6-1. Estimates of maximum breeding abundance by species and bioregion[a].

Species	Bay-Delta		South Coast		Sierra		San Joaquin		Central Coast	
	Point Count[b]	Spot Map[b]	Point Count	Spot Map[c]	Point Count[d]	Spot Map[e]	Point Count[b]	Spot Map	Point Count	Spot Map
Swainson's Hawk	-	-	-	-	-	-	-	-	-	-
Spotted Sandpiper	-	-	-	-	-	-	-	-	-	-
Yellow-billed Cuckoo	-	-	-	-	-	0.85	-	-	-	-
Willow Flycatcher	-	-	-	-	-	9.6	-	-	-	-
Warbling Vireo	1.30	18.0	-	-	1.20	-	-	-	0.54[b]	-
Bell's Vireo	-	-	-	-	-	-	-	-	-	-
Bank Swallow	-	-	-	-	0.56	-	-	-	-	-
Tree Swallow	0.16	-	-	-	0.20	-	1.50	-	-	-
Swainson's Thrush	1.90	322.2	-	-	0.04	-	-	-	0.56[b]	-
Yellow Warbler	-	-	-	0.20	2.50	-	-	-	0.30[b]	-
Common Yellowthroat	0.42	-	-	-	0.83	-	0.53	-	0.10[b]	-
Wilson's Warbler	1.69	288.6	-	-	-	-	0	0	1.20[b]	-
Yellow-breasted Chat	-	-	-	-	0.40	-	-	-	0.15[b]	-
Black-headed Grosbeak	0.91	117.6	-	-	0.17	-	0.43	-	0.72[b]	-
Blue Grosbeak	-	-	-	-	0.05	-	0.33	-	0.07[b]	-
Song Sparrow	3.10	509.6	-	-	1.20	-	3.00	-	1.53[b]	-
Tricolored Blackbird	-	-	-	-	-	-	-	-	-	-

Notes:
[a]Numbers provided from point counts are the average number of detections within 50 meters of the observer during five minute counts. Numbers from spot mapping are pairs per 40 hectares during the breeding season. Reference populations are cited and may not be representative of healthy populations. Point count data provide an *index* of abundance, generally thought to be conservative. Spot mapping numbers are probably closer to true abundance. Dashes represent “no data.” Zeroes indicate the species probably never bred in that bioregion.

[b]PRBO unpublished data: Bay Delta data are from Point Reyes Nat’l Seashore; Central Coast data from Salinas River, Scott Creek and Moore Creek.

[c]Cardiff (1996).

[d]Heath and Ballard (1999).

[e]Shaver and Kern River.

Table 6-1. Estimates of maximum breeding abundance by species and bioregion[a].

Species	Klamath		Sacramento Valley		Modoc		Mojave		Colorado Desert	
	Point Count[b]	Spot Map[b]	Point Count[b]	Spot Map[f]	Point Count[b]	Spot Map[b]	Point Count	Spot Map	Point Count	Spot Map[g]
Swainson's Hawk	-	-	-	-	-	-	-	-	-	-
Spotted Sandpiper	-	-	-	-	0.25[h]	-	-	-	-	-
Yellow-billed Cuckoo	-	-	-	-	-	-	-	-	-	-
Willow Flycatcher	-	-	-	-	0.45	7.9	-	-	-	-
Warbling Vireo	0.41	-	-	-	1.30	33.2	0	0	0	0
Bell's Vireo	0	0	-	-	0	0	-	-	-	-
Bank Swallow	-	-	0.04	-	-	-	-	-	-	-
Tree Swallow	0.50	-	0.98	-	1.20	-	-	-	-	-
Swainson's Thrush	-	-	-	-	0.06	-	0	0	0	0
Yellow Warbler	1.60	16.0	0.13	0.13	1.10	33.2	-	-	-	-
Common Yellowthroat	-	-	1.0	-	-	-	-	-	-	-
Wilson's Warbler	-	-	0	0	0.95	33.2	0	0	0	0
Yellow-breasted Chat	1.20	25.0	0.32	-	-	-	-	-	-	-
Black-headed Grosbeak	0.87	32.0	1.80	-	1.0[h]	-	-	-	-	-
Blue Grosbeak	0	0	0.19	-	0	0	-	-	-	5.0
Song Sparrow	0.79	16.8	1.33	-	1.80	77.6	-	-	-	-
Tricolored Blackbird	-	-	-	-	-	-	-	-	-	-

[a]Numbers provided from point counts are the average number of detections within 50 meters of the observer during five minute counts. Numbers from spot mapping are pairs per 40 hectares during the breeding season. Reference populations are cited and may not be representative of healthy populations. Point count data provide an *index* of abundance, generally thought to be conservative. Spot mapping numbers are probably closer to true abundance. Dashes represent "no data." Zeroes indicate the species probably never bred in that bioregion.

[b]PRBO unpublished data: Sacramento Valley data are from Sul Norte, La Baranca, Dye Creek, Llano Seco, Ohm, and Kopta Slough. Modoc data are from Lassen Volcanic NP and Lassen Volcanic NF. Klamath data are from Lower Clear Creek Floodway Restoration Project.

[f]Gaines (1974).

[g]Rosenberg (1991).

[h]Humple et al. (2002).

Population Size Estimates

Estimates of current population sizes were calculated for select species using mean values from current point count data (1994-2002) for each basin. As a first step, density was calculated using the number of detections within 50 meters x 1/detectability coefficient. Because of variation of species detectability using the point count method, coefficients were derived from sites where point count surveys overlaid spot mapping plots. Spot map data was used for density estimates for species whose populations were rare and patchily distributed (Song Sparrow and Yellow Warbler). Density estimates were then extrapolated across basins using current riparian habitat data layers as determined (Figure 3-1).

Population Target Estimates

Estimates of target populations were calculated with the median of the top 50% (75^{th} percentile) of corrected density estimates from current point count data. This correction of 75% was used in preference to the true mean due to the assumption that most current populations were degraded but could be enhanced. Spot map data also were used from the nearest suspected viable population when point count data were not available (normally due to lack of detections). A riparian data layer based on historical extent of riparian forests and/or the current extent of soil types (The Bay Institute 1998) was used and corrected for permanent habitat loss (urbanization) to extrapolate the 75^{th} percentile density. The amount of current and potential riparian habitat as determined from the GIS data (Table 6-3) was used to calculate population targets in each basin for two select species: Black-headed Grosbeak (Figure 6-1) and Song Sparrow (Table 6-2).

Demographic data (primarily nest success) also may be used to qualify density estimates (see Small and Gardali *in prep*, Sherry and Holmes 2000). The range of nest success observed for Song Sparrow in the Central Valley of 5% to 24% does not allow the growth rate to be positive (lamda > 1). This suggests that populations of Song Sparrows are not viable and will decline in the absence of immigration. Based on the information presented, a minimum target value for nest success of Song Sparrows in the Central Valley should be at least 27%.

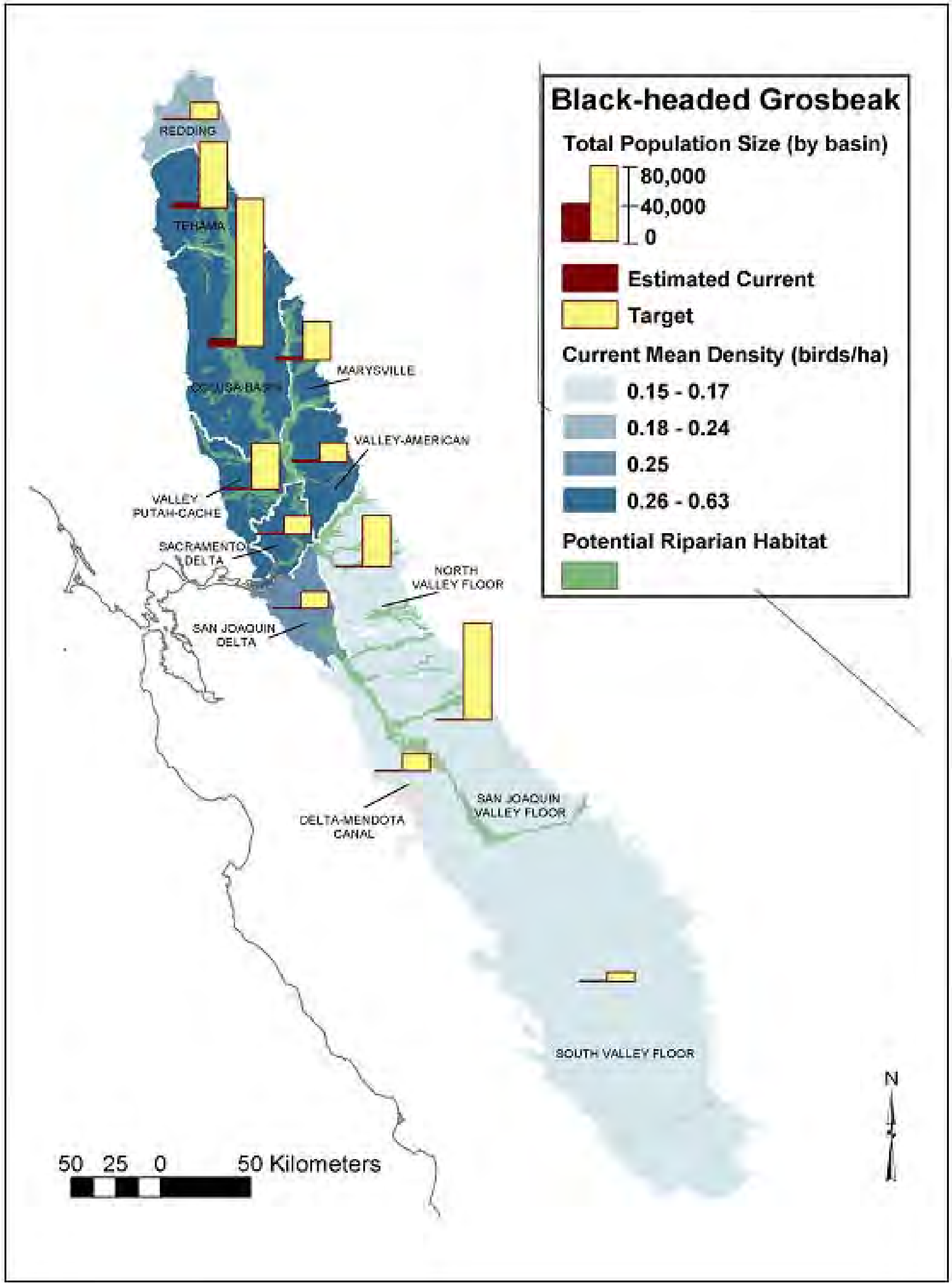


Figure 6-1. Black–headed Grosbeak current population estimates and targets for 12 basins in the Central Valley.

Table 6-2. Song Sparrow current population estimates and targets for 12 basins in the Central Valley.

Basin	Current Birds/Ha, Riparian Point Counts	±SE**	Current Population Size	±SE**	Target Birds/Ha	Target Population Size
Colusa Basin	0.09	±0.06	1128	±750	0.99 (1)	112,360
Marysville*	0.10	na	617	na	0.99 (1)	29,550
North Valley Floor*	0.90	na	2581	na	2.65 (2)	103,937
Redding	0.33	±0.12	1297	±448	0.99 (1)	13,132
Sacramento Delta*	0.10	na	168	na	0.99 (1)	14,279
Tehama	0.01	±0.004	39	±30	0.99 (1)	50,012
Valley Putah-Cache*	0.10	na	122	na	0.99 (1)	34,771
Valley-American*	0.10	na	280	na	0.99 (1)	14,747
Delta-Mendota Canal	1.24	±0.22	1949	±356	2.65 (2)	35,319
San Joaquin Delta	1.22	±0.24	2180	±420	2.65 (2)	33,894
San Joaquin Valley Floor	0.70	±0.16	3403	±788	2.65 (2)	198,253
South Valley Floor	0.93	±0.30	4440	±1444	2.65 (2)	18,805

* If a basin contained less than 30 point count stations, current density estimates were derived from all stations in the respective valley (Sacramento or San Joaquin) and standard errors are not presented (because sample size is not specific to basin). (1) In the Sacramento Valley, spot map densities from known source populations were used as target densities for *Melospiza melodia mailliardi*. (2) In the San Joaquin Valley point counts (75th percentile) were used *for Melospiza melodia heermani.*

** Estimates of population sizes are the product of: a) estimate of number of detected birds per ha for each basin (N); b) inverse of the detectability coefficient; and c) estimate of the number of ha of riparian habitat. There was uncertainty, and thus error, associated with each component. As a first approximation to estimating overall error in population size, we assumed the contribution of the latter two factors to the overall standard error was equal in magnitude to the standard error associated with estimation of N (which could be directly assessed). We thus used the standard error obtained in estimating N and multiplied by 2 to yield a rough estimation of the overall standard error.

Table 6-3. Amount of riparian habitat by Central Valley basin.

Basin	Current Riparian Hectares	Potential Riparian Hectares	Proportion Currently Forested	Number of Riparian Point Counts
Colusa Basin	12,380	113,610	0.11	139
Marysville	6,041	29,879	0.19	16
North Valley Floor	2,880	39,175	0.07	22
Redding	3,903	13,278	0.25	108
Sacramento Delta	1,647	14,438	0.10	9
Tehama	8,131	50,568	0.15	199
Valley Putah-Cache	1,199	35,158	0.03	8
Valley-American	2,746	14,911	0.11	6
Delta-Mendota Canal	1,578	13,312	0,12	90
San Joaquin Delta	1,787	12,775	0.13	46
San Joaquin Valley Floor	4,884	74,724	0.06	166
South Valley Floor	4,751	7,088	0.57	56
Central Valley Totals	51,927	418,916	0.12	865

Species-Specific Objectives

Although the RHJV strongly endorses the concept of multiple species management, it recognizes that special-status species often receive more careful management than non-listed species due to legal mandate. Special status species are those whose populations have been reduced or are in decline, the magnitude of which warrants more immediate conservation action relative to other taxa. Therefore, more information on listed species exists and the species-specific objectives offered in this plan reflect that special knowledge. However, conservation actions must include efforts to monitor their effects on multiple species, not only those on special-status lists. What positively affects one species may have a negative impact upon another. Minimal adjustments to conservation efforts targeting single species may positively impact multiple species, thereby greatly increasing the effectiveness of conservation dollars. Finally, conservation planners must bear in mind that population dynamics are influenced by many factors other than breeding habitats (e.g., over wintering survival) and may result in population declines even as efforts increase available habitat.

Data and figures presented in this section are from the species accounts developed by the authors listed on pages 22-23. Species accounts are an electronic appendix to this document and may be found at http://www.prbo.org/calpif/htmldocs/riparian.html.

<u>Western Yellow-billed Cuckoo (</u>*Coccyzus americanus occidentalis)*

Population:

The current Western Yellow-billed Cuckoo population is about 60 to 100 pairs statewide (Halterman et al. 2001; see Figure 5-4 for statewide range). The RHJV recommends restoring habitat in 25 locations to support 625 pairs (25 pairs per location). Simulation modeling indicates that populations of less than 10 pairs are very unstable, becoming extinct in a short period of time. Current predictions suggest that a minimum of at least 25 pairs in a subpopulation with interchange with other subpopulations should be reasonably safe from extinction by stochastic events. Given that presumably stable populations are at least 25 pairs and that territory size averages 20 to 25 hectares (a minimum of 10 hectares), the optimal goal for each population is to protect and restore habitat in minimum 20-hectare patches that collectively total 500 hectares within a watershed or river reach. The statewide habitat restoration and protection target, in addition to that currently managed for the cuckoo, equals approximately 21,000 hectares statewide, including areas in Arizona along the Colorado River. See Table 6-4 for a summary of the recommended habitat restoration sites.

Table 6-4. Minimum management goals for subpopulations, pairs, and reforestation of suitable habitat, based on 40 hectares per pair, for Western Yellow-billed Cuckoos.

Locality	Subpopulation	Number of Pairs	Current Suitable (hectares)	Reforestation Suitable (hectares)
		Northern California		
Sacramento R.	6	150	2,370	3,700
Feather R.	1	25	240	770
Stanislaus R.	1	25	240	770
Cosumnes R.	1	25	0	1,010
Merced R.	1	25	0	1,010
Kings R.	1	25	0	1,010
Mendota	1	25	0	1,010
Subtotal	**12**	**300**	**2850**	**9,280**
		Southern California		
Kern R.	1	25	400	610
Prado Dam	1	25	240	770
Mojave R.	1	5	80	930
Owens R.	1	25	0	1,010
Subtotal	**4**	**100**	**720**	**3,320**
		Colorado River		
Needles-Parker	4	100	670	3,380
Parker-Blythe	2	50	0	2,020
Blythe-Yuma	3	75	0	3,040
Subtotal	**9**	**225**	**670**	**8,440**
TOTAL	**25**	**625**	**4,240**	**21,040**

MANAGEMENT

Habitat patch size:

Restoration to benefit the Western Yellow-billed Cuckoo requires patches be a minimum of 20-40 hectares, with a minimum width of 100 meters. Optimal habitat for a pair would be 75 hectares or more in length, with a width of more than 600 meters. Research by Laymon and Halterman (1989) led to the development of these parameters based on occupancy rates of existing habitat patches along the Sacramento River. Additionally, higher canopy closure, higher foliage volume, intermediate basal area, and intermediate tree height relative to random sites are preferred by cuckoos for nesting. The best habitats for nesting are therefore at large sites with high canopy cover and foliage volume and moderately large and tall trees. The cuckoo's primary food source, katydid and sphinx moth larvae, hibernate underground and are therefore not available in lowland floodplains in wet years with late-spring flooding. Therefore, upland refugia habitats for foraging in wet years should also be a component of Western Yellow-billed Cuckoo habitat protection and restoration projects.

Pesticide use:

Occasionally, cuckoos nest or forage in orchards adjacent to riparian areas. Pesticide use by farmers may deter cuckoos from more frequent use of these crops. More research is needed as to whether or not Western Yellow-billed Cuckoos more readily use orchards grown with integrated or organic pest management techniques.

Other factors:

Areas of apparently suitable habitat are unoccupied by Western Yellow-billed Cuckoos every year (e.g., Kern River Preserve). Other factors (e.g., over winter survival, juvenile survival and dispersal) should therefore be addressed (M. Halterman pers. comm.).

Photo by Claire DeBeauvoir, Sea and Sage Audubon

<u>Least Bell's Vireo</u> *(Vireo bellii pusillus)*

Photo by James Gallagher, Sea and Sage Audubon

Population:

Grinnell and Miller (1944) once characterized Least Bell's Vireo as one of the most common birds found in riparian habitat throughout the state (Figure 5-7). Over the past sixty years, destruction of riparian habitat and the invasion of California by the parasitic Brown-headed Cowbird have contributed to a steep decline in the vireo's population. Currently, Least Bell's Vireos are restricted to approximately eight counties in southern California and are on the federal Endangered Species List (USFWS 1998).

To be reclassified as "threatened," the Least Bell's Vireo population must achieve one of the following criteria for at least a period of five consecutive years (taken from USFWS 1998):

- Stable or increasing populations/metapopulations, each consisting of several hundred or more breeding pairs, are protected and managed at the following sites: Tijuana River, Salzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, Camp Pendelton/Santa Margarita River, Santa Ana River, an Orange County/Los Angeles County metapopulation, Santa Clara River, Santa Ynez River, and an Anza Borrego Desert metapopulation.

- Stable or increasing Least Bell's Vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, become established and are protected and managed at the following sites: Salinas River, a San Joaquin Valley metapopulation, and a Sacramento Valley population.

- Threats are reduced or eliminated so that Least Bell's Vireo populations/metapopulations listed above are capable of persisting without significant human intervention, or perpetual endowments are secured for cowbird trapping and exotic plant control in riparian areas occupied by least Bell's Vireos.

MANAGEMENT

Habitat enhancement:

Riparian habitat creation and restoration is underway throughout the state. Much of this effort in southern California has been propelled by the need for more Bell's Vireo habitat. Bell's Vireos have responded favorably to restoration efforts, demonstrating increases in occupation at restored sites, and nest success rates similar to non-restored natural habitat (Kus 1998).

The Santa Clara River Enhancement and Management Plan:

This plan seeks to protect the ecological integrity of the longest, unchannelized river in the South Coast bioregion. Current efforts to develop along the Santa Clara and its tributaries may endanger the integrity of the plan.

Brown-headed Cowbird control:
In the short-term, trapping of cowbirds is one of the most effective ways to increase the reproductive success of Least Bell's Vireo on a local scale. At Camp Pendelton, nest parasitism dropped from 47% to less than 1% in less than 10 years (USFWS 1998). However, cowbird trapping is only a temporary remedy to be used in emergency situations. The population cannot be considered healthy until it can survive without significant human intervention.

Monitoring and research:
Research elucidates the habitat variables required to re-establish healthy populations. Monitoring provides important information on population trends, allowing for the employment of appropriate adaptive conservation techniques.

Willow Flycatcher (*Empidonax traillii*)

Photo by James Gallagher, Sea and Sage Audubon

Population:
Willow Flycatchers historically nested throughout California, preferring riparian deciduous shrubs, particularly willow thickets. Currently, three subspecies of the Willow Flycatcher breed in California (Figure 5-5). Each has been listed as state endangered and US Forest Service Region 5 Sensitive in California. The USFWS designated the Willow Flycatcher as a sensitive species in Region 1 (Washington, Oregon, Idaho, California and Nevada). Furthermore, the Southwestern Willow Flycatcher *(Empidonax traillii extimus*) is federally listed as endangered.

Management:
Sierra Nevadan populations have dropped precipitously in the last 50-60 years. Most Sierran meadows are already publicly owned, but many are grazed under permit. Goals for increasing Willow Flycatcher populations focus on increased monitoring, improving management and restoration of habitat, and where necessary, through proper grazing management.

Southwestern Willow Flycatcher:
These flycatchers are concentrated in lowland habitats. The UFWS has recently released a Southwest Willow Flycatcher Recovery Plan (http://ifw2es.fws.gov/Library/ListDocs.cfm) that details management recommendations for this imperiled subspecies. Managers should prioritize the protection and restoration of riparian deciduous shrub vegetation and address the problem of cowbird parasitism, which has severely affected populations in southern California. For example, at the South Fork Kern River Preserve, an average of 63.5% of nests were parasitized from 1989 to 1992, with a range from 50% in 1989 to 80% in 1991. However, Brown-headed Cowbird trapping at the South Fork Kern River Preserve has resulted in a decreased rate of parasitism, "buying time" for this population as riparian habitat restoration proceeds.

Tricolored Blackbird (*Agelaius tricolor*)

Photo by James Gallagher, Sea and Sage Audubon

Population:

The Tricolored Blackbird is largely endemic to California and has been listed as a state Species of Special Concern. Surveys indicate that populations have been rapidly declining for decades, probably due to water diversion, land conversion and heavy predation by mammals, corvids and Black-crowned Night Herons (Beedy and Hamilton 1997, Hamilton et al. 1999). Tricolors are colonial breeders, nesting mainly in wetlands or in dense vegetation near open water. No population targets have been established for this species.

Management:

Hamilton et al. (1999) outlines many specific recommendations for conserving Tricolored Blackbird populations in California. Included are:

Protect existing colonies: Managers must seek to protect existing tricolor colonies and nesting sites (Figure 5-18). Adequate tricolor habitat needs to be designated in Habitat Conservation Plans (HCPs). Managers also need to reduce predation pressure to allow populations to expand. Problem species such as ravens, night herons, and coyotes should be properly managed whenever possible (Hamilton *in press*).

Proper water management can enhance their natural nesting habitat and reduce depredation rates (nest predation by mammals increases when water levels around nesting sites drop). If feasible, a simple water level management strategy is to maintain the level present when initial tricolor settlement occurred.

Consider disturbance effects: Private landowners must be encouraged to consider the needs of tricolors and to avoid harvesting, pesticide application and other disturbances to the species during the breeding season.

Provide suitable nesting habitat: Tricolors will often use exotic plants, such as Himalaya blackberry, as nesting substrates. Efforts that remove shrubs used by tricolors should include plans to replant a suitable alternative. Restoration efforts should emphasize native plants.

Public education: Conservation efforts must educate the public about the species' status and needs (Beedy and Hamilton 1997). Managers should encourage development of colonies in conspicuous urban environments where their educational value will be useful (Hamilton *in press*).

Research and Monitoring: Further research will indicate the variables affecting their reproductive success, outline the threats posed to colonies and monitor population changes over time. For a more extensive review of monitoring needs, see Beedy and Hamilton (1997) and Hamilton et al. (1999).

Chapter 7. Bioregional Conservation Objectives

California harbors more naturally occurring species of plants, insects, vertebrates, and other life forms than any comparable area north of the subtropics (Biosystems Analysis 1994). Isolation by the Sierra Nevada mountain range and southern deserts fostered the evolution of more endemics than any other state in the United States except Hawaii. The great diversity of plants and animals renders conservation planning for the entire state more difficult.

Numerous authorities have divided the state into discrete geographical sections, or bioregions, based on natural communities, climate, topography, and soils. The California Biodiversity Council (RAC 1998) divided the state into 10 bioregions (Figure 7-1) while others, including Biosystems Analysis (1994) and Sawyer and Keeler-Wolf (1995) recognize 11 discrete regions. California Partners in Flight followed the Biodiversity Council's 10-region scheme for the purposes of the bird conservation plans.

Figure 7-1. Bioregions of California. From the Biodiversity Council (2003).

Many organizations have embraced planning on a bioregional basis because bioregions facilitate an adaptable, site-specific focus for projects. Setting and achieving conservation goals by bioregion will:

- Ensure that a suite of ecological communities representative of California's diversity will be conserved.
- Ensure the broadest range of biodiversity and locally adapted races of species will be conserved.
- Facilitate action at the local level.

This chapter introduces each of the 10 bioregions considered in this plan (the Sacramento and San Joaquin are discussed together). These descriptions are offered as an overview; the issues and needs vary depending on particular sites within a bioregion. For more information on each, consult the Resource Agency of California's (1998) *Preserving California's Natural Heritage.*

Portfolio Sites

For each bioregion, we list regional Portfolio Sites. These sites stand out for their significance and contribution to conservation, either through management practices or their value as a reference site. CalPIF and the RHJV are constantly seeking to expand this list of portfolio sites in California. Inquiries concerning the suitability of an area for recognition as a portfolio site should be directed to the RHJV coordinator (http://www.prbo.org/calpif/htmldocs/rhjv/). A specific project, geographic area, or discrete patch of habitat may be designated as a Portfolio Site if:

- It has been recognized as a "flagship project" by the RHJV for outstanding riparian habitat management and restoration activities.

- It implements adaptive management strategies by "closing the feedback loop," i.e., gathering data that provides information about wildlife responses to management practices, then incorporating such data into future management decisions.

- RHJV science partners recognize that the site merits long-term monitoring of avian populations. Long-term data collection provides an important baseline against which to measure short-term changes in regional bird populations and reproductive success. Such projects can serve as reference sites when comparing avian response to management or restoration in other areas with similar habitat and climate. Only through long-term data collection will conservation biologists and ecologists avoid the ongoing pitfall of "shifting baselines," i.e., the phenomenon whereby slowly deteriorating conditions over time can become the norm or standard against which to measure healthy ecological systems.

Sacramento and San Joaquin Valleys

California's Great Central Valley provides breeding, migratory stopover and wintering grounds to millions of birds annually. Though seriously degraded due to human disturbance, the Valley still contains vital riparian habitat, freshwater wetlands and seasonally flooded agriculture, vernal pools, and naturalized annual grasslands. Most think of the Central Valley only in terms of its robust agricultural industry. Yet, the Valley once hosted an extensive network of riparian forests with a rich shrub and herbaceous understory, wetlands, and adjacent upland habitats. However, development pressure from a rapidly expanding population and an increasing demand for water threaten the remnants of the once vast riparian system. Without prompt action, the opportunity to restore critical habitat may be lost.

Portfolio Sites

Lower Clear Creek supports the largest breeding population of Yellow Warbler and Song Sparrow in the region. Priority should be given to ensuring a continuous riparian corridor from Clear Creek to the main stem of the Sacramento River and improving habitat quality through restoration and restoring natural processes.

The Lower Feather River, which includes the Audubon Bobelaine Sanctuary, provides important breeding and migratory stopover habitat for numerous songbird species and has high potential for range expansion of riparian birds.

The Sacramento River continues to provide nesting habitat for many species, including Bank Swallow, Swainson's Hawk and Western Yellow-billed Cuckoo. Many species once common in the area, including the Least Bell's Vireo, have been extirpated while the Yellow Warbler, Song Sparrow, Yellow-breasted Chat, and Blue Grosbeak are missing locally (Nur et al. 1996). Protection efforts include the extensive Sacramento River National Wildlife Refuge Complex. The largest river system in the state, the Sacramento has great potential to support vast expanses of riparian habitat. We recommend focusing restoration efforts in areas where dynamic fluvial processes are still intact, and where connectivity can be established with adjacent intact habitat. Examples of ongoing riparian restoration projects include the Rio Vista Unit owned by the USFWS and CDFG's Pine Creek Unit. These sites can be found at the following web sites: http://www.sacramentoriver.org; http://www.riverpartners.org.

Cottonwood Creek is the largest undammed tributary to the Sacramento River in the Central Valley. The hydrology of Cottonwood Creek still resembles a historical flow regime with high stream flows during rainy winter months and very low flows during dry summer months. With natural flow regimes fairly intact, extensive wildlands in the upper watershed, and intact adjacent upland habitat, it is likely that Cottonwood Creek provides valuable habitat to numerous riparian associated bird species. Current threats to riparian habitat on Cottonwood Creek include subdivision of large properties into ranchettes resulting in an increased intensity of land use within and adjacent to riparian habitat, increased demand for water from a growing population, and the encroachment of exotic invasive plant species.

The Tuolumne River has recently garnered conservation attention primarily through the restoration efforts of agencies and groups such as the Friends of the Tuolumne. Though mining, dredging, water diversion and development continue along its reach, the river continues to support breeding Song Sparrows, Common Yellowthroats, Blue Grosbeaks, and Swainson's Hawks. Fairly large habitat patches remain, especially in the river's upper reach.

The Mokelumne River's riparian habitat is currently restricted to linear patches directly along the river corridor due to agriculture and development as well as upstream dams that limit flows. However, a developing partnership between private landowners and the East Bay Municipal Utility District is pursuing riparian restoration along the river to increase the amount of habitat for the benefit of both farmers and wildlife.

Riparian habitat near the Sacramento River.

The San Joaquin River's water flows and habitat have been seriously diminished by the development of agriculture or mining along nearly every mile of its reach and the construction of Friant Dam. The demand for water from the river is immense. It irrigates the world's largest agricultural industry and can run nearly dry in parts of its reach during the summer. The river continues to host a number of riparian species, including Song Sparrow, Blue Grosbeak, Black-headed Grosbeak, and Swainson's Hawk. For the past two years Yellow Warblers have been documented breeding at the San Joaquin River National Wildlife Refuge (PRBO unpublished data). This hopeful sign that an extirpated breeder has returned to the valley floor is the result of protection and restoration efforts along the river, including the establishment of open space reserves near Friant Dam and a growing network of wildlife areas and refuges along its middle reach. These efforts include the San Luis National Wildlife Refuge Complex, Great Valley Grasslands State Recreation Area, and the San Joaquin River Parkway (Conservation) Trust.

Modoc

Of the California bioregions, perhaps the Modoc most resembles its historic state. It is characterized by hot, dry summers and cold, wet winters, extensive stands of conifers and oaks, and high elevation desert conditions in its northeast portion (RAC 1998). It has the smallest population of the states 10 bioregions, though it is expected to grow as California's population expands. A major effort to restore aspen stands has been taking place in the Eagle Lake Ranger District of the Lassen National Forest since 1999. Here they have employed an aggressive strategy of clear-cutting conifers and fencing the boundaries of aspen stands where livestock grazing is an issue. Preliminary results have been positive with extensive resprouting of aspen stems and associated herbaceous species. In 2004, a monitoring component will be added to this project in order to determine the effects aspen release treatments have on songbirds.

Portfolio Sites

Humbug Valley, totaling over 500 hectares, is the largest meadow in the Northern Sierra Nevada. Fed by two perennial streams, willows, alders, sedges and other wet meadow associated vegetation undoubtedly dominated the valley historically. Overgrazing and subsequent stream erosion has resulted in a drying out of this site over the past 180 years. Fencing off the riparian habitat in the mid-1980's, followed by the complete removal of grazing in 2001, has resulted in a dramatic recovery of this site. New willow and herbaceous vegetation has returned to large portions of the valley. The population of Willow Flycatcher has increased from two singing males in 2002 to at least 13 singing males in 2003 (Humple and Burnett 2004). With full recovery of this site, the valley could potentially sustain over 50 pairs of breeding Willow Flycatcher. Other focal species that breed in the valley that should benefit from the recovery of riparian habitat include Spotted Sandpiper, Tree Swallow, Warbling Vireo, Yellow Warbler, Wilson's Warbler, and Song Sparrow. Current conservation efforts are focused on providing permanent protective status for this biologically important mountain meadow.

Warner Valley, a CDFG wildlife area adjacent to the Lassen National Forest and Lassen Volcanic National Park, is one of the most significant breeding areas for Willow Flycatchers in the state. Approximately 10-15% of the Sierra Nevada population of this species breed at this one location (King and King 2003, Humple and Burnett 2004). Substantial numbers of Wilson's Warbler, Yellow Warbler, and a small population of the regionally rare Swainson's Thrush breed here as well. The Willow Flycatcher population here is now being intensively studied as part of a demographic study of the Willow Flycatcher in the Sierra Nevada.

Bear Creek Meadow, located on private property adjacent to the headwaters of the Fall River, is the site of an extensive meadow restoration project. The meadow already contains numerous Yellow Warblers and several other focal species, including Wilson's Warbler and Warbling Vireo. With the maturation of re-vegetation and natural regeneration following the restoration of a hydrologically functional stream, this site has the potential to provide significant breeding habitat for Willow Flycatcher and other riparian focal species.

The Modoc region now appears to be the only area in the Sierra Nevada where the Willow Flycatcher population is stable or increasing (Humple and Burnett 2004, Green et al. 2003, R. Siegel pers. comm.). This population increase in the Lassen area can be attributed primarily to recolonization of former breeding sites on Pacific Gas and Electric (PG&E) lands. The only restoration action taken on these lands has been the complete cessation of cattle grazing. While grazing remains a highly debated subject in the Sierra Nevada, this evidence suggests that restoring mountain meadows to an ecologically healthier state may be accomplished with minimal active restoration in this region. A rigorous study examining the effects of cattle grazing and the recovery of meadows where it has been removed is vital for ensuring the long-term sustainability of many meadow dependent Sierra bird species.


Photo by Steve Zack, WCS

Willow Flycatcher abundance is increasing in the Lassen

Klamath

The Klamath/North Coast bioregion consists of rocky, steep shorelines, rich conifer forests, and lush riparian corridors. The region is one of the wettest in California, with cool, foggy summers along the coast and rainy winters throughout. Though vast tracts of habitat remain, logging, cattle ranching and agriculture have degraded much of the historic riparian habitat. While the old growth redwoods garner much of the attention of conservationists, riparian habitat merits significant attention as well, providing habitat for salmon, mammals and numerous birds, including the Pacific-slope Flycatcher, Bank Swallow and Willow Flycatcher (RAC 1998).

Portfolio Sites

The Trinity River supports important breeding habitat for half of the focal species. It is also used by large numbers of Willow Flycatchers during the pre-migration and migratory periods (Ralph and Hollinger 2003). Congressional legislation has provided the directive for the restoration efforts by the USDI Bureau of Reclamation Trinity River Restoration Program. Proposed bank rehabilitation and flow manipulation projects are aimed at recreating historic aquatic and riparian habitat conditions primarily in the upper reach of the system. Ongoing bird monitoring within the restoration sites will provide population and habitat use information for effective adaptive management.

Central Coast

The Central Coast Bioregion is characterized by a mild climate, a wide variety of habitat types, and numerous small mountain ranges that roughly parallel the coastline. The region supports a robust agricultural industry, which includes cattle grazing, row crops and vineyards. In recent years, the Central Coast has experienced a dramatic population increase fueled largely by prosperous industries, including the booming computer industry in the Santa Clara "Silicon Valley." This expansive growth seriously threatens riparian habitats in the region because of land conversion, water diversion, resource extraction, intensive grazing, habitat clearing and the introduction of invasive plant species. These changes have rendered the Central Coast one of the three most threatened ecoregions in California, along with the Central Valley and Southwest Ecoregions (TNC 1997), and merits immediate attention for conservation and protection efforts.

Valley areas in the Central Coast once supported large floodplain forests of deciduous riparian trees and shrubs. These areas, dominated by sycamore, willows and cottonwoods, were considered the most productive riparian habitat in terms of biodiversity (Roberson and Tenney 1993). Because of land use practices such as grazing and agriculture and associated flood control and groundwater extraction, valley riparian habitat is rare (TNC 1997). Riparian patches on the Salinas, Nacimiento, and Carmel Rivers and a few other localities in the region are important remnants for native wildlife.

Portfolio Sites

The Big Sur River is one of the most intact free-flowing rivers in the Central Coast region. The majority of the upper portion flows through the Ventana Wilderness and the Los Padres National Forest; the lower portion runs through both state and private lands. The riparian corridor is dominated by dense stands of willow, alder, and cottonwood accompanied by mature sycamore alluvial woodlands. The river provides important breeding habitat for a variety of riparian focal species including Warbling Vireo, Swainson's Thrush, Wilson's Warbler, Black-headed Grosbeak, and Song Sparrow. Data collected from long-term monitoring in the lower Big Sur River valley suggest that the breeding population of Warbling Vireos is significantly declining on a local level (VWS unpublished data). This coastal riparian corridor also provides critical stopover habitat during both spring and fall migration. Monitoring along the lower Big Sur River continues, making this a valuable reference site.

Photo by BSOL.

Riparian habitat along the Big Sur River.

The Carmel River flows northwest out of the Carmel Valley between the Santa Lucia Mountains on the South and the Sierra del Salinas Mountains to the north and east, draining approximately 255 square miles. Following the establishment of two dams and intensified floodplain development over the past 80 years, the river and its riparian corridor has shrunk dramatically. The watershed recently has become the focus of multiple restoration programs in an attempt to restore critical coastal riparian habitat and hydrologic function. The primary objective of songbird monitoring at these sites is to study avian responses to habitat restoration efforts, with particular attention given to riparian focal species. Currently, seven riparian focal species breed within the watershed. Although water diversion and intensive development continue, the river still provides important breeding, migratory-stopover, and overwintering habitat.

The Salinas River is the Central Coast bioregion's largest river, flowing through the longest inter-mountain valley in the state. Remnant habitat patches on the Salinas are important for the restoration and recolonization potential they provide for lowland forests and associated species, and include some of the last known potential breeding areas of the Least Bell's Vireo. Over 75% of the riparian habitat along the Salinas is considered disturbed or degraded (Roberson and Tenney 1993), underscoring the need for restoration and Brown-headed Cowbird management.

Priority streams and rivers were identified by TNC after it conducted a biological assessment of the Central Coast Bioregion. Priorities were determined based on factors such as landscape integrity, species richness of targeted species, and the presence of sycamore alluvial woodlands (TNC 1997). Highest priority sites include Pescadero Creek, Scott Creek, Uvas Creek, lower Salinas River, Arroyo Seco, Nacimiento River, upper San Benito River, Big Sur River, Arroyo de la Cruz, San Simeon Creek, San Antonio Creek, and Santa Ynez River.

Vandenberg Air Force Base supports some of the most extensive riparian habitat along the Central Coast (Farmer 1999). The base has high avian diversity and productivity and should be a conservation priority (Gallo et al. 2000).

Bay Delta

The Bay Area Delta Bioregion includes the San Francisco Bay area and spreads eastward to encompass the sprawling Sacramento San Joaquin River Delta. The climate is generally mild, with regular fog on the coast, wet winters, and warm summers inland. Historically, it supported a lush interconnected system of marshes, wetlands and riparian habitat. Though much has been lost to water projects and land conversion, the region continues to provide vital breeding habitat to riparian associated species.

Portfolio Sites

The Point Reyes National Seashore supports significant amounts of riparian habitat in the form of many small willow-alder dominated creeks. The National Park Service in collaboration with PRBO Conservation Science has conducted extensive bird monitoring at three riparian sites: Muddy Hollow, Redwood Creek and Lagunitas Creek. Currently, seven riparian focal species breed within these watersheds; most of which occur here in densities far higher than any other bioregion (Table 6-1). In addition to breeding habitat, these sites also provide critical stopover habitat during spring and fall migration.

The Cosumnes River Preserve, located at the eastern tip of the bioregion, is focused around the only undammed river on the west slope of the Sierras and encompasses over 5,670 hectares of riparian and upland habitats. The Preserve protects the largest remaining tracts of valley oak riparian forest. Management of the Preserve is an excellent example of a working partnership between BLM, The Nature Conservancy, California Dept. of Fish and Game, Ducks Unlimited, Sacramento County and the Wildlife Conservation Board. The Preserve is also an ideal site for studies assessing landbird response to natural recruitment restoration. Managers there have breached levees to capitalize upon natural flooding events and allow natural recruitment of riparian habitat within the Cosumnes bottomlands. The mosaic of different aged patches of habitat resulting from regeneration demonstrates the dynamic processes that result from a river being reconnected to its floodplain. However, low productivity of Song Sparrows and other species in some of these habitats along the Cosumnes indicates that these populations may be in danger of local extirpation, as seems to already have occurred locally in portions of the lower Sacramento River Valley (PRBO unpublished data).

South Coast

The South Coast bioregion includes miles of sandy beaches and steep cliffs along the Pacific, small mountain ranges, and extensive riparian, scrub and conifer habitats. The human population continues to expand rapidly, converting and fragmenting native landscapes at an alarming rate. The climate is arid and warm year round, increasing the importance of the few remaining riparian areas. The South Coast serves as the last refuge for the Least Bell's Vireo in California. Though the species once bred in riparian habitat throughout the state (Grinnell and Miller 1944), years of habitat reduction, nest predation and parasitism by the Brown-headed Cowbird have severely reduced the species' range (USFWS 1998).

Portfolio Sites

The Santa Clara River, is the largest unchannelized river in southern California. The Santa Clara River Enhancement and Management Plan, developed by the USFWS, the California Coastal Commission, and several southern counties, seeks to protect the natural resources and wildlife along the river and proactively avoid the listing or extirpation of any new species. However, current efforts to develop areas along the river's reach may further jeopardize the habitat.

Mojave and Colorado Deserts

While the desert regions have yet to be adequately assessed in this plan, desert oases and associated riparian habitat clearly represent critical bird breeding grounds that also serve as important migratory stopover and wintering sites for many species (Grinnell and Miller 1944, Massey and Evans 1994, Flannery et al. 2004). Water diversion, grazing, exotic plant species and recreational activities threaten riparian habitat in desert oases. The Colorado River hosts an impressive suite of resident and Neotropical migratory breeders (Rosenberg et al. 1991). Efforts along the Colorado River seek to restore some of the native habitat after over a century of degradation due to human disturbance, water diversion and exotic plant invasions. Riparian habitats in the Mojave and Colorado Desert bioregions will be covered more extensively in the CalPIF Desert Bird Conservation Plan (CalPIF *in prep*.).

Portfolio Sites

The Colorado River has recently become the focus of a multi species conservation plan that includes provisions for fish, birds and plants. Restoration efforts include protection and restoration of riparian vegetation and exotic plant control (specifically for tamarisk). Management of flows and reconnection of the river to historic backwater areas will benefit native fish, recreational fishing and riparian habitat.

Sierra

The Sierra Bioregion has faced over a century of land and water conversion, resource exploitation, invasive plant species and rural sprawl. The Sierra Nevada range is considered to be one of 233 sites of globally important biodiversity. Of those sites, it is one of 110 considered critically threatened or endangered (Olson and Dinerstein 1998). While riparian montane meadows historically provided ample habitat for species such as the Yellow Warbler and Willow Flycatcher, they have been degraded or destroyed by grazing and water diversion. Siegel and DeSante (1999) and the Sierra Nevada Ecosystem Project (Davis and Stoms 1996) provide an extensive review of conservation needs and recommendations for the Sierra Nevada region.

The Sierra Bioregion, as distinguished by the Biodiversity Council (RAC 1998), includes a portion of the eastern Sierra escarpment and the western Great Basin. Desert riparian habitats of the Owens Valley alluvial fan zone provide spring and fall migration and dispersal habitat not only for riparian associated species, but also upland species breeding in adjacent sagebrush habitats (Heath et al. 2001, Heath and Ballard 2003). Higher elevation riparian aspen habitats harbor the most diverse breeding songbird communities in the region (Heath and Ballard 2003[a]).

The Los Angeles Department of Water and Power (LADWP), the primary water rights and landowner of lands adjacent to the Owens River and Mono Basin feeder streams, has begun restoration efforts of riparian habitats in the eastern Sierra. Restoration plans for both the Mono Basin feeder streams and the lower Owens River rely primarily on returning water to these diverted systems. A majority of the Sierra Bioregion lands are managed by public agencies. Resource managers and landowners appear willing to invest time and money into finding more ecologically sound management practices and are incorporating conservation recommendations into work plans and project goals (LORP 1999, Siegel and DeSante 1999, Heath et al. 2001).

Portfolio Sites

Sierran mountain meadows are critically important for breeding and post breeding dispersal of Neotropical migrants and resident landbirds (Siegel and DeSante 1999, Burnett and Geupel 2001). These meadows also provide important stopover habitat for many migrating species. Examples of important Sierran meadows include Perazzo, Humbug Valley, Little Truckee River, and Sage Hen.

The South Fork Kern River supports high species diversity and an intensively managed program to support the reproductive success of riparian birds. It remains a high conservation priority, as it provides one of the most important breeding grounds for Yellow-billed Cuckoos and Willow Flycatchers in the West and continues to host a richly diverse bird community (including most of the 17 focal species considered in this Conservation Plan).

The Mono Lake tributaries, compromised for decades by water diversions to the Los Angeles aqueduct, are currently undergoing restoration and have been void of livestock grazing since the 1991 removal of cattle and sheep (LADWP 1996). The streams have been rewatered since 1989 and now harbor abundant breeding populations of many of the riparian focal species (Heath et al. 2002[b]). Rush Creek harbors the densest breeding population of Yellow Warblers currently recorded in the state, and a small population of Willow Flycatchers has recently been discovered breeding among Rush Creek's wild rose patches (Heath et al. 2002[c], McCreedy and Heath *in review*). Court mandated restoration monitoring efforts in the Mono Basin focus on hydrological functions, fish populations and plant regeneration. Songbird monitoring of Mono Basin streams continues to investigate songbird community response to passive riparian regeneration.

The Owens River and its riparian habitat, though compromised due to water diversions since the early 1900's, harbors remnant breeding populations of the Southwest Willow Flycatcher and perhaps the Western Yellow-billed Cuckoo (Laymon and Williams 1994). Once, this river system provided breeding or migratory habitat for nearly all of the 17 riparian focal species, including the Least Bell's Vireo (Fisher 1893, Laymon and Williams 1994, MacMillen et al 1996). As part of the Lower Owens River Project, water is scheduled to be released into over 60 miles of the River system by 2005. Restoration efforts will be primarily passive, relying on the reintroduction of water into the decades long dry channel (LORP 1999). Extensive baseline songbird monitoring on the Lower Owens River began in 2002 and will continue for several years after initial rewatering (Heath and Gates 2002).

Chapter 8. Conservation Recommendations

This chapter provides specific recommendations for riparian habitat activities throughout the state. They consider habitat protection and restoration, land management, research and monitoring, and policy action. Conservation organizations, agencies, scientific researchers and the public provided the information used in developing this chapter and most recommendations were derived from the most recent scientific data and analyses available. Unless otherwise referenced, most information from this section is derived from the focal species accounts (see http://www.prbo.org/calpif/htmldocs/riparian.html). Some, however, rely upon well-informed assumptions that require more scientific investigation. Standardized monitoring and adaptive management will test and develop these assumptions, continually improving our knowledge of conservation and restoration science.

These recommendations seek to reverse the current declines of many riparian-associated bird populations. By restoring healthy, stable populations, we will avoid the expensive and intrusive last resort of listing more species as threatened and endangered. We hope that these recommendations will galvanize and guide conservation organizations, project funding, and the actions of land managers and owners across the state. All of the following objectives and recommendations seek to fulfill the RHJV's central mission, which is to promote conservation and restoration of riparian habitat sufficient to support the long-term viability and recovery of native bird populations.

Habitat Protection Recommendations

Objective 1

Prioritize riparian sites for protection and restoration.

Recommendations

1.1. Prioritize potential riparian protection sites according to current indicators of avian population health.

Conservation efforts should use the most recent information regarding the quality of existing habitat and wildlife populations to prioritize the acquisition and protection of sites. Reproductive success, in particular, is an important demographic parameter that provides a foundation around which to build riparian conservation programs. After a four-year study of passive riparian restoration, Dobkin et al. (1998) suggested that the presence of "key" species in areas undergoing restoration during their third and fourth years signaled the beginning of avian restoration.

Key or "rapid-indicator" species are those that:

- Are still locally abundant in riparian habitats throughout the state.
- Can rapidly colonize an area.
- Depend upon early successional riparian shrub habitats.

1.2. Prioritize restoration sites according to their proximity to existing high-quality sites.

Restoration sites near existing high-quality sites and population sources have a higher probability of being recolonized by extirpated species. Along the San Luis Rey and San Diego Rivers in San Diego County, Kus (1998) documented Least Bell's Vireos' occupation of restored sites more rapidly in habitats adjacent to mature and intact riparian habitat. Tewksbury et al. (2002) found, for the Sacramento River basin and four other western study areas, that sites surrounded by more riparian habitat at the regional scale (5 km) tended to have more long-distance migrants, as well as resident birds.

1.3. Protect and restore riparian areas with intact adjacent upland habitats.

Riparian-associated birds make use of grass, shrub and woodland habitats adjacent to riparian zones throughout their lives. Upland zones provide migratory stopover grounds, foraging habitat, and dispersal corridors for non-breeding adults and juveniles. The Western Yellow-billed Cuckoo, Common Yellowthroat, and Least Bell's Vireo are among the many riparian species that commonly use upland habitats adjacent to riparian nesting sites. These areas act as both flood refugia and supplemental foraging areas. For example, the Common Yellowthroat will not nest over water and therefore must have access to alternative upland nest sites during late spring floods. The Western Yellow-billed Cuckoo's prey base, largely katydid and sphinx moth larvae, winters underground. In wet years, cuckoos must forage in upland areas until the prey base in the lower floodplain recovers. Because most extant riparian habitat is in the primary floodplain, floods may regularly reduce the cuckoo's prey-base and contribute to the decline of cuckoos in the West. Several riparian bird species, including the Warbling Vireo and Black-headed Grosbeak, commonly nest in upland habitats adjacent to riparian zones.

Riparian areas can also support primarily upland nesting bird species. For example, narrow riparian strips in the Owens Valley alluvial fan of the eastern Sierra Nevada provided perching sites, nesting material, foraging and watering areas for predominantly sagebrush nesting species. Additionally, these water birch drainages received an influx of Sage Sparrow families in late summer, suggesting the importance of riparian habitat for post-fledgling dispersal of sagebrush-associated juveniles (Heath and Ballard 2003[b]).

The importance of adjacent intact habitats can be illustrated by taxa other than birds. The Arroyo Southwestern Toad is another example of an animal that uses both riparian and upland habitats, and continuity between the two habitat types may be essential for species survival. This federally listed endangered species uses common riparian types in southern California for foraging and dispersal, even though dense, tall vegetation structures are least preferred for burrows. Females and breeding season males prefer channel and terrace habitats to campground, agricultural or upland habitats, but males use uplands after breeding season commences (Griffin and Case 2001).

A study on riparian lizards on the South Fork of the Eel River concluded that "rivers can feed the forests" and demonstrated that strong links between rivers and surrounding watersheds has implications for resource management. Riparian systems provide food and prey for riparian and upland lizard species alike. Land uses (e.g., river impoundments) that alter downstream productivity and diversity of insects may influence not only downstream river biota, but adjacent terrestrial biota as well (Sabo and Power 2002).

1.4. Prioritize sites with an intact natural hydrology or the potential to restore the natural processes of the system.

Of the 11 focal riparian bird species that have suffered population declines, seven prefer to nest in early successional riparian habitat, particularly willow/alder shrub habitats with dense understory cover. To flourish, early successional habitats depend upon natural hydrology, including flooding, soil deposition, and point bar formation, for establishment (Sacramento River Advisory Council 1998). Seed dispersal and natural tree regeneration and growth also are sometimes compromised due to the absence of high peak flows or seasonal fluctuations in water levels (Smith et al. 1991, Stromberg and Patten 1992). Restoring or mimicking natural hydrology contributes to recreating the structural diversity found in natural riparian systems, increasing the habitat quality for native wildlife. Sites with intact natural hydrology or the potential to return to one should receive special consideration.

For the long-term conservation of the federally endangered Arroyo Southwestern Toad, management of natural disturbance regimes such as flooding, fires, and successional dynamics that promote continuous availability of preferred channel and terrace breeding sites is essential. Reservoirs, low water tables, paving, sediment mining, and exotic flora introduction have all negatively impacted habitats vital for Arroyo Toad breeding and larval development (Griffin and Case 2001).

1.5. Prioritize sites according to surrounding land use.

Management of riparian areas at a watershed-level is the best method for conserving bird populations. Landscape scale land use patterns may significantly affect the sustainability of riparian bird populations over the long term (Petit et al. 1995). Surrounding land uses influence the population sizes of Brown-headed Cowbirds and predators such as domestic cats, jays, skunks, raccoons, ravens, and crows. More research is needed regarding habitat buffers and their influence on predation and parasitism rates. It is known that Brown-headed Cowbirds may commute more than 12 kilometers between foraging grounds and the nest sites of their hosts (Mathews and Goguen 1997). For more information, refer to Recommendation 6-3.

The Swainson's Hawk demonstrates the need for protected and properly managed habitats surrounding riparian zones. In the Central Valley, Swainson's Hawks prefer to nest in riparian vegetation but typically forage upland. Historically, they hunted small mammals in native perennial grasslands. Today, they seek prey in grazed grasslands and certain forms of agricultural land (Table 8-1). Landscape-scale variables determine habitat suitability for these hawks: nest placement not only depends on vegetation characteristics around the nest site, but the suitability of surrounding habitat for foraging. In this case, protecting or restoring a pristine riparian forest is insufficient for the conservation of this species.

Table 8-1. Ranking of various habitats as foraging habitat for Swainson's Hawks in California[1]

Vegetation Type	Rank [2]	Access to Prey [3]	Prey Abundance [4] (Prey Population size and availability)
Perennial Grassland	1, 2	Consistently high	High prey and high availability
Alfalfa	1, 2	Consistently high	High prey and high availability
Fallow Fields	3, 5	Consistently moderate	Moderate prey and high availability
Dryland Pasture	4	Consistently moderate	Low prey, but high availability
Beets	4, 5	Usually low, high at harvest	Moderate prey, only highly available at harvest
Tomatoes	5, 6	Normally low, high at harvest	Moderate prey, only highly available at harvest
Weedy/Ruderal Field	5-11	Highly variable	Moderate prey with variable availability
Irrigated Pasture	7	Consistently low	Very low prey, but high availability
Shrub/Sage	7-12	Highly variable	Low prey and moderate availability
Grains	8	Consistently low	Low prey and low availability
Other Row Crops	9-12	Consistently low	Low prey and low availability
Orchard/Vineyard	10-12	Consistently low	Low prey and low availability

1. Table based on studies in the Central Valley (Estep 1989) and Great Basin (Woodbridge 1991).
2. Ranked from 1 to 12, highest to lowest value as foraging habitat, depending on prey abundance and availability.
3. Different foraging habitats provide varying amounts of prey throughout the year. Tilling and harvest activities strongly affected the availability of prey within each crop type (Estep 1989).
4. Ranked as high, moderate or low prey abundance and the degree of availability of the prey. Each crop type supports a different abundance of prey (Estep 1989).

The following land uses within a riparian buffer zone are listed in general order of preference. This list provides only rules of thumb and must be considered in context with many other factors when assessing each unique conservation opportunity. The land uses generally beneficial with sustainable management are:

- Natural habitat not used for commodity production (e.g., wilderness).
- Unimproved parks/open space (provided substantial non-native species problems do not exist).
- Commercially managed habitat (e.g., grazed oak woodlands or timber production forest).

The land uses that can be beneficial, neutral, or detrimental depending on the wide variety of crops, cultivation, and pest control techniques used (Table 8-1) are:

- Horse/cow pasture.
- Campgrounds and picnic areas.
- Row crops.
- Permanent crops (e.g., orchards, vineyards).

The land uses within a riparian corridor or buffer zone that can be detrimental to birds because they support and attract cowbirds and predators are:

- Manicured parks and golf courses.
- Rural homes/ranchettes.
- Dairies and intensive feedlots.
- Intensive development (urban/suburban) and intensive agriculture.

The land surrounding a proposed protection or restoration site should be assessed for its risk of change or conversion and how that may affect bird populations. For example, is the land available for conversion to other uses? Or, is it permanently prohibited from development (e.g., in a floodplain; in public ownership; or protected through an agricultural conservation easement, a habitat conservation plan, local zoning, or an urban limit line)?

Objective 2

Promote riparian ecosystem health (i.e., a self-sustaining, functioning system).

<u>Recommendations</u>

2.1. Ensure that the patch size, configuration, and connectivity of restored riparian habitats adequately support the desired populations of riparian dependent species.

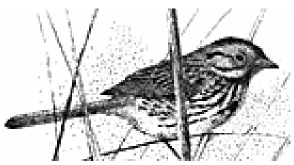
The size and connectivity of riparian habitat patches may be limiting to bird species' occupancy and population size. A habitat patch is a contiguous area of similar vegetation, usually defined by the dominant vegetation (e.g., a cottonwood willow patch within the valley foothill riparian type). Patch sizes must not fall below the minimum necessary to support populations based on:

- Territory size requirements.
- Community dynamics.
- Sensitivity of some species to fragmentation and edge effects (increased predation/parasitism rates).

When determining the minimum acceptable patch size for a site, managers should consider the mean territory size of their target species as a guideline. When considering a suite of species, managers should use the species with largest territory needs (e.g., Western Yellow-billed Cuckoo) to set the minimum patch size requirement, and they should design corridors to connect habitat fragments according to the needs of the species with the highest sensitivity to fragmentation (Bolger et al. 2001).

Western riparian habitats are naturally linear systems with extensive edges. Patch isolation (lack of connectivity) may influence bird communities as much as habitat fragmentation. Small patch size and/or patch isolation may increase predation and brood parasitism rates and limit population dispersal. For example, although a number of riparian areas in California are of sufficient size (41 hectares, Laymon and Halterman 1987, 1989) and structure to support Western Yellow-billed Cuckoos, individuals may not colonize these areas because of their distance from existing populations and the lack of enough potential mates in close proximity. Some studies have suggested that amount of available riparian habitat, at various spatial (e.g., Tewksbury et al. 2002) and temporal (e.g., Greco et al. 2002) scales, is more important than patch size *per se*. Because riparian systems are dynamic, patch sizes may differ from year to year and should be considered on a landscape scale (Greco et al. 2002).

2.2. Restore natural hydrology in riparian systems wherever possible. (see Recommendation 1.4).



Restoration Recommendations

Objective 3

Increase the value of ongoing restoration projects for bird species.

Recommendations

3.1. Restore and manage riparian forests to promote structural diversity and volume of the understory. (See Recommendation 5.2.)

Loss of appropriate microhabitat, such as habitat structure or heterogeneity, may explain a species decline or absence in areas where riparian habitat appears intact. In restored riparian areas, large tree size and high foliage volume promote avian diversity, but diversity of vegetation structure may be even more important (Nur et al. 1996, Holmes et al. 1999). Seven of the ten focal species that have suffered the greatest range reductions and/or are declining tend to depend upon early successional riparian habitat, particularly willow-alder shrub habitats with dense understory cover. These include the Willow Flycatcher, Song Sparrow, Bell's Vireo, Blue Grosbeak, Yellow-breasted Chat, Yellow Warbler, and Common Yellowthroat. Many other species, such as the Wilson's Warbler, Spotted Towhee, and Swainson's Thrush nest on or near the ground and need a healthy understory to successfully reproduce (PRBO unpublished data). The nest success of some species, such as Calliope Hummingbirds, Bushtits and Black-headed Grosbeaks in the eastern Sierra Nevada is positively influenced by herbaceous ground cover or wild rose shrub cover, even though these species tend to nest in the higher layers of the riparian canopy (Heath et al. 2001). Among several bioregions, riparian bird abundance, richness and occurrence is significantly and positively associated with herbaceous or shrub cover as well as tree DBH and tree cover (Gardali et al. 2001, Small et al. 2001, Heath and Ballard 2003a).

In coniferous forest habitats, managers frequently plant conifers in riparian corridors to produce large, woody debris that provides aquatic habitat. This practice should be reassessed, minding that a deciduous component creates the structural diversity needed to support riparian-dependent terrestrial species. For example, in aspen riparian habitats of the eastern Sierra Nevada, breeding bird species richness decreased as conifer cover and white fir cover increased, but was positively influenced by the cover of herbaceous layers, willow shrubs, and snowberry (Heath and Ballard 2003a).

3.2. Restore the width of the riparian corridor.

Most riparian corridors today are much narrower than they were historically, particularly in the Central Valley. Hence, restoration planners should consider increasing corridor width to historic margins when possible. In coastal riparian habitats, for example, the presence of Warbling Vireos, Common Yellowthroats, and Swainson's Thrushes positively correlates with the width of the riparian corridor. The mean riparian corridor width at sites supporting Warbling Vireos was 82 meters, 30 meters greater than the mean width at sites without vireos (Holmes et al. 1999, Gardali et al. 2001). Breeding bird diversity in the eastern Sierra Nevada is positively associated with riparian width at several landscape scales (Heath and Ballard 2003[b]).

Quantifying a specific target width of riparian habitat is extremely complex; the effect of riparian width varies by bird species and riparian type and is only one of many variables affecting species occurrence and reproductive success. For example, while insufficient width of riparian corridors has been shown to negatively affect the breeding success at some locations (Bednarz et al. 1998, Small and Geupel 1998), riparian width had no affect on Yellow Warbler nest success in 50m – 250m wide riparian sites in eastern California (Heath and Ballard 2002[b]). Future research and landscape-level analysis will elucidate the problem. Regardless, wider riparian corridors are likely to provide more and better habitat.

Objective 4

Ensure that large landscape scale management and flood control projects maximize benefits to wildlife while benefiting agriculture and urban populations. Achieving multiple goals simultaneously enhances the overall value of such projects to the people of California.

Recommendations

4.1. Management of new or existing flood bypass areas should consider the benefits of a regenerating riparian habitat against those of other uses.

Recent floods in California, such as the New Year's flood of 1997 or the Napa River flood of 1997-98, demonstrate the need for a new model for flood control and habitat protection. Management of bypass areas as riparian habitat maximizes the public benefits of floodway/bypass projects currently under consideration throughout the state.

The preliminary report of the California governor's Flood Emergency Action Team (1997) stated that new or enlarged flood bypass or levee setback systems should be considered as options for nonstructural flood control. This approach may be particularly useful in areas with little permanent infrastructure or development, such as the San Joaquin River floodplain and the Delta. The Army Corps of Engineers recently assessed the Sacramento and San Joaquin River Valleys for the potential to initiate nonstructural alternatives (NSAs), such as levee setbacks and flood bypass channels, rather than traditional flood control projects (i.e., dams, levees, and channelization).

Cultivated Restoration Recommendations

Restoration and improved management are the best means by which to increase the amount and quality of riparian habitat in the state, thereby increasing the reproductive success and population sizes of riparian-associated birds. California's restoration experts have pioneered the development of riparian habitat restoration techniques over the past few decades.

Scientists are evaluating restoration's effects on threatened or endangered bird populations in California (e.g., Kus 1998, McKernan and Braden 2001), and the Herculean effort of restoring riparian habitat to the Lower Colorado River has been well studied in regards to its benefits to bird populations (e.g., Anderson and Ohmart 1982, Rosenberg et al. 1991). Yet, only recently have scientists evaluated the effects of restoration on more common bird species in other regions of the state (Gardali et al. 2001, Larison et al. 2001, DiGaudio 2003, Haff 2003, Jaramillo and Hudson 2003) and many data remain unpublished or in report form (e.g., Geupel et al. 1997a, b; Small et al. 2000, Burnett and DeStaebler 2001, Small et al. 2001, Heath and Gates 2002, Heath et al. 2002[a]). The results from many of these studies suggest that greater attention should be directed to restoration of the understory to increase cover, particularly forbs (Larison et al. 2001, Burnett and DeStaebler 2002, Recommendation 5.2). Furthermore, primary and secondary cavity nesters greatly benefit when deadwood is maintained at a restoration site (Marzluff and Ewing 2001, Gilchrist et al. 2002).

Objective 5

Design and implement cultivated restoration projects that mimic the diversity and structure of a natural riparian plant community.

Recommendations

5.1. Plant a minimum of two or more species of native shrubs or trees (i.e., avoid monotypic plantings).

Several vegetation features have broad positive effects on bird species diversity, abundance and nesting success (Table 8-2, 8-3). Many non-avian species also respond positively to these vegetation components in riparian habitats. Microhabitat characteristics can also influence nest-site selection by breeding birds. The availability of appropriate nest sites may have a direct effect on the ability of birds to reproduce and maintain a viable population (Martin 1993, Nur et al. 1996, Small et al. 1998). Results from three years of monitoring of restoration sites along the lower Sacramento River indicate that bird diversity in an area increases when two or more shrub species are present and is substantially greater when there are seven or more species (Geupel et al. 1997a). Because many of the "shrubs" detected are actually young trees, high shrub species richness may indicate riparian forests with good structure and regeneration. Studies in coastal Marin County show that bird species diversity in riparian habitats significantly correlates with tree species richness, tree height, and tree girth (Holmes et al. 1999).

5.2. Increase shrub richness, shrub density, and the rate of natural reestablishment by including plantings of understory species in restoration design.

Understory vegetation is critical as nesting substrate for many riparian bird species, especially in newly restored habitats (Larison et al. 2001, Twedt et al. 2002, DiGaudio 2003). Avian density may increase in a habitat with increased foliage density because of a higher number of potential nest sites (Martin 1988). The greater the number of potential nest sites within a given habitat patch, the greater the effort required for predators to locate prey (nest sites). Thus, nests may possess a higher probability of fledging young.

Many revegetation projects enhance growth of tree plantings by mowing the restoration plots during the first two years. After mowing, restoration managers should plant a second stage to enhance recruitment of a native understory, thereby increasing the quality of the shrub and forb layers.

5.3. Plant native forb and sedge species.

The Common Yellowthroat and Spotted Towhee use native grass and sedge frequently in the Sacramento Valley as nest substrate. An excellent resource detailing type, sources, and techniques for planting and restoring native grasses is provided in *Bring Farm Edges Back to Life!* (YCRCD 1998).

5.4. Cultivate tree species where natural hydrological processes are compromised and natural tree regeneration is limited or absent.

Seed dispersal and natural tree regeneration is sometimes compromised due to the absence of high peak flows or seasonal fluctuations in water levels (Stromberg and Patten 1990, Smith et al. 1991). Cultivating tree species where regeneration is lacking is recommended.

5.5. Plant vegetation in a mosaic design with dense shrub patches interspersed with trees to achieve a semi-open canopy.

Plantings that are concentrated into clumps will create more productive patches of habitat for nesting birds than plantings uniformly spaced over a large area. "Clumped" planting designs more closely mimic the natural establishment of vegetation after scouring or soil deposition from a flood. For example, many willows grow naturally in clumps and can be easily planted this way.

Table 8-2. The following plant species and cover types have been found to positively influence breeding bird diversity or breeding species richness in riparian habitats, by California bioregion.

	Sacramento and San Joaquin Valleys[1]	Modoc	Klamath[2]	Central Coast	Bay-Delta[3]	South Coast	Mojave and Colorado Deserts[5]	Sierra Nevada[4]
Canopy layer	• Large trees • Oregon ash	No data	• Tree cover • Big leaf maple	No data	• Tree DBH • Tree cover • Tree richness	No data	• Freemont cottonwood • Black willow	• Aspen • Black willow • # snags
Shrub layer	• Blue elderberry • Box elder • Willow species • Wild rose • California blackberry • Wild grape • Poison oak • Shrub richness • Mugwort • Shrub cover	No data	• Big leaf maple • Ponderosa pine	No data	• Shrub height diversity	No data	No data	• Willow • Snowberry • Shrub cover
Ground cover	• Mugwort	No data	• Blackberry (Himalayan or California)	No data	No data	No data	No data	• Herbaceous cover • Grass cover • Rush cover

[1] Geupel et al. 1997[a], Small et al. 2001, Burnett and DeStaebler 2001, Burnett et al. *in press.*
[2] Nur et al. 1996.
[3] Gardali et al. 1999; Gardali et al. 2001, Holmes et al. 1999, DiGaudio 2003.
[4] Heath et al. 2001, Heath and Ballard 2003a, Heath and Ballard 2003[b], Heath 2002, Stefani 2000.
[5] Anderson et al. 1983.

5.6. Retain at least some existing trees on restoration sites, planting around them, to promote occupancy of the plot by birds requiring mature trees (e.g., cavity nesters, orioles, etc.). Projects that plan to remove orchards should consider leaving a few trees in small clumps (with the exception of fig or other species with invasive root stocks).

Both primary and secondary cavity nesters are common in natural forests and are excluded from nesting on restoration sites that lack older trees due to lack of nest sites. When possible, restoration managers should leave a few old trees with cavities and snags or girdle younger, healthy, non-native trees. It is essential to provide cavity nesters with habitat until planted trees grow sufficiently to provide nests.

Photo by Eric Preston, ericpreston.com

Consider the needs of cavity nesters at restoration sites.

5.7. Connect patches of existing riparian habitat with strips of dense, continuous vegetation that are at least 3-10 meters wide.

The connection of habitat patches is an important restoration consideration. Relatively sedentary species, such as Song Sparrows, Spotted Towhees, and Wrentits, may be affected most by patch isolation. These birds may disperse more widely and effectively if existing source populations were well connected with unoccupied habitats (such as linking the Butte Sink, which supports Song Sparrows, with the Sacramento National Wildlife Refuge, which does not, despite appearing to have suitable habitat). Even narrow strips may function as dispersal corridors. Song Sparrows, Wrentits, and Spotted Towhees have been observed in strips as narrow as 1 meter, and other species have been observed in strips 10 meters wide (Soulé 1988, PRBO unpublished data). These strips probably do not provide adequate breeding habitat, and nesting individuals may have low reproductive success. However, they may be vital in linking populations that would otherwise be isolated from one another, a benefit which outweighs the low reproductive success of relatively few individuals.

Management Recommendations

Effective management of riparian areas is as crucial as habitat restoration to the survival and recovery of riparian birds. Proper management increases habitat value to wildlife, arrests species declines, and contributes to the recovery of declining bird populations. Landscape-scale patterns of land use are of critical importance, influencing whether riparian bird populations remain stable over the long term.

Objective 6

Implement and time land management activities to increase avian reproductive success and enhance populations.

Recommendations

6.1. Manage riparian and adjacent habitats to maintain a diverse and vigorous understory and herbaceous layer, particularly during the breeding season.

The number of young produced in a bird population (reproductive success) may be the most important factor influencing a species' occurrence and persistence in an ecosystem. When less than 20% of nests survive to fledge young, nest success is considered poor and it probably indicates a nonviable population (Martin 1992, Robinson et al. 1995, Trine 1998, Budnik et al. 2000). Early successional habitats with a dense, shrubby understory and herbaceous groundcover are critical for successful nesting of nine of the 17 focal riparian species. Not surprisingly, shrub cover around the nest is an important variable in nest-site selection for many species (Table 8-3). The following recommendations will promote understory and groundcover quality:

- Use groundcover in orchards and vineyards to discourage foraging by Brown-headed Cowbirds, thereby increasing birds' reproductive success. Use of a native species groundcover is preferable. Managers should either avoid mowing through the nesting season or maintain the layer to 6 inches in height to discourage use by nesting birds.

- Control star thistle and other "weedy" non-native species to promote a diverse herb layer.

- Allow natural disturbance regimes, particularly periodic floods.

Grazing, mowing, and burning are common land management practices that significantly affect the understory. Options for managing these activities include:

- Manage grazing intensity and location to ensure riparian deciduous shrubs are recruiting well and are not "highlined" (i.e., cattle do not destroy all the foliage within their reach).

- Manage grazing intensity and timing to avoid direct impacts to low-nesting birds during breeding season.

- Postpone mowing until after peak breeding season. If mowing must be done during breeding season, maintain a low herbaceous layer of no more than 6 inches to discourage birds from nesting there in the first place.

- If burning must be used as a management technique, burn the groundcover in riparian habitats after the end of the breeding season.

The Willow Flycatcher demonstrates how land management activities can affect a breeding population. The subspecies of Willow Flycatcher *E. t. brewsteri* depends upon montane meadows in the Sierra Nevada for nesting. Grazing cattle in mountain meadows during the breeding season has both direct and indirect effects on Willow Flycatchers. Directly, cattle move through meadow willows and destroy Willow Flycatcher nests by bumping against or trampling them. Indirectly, browsing decreases foliage density in willows and other shrubs at heights lower than 1.5 meters, where Willow Flycatcher nests occur. This reduces the number of available nest sites and exposes existing nests to predators.

In desert riparian areas, grazing by wild burros severely affects riparian vegetation and associated bird species. The effects of burros in some areas include (BLM 1998):

- High browse lines and severe hedging of riparian trees and shrubs, which eliminates understory nesting habitat.

- Pulling forage plants out by the roots, possibly contributing to invasion by competitive non-native plants.

- Soil compaction along burro trails, which leads to erosion or inhibits seedling establishment.

These effects combine to destroy the vegetation, and in the harsh desert environment, the habitat recovers more slowly than in other riparian types in California.

Table 8-3. The following plant species and cover types have been found to positively influence select focal species occurrence[a], abundance[b], nest success[c] and nest site selection[d] in riparian habitats, by California bioregion.

	Sacramento and San Joaquin Valleys[1]	**Bay-Delta[2]**	**South Coast[3]**	**Sierra Nevada[4]**
Willow Flycatcher	Species not present	Species not present		• Willow cover[a,b] • Foliage density[a,b]
Warbling Vireo		• Tree richness[a] • Shrub height diversity[a]		• Aspen[a] • Tree height[a]
Least Bell's Vireo	Species not present	Species not present	• Shrub cover[a,b] • Tree cover[a,b] • Tree DBH[c] • Herbaceous cover[d] • Low Aquatic vegetation[d]	Species not present
Swainson's Thrush		• Tree cover[a,d] • Tree height[a] • Hedgenettle[d]		• Canopy closure[a] • Willow patch size[a]
Yellow Warbler	• Himalayan blackberry[b] • Valley oak[b]			• Grass[a] • Wild rose[c] • Willow[a]
Common Yellowthroat	• Shrub richness[a] • Mugwort[a] • Santa Barbara sedge[a]	• Herb cover[a] • Marsh cover[a] • Shrub cover[a]		

Table 8-3 continued

	Sacramento and San Joaquin Valleys[1]	Bay-Delta[2]	South Coast[3]	Sierra Nevada[4]
Wilson's Warbler		• Tree richness[a] • Small trees[a] • California bay[c]		
Yellow-breasted Chat	• Sedge[b] • Black mustard[b] • Sandbar willow[b] • California blackberry[b]			
Black-headed Grosbeak	• Tree richness[a] • California blackberry[a] • Mugwort[a] • Freemont cottonwood[b] • Black mustard[b]	• Tree height[a] • Shrub height diversity[a] • Tree cover[a] • Shrub cover[a] • Tree richness[a]		• Tree species richness[a] • Wild rose[c]
Blue Grosbeak		• Tree richness[a] • Shrub cover[a]		
Song Sparrow	• Valley Oak[b] • Pipevine[b] • Mugwort[b] • Black mustard[b]	• Marsh cover[a] • Shrub height[a] • Herb cover[a] • Red alder[c] • Litter depth[c] • Shrub cover[a,c] • Tree richness[a]		• Willow[a]

[1] Small et al. 2001, Burnett and DeStaebler 2001, Burnett et al. *in press*.
[2] Holmes et al. 1999, PRBO data, Gardali et al. 1999, DiGaudio 2003, Haff 2003.
[3] Salata 1981, Salata 1983, Goldwaser 1981, RECON 1989, Olson and Gray 1989, Kus 1998.
[4] Heath and Ballard 2003, Heath et al. 2001, Heath and Gates 2002, Stefani 2000, Bombay et al. 2003, Bombay 1999, Sanders and Flett 1989.

6.2. Manage or create "soft" edges (through establishment of hedgerows at field margins) appropriate to historical vegetation patterns.

"Soft" edges are gradual boundaries between differing vegetation or land uses where plant succession occurs. Historically, along many of California's rivers, a wetland area graded into scrubby willow that graded into riparian forest. This pattern created a mosaic landscape, where different habitats smoothly merged together into an ecotone. Soft edges are preferable to "hard" edges (abrupt changes in vegetation type) because predation levels along hard edges are higher (Suarez et al. 1997). Creating hedgerows using native plant species along forested riparian zones at the edge of agricultural fields results in "softer" edges. The Yolo County Resource Conservation District publication, *Bring Farm Edges Back to Life!* (YCRCD 1998), details how to create and mange hedgerows.

6.3. Avoid the construction or use of facilities and pastures that attract and provide foraging habitat for Brown-headed Cowbirds.

Management should avoid aggregations of livestock and associated livestock facilities (e.g., corrals, pack stations, salting areas and feedlots) near riparian nest sites during the breeding season whenever possible. Livestock, livestock facilities and human habitation provide foraging areas for cowbirds (Mathews and Goguen 1997, Tewksbury et al. 1998), who feed in short stature vegetation within "commuting distance" of their laying areas. In the eastern Sierra Nevada, weekly point counts at pack stations and adjacent riparian areas revealed significantly more cowbirds at pack stations than in riparian areas in most years and at most sites (Heath et al. 2002[a], 2002[b]). Furthermore, managers should discourage human habitation near riparian areas and bird feeders should be avoided during the breeding season if cowbirds are using them as supplemental food. In the eastern Sierra Nevada, weekly evening area searches in a suburban development near a riparian drainage documented, on average, six cowbirds per visit, with as many as 60 cowbirds observed foraging at one bird feeder on several occasions (PRBO data).

The proximity of active livestock grazing may also determine the feeding distributions of cowbirds and the distances they will commute between foraging and laying areas (Mathews and Goguen 1997). Grazing and human facilities within one kilometer of breeding sites affect reproductive success more negatively than facilities located farther away. Establishing cowbird buffer zones around riparian areas during the avian breeding season may reduce the impact of cowbirds on host species. The creation of such buffers may be difficult, however, since cowbirds may regularly commute up to 12 km between foraging and laying areas (Mathews and Goguen 1997).

In the Bitteroot River Valley of Montana, cowbird abundance declined significantly with increasing distance from agriculture (Tewksbury et al. 1998). Additional feeding areas (i.e., agriculture, livestock) located farther than one km from a laying area have no apparent additional impact on the density of cowbirds or brood parasitism. However, this study did not assess the effect of facilities located at greater than one km from the riparian zone in the absence of facilities located within a one km range. Forest Service management guidelines focused on the Willow Flycatcher recommend avoiding the establishment of new facilities within a two to five km range of important riparian areas. If this is not possible and if landscape features aggregate livestock, then livestock use should be limited during the breeding season (generally, April 1- June 30 for lowland nesting species and May 15 August 15 for nesting areas at high-elevation).

6.4. Brown-headed Cowbird trapping should only be used as an interim/emergency measure. Trapping can save or maintain a threatened population of host species while sustainable, habitat based solutions are developed, but should not be considered a long-term solution.

The consensus of expert opinion indicates that cowbird trapping is at best a temporary stopgap solution (Morrison et al. 1999). Preferably, land managers should focus on restoring riparian habitat and guide land use to lessen the negative impacts of cowbirds. A species will never fully recover as long as they rely upon human intervention for their survival (Kus 1999). The North American Cowbird Advisory Council recently formed to address trapping issues, review trapping programs, and advise land managers and regulatory agencies (http://cowbird.lscf.ucsb.edu/). Cowbird trapping is not an appropriate response to parasitism in many cases because:

- The Brown-headed Cowbird is a native North American breeding species
- It is not a long-term solution.
- It can be expensive and requires constant management
- There are ethical considerations and impacts on non-target species.
- A permanent trapping program may be a factor that weighs against delisting of threatened and endangered species (Kus 1999, Morrison et al. 1999).
- It may be detrimental to host species by removing experienced female cowbirds that are more selective in their host selections and egg laying, creating a void filled by more numerous, younger individuals (Hahn et al. 1999).

Additionally, cowbird trapping in areas such as the lower Sacramento River and the Cosumnes River, where restoration of habitat through large-scale natural recruitment is currently underway, would preclude the ability to monitor wildlife response to restoration efforts in the absence of cowbird trapping. Therefore, we will miss opportunities to learn whether songbird populations can recover simply due to habitat restoration without active cowbird management.

6.5. Manage or influence management at the landscape level (i.e., land surrounding riparian corridors or, preferably, the whole watershed).

Landscape scale land use patterns significantly affect the population levels of Brown-headed Cowbirds and avian predators in an area. With increases in cowbird and predator populations, species often suffer poor reproductive success and, possibly, population declines. Eventually, local extirpation of the species may occur. Managers should discourage certain adjacent land uses that subsidize cowbirds and avian predators, including intensive grazing, golf courses, human habitation and recreation areas, and pack stations. Grazing should be avoided during the breeding season in livestock pastures bordering riparian areas (Goguen and Mathews 1999, Hochachka et al. 1999). Linking and buffering large sections of riparian and associated upland habitat may restore top predators, such as coyotes or bobcats to the riparian system. These predators may, in turn, reduce populations of avian nest predator such as skunks, raccoons and snakes.

When grazing or agriculture constitutes a significant percentage of the landscape near the riparian corridor (particularly within a 1-12 km distance), the following are recommended:

- Use integrated pest management or organic production as an alternative to pesticide use. This prevents damage to nesting birds and increases available foraging habitat, especially in orchards immediately adjacent to healthy riparian areas. Riparian songbirds rely on local insect populations to feed young during the breeding season.

- Use groundcover crops in orchards and vineyards to minimize cowbird foraging habitat. Managers should limit or avoid mowing groundcover during the breeding season (see Recommendation 6-1).

- Eliminate, reduce, or closely manage grazing in spring and during the breeding season (April-July) to maximize the understory habitat value to wildlife and minimize foraging habitat for cowbirds.

- If grazing must occur in riparian zones, establish wide pastures and move cattle often to avoid the devastating impacts of year-round grazing.

6.6. Limit restoration activities and disturbance events such as grazing, disking, herbicide application, and highwater events to the nonbreeding season. When such actions are absolutely necessary during the breeding season, time disturbance to minimize its impacts on nesting birds.

The nesting season is a critical period for the maintenance of bird populations (Martin 1993). Some management activities, such as ground preparation for planting or water impoundment, can have serious consequences for breeding songbirds by destroying nests and nesting habitat or causing nest abandonment. Managers often have a degree of flexibility, allowing them to schedule these activities outside the breeding season while still achieving their management objectives. In general, the breeding season in California may begin as early as March and continue through August, depending on region, habitat type and elevation (Table 8-4).

6.7. Coordinate with management and restoration projects targeted at non-avian taxa to maximize the benefits of conservation of riparian habitats.

Extending riparian habitat restoration and management beyond avian requirements alone is essential. Many non-avian species respond positively to vegetation components and riparian functions that are important for bird populations in riparian habitats of California. The federally endangered riparian brush rabbit is an excellent example of a riparian-dependent species that needs our attention immediately. The riparian brush rabbit, or "brush bunny," is a small cottontail rabbit that is one of eight subspecies of brush rabbits native to California. Like many birds outlined in this document, they depend on a dense understory in riparian oak forests that includes willow thickets, California wild rose, wild grape and Pacific blackberry. In response to their perilous status, the Endangered Species Recovery Program leads a captive breeding program to reintroduce brush rabbits into California riparian areas. The story of the brush bunny illustrates a critical conservation concept: not only do birds benefit from dense riparian understories, but also other species like the endangered brush rabbit. For more information on the riparian brush rabbit, see the following web site: (http://sacramento.fws.gov/es/animal_spp_acct/riparian_brush_rabbit.htm).

Table 8-4. Dates of earliest egg, latest first egg, peak of egg initiation and timing of breeding season for riparian-breeding bird species by study site and bioregion. Derived from nests monitored every four days, all nests for all species combined.

Bioregion and study site	Earliest first egg	Latest first egg	Peak of egg initiation	Breeding Season
Sacramento Valley				
Clear Creek[5]	1st week March	2nd week July	April 30 – June 30	mid March – mid August
San Joaquin Valley				
San Luis NWR	April 12	July 23	April 1 – August 20	
Modoc[1]				
Lassen NF and NP	April 10	----	----	April 5 – August 31
Klamath		No data for this bioregion		
Central Coast		No data for this bioregion		
Bay-Delta				
West Marin county[4]	March 19	July 6	----	mid March – mid August*
South Coast		No data for this bioregion		
Mojave Desert		No data for this bioregion		
Colorado Desert		No data for this bioregion		
Sierra				
Owens Valley alluvial fan[2]	March 29	July 21	May 16 – June 15	Mar 25–August 31
Mono Basin[3]	April 4	July 25	May 16 – June 15	April 1–August 31
> 2500m Mono and Inyo co[3]	April 29	July 26	May 16 – June 15	April 20–August 31

[1] King et al. 1999
[2] Heath et al. 2001
[3] Heath et al. 2002a, Heath et al. 2002b
[4] Gardali et al. 1999
* Hummingbirds can nest year-round in this bioregion.

Objective 7

Protect, enhance or recreate natural riparian processes, particularly hydrology and associated high water events, to promote the natural cycle of channel movement, sediment deposition, and scouring that create a diverse mosaic of riparian vegetation types.

Recommendations

7.1. Avoid impacts on the natural hydrology of meadows, streams, and river channels, particularly in high-priority areas managed for riparian species. (See Recommendation 1.4)

The following options minimize damage to natural hydrology:

- Protect areas where grazing may be drying meadows or streams through soil compaction and gullying; provide alternative water sources for cattle.

- Implement grazing standards that protect natural hydrology; reduce soil compaction, erosion, and water pollution due to grazing.

- Limit or contain recreational use of meadows (e.g., off-road vehicles, horses, camping) that can compact soils and negatively affect hydrology.

- Manage upslope areas (e.g., timber harvest, road building) so that hydrologic function is maintained.

- Implement revegetation projects such as "willow walls" to prevent erosion and provide habitat.

7.2. At sites with dams or other flood control devices, manage flow to allow a near natural hydrograph (i.e., mimic natural flood events) sufficient to support scouring, deposition, and point bar formation. Time managed flood events to avoid detrimental impacts on Bank Swallow nesting colonies.

Managers should modify reservoir storage during wet years to simulate the natural, seasonal pattern of short duration flood peaks. The establishment and succession of native riparian vegetation rely upon a natural hydrology in the river system and provide essential habitat for many riparian-associated birds. Interruptions of these processes, including dams, levees, and water diversion, have significantly contributed to the decrease in riparian habitat and the consequent decline in songbird populations. Many non-native plant species are flood-intolerant, and the loss of regular scouring floods has abetted their invasion of the Central Valley. As invasive plants increasingly dominate a habitat, many native birds lose essential nesting and foraging habitat. For more information, please see the Sacramento River Conservation Area Handbook (Sacramento River Advisory Council 1998).

Bank Swallows are particularly vulnerable to poorly timed water management. The Bank Swallow nesting season extends from late March through early July, varying with seasonal weather fluctuations. During this period, the swallows nest in sandy banks along rivers. "Pulse flows" or "flushing flows" designed to mimic natural flood events may potentially wipe out entire colonies in a single event. These artificial flows, often used in fish management and restoration projects, should be prohibited (or at least severely curtailed and closely monitored) during the swallow's breeding season (April through July). Flows that artificially raise levels more than 2-3 feet during the breeding season should be avoided altogether. With 50% of the state's remaining Bank Swallow population nesting along the Sacramento River from Red Bluff to Colusa, a poorly timed flow event could have dire consequences.

7.3. Control and eradicate non-native plant species. Such control is best planned and implemented on a watershed scale.

The non-native plant species listed in Table 8-5 have invaded riparian habitats to the detriment of native flora and fauna. Their negative effects on bird communities are probably much more widespread than noted in the table. Invasive, introduced plants affect native birds by:

- Competing with native vegetation, thereby eliminating useful foraging and nesting habitat.
- Providing a sub-optimal nesting substrate, in which nest success is reduced
- Reducing several orders of native insects (NPS 1998).
- Enhancing non-native animal populations.

In river systems, these non-native plants often spread very quickly and should be controlled at the first sign of their presence. Managers should be especially concerned with the invasion of tamarisk and giant reed in desert riparian habitats. The species displace native vegetation and disrupt the system by drying perennial streams. Species diversity of resident songbirds was negatively correlated with riparian vegetation dominated by saltcedar at the Salton Sea and several bird species were negatively associated with saltcedar dominance (Holmes et al. 2003). Removal of these species can restore the flow of these seasonal streams (BLM 1998), allow native vegetation growth, and subsequently provide more and better habitat for birds.

Control of non-native species is much less expensive and more effective if conducted before the species has spread into extensive monotypic stands. This is particularly true in a riparian system where seeds, rhizomes and vegetation easily spread downstream. Control efforts, therefore, must be planned and undertaken on a watershed scale, preferably beginning with the removal of the invasive species which is furthest upstream.

In many areas, California black walnut is planted as a native; however, some botanists believe this plant was introduced early during the colonization of California. Black walnuts exude a sap that is a natural herbicide (juglans) that can result in a sparse understory beneath a black walnut canopy. Black walnut is detrimental to the nesting success of Yellow-billed Cuckoo and shows no positive influence on nest success of those species that do use it as nest substrate, including the Black-headed Grosbeak, Western Wood-pewee, Western Kingbird, House Wren, and Nuttall's Woodpecker. Black Walnut negatively influences nest-site selection by Lazuli Bunting, House Wren, and Spotted Towhee and negatively influences nest success of many cavity-nesting birds (Geupel et al. 1997[a]).

7.4. Control and eradicate non-native animal species.

Non-native animals can have a severely negative impact on birds. Invasive bird species such as European Starlings and House Sparrows often out-compete native birds for nest sites and have been known to destroy active nests and even kill nesting adults. Introduced animals, such as domestic cats, kill millions of birds every year. To reduce the effects of non-native animals on native birds:

- Avoid establishing human habitat near riparian zones.
- Do not feed or otherwise encourage populations of feral animals.
- Keep cats indoors.
- Do not put bird feeders in a yard where a cat might ambush feeding birds.
- Humanely control non-native species when necessary.

Table 8-5. Non-native species and their effects in riparian habitat.

Introduced Species	Scientific Name	Effects/Bird Species Affected [1]
Acacia	*Acacia dealbata*	Out-competes and hinders the establishment of willow-alder stands (Danner pers. comm.)
Black locust	*Robinia pseudoacacia*	Displaces native habitat
Black walnut	*Juglans californica*	Western Yellow-billed Cuckoo, Lazuli Bunting, Spotted Towhee, House Wren and other cavity nesters
Cocklebur	*Xanthium strumarium*	Bell's Vireo
Cape-ivy (German ivy)	*Delairea odorata*	Swainson's Thrush. Overtops and out-competes native understory and trees
Edible fig	*Ficus carica*	Western Yellow-billed Cuckoo
English ivy	*Hedera helix*	Chokes riparian trees
Giant reed	*Arundo donax*	Bell's Vireo
Periwinkle	*Vinca major*	Out competes understory plant species (Danner pers. comm.)
Purple loosestrife	*Lythrum salicaria*	Grows in dense stands that support less avian diversity but greater density than some native habitats (Whitt et. al. 1999)
Russian olive	*Elaeagnus augustifolius*	Willow Flycatcher
Sticky eupatorium	*Ageratina adenophora*	Obstructs waterways and forms dense strands on drier uplands (Danner pers. comm.)
Tamarisk	*Tamarix chinensis*	Least Bell's Vireo
Tasmanian blue gum	*Eucalyptus globulus*	Golden-crowned Kinglet, Ruby-crowned Kinglet
Opossum	*Didelphis virginiana*	Predator of many species, particularly those that forage and nest near or on the ground
House cats	*Felis catus*	Predator of many species, particularly those that forage and nest near or on the ground

[1] Unless otherwise noted, sources for the information provided in this table came from the species accounts developed as the first step in producing this conservation guide. Visit http://www.prbo.org/calpif/htmldocs/riparian.html.

Monitoring and Research Recommendations

Objective 8

Provide data on pressing conservation issues affecting birds.

In order to successfully protect and expand native bird populations, managers must have the most recent data available on populations and their habitat needs. Standardized scientific monitoring of populations will provide decision-makers with these essential tools.

Recommendations

8.1. Consider reproductive success and survival rates when monitoring populations, assessing habitat value, and developing conservation plans.

The number of young produced in a bird population (reproductive success) critically influences a population's presence, health and sustainability in an area. Reproductive success is a primary demographic parameter that provides critical information for understanding patterns of population change. Hence, these data can be used to understand trends, focus conservation action and funds, and identify hypotheses for further evaluation. When fewer than 20% of nestlings survive to fledge young, nest success is considered poor and probably indicates a nonviable population. Nur et al. (2004) and Shaffer (*in press*) describe feasible analytical techniques for monitoring nest survival as a function of covariates such as environmental and/or temporal variables. These variables may be quantitative (e.g., vegetation measurements, nest height, date, nest age) or qualitative (e.g., habitat type, management practice). However, to adequately measure annual productivity, investigators should not stop at calculating nest success alone (Thompson et al. 2001, Anders and Marshall *in press*); instead we should also strive to accurately 1) count re-nesting attempts after nest failure, 2) count number of young fledged per successful nest, 3) measure double brooding frequency by following color-marked birds throughout the breeding season.

Monitoring annual adult survival is important in the same way as discussed for reproductive success; population trends can thus be better understood from monitoring the interaction of these demographic parameters. Survival can only be confidently calculated for adults after at least four years of mark/recapture data (such as mist-netting) have been obtained (Nur et al. 1999). Research seeking to determine productivity for a breeding population should include at least four years of nest-searching and/or mist-netting.

8.2. Conduct intensive, long-term monitoring at selected sites. In order to analyze trends, long-term monitoring should continue for more than five years.

Long-term data are vital to deciphering the difference between a true population decline and a natural fluctuation in population size. Because conservation dollars are limited, the best possible data on population trends are needed so as not to squander scarce resources on a species that is not truly in decline. Long-term monitoring should be conducted at reference sites that embody the characteristics restoration efforts strive to recreate. Additionally, long-term monitoring at key experimental sites can test the assumptions that currently drive restoration and management practices. Intensive monitoring includes collecting data on primary demographic processes and associated habitat characteristics and seeks to identify causal connections between habitat variables and species viability. Biologists collect data on reproductive success, breeding densities, reproductive success, parasitism, survival, vegetation data, suitable habitat requirements, and general life-history information. Managers can employ these data to make well-informed, adaptable management plans.

8.3. Investigate the relationship between herbaceous vegetation height and avian productivity and recruitment, especially in wet meadows.

Wet meadows are vital habitats for birds in the Sierra Nevada (Siegel and DeSante 1999). Grazing and other resource-extraction activities compromise these areas and endanger some local avian populations (see Chapter 7: Bioregional Conservation Objectives). More study of the effects of grazing, fire suppression and non-native plant invasion would facilitate the development of grazing prescriptions that are less detrimental to nesting and migrating birds.

8.4. Develop a series of monitoring and research projects that:

1) Determine the habitat attributes that affect migratory stopover use.
2) Assess how migratory stopover habitat may affect species survival.
3) Define conservation priorities and recommendations for stopover habitat.

While vital as breeding grounds, riparian corridors also provide essential stopover habitat for migrating birds. However, little information exists regarding which habitat factors attract and affect migrants. Events at migratory stopover areas may significantly affect certain populations and contribute to declines (Moore et al. 1995, Yong et al. 1998). Monitoring programs should attempt to have a broad geographic scope and seek to collect data on a wide variety of variables, including avian diversity, abundance, stopover duration, fat deposition/physical condition, and vegetation characteristics.

8.5. Conduct selective monitoring at critical sites to determine the effects of cowbird parasitism on the Willow Flycatcher, Bell's Vireo, Warbling Vireo, Common Yellowthroat, Blue Grosbeak, Wilson's Warbler and Yellow Warbler.

Brown-headed Cowbird parasitism has potentially devastating effects on the populations of these and many other species in California. Habitat size, vegetation structure, and adjacent land use all influence the rates of cowbird parasitism. By studying the variables involved, conservationists can better formulate landscape-level management plans to enhance bird populations.

8.6. Conduct selective monitoring at key sites to determine the factors influencing nest success of the Song Sparrow, Lazuli Bunting, Yellow Warbler, Willow Flycatcher and Warbling Vireo.

Relatively recent, local extirpation and declines of these and other western species from their historical breeding range appear to be caused by low productivity (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 1998, Gardali et al. 2000). Local extirpation may signal the early stages of a process of severe population declines. By determining the factors associated with low reproductive success, research may identify which management and restoration actions will help reverse songbird population declines. Land managers, owners and regulatory agencies gain greater freedom in their decision-making if they conserve bird species before special-status listing becomes necessary.

Monitoring the reproductive success of key species provides gauges that allow management changes before it is too late.

Objective 9

Maximize the effectiveness of ongoing monitoring and management efforts.

Recommendations

9.1. Increase communication and coordination between land managers and specialists hired to implement specific projects or conduct monitoring.

Experts, such as those conducting endangered species or biodiversity inventories, should be consulted and included as part of project implementation teams. By doing so, managers can quickly and easily access a wealth of detailed information on local birds and their response to management activities. For example, bird monitoring in restored riparian habitats on the Stony Creek Preserve along the Sacramento River has provided detailed information about breeding birds and their habitat requirements and offered suggestions on how maintenance activities can be implemented with minimal disturbance. Managers on the preserve can quickly incorporate new data into management regimes, honing their project designs to better benefit birds.

9.2. Use standardized monitoring protocols.

By standardizing monitoring techniques, researchers ensure that results can be compared across space and time. The USDA Forest Service published guidelines for standardized monitoring techniques for monitoring birds (Ralph et al. 1993). Please refer to Appendix A for more information.

9.3 The CALFED Bay-Delta Authority should continue to incorporate bird monitoring into all riparian and wetland habitat restoration projects as a way to assess avian response, evaluate projects, and most importantly, adaptively manage.

CALFED is a state agency in California formed to implement the Bay-Delta Accord, signed in 1994. The Accord agreed to develop a Bay-Delta Conservation Plan that would seek to address issues of water quality, water supply, wildlife habitat, and flood control. A major CALFED program is the Ecosystem Restoration Plan, which, when approved, could be implemented with close to $1 billion in state and federal funds over the next 20 years. While the Ecosystem Restoration Plan considers the Central Valley, Delta, and San Francisco Bay riparian and wetland habitats, it historically focused on aquatic species. Realizing the efficacy of bird monitoring programs and their ability to provide information to adaptively manage habitat projects, most new CALFED projects now contain a bird monitoring element. Furthermore, if mistakes are made and practices are harming bird populations, managers can alter their methods and avoid similar mistakes in the future. With additional monitoring, a steady feedback loop of management, monitoring, and revision of practices is established.

9.4. Maximize the cost effectiveness and value of existing specialized monitoring programs for listed species (e.g., those oriented toward Western Yellow-billed Cuckoo and Willow Flycatcher) by collecting standardized data on multiple species (such as point counts) in addition to any specialized protocols aimed at one species.

Many state and federally sponsored surveys only monitor special-status species. By adding a standard protocol that provides information on multiple species while conducting special-status species surveys, researchers could rapidly expand their knowledge of California's birds. Such data could be shared and analyzed and results would be added to conservation plans and incorporated into management regimes. Even if resources are not immediately available for analysis, the information will provide a baseline or historical perspective on bird distribution and abundance.

9.5. Determine what habitat and population characteristics are necessary to successfully wean a songbird population from cowbird trapping.

Most experts agree that cowbird trapping is only a temporary measure for relieving parasitism pressure on landbirds (Morrison et al. 1999). Furthermore, intense cowbird trapping has proven ineffective for certain local populations on the edge of extirpation. Willow Flycatcher populations at both the Kern River Valley and Camp Pendleton failed to increase after extensive cowbird control efforts. It is likely that there are other factors negatively influencing these populations. Although some species experience marked population growth following cowbird trapping (i.e., Least Bell's Vireo), often times little attempt is made to assess the extent to which other management actions, such as improved and expanded habitat, have contributed to the increases (USFWS 2002).

9.6. Coordinate with monitoring and research projects targeted at non-avian taxa to maximize the benefits of the protection, management and restoration of riparian habitats. Stream amphibians also provide another means of measuring environmental stress, and like birds, amphibians can be good indicators of different niches within riparian habitats (Welsh and Olliver 1998). Like birds, widespread declines of amphibians are well documented (Blaustein and Wake 1990, Wake 1991 and 1998, Pechmann and Wilbur 1994) and amphibians use diverse riparian habitats throughout California. The federally listed endangered Arroyo Southwestern Toad uses most common riparian types in southern California for foraging and dispersal, and females and breeding season males prefer channel and terrace habitats to campground, agricultural or upland habitats. The natural flooding disturbance regimes that encourage understory vegetation growth and provide habitat for declining bird species also promote continuous availability of preferred breeding habitat for the Arroyo Toad (Griffin and Case 2001).

Objective 10

Expand research and monitoring of selected special-status species to address pressing conservation issues.

<u>Recommendations</u>

10.1. Identify and implement research relevant to management of Tricolored Blackbirds, which continue to decline in California.

The most recent surveys of Tricolored Blackbirds in California show a continued population decline in Central Valley wetland habitats. This is likely due to a lack of management for this species. Tricolored Blackbirds require acceptable nesting substrates and adequate water levels throughout the breeding season to discourage mammalian predators. Harvesting of silage and plowing of weedy fields currently are the most common reasons for destruction of nesting colonies (Beedy and Hamilton 1999). Therefore, managers must make thoughtful, well-informed decisions to protect these populations.

10.2. Identify winter range, habitat, and possible overwintering conservation issues for as many Neotropical migrants as possible, including the Western Yellow-billed Cuckoo, Least Bell's Vireo, and Swainson's Hawk.

Wintering grounds play a significant role in the life cycles of Neotropical migratory birds. If a population is declining primarily due to low overwinter survival, no amount of effort to restore or protect breeding grounds will suffice to conserve the species. Additionally, recent research implies that declines in habitat quality on wintering or migratory stopover grounds may lead to lower productivity on breeding grounds (Marra 1998).

For many species, little information is available on overwintering habitat requirements and survival. Least Bell's Vireos overwinters in unknown locations in Baja California. Western Yellow-billed Cuckoos show a very distinct sex ratio in their breeding populations (8 males to every 1 female); if the sexes have different wintering grounds, and the females' has been destroyed or compromised, the ratio could skew further in the future, further imperiling the population. Preliminary radio telemetry data indicate that the Central Valley Swainson's Hawk overwinters in Mexico and Colombia, while Swainson's Hawks from other regions winter in the pampas of Argentina. Conservationists would learn much from solving such questions regarding overwintering habitats.

10.3. Inventory the Central Valley for Swainson's Hawk territories and map distributions of nesting and foraging habitat to develop a target population size. Plan management strategies for protecting priority habitats.

Swainson's Hawks in the Central Valley are more closely associated with riparian habitats than populations in other bioregions. Migratory patterns, overwintering areas, and relative isolation of breeding grounds suggest that this area may support a distinct metapopulation, which should therefore be managed as such.

10.4. Conduct statewide surveys to establish current population and range sizes every five years for the Swainson's Hawk and Bank Swallow, and every 10 years for the Western Yellow-billed Cuckoo.

Such surveys will provide a comprehensive picture of the state of these species and monitor long-term population trends in California. They would alert managers to population declines or expansions. As recommended in 8-2, these surveys should include the collection of as much data as possible on all other riparian birds.

Objective 11

Use information gathered from avian monitoring and research programs to improve the effects of agricultural and land management techniques on birds.

Recommendations

11.1. Work cooperatively with agricultural researchers to assess the potential of agriculture adjacent to existing riparian areas to be more "bird friendly."

Researchers could explore:

- Techniques for minimizing or eliminating cowbird foraging habitat.

- The relative utility to wildlife of row crops versus permanent crops (e.g., orchards, vineyards) as buffers.

- Creating habitat within a farming system through the use of hedgerows, tailwater ponds, hill ponds, irrigation canal and levee revegetation, and roadside buffer strips (YCRCD 1998).

- USFWS records describe Swainson's Hawk mortality events involving from one to 40 birds killed by applications of organophosphate and carbamate insecticides in agricultural fields, particularly in autumn, when flocks fed on insects in harvested fields. Goldstein et al. (1999) attributed high hawk mortality in the pampas of Argentina to poisoning by the organophosphate insecticides monocrotophos and dimethoate, used to control grasshoppers.

11.2. Devise an urgently needed method for controlling giant reed.

Giant reed, often referred to as Arundo, has spread throughout riparian zones in southern and central California, wreaking havoc with native plant communities and the natural hydrology of the area (see Recommendation 7.3). Current control efforts, which primarily employ physical removal and herbicides, appear inadequate to halt the invasion of this species. More effective measures, including biocontrol, must be sought.

Policy Recommendations

Conservation efforts will make little headway without effective policy development. The future of habitat conservation in the West lies not only in the activity of scientists and restoration experts in the field, but also within the walls of statehouses and the pages of law. Policy makers need to examine and appropriately amend statutory and regulatory programs that endanger native habitats or that unnecessarily impede restoration actions. Whenever possible, policy should encourage governmental support of innovative local conservation and sustainable-growth projects.

To achieve conservation and management goals, diverse interests must effectively combine their skills and financial resources. Partners in Flight and the Riparian Habitat Joint Venture embody this kind of cooperative effort. In these groups, scientists, governmental agencies, nonprofit organizations and private citizens share information and concerns and collaborate on solutions. The biological recommendations in this Conservation Plan are readily available to policy-makers, public land managers and private landowners. Furthermore, the findings described here will be relevant to the Partners in Flight North American Landbird Conservation Plan, enhancing conservation efforts throughout the country.

Funding from the National Fish and Wildlife Foundation, derived from the Neotropical Migratory Bird Conservation Initiative, and the USDA Forest Service Partners in Flight awards continue to catalyze conservation activity across the country. Government agencies participating in the RHJV intend to use this Conservation Plan to guide their riparian conservation projects. These agencies include the California Wildlife Conservation Board, the U.S. Bureau of Reclamation, the U.S. Fish & Wildlife Service, the USDA Forest Service, and recent efforts by the Bureau of Land Management.

The following recommendations seek to assist policy advocates and decision-makers as they shape the regulations and procedures that affect avian conservation in the West.

Objective 12

Encourage regulatory and land management agencies to recognize that avian productivity is a prime criterion for determining protected status of specific habitats, mitigation requirements for environmental impacts, and preferred land management practices.

Recommendations

12.1. Land managers should consider avian population parameters, such as reproductive success, as important criteria when designating priority or special-status sites, such as Areas of Critical Environmental Concern (BLM), Research Natural Areas (BLM, USFS) and other publicly owned areas specially managed for biodiversity.

Until recently, few data regarding avian reproductive success at many important riparian sites have been available. Government land managers should consider reproductive success data when designating and managing areas in support of biodiversity, including state wildlife areas and ecological reserves. This information complements ongoing efforts by agencies to evaluate and restore riparian areas, such as efforts by the BLM, USFS, and NRCS to assess proper functioning condition of riparian areas on public lands throughout the West.

12.2. When developing management practices for natural areas, government agencies, such as the USFWS and CDFG, should consider environmental impacts on local bird populations. Such evaluations should also occur when developing plans for habitat mitigation, habitat conservation, multi-species conservation, and natural community conservation.

The California Department of Fish & Game estimates that more than 89 habitat conservation plans, natural community conservation plans, and resource management plans were ongoing in California in 1998. Of these, 33 addressed the needs of one or more bird species. Additionally, the U.S. Fish & Wildlife Service constantly makes decisions regarding mitigation requirements for private and federally sponsored projects that affect the habitats of threatened or endangered species. By incorporating the conservation, restoration, management and monitoring recommendations of this Conservation Plan into their regulatory plans, agencies can implement the most effective conservation actions.

12.3. Land managers should consider the impacts of horses and burros on riparian vegetation and associated birds when designating acceptable numbers of wild horses and burros on public land.

Public Law 92-195, the Wild Free-roaming Horse and Burro Act of December 1971, mandates that the Bureau of Land Management and USFS manage and control wild horses and burros on public lands. Horse and burro population levels are to be maintained at an "optimum number" that results in a thriving ecological balance and avoids deterioration of the range (BLM 1998). Because browsing animals can significantly degrade riparian habitats, land managers must consider the requirements of breeding and migrating birds and monitor habitat quality when establishing acceptable ungulate population sizes.

12.4. Incorporate the costs of limited-term (two–five years) or long-term bird monitoring into management endowments prescribed for conservation projects, including mitigation banks, habitat conservation plans and natural community conservation reserves.

The size of management endowments for preserves in Southern California, for example, varies substantially with management needs and staffing levels. In 1998, they varied from $70,000 at Dos Palmas (covering coordination meetings and management support to the BLM) to $2.5-$3 million at the Coachella Preserve (providing for 1.5 to 2 staff positions, buildings, vehicles, management activities and monitoring). Most endowments for unstaffed preserves are less than $1 million (usually less than $500,000). Most endowments for staffed preserves are greater than $2 million, depending upon the level of management, staffing, and partnerships at the site. Endowments of up to $510 million are common for sites requiring several staff, building maintenance, and active management, and that lack partners with whom to share costs.

Incorporating the long-term cost of bird monitoring into the management endowments of large-scale reserves is an efficient way to ensure that monitoring occurs. In 2000, a monitoring program costing $35,000 per year could provide extensive data from point count routes, mist-netting and two nest monitoring plots (see Appendix A for more information regarding methods). Using progressive investment strategies and a 5% capitalization rate, an endowment of approximately $700,000 would support this level of monitoring. Under these assumptions, one can calculate the cost for endowing monitoring at a site. A good rule of thumb is to add $150,000 to an endowment for every additional $7,500.00/year cost added to the long-term management (i.e., take the additional annual cost, e.g., $7,500, and divide by 5%) (Teresa, pers. comm. 1998).

12.5. Local governments should establish locally-relevant riparian buffer zones to protect riparian habitat and associated surrounding uplands from development and disturbance, through zoning ordinances and/or general plan provisions.

Many California cities and counties have adopted some type of riparian development setback requirements, prohibiting various types of construction activities within a given distance from a stream. Typical development setbacks range from 15 to 30 m from the stream centerline, depending on stream type (perennial vs. intermittent) or land use type (urban vs. rural). In many areas, this small setback distance may not even extend outside the riparian zone. Although some local governments have adopted setbacks that start at the edge of the riparian zone, this is still not general practice. In addition, most zoning ordinances address the construction of a "structure," but often do not require setbacks for other activities that could disturb riparian areas, including roads, corrals/pens, pools, and other types of impervious surfaces that are not "structures" (Clark, pers. comm.).

Existing development setback distances are generally adopted from forestry standards, which are based primarily on the height of the highest tree and are generally focused on protecting water quality and habitat for anadromous fish (Erman et al. 1977, Peterjohn and Cornell 1984). While many have advocated the protection of larger, variable-width riparian buffer zones that incorporate variations in local hydrology and vegetation (Moyle et al. 1996), the emphasis has largely been on aquatic, rather than terrestrial resources. While more research is needed to identify appropriate riparian buffer widths for different terrestrial species, the value of preserving at least the width of a species' home range is well recognized (Warner and Hendrix 1984, Granholm 1987, Chapel 1992). For many, if not most, riparian-associated species, home ranges extend well outside the riparian zone, including adjacent upland vegetation such as grassland, shrub, oak woodland, or coniferous forest. Much of the research to date on effects and appropriate sizes of riparian buffer zones have been conducted in forested landscapes, where the nearby disturbance is timber extraction (e.g., Hagar 1999, Pearsono and Manuwal 2001, Robichaud et al. 2002). Little research on the topic has been done in urban and suburban areas, where the level of disturbance is arguably much greater.

Local ordinances and general plan provisions on riparian development setbacks should be expanded to include a wide range of riparian disturbances, and should start from the edge of the riparian zone, providing an additional upland buffer zone for species whose home ranges extend outside the riparian zone. A review of reptile and amphibian minimum habitat requirements found that a buffer of up to 290 m from the stream edge would be necessary to protect the core habitat of these taxa (Semlitsch and Bodie 2003). While a similar review of home range sizes should be conducted for riparian-associated bird species, territory sizes of locally breeding species (see Table 5-2) may be used as a minimum guideline.

Objective 13

Increase protection and management actions to benefit severely declining or locally extirpated bird species in California.

Recommendations

13.1. Establish a committee to review management and research objectives and progress for Tricolored Blackbirds, seeking to incorporate the efforts and viewpoints of those actively involved in wetland management for waterfowl and shorebirds.

As Tricolored Blackbirds continue to decline, a concerted effort is required to address the needs of this species within the context of overall wetland and waterbird management within the Central Valley. This committee should review and amplify protection, management and research recommendations developed by researchers and agencies. The committee should maximize coordination of conservation efforts with conservation groups and land managers that are focused primarily on waterfowl or shorebird management. Distribution, abundance and reproductive success of Tricolored Blackbirds should be monitored annually.

13.2. Develop GIS layers representing the extent of riparian zone habitats throughout the state at a resolution fine enough for the analysis of territory-level bird data in association with the occurrence of various habitat types. Resulting maps should be field-verified and may be used to identify suitable habitat for riparian birds, including Western Yellow-billed Cuckoos and habitats for other declining or sensitive species.

Riparian habitat covers a small area relative to its importance and value to wildlife. Because most regional landcover maps are based on satellite imagery with 30-m pixel resolution, they generally do not adequately represent riparian habitats, which are often (a) smaller than the minimum mapping unit and/or (b) not easily distinguishable from surrounding uplands in forested areas. Although riparian vegetation may be mapped at a more local scale using high-resolution aerial photos, the quality and composition of the understory is not easily mapped without extensive ground-truthing (as is true for any forest vegetation type). Thus, existing riparian GIS layers are variable in spatial resolution, floristic detail and quality, as well as inconsistent in vegetation and hydrologic classification standards. The dynamic nature of riparian systems, as well as on-going restoration efforts also make this habitat particularly difficult to represent in map form.

Through the California Legacy Project, with the California Department of Forestry and Fire Protection (CDF) and the U.S. Forest Service, efforts are currently underway to develop an intermediate-scale statewide riparian vegetation map/GIS layer for the State of California. In addition, the Riparian Habitat Joint Venture (RHJV) is coordinating efforts to map smaller areas at a higher spatial resolution. Finally, a list of riparian GIS layers can be found at the California Partners in Flight website at: http://www.prbo.org/calpif/htmldocs/riparian.html.

Objective 14

Promote federal, state, and local government flood control policies that will benefit wildlife in tandem with community safety.

The Army Corps of Engineers' mandate to develop non-structural flood control alternatives for the state of California in the aftermath of the 1996-97 floods is a positive step in floodplain management. The importance of flood events has been discussed throughout this document. For specific examples, please see Recommendations 1.4, 4.1, 6.1, 7.1, and 7.2.

Chapter 9. Implementation of Conservation Plan Recommendations

The Riparian Habitat Joint Venture (RHJV) has developed a Strategic Plan and an Annual Operating Plan to achieve the habitat protection/restoration goals set forth in this Conservation Plan. The Strategic Plan articulates the vision, mission, and goals of the Riparian Habitat Joint Venture. It also provides a framework for understanding the long-term goals of the RHJV, and direction for the Operating Plan. The Operating Plan will detail the specific tasks the RHJV will undertake during each year to meet their mission, as well as identify tasks planned for the next three-five years. The Operating Plan will identify measures of success for each identified task, will document achievements, and will be updated annually. The RHJV anticipates working closely with other statewide conservation efforts with overlapping goals during the implementation phase, particularly the Biodiversity Council, Sacramento River Advisory Council (SB1086), and the Coordinated Resource Management Plan Council. Some of the tasks in the Operating Plan include:

- Develop a riparian map and data layer to identify the extent and condition of riparian habitat
- Develop conservation/restoration acreage objectives and a system to prioritize areas for conservation efforts.
- Conduct local workshops to familiarize constituents with the RHJV and the Conservation Plan and to identify partners and initiatives to collaborate with in implementing riparian conservation.
- Provide guidance for a statewide riparian policy to fully protect riparian habitat.

In areas that already have a thriving conservation process in place, such as the SB1086 program along the lower Sacramento River (from Keswick Dam to Verona), the process will provide support and technical assistance for ongoing efforts.

The North American All Bird Initiative

In 1998, participants at a meeting of the International Association of Fish and Wildlife Agencies developed a vision to link all of the major bird conservation initiatives in Canada, the U.S. and Mexico (CEC 1998). The participants represented each of the four major bird conservation initiatives already underway on the continent: the North American Waterfowl Management Plan, Partners in Flight, the Shorebird Conservation Plan, and the Colonial Waterbird Conservation Plan. This new, overarching program, known as the North American All Bird Conservation Initiative (NABCI), seeks to synthesize the efforts of all of these groups by creating "regionally based, biologically driven, landscape-oriented partnerships delivering the full spectrum of bird conservation across the entirety of the North American continent, including simultaneous, on-the-ground delivery of conservation for both game and nongame birds." NABCI aims to ensure that populations and habitats of North America's birds are protected, restored, and enhanced through coordinated efforts at international, national, regional and local levels guided by sound science and effective management. It is designed to increase the effectiveness of new and existing initiatives through:

- Effective coordination;
- Building on existing regional partnerships such as joint ventures; and
- Fostering greater cooperation among the nations and the peoples of the continent.

State, provincial, federal and non-governmental representatives from Canada, Mexico and the U.S. adopted an ecological framework that facilitates coordinated conservation planning, implementation, and evaluation among major bird initiatives. These Bird Conservation Regions (BCR) were defined by adopting the hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC). Existing Joint Ventures as formed under the North American Waterfowl Management Plan (NAWMP) are recognized as important vehicles for local and regional delivery of bird conservation goals. Joint venture focus areas do not always correspond with BCR boundaries, but joint ventures are coordinating with the BCRs encompassed within their boundaries. Many joint ventures in North America have embraced the concept of "all-bird" conservation.

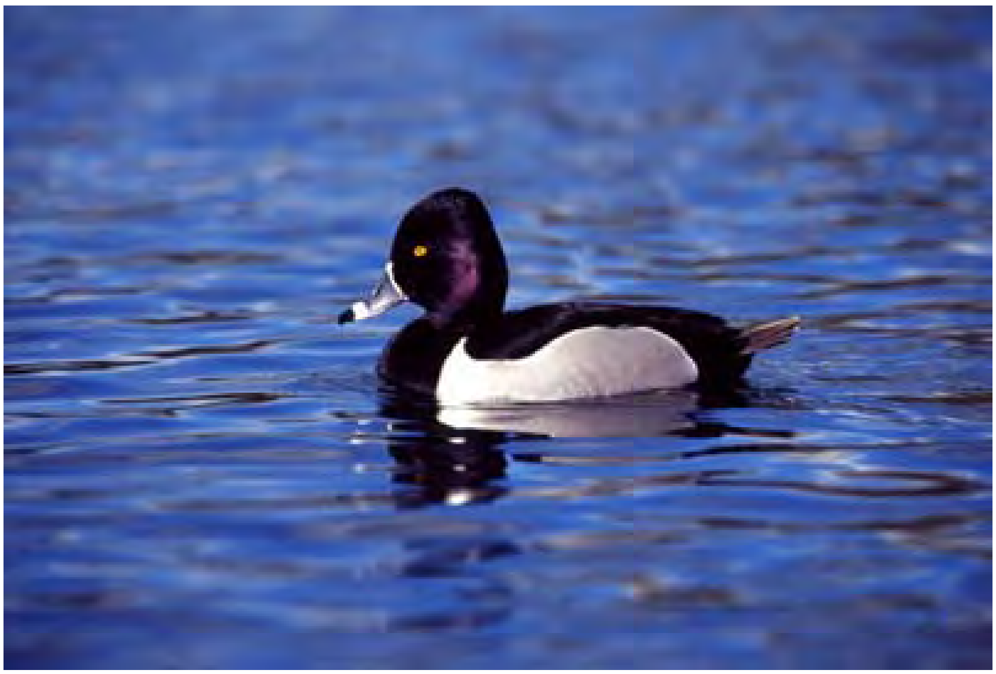


Photo by Eric Preston, ericapreston.com.

Joint Ventures, originally created to protect North America's waterfowl such as this Ring-necked Duck, are now embracing the conservation of all birds.

California is encompassed within five BCRs: the Northwestern Pacific Rainforest region, the Sierra Nevada region, the Coastal California region (which includes the Central Valley), the Great Basin region, and the Sonoran and Mojave Desert region. The state currently hosts five official joint ventures: the Central Valley Habitat Joint Venture, the San Francisco Bay Joint Venture, the Intermountain West Joint Venture, the Pacific Coast Joint Venture, and the Riparian Habitat Joint Venture (Chapter 1). Future bird conservation in California priority habitats will be achieved by encouraging adoption of the all-bird conservation concept within existing joint ventures or by creating new joint ventures, organized regionally around specific habitats and habitat conservation goals.

Chapter 10. Outreach and Education

Scientific efforts for conservation have little impact without the support of local communities, including private landowners, government land managers, and the public of all ages. To gain crucial support, research, management, and conservation programs must share their findings and involve community groups and partners in conservation through education and outreach. For the purposes of this chapter, outreach refers to communication with land managers, agencies, planners, business interests, nonprofit organizations, academia, and volunteers. Outreach activities include, but are not limited to, conferences and workshops that facilitate communication among experts, participation in land use planning, volunteer restoration and monitoring programs, field trips, and ecotourism. Education, an important component of outreach, refers to the range of activities that educate and involve students and adults. Education activities include visits for classes and groups to field sites, interpretive displays, specialized curricula, and participation in festivals.

This chapter will:

- outline key concepts to be disseminated through riparian focused outreach programs;
- identify user groups to address through outreach programs;
- summarize existing resources for use by educators and outreach groups; and
- highlight examples of educational opportunities and successful programs.

Key Concepts

The following list of *Key Concepts for Bird Conservation* should be incorporated into education and outreach programs. These concepts are important to include in any program concerning conservation, and are indispensable in programs focusing on birds and riparian habitats.

- **Reproductive success may be the most important factor influencing bird population health.** It contributes directly to a population's size and viability in an area. A number of factors influence reproductive success, including predation, nest parasitism (ex. Brown-headed Cowbird), nest site availability, and food availability.

- **Nesting habitat requirements vary among species.** Different bird species place their nests in different locations, from directly on the ground to the tops of trees. Most birds nest within five meters of the ground. Managers must consider that habitat needs for different species vary and manage for this diversity accordingly. This can be accomplished by managing grass and forbs to a height greater than 6 inches for ground nesters, retaining a structurally diverse shrub and tree layer for low to mid-height nesters, and leaving dead trees and snags for cavity nesters. Additionally, older tall trees should be retained for birds that build their nests in the canopy (Figure 5-1).

- **The breeding season is a vital period in birds' lives.** Birds nest during the spring and early summer of each year (generally mid-March-August). Nestlings are particularly sensitive to changes in the environment and are indicators of ecosystem health. Disturbances during the breeding season, such as vegetation clearing, habitat restoration, and recreation, may result in nest abandonment, remove potential nest sites, directly destroy nests, expose nests to predators, and decrease food sources such as insects. Predators, such as domestic cats, skunks, and jays, can decimate breeding populations, thus land managers should avoid subsidizing their populations through human food and garbage.

- **Understory (the weedy, shrubby growth underneath trees) is crucial to birds.** A healthy and diverse understory with lots of ground cover offers well-concealed nest and foraging sites. Manicured parks and mowed lawns provide poor nesting conditions for all but a few bird species.

- **Native plants are important to birds.** Native bird populations evolved with the regional vegetation, learning to forage and nest in certain species. Introduced plant species may not provide the same nutrition, host sites for insects, or nest site quality. Introduced plants can also quickly dominate an area, reducing the diversity of vegetation. Less diverse vegetation can lower the productivity and viability of a bird population.

- **Natural predator-prey relationships are balanced, but human disturbance creates an imbalanced system.** Interactions with predators are a natural and essential part of an ecosystem. However, a preponderance of non-native predators or a sustained surplus of natural predators severely affects the health and persistence of bird populations. Feeding wildlife, especially foxes, raccoons, and skunks, should be discouraged. Feeders that are frequented by jays, crows and cowbirds should not be maintained during the breeding season (most songbirds feed their young insects). Domestic and feral cats are responsible for an estimated 4.4 million birds killed each day (Stallcup 1991). It is not true that a well-fed cat will not hunt! In fact, a healthy cat is a more effective predator.

- **Natural processes, such as flood and fire, are integral to a healthy ecosystem.** They provide the natural disturbance needed in an area to keep the vegetative diversity high, an important factor for birds.

"Did you know" and "How you can help" facts about Riparian Habitat

Did you know facts are a great way to teach the public of all ages about riparian habitats? Here are a few to include in educational programs, signs, curriculum, flyers, and presentations:

Did you know…

Cats kill approximately 4 million birds a day in this country alone.

How you can help….

- If you own a cat, help reduce the impact of cats on bird populations. Domestic cats kill hundreds of millions of native birds, reptiles and small mammals every year. This unnecessary impact can easily be reduced if cat owners would keep their cats indoors, and if broad education on the impact of cats on wildlife is conducted.

- The American Bird Conservancy's (ABC) Cats Indoors! campaign seeks to educate the public on the facts of cat predation on birds and other wildlife, and the hazards to free roaming cats. This information is available at the American Bird Conservancy's web site at http://www.abcbirds.org.

- Educate your community about outdoor cats as a conservation threat to birds and other wildlife and distribute brochures and information from ABC's website broadly.

- Attend town hall meeting to raise awareness, especially in problem areas where there are large concentrations of feral or stray cats.

Other actions that cat owners can take to help birds:

- Keep cats as indoor pets.
- Don't abandon unwanted cats; rather, give them to the local SPCA or Humane Society.
- Spay and neuter your cats.
- Cats on ranches or farms, kept to control rodent populations, should be kept to a minimum. Spayed females tend not to stray or wander from the barn area. Keeping feed in closed containers also helps reduce rodent populations (Coleman et al. 1997). Trapping rodents can also be more effective than relying on cats to do the job.
- Don't feed stray or feral cat populations. A more humane alternative for cats and wildlife is to reduce the unwanted cat population by limiting reproduction and facilitating adoption by responsible pet owners.
- Support local efforts to remove feral cats.

Did you know…

Predation is the main cause of nest failure for songbirds. Humans can contribute to an unbalanced predator-prey relationship of both native and non-native predators. Increased numbers of these predators can depress bird populations.

How you can help…

- Eliminate outdoor sources of food including pet food dishes, garbage, and open compost piles that may attract stray cats, jays, raccoons, rats, opossums.
- Avoid indiscriminate open tray bird feeders or seed scattered on the ground that may attract jays, cowbirds, ravens, rats, squirrels, etc. and support unhealthy predator numbers (see the Feeding Birds Safely handout in the resource table).
- Keep cats indoors
- Construct safe bird boxes that are predator proof (see the Keeping your nest box safe Table 10-1).
- Do not feed wildlife or allow wildlife access to your trash when hiking or camping. If you feed birds, avoid doing more harm than good.

Did you know…

Feeding birds can be beneficial if properly done, but it always carries the potential for upsetting the natural balance between native predators and prey species. Improper feeding can help to spread disease, support predator populations that prey on birds and other organisms, or increase non-native populations that displace the natives.

How you can help…

- Feeder placement should be away from shrubs or bushes that provide places for cats to ambush birds (Coleman et al. 1997).

- Avoid feeding birds in the spring and summer. Feeding birds supplements their natural diet, but springtime feeding may encourage a lower quality diet for nestlings that need high-protein insects, which are naturally abundant throughout the breeding season.

- Do not supplement the diet of avian nest predators such as jays, magpies, crows and ravens by feeding them during the breeding season. These predators tend to benefit disproportionately from human habitation, and as their populations expand they are negatively affecting the health of other bird populations. The National Audubon Society produces bird feeders that discourage use by avian predators.

- Avoid supplementing the diet of Brown-headed Cowbirds, which parasitize songbird nests. If cowbirds come to your feeder, try eliminating millet from the birdseed you provide. Evidence indicates that Brown-headed Cowbirds are attracted to bird feeders primarily for millet. Sunflower seeds and other types of birdseed attract many songbird species, but may not attract cowbirds. In addition, do not use open tray feeders or scattered seed on the ground to feed birds; this attracts cowbirds as well as predators.

- When feeding birds in winter, change birdseed if it gets wet from rain as the moisture may promote mildew or sprouting, which can cause birds to become ill.

- In feeding hummingbirds, use a solution of four parts water to one part sugar. Do not use brown sugar, artificial sweeteners, or red dye. Place the feeders in the shade and change the feeder solution every two to three days to avoid cultivating pathogens that can cause hummingbirds to become ill. In freezing weather, bring feeders indoors at dusk and return them with lukewarm fluid at dawn. Clean feeders every 10 days using a few drops of bleach in the wash water, and let stand before rinsing. Rinse thoroughly many times.

Did you know…

Baby birds will often leave, or fledge, the nest before they look fully-grown. Newly fledged birds are often mistaken for "abandoned." Their parents, however, can find them on the ground and will feed them. Most fledglings will continue to be fed by their parents even after leaving the nest.

How you can help…

Leave young uninjured birds alone, as it is likely their parents are nearby. It is not true that parents will avoid young after humans have handled them, but it is still best to leave nests and young undisturbed. Fledglings should not generally be returned to their nest, as this may disturb the nest site. Trampled vegetation and human activity can alert predators to the presence of the nest. Allowing baby birds to remain in the care of their parents provides them their best opportunity for survival. Be aware that it is against federal law to collect wild birds, nests, or their eggs without a permit.

Did you know…

Bird watching is one of the fastest growing hobbies in this country. According to the US Fish and Wildlife Service, about one-fifth of the American population, more than 50 million people, watch birds each year. This outnumbers hunters and anglers combined. Bird watchers are excellent observers and can contribute to the conservation process.

How you can help…

If you are a bird watcher, volunteer for a bird monitoring program. There are increasing opportunities for bird watchers of all skill levels to gain training and experience in various bird monitoring techniques. Participants gain knowledge in a subject area of interest, learn new skills, and can directly contribute to the science of conservation while enjoying birds in the outdoors. There are increasing opportunities to contribute to bird monitoring projects in riparian habitats throughout the state. Subscribe to the Birder Conservationist, an online newsletter of the American Birding Association at http://www.americanbirding.org/programs/constbc.htm.

Key Audiences for Outreach

When designing and implementing education and outreach programs on riparian habitat in your region, you should ensure your program is addressing one or more of the target groups. The four key user groups that need to be targeted through riparian education and outreach programs are:

- Stakeholders (farmers, ranchers)
- Community Members (families, outdoor recreators, homeowners)
- Educators (school teachers and educators)
- Land managers (government agencies, private landowners, homeowners)

Each of the user groups is outlined here with suggestions of the types of outreach activities that are appropriate for each group.

Stakeholders: Stakeholders are people who rely on the habitat for their livelihood, ranching, farming, recreation companies, etc. These are often the group of people that have the highest potential for protecting riparian birds yet they may be the most difficult to reach. In order to effectively communicate with them, conservationists and educators need to find a common ground and build a relationship of trust. Often times highlighting the economic value of songbirds is a great way to reach these groups, e.g., highlighting the role of songbirds as natural pest control at farms.

There is a wide assortment of government funded agricultural/wildlife conservation programs for farmers (http://www.nrcs.usda.gov/programs/farmbill/2002/products.html). Effective programs that target stakeholders include restoration programs that provide incentives to landowners for restoration and conservation. Private landowners can be reached through flyers, brochures, posters, talks at local growers clubs, county fairs, farmers associations, Natural Resource Conservation Service (NRCS) groups, Resource Conservation Districts (RCD's), etc. Tours that take stakeholders into the field to observe the wildlife that depend and co-exist with their agricultural practices are another effective tool. Incorporating articles about riparian songbirds into stakeholder newsletters is a great way to communicate key messages for songbirds in your region. Perhaps most important is person-to-person contact.

Private landowner conservation programs on agricultural lands work best when there is a person getting to know the farmer and showing them the birds. For example, in the years 2001-2002, the Marin County Resource Conservation District (MRCD), in partnership with PRBO, hired a Riparian Habitat Conservationist. The purpose of this position was to link landowners with the riparian songbirds and habitat on their land through monitoring, newsletter articles, presence at MRCD meetings, and person-to-person contact. As a result, farmers who may not have otherwise thought about the songbirds on their land began allowing a biologist to monitor their creeks, agreeing to initiate restoration projects, and looking for ways to protect their creeks while still supporting their cattle operation. This project was an effective way of bridging the gap between a stakeholder group and wildlife conservation. For more information please contact the MRCD (415) 663-1170 or visit http://www.sonomamarinrcds.org/district-mc/.

Community Members: Community members include the public, birders, local businesses, homeowners, families, and outdoor recreation groups. Economically, this group has a lot of influence especially in terms of access to recreation areas. In addition, community members can participate in conservation indirectly through creating favorable public sentiment, promoting legislation to protect riparian habitat and voting on measures to protect and enhance riparian habitat. As a result it is important that education and outreach programs be targeted to these users.

Appropriate programs for this group include general awareness building programs such as informational flyers, birding trips, mist-netting demonstrations, presentations within the community, outreach at local fairs, articles in newspapers and newsletters, and educational materials on the web. In this broad audience there will be users that are receptive to messages about riparian songbird conservation such as birders or conservationists. Other users, such as homeowners, or equestrians, may be more difficult to reach because conservation measures may limit their activities. In this case, continued outreach is needed to build a trusting relationship. It is essential to provide conservation messages to the bilingual or multilingual communities. To improve communication in diverse communities it is important to work with partners in the community to build conservation connections.

Educators: Educating educators expands the potential to reach larger numbers of people with fewer direct staff. Training educators such as schoolteachers, naturalists, bird tour leaders, and docents in the key messages for riparian songbird conservation for each region is essential. Identifying existing education programs in schools, nature centers, and visitor centers and partnering to infuse conservation messages into their existing programs is a cost effective way to reach a broader audience.

To accomplish this, teacher trainings through existing networks and partnerships are an excellent way to train teachers. Providing them with materials in the form of activities, posters, and bird identification guides are well received. Aligning educational programs with state science standards also makes the teachers more receptive to the messages presented through our materials. When trying to reach educators at nature centers or other docent groups, it is best to offer training for staff and provide them with outreach materials to distribute (informational flyers, posters) (Table 10-1).

Land managers: Land managers are user groups that require more technical information to make informed decisions about changing land management practices to benefit songbirds. In addition, land managers are often charged with managing their preserve or refuge for a variety of resources and are often understaffed for the amount of work they are expected to accomplish. As a result, connecting land managers with riparian songbirds becomes extremely important. Getting land managers into the field with biologists, connecting them to their resource, and showing them the direct benefit their actions can produce for songbirds is critical. Clear, concise messages advising managers on how to alter practices are needed. Slide presentations are also effective in reaching this group.

Educational Opportunities and Successful Programs

We now understand that the majority of plant and wildlife population declines are intimately tied with habitat loss and degradation. Diverse flora and fauna depend on riparian habitats in California during some or all phases of their life cycles; however, with less than 5% of riparian habitat left from historical ranges, these species are under pressure. With these facts in mind, we must act now to turn the tide.

Targeted education and outreach programs are effective tools to heighten awareness about the biological wealth of riparian habitats. Thankfully, in California there are a number of innovative and inspirational education programs focused on riparian habitats and the surrounding watersheds, some of which are outlined in this section. The success of these educational programs is largely built around meaningful learning experiences that inspire appreciation, generate inquiry, and encourage action in the learner; moreover, the programs involve many regional partners in conservation.

Certain educational programs teach hands-on activities, such as ecological restoration.

Education programs engage participants most effectively when they involve hands-on activities. Conservation education has the whole of the outdoors as a classroom - what better way to elicit the interest and enthusiasm of students and the public! Teaching ecosystem connections between plants, birds, fish, invertebrates, amphibians, mammals, hydrology, etc. enriches riparian habitat education programs. There are, in fact, many commonalities between riparian-dependent species that lend themselves to excellent 'teachable topics'; for example, the endangered riparian brush rabbit and many nesting songbirds all need a dense understory of diverse plants in the riparian forest to successfully complete some part of their life cycle (see Recommendation 6.7). Seizing educational opportunities, building alliances among educators, and sharing your program's successes and challenges with other others (e.g., California Partners in Flight Education and Outreach Committee) will help ensure well-informed decision-making in California communities into the future.

Table 10-1. Outreach and education resources for schools, educators, and community groups.

Title	Description	Grade and language	Geographic Range	How to Order
International Migratory Bird Day	Celebration information on IMBD. Activities include bird walks, displays, videos	All grades, Spanish and English	Throughout the Americas	http://www.fs.fed.us/dxnf/IMBD.html
PRBO Teacher Resource Packets	11 activities teaching students about birds and conservation	Adaptable for all grades, English	All of CA	PRBO Education Program 4990 Shoreline Hwy. Stinson Beach, CA 94970 (415) 868-1221 or on the web: www.prbo.org/education
Where Do Birds Nest Poster	11 X 17 black and white poster showing where riparian focal species nest in riparian habitat	All grades, English	All of CA	PRBO Education Program Address previously listed
Helping Birds at Bird Feeders	Handout on safe tips for feeding songbirds	All grades, English	All of CA	PRBO Education Program Address previously listed
The Birders Handbook: A Field Guide to the Natural History of North American Birds	Book gives detailed life history information for all birds in North America	High-school, adult, teacher resource	All of CA	Ehrlich et al. 1988
The Sibley Guide to North American Birds by David Sibley.	Resource field guide	High-school, adult, teacher resource	All of CA	Sibley 2000
Bird Study Guide, Tiburon Audubon Society	On-line study guide for students with information about birds and habitats in Marin County.	Grades 4-12	Marin Co. CA	www.tiburonaudubon.org/jrbird/background.html
Bird Songs of California	Cornell's latest audio guide, "Bird Songs of California" - a 3-CD set featuring the voices of 220 bird species from across the Golden State.	All grades	All of CA	http://birds.cornell.edu/

Table 10-1 continued

Title	Description	Grade and language	Geographic Range	How to Order
Birds Beyond Borders	An international environmental education program linking students in the western US with western Mexico through birds.	Grades 3-6	All of the western US	Rocky Mountain Bird Observatory 14500 Lark Bunting Lane Brighton, CO 80601 303-659-4348 education@rmbo.org
The Songbird Blues	A trunk of materials and resources exploring neotropical birds	Grades K-5	All of the Americas	Montana Natural History Center 1617 Roland Ave. Missoula, MT 59801 406 543-6886
Birds in Hand and Field	An activity booklet that makes a great accompaniment to a visit to a mist-netting or bird banding demonstration	K-7	Throughout the West.	Rocky Mountain Bird Observatory 14500 Lark Bunting Lane Brighton, CO 80601 303-659-4348 education@rmbo.org
Keeping Your Nest Box Safe for Songbirds in the West	Handout on how to safely use nest boxes	All grades, English	All of CA	PRBO Education Program Address previously listed
Helping Birds At Home	Handout on how to landscape your yard to help songbirds	All grades, English	All of CA	PRBO Education Program Address previously listed

Table 10-2. Outreach and education resources for wildlife managers and stakeholders (farmers, ranchers).

Title	Description	Geographic Range	How to Order
Riparian Bird Conservation Plan	Science-based bird conservation plan containing recommendations for land managers on enhancing riparian habitat for birds	All of CA	California Partners In Flight 4990 Shoreline Hwy. Stinson Beach, CA 94970 (415) 868-0655 or on the web: www.prbo.org/calpif
Recommendations for Improving Riparian Bird Habitat on Private Lands in Marin County	Handout on how private landowners can enhance their Riparian habitat for birds	Marin County	PRBO Education Program 4990 Shoreline Hwy. Stinson Beach, CA 94970 (415) 868-1221 or on the web: www.prbo.org/education
Improving Songbird Habitat on Your Horse Ranch	Handout on how to improve songbird Habitat on Your Horse Ranch	All of CA	PRBO Education Program Address previously listed
Decreasing Crows and Ravens on Ranches and Dairies	Handout on how to decrease the number of crows and ravens associated with livestock.	All of CA	PRBO Education Program Address previously listed
Horse Keeping: A guide to Land Management for Clean Water	A guidebook prepared by the Bay Area Resource Conservation Districts outlining land management for clean water on horse facilities.	Designed for the Bay Area but could be used throughout CA.	PRBO Education Program Address previously listed

Educational Opportunities

The concepts and guidelines outlined in this chapter can be presented to the public and to students through a variety of media. Following is a list of common education opportunities and some suggestions for content:

Classroom Education

Programs in the classroom should focus on communicating key concepts to students through hands-on activities. Lessons should stress studying birds in the field - whether in the backyard, on school grounds, or in a nearby natural area - and include keeping field notes and observing natural behaviors of birds. Field trips to riparian areas with groups conducting bird conservation and monitoring projects fosters interest and enthusiasm for wildlife and teaches students the importance of conserving birds.

One method of educational outreach, called project-based learning, allows an open-ended approach to solving a conservation problem. Students identify a local conservation issue in their community and through library and field research plan and implement a project from idea conception to project completion. Teachers and students work co-operatively to make important decisions, while working with biologists, land managers, business people, private landowners and others in the community. Because of this investment and emphasis on self-direction, students take ownership of their work, and the lessons learned are profound and long lasting (Rogers, pers. comm.).

A great way to get students interested in birds is through bird observation in the field. While access to binoculars is sometimes limited, you can contact your local Audubon Society, nature center or other local wildlife education group to see if sets are available for check out. If you feel uncertain of your birding skills, contact your local Audubon Society or Nature Center to see if there are any docents or naturalists who will can join your class for a day of birding. An invaluable experience that catches students' interest immediately is to visit a mist-netting site where students have the opportunity to examine birds up close and interact with biologists.

There are many excellent sources for curriculum and hands-on bird activities for the classroom. Many can be found in the table of educational resources listed on pages 100-101. Another useful source is *A Guide to Bird Education Resources* produced by Partners in Flight and the National Fish and Wildlife Foundation. Copies of this book are available from American Birding Association Sales, PO Box 6599, Colorado Springs, CO 80934, phone 1-800-850-2473, member@aba.org. In addition, the California Partners in Flight Education Committee is working on producing educational tools, kits, and resource guides for educators in California. Contact the CalPIF Education Coordinator through the website at http://www.prbo.org/calpif/education.html to find out more.

Volunteer Involvement

Using volunteers to aid in data collection and restoration is an excellent way to gain additional help and to teach people about conservation. Increasingly, families and school groups have opportunities to participate in habitat restoration projects at local parks or nature preserves. Volunteers that participate in counting and studying birds quickly develop a connection to them, which intimately involves the volunteer in the conservation effort. Furthermore, volunteers provide additional support and resources that make long-term monitoring of songbirds viable. To ensure reliable data collection, supervisors must match monitoring techniques with the skill level of the volunteer.

Interpretation at Natural Areas

Interpretation is an excellent way to disseminate key concepts about bird conservation to the public. Displays at preserves, public parks, nature trails, picnic areas, and other natural areas should highlight the birds using the habitats and show the specific features of the habitat that are critical to bird reproduction and survival, including assemblages of native plants. Displays can effectively illustrate how individuals can make a difference at home (e.g., planting native plants in their yards or restraining cats from killing birds). These displays should be aimed at the general public, emphasizing the causes of the decline of songbirds. Again, integrating people as part of the solution encourages their support for conservation issues.

Participation in Birding Festivals and Environmental Fairs

Birding festivals are becoming a popular means of enhancing local economies through ecotourism, which can help to promote local support for conservation of natural areas–a requirement for long-term sustainability of conservation actions. Festivals also present an excellent opportunity to further educate people already familiar with birds about the scientific reasons behind bird conservation. Birders already recognize and love birds and can easily be taught the reasons for bird conservation and what a healthy bird population needs to survive. Birders also constitute a pool of experienced observers who may volunteer for monitoring programs.

Representation of bird conservation at environmental fairs is another way to reach large numbers of people, convey the key concepts behind bird conservation, and build conservation partnerships in the region. Booths that convey the key conservation messages and provide information on how individuals can help through interactive games or activities for children engage families and visitors in bird conservation topics. The National Fish and Wildlife Foundation has published Bridges to Birding, an interactive program for introducing birds, bird watching, and bird conservation to your community. It contains step-by-step instructions on how to put on a festival or fair focusing on birds. To obtain a copy contact IMBD Information Center at (703) 358-2318 or IMBD@fws.gov.

Conducting an International Migratory Bird Day celebration is another excellent way to get local recognition of birds through this international program of the National Fish and Wildlife Foundation. International Migratory Bird Day celebrates the incredible journeys of migratory birds between their breeding grounds in North America and their wintering grounds in Mexico, Central, and South America. The event, which takes place on the second Saturday in May each year, encourages bird conservation and increases awareness of birds through hikes, bird watching, information about birds and migration, public events, and a variety of other education programs. Schedule an IMBD celebration near you. For more information visit www.birdday.org.

Examples of Successful Programs

Mono Basin Birding Chautauqua

The Mono Basin Bird Chautauqua is a birding festival with a mission to enhance the appreciation and understanding of the Mono Basin's diverse and abundant bird life and to educate the public about the area's value to birds and people. The Chautauqua takes place annually over the summer solstice weekend when bird activity in the Basin is at its height. Through field trips, evening presentations by Mono Basin expert biologists, seminars, and special kids' activities, many levels of bird enthusiasts can find something of interest. The event is both volunteer operated and cooperatively organized by several agency and nonprofit partners including Inyo National Forest, Mono Lake Tufa State Reserve, Mono Lake Committee, PRBO Conservation Science, and the Eastern Sierra Audubon Society. Interest and attendance has dramatically increased in the first two years of the Chautauqua, and enthusiasm for the event continues to grow. In 2002 and 2003, 150 and 250 people participated, respectively. The Mono Basin Bird Chautauqua is an excellent example of a bird-focused event that targets a diverse audience and provides a powerfully informative and affective experience for visitors. For more information about the event please visit the website: http://www.birdchautauqua.org/. A similar type of festival is held annually at the Kern River Preserve celebrating the wildlife of the Kern River Valley. For more information visit http://www.valleywild.org/bioregion.htm.

STRAW Bird Project

The STRAW Project coordinates and sustains a network of teachers, students, restoration specialists and other community members as they plan and implement watershed studies and restoration projects in Marin and Sonoma counties. STRAW provides teachers and students with the scientific, educational and technical resources to prepare them for hands-on, outdoor watershed studies, including ecological restoration of riparian corridors. STRAW's overarching goals are to empower students, support teachers, restore the environment, and reconnect communities. STRAW's educational programs include restoration, birds, water quality, and plants. For more information visit www.bay.org/watershed_education.htm.

Mist-netting demonstrations for the public

Providing opportunities for the public to observe mist netting and bird banding demonstrations is an excellent way to connect people with birds and bird conservation science. The following organizations and bird observatories offer public and/or school programs: Big Sur Ornithology Lab www.ventanaws.org/lab.htm, Klamath Bird Observatory www.kbo.org, Humboldt Bay Bird Observatory (a subsidiary of Klamath Bird Observatory), PRBO Conservation Science www.prbo.org, San Francisco Bay Bird Observatory www.sfbbo.org, and Wright Wildlife Refuge.

Chapter 11. Literature Cited

Anders, A. D. and M. R. Marshall. In press. Increasing the accuracy of productivity and survival estimates in assessing landbird population status. Conservation Biology.

Anderson, B. W. and R. D. Ohmart. 1982. Revegetation and wildlife enhancement along the lower Colorado River. U.S. Dept. of the Interior, Bureau of Reclamation. Contract 7-07-30-V0009. 215 pp.

Anderson, B. W., R. D. Ohmart, and J. Rice. 1983. Avian and vegetation community structure and their seasonal relationship in the lower Colorado River Valley. Condor 85(4):392-405.

Andren, H. 1992. Corvid density and nest predation in relation to forest fragmentation: a landscape perspective. Ecology 73:794-804.

Andren, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71:355-366.

Ballard, G. 2003. Tools for songbird monitoring. PRBO's terrestrial program protocols, data structures, field data forms, and computer programs for data management and analysis. www.prbo.org/tools/. Point Reyes Bird Observatory, Stinson Beach, CA.

Ballard, G., G. R. Geupel, D. Barton, and D. Moody. 2003a. California Partners In Flight study areas database: an interactive geographic interface to California's landbird monitoring data: http://cain.nbii.gov/prbo/calpifmap/livemaps/. Point Reyes Bird Observatory. Stinson Beach, CA.

Ballard, G., G. R. Geupel, N. Nur, & T. Gardali. 2003b. Long-term declines and decadal patterns in population trends of songbirds in western North America. Condor 105:737-755.

Bednarz, J. C., J. C. Hovis, and D. M. Evans. 1998. Ongoing changes in Swainson's Thrush population related to landscape fragmentation and forest management. Paper presented at the North American Ornithological Conference, April 1998. St. Louis, MO.

Beedy, E. and W. J. Hamilton III. 1997. Tricolored Blackbird status update and management guidelines. Report prepared for the U.S. Fish and Wildlife Service, Portland, OR and the California Department of Fish and Game.

Beedy, E. C. and W. J. Hamilton III. 1999. Tricolored Blackbird (*Agelaius tricolor). In* The Birds of North America, No. 423 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Biodiversity Council. 2003. http://ceres.ca.gov/biodiversity/

Biosystems Analysis, Inc. 1994. Life on the Edge: a Guide to California's Endangered Natural Resources. Heyday Books, Berkeley, CA and BioSystems Books, Santa Cruz, CA.

Blaustein, A. R. and D. B. Wake. 1990. Declining amphibian populations: a global phenomenon? Trends in Ecology and evolution 5:203-204.

BLM (U.S. Bureau of Land Management). 1998. Northern and eastern Colorado Desert coordinated management plan (NECO Plan). Bureau of Land Management. Riverside, CA.

Bolger, D. T., A. C. Alberts, and M. E. Soulé. 1991. Occurrence patterns of bird species in habitat fragments - sampling, extinction, and nested species subsets. American Naturalist 137:155-166.

Bolger, D. T., T. A. Scott, and J. T. Rotenberry. 2001. Use of corridor-like landscape structures by bird and small mammal species. Biological Conservation 102:213-224.

Bombay, H. L. 1999. Scale perspectives in habitat selection and reproductive success for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. M.S. Thesis, California State University, Sacramento, CA.

Bombay, H. L., M. L. Morrison, and L. S. Hall. 2003. Scale perspectives in habitat selection and animal performance for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. Studies in Avian Biology 26:60-72.

Bonney, R., D. N. Pashley, R. J. Cooper, and L. Niles (eds.). 2000. Strategies for bird conservation: The Partners in Flight planning process; Proceedings of the 3rd Partners in Flight Workshop; 1995 October 1-5; Cape May, N.J. Proceedings RMRS-P-16. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 281 pp.

Bryce, S. A., R. M. Hughes, and P. R. Kaufmann. 2002. Development of a bird integrity index: using bird assemblages as indicators of riparian condition. Environmental Management 30(2):294-310.

Budnik, J. M., M. R. Ryan, and F. R. Thompson. 2000. Demography of Bell's Vireo in Missouri grassland-shrub habitats. Auk 117(4):925-935.

Burnett, R. D. and J. DeStaebler. 2001. Songbird monitoring in the Lower Clear Creek Floodway Restoration Project, 2001. PRBO contribution # 1005.

Burnett, R. D. and J. DeStaebler. 2002. Songbird monitoring in the Lower Clear Creek Floodway Restoration Project, 2002. PRBO contribution # 1098.

Burnett, R. D. and G. R. Geupel. 2001. Songbird monitoring in the Lassen National Forest: results from the 2001 field season. PRBO contribution # 1003.

Burnett, R. D., T. Gardali and G. R. Geupel. In press. Using songbird monitoring to guide and evaluate riparian restoration in salmonid focused stream rehabilitation projects. *In* C. J. Ralph and T. D. Rich (eds.). Proceedings of the Third International Partners in Flight conference. USDA Forest Service Publication. Asilomar, CA.

Cain, J. W. III., M. L. Morrison, and H. L. Bombay. 2003. Predator activity and nest success of Willow Flycatchers and Yellow Warblers. Journal of Wildlife Management 67:600-610.

CalPIF (California Partners in Flight). In prep. The Desert Bird Conservation Plan.

Callicott, J. B. 1986. On the Intrinsic Value of Nonhuman Species in the Preservation of Species: the value of biological diversity. Bryan G. Norton (ed.). Princeton University Press, pp. 138-172.

Cardiff, E. A. 1996. Breeding bird census 1995: desert riparian freshwater marsh. Journal of Field Ornithology. 67:75.

Carter, M. F., W. C. Hunter, D. N. Pashley, and K. V. Rosenberg. 2000. Setting conservation priorities for landbirds in the United States: the Partners in Flight approach. Auk 117:541-548.

CDF (California Department of Forestry and Fire Protection). 2002. Multi-source Land Cover Data (2002 V2). http://www.fire.ca.gov/php/

CDFG and PRBO. 2001. California Bird Species of Special Concern: Draft List and Solicitation of Input. http://www.prbo.org

CEC (Commission for Environmental Cooperation). 1998. A Proposed framework for delineating ecologically-based planning, implementation, and evaluation units for cooperative bird conservation in the U.S.

Chalfoun, A. D., F. R. Thompson, and M. J. Ratnaswamy. 2002. Nest predators and fragmentation: a review and meta-analysis. Conservation Biology 16:306-318.

Chapel, M. Z. 1992. Recommendations for managing late-seral stage forest and riparian habitats on the Tahoe. U.S. Forest Service. Region 5.

Chase, M. K., N. Nur, and G. Geupel. 1997. Survival, productivity, and abundance in a Wilson's Warbler Population. Auk 114:354-366.

Chase, M. K., W. B. Kristan III, A. J. Lynam, M. V. Price, J. T. Rotenberry. 2000. Single species as indicators of species richness and composition in California coastal sage scrub birds and small mammals. Conservation Biology 14:474-487.

Chase, M. K. and G. R. Geupel. In press. The use of avian focal species for conservation planning in California. *In* C. J. Ralph and T. D. Rich (eds.). Proceedings of the Third International Partners In Flight conference. USDA Forest Service Publication. Asilomar, CA.

Cogswell, H. L. 1962. Operation recovery begun in California's Central Valley. Western Bird Bander 37:5254.

Coleman, J. S., S. A. Temple, and S. R. Craven. 1997. Cats and wildlife: A conservation dilemma. Cooperative Extension Publications, Room 170, 630 W. Mifflin Street, Madison, WI 53703, 608-262-3346. http://www.wisc.edu/wildlife/e-pubs.html.

Cooper, C. B. and J. R. Walters. 2002. Experimental evidence of disrupted dispersal causing decline of an Australian passerine in fragmented habitat. Conservation Biology 16:471-478.

Crooks, K. R. and M. E. Soulé. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

Crooks, K. R., A. V. Suarez, D. T. Bolger, and M. E. Soulé. 2001. Extinction and colonization of birds on habitat islands. Conservation Biology 15:159-172.

Davidson, C. 1995. Determining habitat conservation priorities for Neotropical migrant birds in California. Draft report. USDA. Forest Service, Pacific Southwest Research Station and Pacific Southwest Region. San Francisco, CA.

Davis, F. W. and D. M. Stoms. 1996. Sierran vegetation; a gap analysis. Sierra Nevada Ecosystem Project, Final Report to Congress, vol II, Assessments and Scientific Basis for Management Options. University of California, Davis.

Dawdy, D. R. 1989. Feasibility of mapping riparian forests under natural conditions in California. Pp. 63-68 *in* Proceedings of the California Riparian Systems Conference. GTR PSW-110, Davis, CA.

DeSante, D. F. 1992. Monitoring Avian Productivity and Survivorship (MAPS): a sharp, rather than blunt, tool for monitoring and assessing landbird populations. Pp. 511-521 *in* D. R. McCullough and R. H. Barrett (eds.). Wildlife 2001: Populations. Elsevier Applied Science, London, U.K.

DeSante, D. F. 1995. Suggestions for future directions for studies of marked migratory landbirds from the perspective of a practitioner in population management and conservation. Journal of Applied Statistics 22:949-965.

DeSante, D. F. and G. R. Geupel. 1987. Landbird productivity in central coastal California: the relationship to annual rainfall and a reproductive failure in 1986. Condor 89:636-653.

DeSante, D. F. and T. L. George. 1994. Population trends in the landbirds of western North America. Pp. 173-190 *in* J. R. Jehl, Jr. and N. K. Johnson (eds.). A century of avifaunal change in western North America. Studies in Avian Biology No. 15. The Cooper Ornithological Society, Lawrence, KS.

DeSante, D. F. and D. K. Rosenberg. 1998. What do we need to monitor in order to manage landbirds? Pp. 93-110 *in* J. M. Marzluff and R. Sallabanks (eds.). Avian Conservation: Research and Management, Island Press, Washington, D.C.

DeSante, D. F., K. M. Burton, J. F. Saracco, and B. L. Walker. 1995. Productivity indices and survival rate estimates from MAPS, a continent-wide program of constant-effort mist-netting in North America. Journal of Applied Statistics 22:935-947.

DeSante, D. F., K. M. Burton, P. Velez, and D. Froehlich. 1999[a]. MAPS Manual: 1999 Protocol. The Institute for Bird Populations, Point Reyes Station, CA.

DeSante, D. F., D. R. O'Grady, and P. Pyle. 1999[b]. Measures of productivity and survival derived from standardized mist netting are consistent with observed population trends. Bird Study 46 (suppl.): s178-s188.

DiGaudio, R. T. 2003. Songbird richness, diversity and abundance in mature and early successional stage riparian habitat on the Cosumnes River. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Dobkin, D. S. 1994. Conservation and management of Neotropical migrant landbirds in the Northern Rockies and Great Plains. University of Idaho Press, Moscow.

Dobkin, D. S., A. C. Rich, and W. H. Pyle. 1998. Habitat and avifaunal recovery from livestock grazing in a riparian meadow system of the northwest Great Basin. Conservation Biology 12:209-221.

Donovan, T. M., P. W. Jones, E. M. Annand, and F. R. Thompson, III. 1997. Variation in local-scale edge effects: mechanisms and landscape context. Ecology 78: 2064-2075.

Donovan, T. M., C. J. Beardmore, D. N. Bonter, J. D. Brawn, R. J. Cooper, J. A. Fitzgerald, R. Ford, S. A. Gauthreaux, T. L. George, W. C. Hunter, T. E. Martin, J. Price, K. V. Rosenberg, P. D. Vickery, and T. B. Wigley. 2002. Priority research needs for the conservation of Neotropical migrant landbirds. Journal of Field Ornithology 73(4):329-339.

Eckerle, K. P., and C. F. Thompson. 2001. Yellow-breasted Chat (*Icteria virens*). *In* The Birds of North America, No. 575 (A. Poole ad F, Gukkm eds.). The Birds of North America, Inc., Philadelphia, PA.

Erlich, P., Dobkin, D., and Wheye, D. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon and Schuster, Inc.

Erman, D.C., J.D. Newbold, and K.B. Roby. 1977. Evaluation of streamside bufferstrips for protecting aquatic organisms. Univ. of California, California Water Resources Center, Davis. 48pp.

Estep, J. A. 1989. Biology, movements and habitat relationships of the Swainson's Hawk in the Central Valley of California. California Department of Fish and Game. Project Number: CA W-064-4-02.

Faaborg, J. 2002. Saving migrant songbirds: developing strategies for the future. University of Texas Press.

Faber, P.M. (ed.) 2003. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Farmer, C. 1999. The density and distribution of Brown-headed Cowbirds: the central coast enigma. Studies in Avian Biology No. 18:62-67.

Flood Emergency Action Team (FEAT) 1997. Final Report of the Flood Emergency Action Team. http://rubicon.water.ca.gov/FEATReport120.fdr/featindex.html

Fisher, A. K. 1893. The Death Valley Expedition: a biological survey of parts of California, Nevada, Arizona, and Utah (Part II). North American Fauna 7:1-393. USDA, Div. Ornith. and Mammal., Washington D.C.

Flannery, M. E., S. L. Guers, T. Gardali, N. Nur, and G. R. Geupel. 2004. Landbird migration at the Salton Sea: the importance of desert riparian habitat. Studies in Avian Biology: 27:106-115.

Forman, R. T. T. 1995. Some general principles of landscape and regional ecology. Landscape Ecology, 10(3):133-142.

Forman, R. T. T. and M. Godron. 1986. Landscape Ecology. John Wiley & Sons, New York.

Franzreb, K. E. 1989. Ecology and conservation of the endangered Least Bell's Vireo. U.S. Fish and Wildlife Service, Biol. Rep. 89(1). 17pp.

Freemark, K. E., J. B. Dunning, S. J. Hejl, and J. R. Probst. 1995. A landscape ecology perspective for research, conservation and management. Pp. 381-427 *in* T. Martin and D. Finch (eds.). Ecology and Management of Neotropical Migratory Birds. Oxford University Press, New York.

Gaines, D. 1974. The nesting riparian avifauna of the Sacramento Valley, California and the status of the Yellow-billed Cuckoo. MS Thesis. University of California. Davis, CA.

Gaines, D. F. 1977. The valley riparian forests of California: their importance to bird populations. *In* A. Sands (ed.). Riparian forests in California: their ecology and conservation. Institute of Ecology Publication 15. University of California. Davis, CA.

Gallo, J. A., J. A. Scheeter, M. A. Holmgren, and S. I. Rothstein. 2000. Initiation of a long term ecological monitoring project: Avian point counts and habitat assessment in riparian communities in 1998 at Vandenberg Air Force Base, California. University of California, Santa Barbara, Museum of Systematics and Ecology. Environmental Report No. 13.

Gardali, T., A. King, and G. Geupel. 1998. Cowbird parasitism and nest success of the Lazuli Bunting in the Sacramento Valley. Western Birds 29:174-179.

Gardali, T., S. E. Scoggin, G. R. Geupel. 1999. Songbird use of Redwood and Lagunitas Creeks: management and restoration recommendations. Report to the Golden Gate National Recreation Area. PRBO contribution # 903.

Gardali, T., G. Ballard, N. Nur, and G. R. Geupel. 2000. Demography of a declining population of Warbling Vireo in coastal California. Condor 102:601-609.

Gardali, T., C. Shoulders, D. Hatch, A. L., S. E. Scoggin, and G. R. Geupel. 2001. Songbird monitoring in the Golden Gate National Recreation Area: a multifaceted tool for guiding restoration of Redwood Creek. Park Science 21(1):28-32.

Geupel, G. R., G. Ballard, N. Nur, and A. King. 1997[a]. Population status and habitat associations of songbirds along riparian corridors of the lower Sacramento River: results from 1995 field season and summary of results 1993 to 1995. Point Reyes Bird Observatory report to the U.S. Fish and Wildlife Service and The Nature Conservancy. Stinson Beach, CA.

Geupel, G. R., G. Ballard, and A. King. 1997[b]. Songbird monitoring on the Cosumnes River Preserve: results from the 1995 field season. Point Reyes Bird Observatory report to The Nature Conservancy. Stinson Beach, CA.

Geupel, G. R., G. Ballard, L. Pomara, D. Stralberg, N. Nur, and S. Scoggin. 2003. Developing population objectives for California landbirds. Paper presented at the 72nd annual meeting of the Cooper Ornithological Society, April 2003. Flagstaff, AZ.

Gilchrist, J., P. Pintz, and S. L. Small. 2002. Riparian bird communities in the Sacramento Valley: a report of the 2001 field season. A report of the Point Reyes Bird Observatory to The Nature Conservancy California, U.S. Fish and Wildlife Service, California Department of Parks and Recreation, and Sacramento River Partners. PRBO contribution # 1041.

Golet, G. H. 2001. The Riparian Bird Conservation Plan: Book Review. Western Birds 32:182.

Goguen, C. B. and N. E. Mathews. 1999. Review of the causes and implications of the association between cowbirds and livestock. Studies in Avian Biology No. 18:10-17.

Goldstein, M. I., T. E. Lacher, B. Woodbridge, M. J. Bechard, S. B. Canavelli, M. E. Zaccagnini, G. P. Cobb, E. J. Scollon, R. Tribolet, and M. J. Hooper. 1999. Monocrotophos-induced mass mortality of Swainson's Hawks in Argentina, 1995-96. Ecotoxicology 8(3):201-204.

Goldwasser, S. 1978. Distribution, reproductive success and impact of nest parasitism by Brown-headed Cowbirds of Least Bell's Vireos. State of Calif., The Resources Agency, Calif. Dept. of fish and Game. Fed. Aid. Wildl. Rest. W-54-R-10, Nongame Wildl. Prog. Job W 1.5.1, Final Rept.

Goldwasser, S., D. Gaines, and S. Wilbur. 1980. The Least Bell's Vireo in California: a de facto endangered race. Am. Birds 34:742-745.

Granholm, S. L. 1987. Wildlife Handbook for Tuolumne County Wildife Inventory and Evaluation Project. Holton Associates, Berkeley, CA 94706.

Greco, S. E., R. E. Plant, and R. H. Barrett. 2002. Geographic modeling of temporal variability in habitat quality of the Yellow-billed Cuckoo on the Sacramento River, miles 196-219, California. *In* J. M. Scott, P. J. Heglund, M. L. Morrison, J. G. Haufler, M. G. Raphael, W. A. Wall, and F. B. Samson (eds.). Predicting Species Occurrences: Issues of Accuracy and Scale. Island Press, Washington, D.C.

Griffin, P. C. and T. J. Case. 2001. Terrestrial habitat preferences of adult arroyo southwestern toads. Journal of Wildlife Management 65(4):633-644.

Griffith Wildlife Biology. 1999. The status of the Least Bell's vireo at Marine Corps Base Camp Pendleton in 1999. Unpublished report prepared for AC/S, Camp Pendleton by Jane C. Griffith and John T. Griffith, Griffith Wildlife Biology, Calumet, Michigan.

Grinnell, J. and A. H. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna 27. Cooper Ornithological Club. Berkeley, CA.

Haff, T. M., R. T. DiGaudio, G.R. Geupel. 2001. Songbird Monitoring on the Consumnes River Preserve: a progress report of the 2000 field season.

Haff, T. M. 2003. Riparian restoration and nest success. What can we learn from the Modesto Song Sparrow? California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Hagar, J. C. 1999. Influence of riparian buffer width on bird assemblages in western Oregon. Journal of Wildlife Management 63:484-496.

Hahn, D. C., J. Sedgwick, I. Painter, and N. J. Carna. 1999. A spatial and genetic analysis of cowbird host selection. Studies in Avian Biology No. 18:204-217.

Haig, S. M., D. W. Mehlman, and L. W. Oring. 1998. Avian Movements and wetland connectivity in landscape conservation. Conservation Biology 12:749-758.

Halterman, M. D., D. S. Gilmer, S. A. Laymon, and G. A. Falxa. 2001. Status of the Yellow-billed Cuckoo in California: 1999-2000. Report to the USGS-BRD Dixon Field Station, 6924 Tremont Rd, Dixon, CA 95620.

Hamilton, W. J., III. In press. Current policies and programs affecting Tricolored Blackbird (*Agelaius tricolor*) restoration.

Hamilton, B., L. Cook, and K. Hunting 1999. Tricolored Blackbirds 1999 Status Report. Unpublished report to California Department of Fish and Game.

Hammond, J. and G.R. Geupel. 2000. Songbird monitoring on the San Joaquin River National Wildlife Refuge: a progress report for the 2000 field season.

Hanski, I. A. and M. E. Gilpin. 1997. Metapopulation Biology: ecology, genetics, and evolution. Academic Press, San Diego.

Harris, C. 1991. The Avocet, Feb. 1991. Santa Clara Valley Audubon Society. Palo Alto, CA.

Heath, S. K. 2002. Bird monitoring, habitat assessment and visitor education in montane meadow and riparian habitats of Devil's Postpile National Monument: Results from the 2002 field season. PRBO contribution #1064.

Heath, S. K. and G. Ballard. 1999. Songbird monitoring of riparian communities in the eastern Sierra Nevada and western Great Basin region: Results of the 1998 field season. PRBO contribution # 849.

Heath, S. K. and G. Ballard. 2002[a]. Riparian monitoring and habitat assessment in the East and West Walker River watersheds, Bridgeport Ranger District, Humboldt-Toiyabe National Forest: results from the 2001 field season.

Heath, S.K. and G. Ballard. 2002[b]. How viable are Yellow Warbler populations in eastern California and what habitat features affect their nesting success? Poster presented at the 3rd International Partners in Flight Conference. Asilomar, CA.

Heath, S. K. and G. Ballard. 2003[a]. Breeding bird species richness and occurrence in riparian aspen habitats of the eastern Sierra Nevada: are all aspen groves the same? Poster presented at Aspen Management Workshop. May 2003.

Heath, S. K. and G. Ballard. 2003[b]. Bird species composition, phenology, nesting substrate and productivity for the Owens Valley alluvial fan, eastern Sierra Nevada, California 1998-2002. Great Basin Birds 6(1):18-36.

Heath, S. K. and G. Ballard. 2003. Patterns of breeding songbird diversity and occurrence in riparian habitats of the eastern Sierra Nevada. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.. PRBO contribution # 767.

Heath, S. K. and H. R. Gates. 2002. Riparian bird monitoring and habitat assessment in riverine/riparian habitats of the Lower Owens River Project: baseline results from the 2002 field season. PRBO contribution # 809.

Heath, S. K., C. McCreedy, and G. Ballard. 2001. Eastern Sierra Riparian Songbird Conservation. 1998-2000 final report and Mono Basin 2000 progress report. PRBO contribution # 1002.

Heath, S. K., C. McCreedy, and G. Ballard. 2002[a]. Eastern Sierra Riparian Songbird Conservation. 2001 progress report. PRBO contribution # 1010.

Heath, S. K., C. McCreedy, H. R. Gates, and Q. Latif. 2002[b] . Eastern Sierra Riparian Songbird Conservation. Results of the 2002 field season. PRBO contribution # 1066.

Heath, S. K., G. Ballard, and C. McCreedy. 2002[c]. How viable are Yellow Warbler populations in eastern California and what habitat features affect their nesting success? Poster presented at the 3rd International Partners in Flight Conference. Asilomar, CA.

Hochachka, W. M., T. E. Martin, V. Artman, C. R. Smith, S. J. Hejl, D. E. Andersen, D. Curson, L. Petit, N. Mathews, T. Donovan, E. E. Klaas, P. B. Wood, J. C. Manolis, K. P. McFarland, J. V. Nichols, J. C. Berdnarz, D. M. Evans, J. P. Duguay, S. Garner, J. Tewksbury, K. L. Purcell, J. Faaborg, C. B. Goguen, C. Rimmer, R. Dettmers, M. Knutson, J. A. Collazo, L. Garner, D. Whitehead, and G. Geupel. 1999. Scale dependence in the effects of forest cover on parasitization by Brown-headed Cowbirds. Studies in Avian Biology No. 18:80-88.

Holmes, A., D. L. Humple, T. Gardali, and G. R. Geupel. 1999. Songbird habitat associations and response to disturbance in the Point Reyes National Seashore and the Golden Gate National Recreation Area. Point Reyes Bird Observatory, Stinson Beach, CA.

Holmes A. L., M. E. Flannery, and G. R. Geupel. 2003. The effects of saltcedar (Tamarix spp.) on resident songbirds in riparian habitats of the Salton Sea. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Humple, D. L. and G. R. Geupel. 2002. Autumn populations of birds in riparian habitat of California's central valley. Western Birds 33:34-50.

Humple, D. L. and R. D. Burnett. 2004. Songbird monitoring in meadow and shrub habitats within the Lassen National Forest: Results from the 2003 field season. A progress report to the U.S. Forest Service. PRBO contribution # 1173.

Humple, D. L., A. L. Holmes, K. Lindquist, and A. Campomizzi. 2002. Monitoring shrubsteppe and riparian bird communities in northeastern California and northwestern Nevada. A progress report to BLM. PRBO contribution # 1062.

Hunter, J. C., K. B. Willett, M. C. McCoy, J. G. Quinn, and K. E. Keller. 1999. Prospects for preservation and restoration of riparian forests in the Sacramento Valley, California, USA. Environmental Management 24:65-75.

Jaramillo, A. and S. E. Hudson. 2003. Long terms trends and habitat associations of birds using a riparian restoration site. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. 2001 Riparian Habitat and Floodplain Conference. Riparian Habitat Joint Venture, Sacramento, CA.

Jensen, D., S. Torn, and J. Harte. 1993. In our hands: a strategy for conserving California's biological diversity. University of California Press. Berkeley, CA.

Johnson, J. and F. McCormick, Technical Coordinators. 1979. Strategies for protection and management of floodplain wetlands and other riparian ecosystems. General Tech. Report WO12. U.S. Forest Service.

Johnson, M. and G. Geupel. 1996. The importance of productivity to the dynamics of a Swainson's Thrush population. Condor 98:133-141.

Johnson, R. R., C. D. Ziebell, D. R. Patton, P. F. Ffolliot, and R. H. Hamre, Technical coordinators. 1985. Riparian ecosystems and their management: reconciling conflicting uses. Gen. Tech. Report GM-120. U.S. Forest Service. Fort Collins, CO.

Kareiva, P. and M. Andersen. 1988. Spatial aspects of species interactions. Pp. 35-50 *in* A. Hastings (ed.). Community Ecology: Workshop held at Davis, California, April 1986. Springer-Verlag, New York, New York.

Katibah, E. F. 1984. A brief history of riparian forests in the Central Valley of California. *In* R. E. Warner and K. M. Hendrix (eds). California Riparian Systems: Ecology, Conservation, and Productive Management. University of California Press Ltd. London, England.

King, A., J. R. King, and G. R. Geupel. 1999. Songbird monitoring in the Lassen National Forest and Lassen Volcanic National Park: Progress report of the 1998 field season.

King, A. M., J. R. King, A. L. Holmes, and N. Nur. 2001. Songbird monitoring in Almanor Ranger District (Lassen National Forest) and Lassen Volcanic National Park: 1997-1999. PRBO contribution #949.

King, A. M. and J. R. King. 2003. Willow Flycatchers in Warner Valley, Plumas County, California. *In* M. K. Sogge, B. E. Kus, S. J. Sferra, and M. J. Whitfield (eds). Ecology and Conservation of the Willow Flycatcher. Studies in Avian Biology No. 26. Pp. 56-59.

Knopf, F. L., R. R. Johnson, T. Rich, F. B. Samson, and R. C. Szaro. 1988. Conservation of riparian ecosystems in the United States. Wilson Bulletin 100:272-284.

Kus, B. E. 1998. Use of restored riparian habitat by the endangered Least Bell's Vireo (*Vireo bellii pusillus*). Restoration Ecology 6:1.

Kus, B. 1999. Impacts of Brown-headed Cowbird parasitism on productivity of the endangered Least Bell's Vireo. Studies in Avian Biology 18:160-166.

Kus, B.E. 2002. Fitness consequences of nest desertion in an endangered host, the Least Bell's Vireo. Condor 104(4):795-802.

LADWP (Los Angeles Department of Water and Power). 1996. Mono Basin stream and stream channel restoration plan. Prepared for the State Water Resources Control board in response to the Mono Lake Basin Water Rights Decision 1631. Los Angeles, CA.

Lambeck, R. J. 1997. Focal species: a multispecies umbrella for nature conservation. Conservation Biology 11:849-856.

Larison, B., S. A. Laymon, P. L. Williams, and T. B. Smith. 1998. Song Sparrows vs. cowbird brood parasites: impacts of forest structure and nest-site selection. Condor 100:93-101.

Larison, B., S. A. Laymon, P. L. Williams, and T. B. Smith. 2001. Avian responses to restoration: nest-site selection and reproductive success in Song Sparrows. Auk 118(2):432-442.

Laymon S. A. 1987. Brown-headed Cowbirds in California: historical perspectives and management opportunities in riparian habitats. Western Birds 18:63-70.

Laymon, S. A and M. D. Halterman. 1985. Yellow-billed Cuckoos in the Kern River Valley: 1985 population, habitat use, and management recommendations. California Department of Fish and Game. Prepared for The Nature Conservancy, Kern River Preserve. 64pp.

Laymon, S. A., and M. Halterman. 1987. Can the western subspecies of the Yellow-billed Cuckoo be saved from extinction? Western Birds 18:19–25.

Laymon, S. A. and M. D. Halterman. 1989. A proposed habitat management plan for Yellow-billed Cuckoos in California. USDA Forest Service General Technical Report PSW-110 pp. 272-277.

Laymon, S.A. and P. L. Williams. 1994. Riparian and wetland breeding bird surveys, Inyo County, California, with emphasis on the Yellow-billed Cuckoo and the Snowy Plover. Final Report to the California Department of Fish and Game.

Laymon, S. A., and P. A. Williams. 1997. Avifauna in California riparian systems. A report to National Fish and Wildlife Foundation. Kern River Research Center. Weldon, CA.

Leopold, A. 1949. A Sand County Almanac. Oxford University Press, Inc.

LORP (Lower Owens River Project). 1999. Inyo/Los Angeles Water Agreement, technical memoranda, action plan and memorandum or understanding concerning the Lower Owens River Project. Available on the Inyo County Water Department web site: http://www.inyowater.org/LORP/.

Lowther, P. E. 1993. Brown-headed Cowbird (*Molothrus ater*). *In* the Birds of North America No. 47 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington D.C.: The American Ornithologists' Union.

MacArthur, R. H., and E. O. Wilson. 1967. The Theory of Island Biogeography. Princeton University Press, Princeton, NJ.

MacMillan, R .E., D. W. Sada, and M. DeDecker. 1996. Owens Basin sensitive wetland and aquatic species management guidelines plan Inyo and Mono Counties, California. Draft report to the California Department of Fish and Game. Sacramento, CA.

Manley, P. and C. Davidson. 1993. A risk analysis of Neotropical migrant birds in California, U.S. Forest Service report, Region 5. San Francisco, CA.

Marra, P. P., K. A. Hobson, and R. T. Holmes. 1998. Linking winter and summer events in a migratory bird by using stable-carbon isotopes. Science 282:1884-1886.

Martin, T. E. 1988. Habitat and area effects on forest bird assemblages: is nest predation an influence? Ecology 69:74-84.

Martin, T. E. 1992. Breeding productivity considerations: What are the appropriate habitat features for management? *In* J. M. Hagan and D. W. Johnson (eds.). Ecology and Conservation of Neotropical Migrant Birds. Smithsonian Institute Press, Washington, D.C.

Martin, T. E. 1993. Nest predation and nest sites: new perspectives on old patterns. BioScience 43(8):523-532.

Martin, T. E. 1995. Summary: model organisms for advancing and understanding of ecology and land management. Pp. 477-484 *in* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds: a synthesis and review of critical issues. Oxford University Press, New York.

Martin, T. E. and G. R. Geupel. 1993. Nest monitoring plots: methods for locating nests and monitoring success. Journal of Field Ornithology 64:507-519.

Martin, T. E., C. Paine, C. J. Conway, W. M. Hochachka, P. Allen, and W. Jenkins. 1997. BBIRD Field Protocol. Biological Resources Division, University of Montana, Missoula, MT.

Marzluff, J. M. and K. Ewing. 2001. Restoration of fragmented landscapes for the conservation of birds: a general framework and specific recommendations for urbanizing landscapes. Restoration Ecology 9(3):280-292.

Massey, B. W. and M. U. Evans. 1994. An eight-year census of birds of Vallecito Creek, Anzo-Borrego Desert, California. Western Birds 25:178-191.

Mathews, N. and C. Goguen. 1997. Cowbird parasitism and cattle grazing in New Mexico. Quarterly Programmatic Report, April 24, 1998, Project #97-118. National Fish and Wildlife Foundation, Washington, D.C.

Mayer, K. E. and W. F. Laudenslayer, Jr., eds. 1988. A Guide to the Wildlife Habitats of California. California Dept. of Forestry and Fire Protection. Sacramento, CA. 166pp.

Mayfield, H. F. 1975. Suggestions for calculating nest success. Wilson Bulletin 87:456-466.

McKernan, R. L. and G. Braden. 2001. Status, distribution, and habitat affinities of the Southwestern Willow Flycatcher along the Lower Colorado River – Year 5, 2000. Bureau of Reclamation Lower Colorado River office, P.O. Box 61470, Boulder City, NV 89006-1470.

McCreedy, C. L. and S. K. Heath. In review. Atypical Willow Flycatcher nesting sites in a recovering riparian corridor at Mono Lake, CA. Western Birds.

Meffe, G. K. and C. R. Carroll. 1997. Principles of Conservation Biology, 2nd edition. Sinauer Associates, Inc., Sunderland, MA.

Miller, A. H. 1951. An analysis of the distribution of the birds of California. University of California Pub. Zool. 50:531-643.

Moore, F. R., S. A. Gauthreaux, Jr., P. Kerlinger, and T. R. Simmons. 1995. Habitat requirements during migration: important link in conservation. Pp. 121-144 *in* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds: a synthesis and review of the critical issues. Oxford University Press, New York, NY.

Morrison, M. L., L. S. Hall, S. K. Robinson, S. I. Rothstein, D. C. Hahn, and T. D. Rich. 1999. Research and management of the Brown-headed Cowbird in Western landscapes. Studies in Avian Biology No. 18.

Moyle, P., R. Kattelmann, R. Zomer, and P. J. Randall. 1996. Management of Riparian Areas in the Sierra Nevada. *In* Sierra Nevada Ecosystem Project: Final report to Congress, vol. III, Assessments and scientific basis for management options. University of California Davis, Centers for Water and Wildland Resources.

National Research Council. 2002. Riparian areas : functions and strategies for management. Committee on Riparian Zone Functioning and Strategies for Management, Water Science and

Technology Board, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies, National Research Council. Washington, D.C., 428 pp.

Norris, D. R. and B. J. M. Stutchbury. 2001. Extraterritorial movements of a forest songbird in a fragmented landscape. Conservation Biology 15:729-736.

Noss, R. F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology 4:355-364.

NPS (National Park Service). 1998. Cape-ivy management in the Golden Gate National Recreation Area and Point Reyes National Seashore. GOGA-N-074.

NSRE (National Survey on Recreation and the Environment). 2000-2002. The Interagency National Survey Consortium, Coordinated by the USDA Forest Service, Recreation, Wilderness, and Demographics Trends Research Group, Athens, GA and the Human Dimensions Research Laboratory, University of Tennessee, Knoxville, TN.

Nur, N., C. J. Ralph, S. Laymon, G. Geupel, and D. Evans. 1996. Save Our Songbirds: Songbird conservation in California's riparian habitats: populations assessments and management recommendations. Annual Report, project 94-232. National Fish and Wildlife Foundation, Washington, D.C.

Nur, N., S. L. Jones, and G. R. Geupel. 1999. A statistical guide to data analysis of avian monitoring programs. U.S. Department of the Interior, Fish and Wildlife Service, BTP-R6001-1999, Washington D.C.

Nur, N., G. R. Geupel, and G. Ballard. 2000. The use of constant-effort mist-netting to monitor demographic processes in passerine birds: annual variation in survival, productivity, and floaters. Pp. 185-194 *in* R. Bonney, D.N. Pashley, R.J. Cooper, and L. Niles (eds). Strategies for Bird Conservation; Proceedings of the 3rd Partners in Flight Workshop 1995 October 1-5. USDA Forest Service RMRS-P-16, Ogden, Utah.

Nur, N., A. L. Holmes, and G. R. Geupel. 2004. Use of survival time analysis to analyze nesting success in birds: an example using Loggerhead Shrikes. Condor 106: 457-471.

Ohmart, R. D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 15:273-285.

Olson, D.M. and E. Dinerstein. 1998. The global 200: A representation approach to conserving the Earth's most biological valuable ecoregions. Conservation Biology 12:502-515.

Olson, T. E. and M. V. Gray. 1989. Characteristics of Least Bell's Vireo nest sites along the Santa Ynez River. Pp. 278-284 *in* Dana L. Abell (ed.). Proceedings of the California Riparian Systems Conference: protection, management, and restoration for the 1990's; September 22-24; Davis, CA. Gen. Tech. Rep. PSW-110, Berkeley, CA.

Overmire, T. G. 1962. Nesting of the Bell Vireo in Oklahoma. Condor 64:75.

Pearson, S. F. and D. A. Manuwal. 2001. Breeding bird response to riparian buffer width in managed Pacific Northwest Douglas-fir forests. Ecological Applications 11:840-853.

Pechmann, J. H. K. and H. M. Wilbur. 1994. Putting amphibian declines into perspective: natural fluctuations and human impacts. Herpetologica 50:64-84.

Peterjohn, W. T. and D. L. Cornell. 1984. Nutrient dynamics in an agricultural watershed: observations on the role of a riparian forest. Ecology 65:1466-1475.

Peterjohn, B. G., J. R. Sauer, and C. S. Robbins. 1995. Population trends from the North American Breeding Bird Survey. Pp. 3-39 i*n* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds. Oxford University Press, New York.

Petit, L. J., D. R. Petit, and T. E. Martin. 1995. Landscape-level management of migratory birds: looking past the trees to the forest. Wildlife Society Bulletin 23:420-429.

Pienkowski, M. W. 1991. Using long-term ornithological studies in setting targets for conservation in Britain. Ibis 13 suppl:62-75.

Pietz, P. J. and D. A. Granfors. 2000. Identifying predators and fates of grassland passerine nests using miniature video cameras. Journal of Wildlife Management 64(1):71-86.

Porneluzi, P. A. and J. Faaborg. 1999. Season-long fecundity, survival, and viabilitiy of Ovenbirds in fragmented and unfragmented landscapes. Conservation Biology 13:1151-1161.

Powell, L. A., M. J. Conroy, D. G. Krementz, and J. D. Lang. 1999. A model to predict breeding-season productivity for multibrood songbirds. The Auk 116: 1001-1008.

Pulliam, H. R. 1988. Sources, sinks, and population regulation. The American Naturalist 132:652-661.

RAC (Resources Agency of California). 1998. Preserving California's Natural Heritage. A Bioregional Guide to Land and Water Conservation. Revised edition.

Ralph, C. J. 1998. A comparison of timing, content, and monitoring methods of landbird migration in the Pacific States. Paper presented at the North American Ornithological Conference, April 1998. St. Louis, MO.

Ralph, C. J. and K. Hollinger. 2003. The status of the Willow and Pacific-slope Flycatchers in northwestern California and southern Oregon. Pp. 104-117 i*n* M. Sogge, B. Kus, M. Whitfield, and S. Sferra (eds.). Ecology and Conservation of the Willow Flycatcher. Studies in Avian Biology No. 26.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Field methods for monitoring landbirds. USDA Forest Service Publication, PSW-GTR 144. Albany, CA.

Ralph, C. J., J. R. Sauer, and S. Droege. 1995. Monitoring bird populations by point counts. USDA Forest Service Publication, PSW-GTR 149. Albany, CA.

Rappole, J. H. and M. V. McDonald. 1994. Cause and effect in population declines of migratory birds. Auk 111:652-660.

RECON (Regional Environmental Consultants). 1989. Comprehensive species management plan for the Least Bell's Vireo (*Vireo belli pusillus*). Prepared for San Diego Association of Governments, San Diego.

Rich, T. 1998. Guide for assessing the occurrence of breeding birds in western riparian systems. Draft Report, Fish, Wildlife and Forests Group, Bureau of Land Management. Boise, ID.

Riparian Habitat Joint Venture (RHJV). 2003[a]. Riparian Habitat Joint Venture Strategic Plan.

Riparian Habitat Joint Venture (RHJV). 2003[b]. Riparian Habitat Joint Venture Annual Operating Plan.

Riitters, K. H., R. V. O'Neill, and K. B. Jones. 1997. Assessing habitat suitability at multiple scales: a landscape-level approach. Biological Conservation 81:191-202.

Robbins, C. S. 1970. Recommendations for an international standard for a mapping method in bird census work. Audubon Field Notes 24:723-726.

Roberson, D., and C. Tenney, eds. 1993. Atlas of Breeding Birds of Monterey County. Monterey Peninsula Audubon Society, Carmel, CA.

Robichaud, I., M. A. Villard, and C. S. Machtans. 2002. Effects of forest regeneration on songbird movements in a managed forest landscape of Alberta, Canada. Landscape Ecology 17:247-262.

Robinson, S. K., F. R. Thompson III, T. M. Donovan, D. R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267: 1987-1990.

Rosenberg, K.V. and P.J. Blancher. In press. Setting numerical population objectives for priority landbird species. *In* C. J. Ralph and T. D. Rich (eds.). Proceedings of the Third International Partners in Flight conference. USDA Forest Service Publication. Asilomar, CA.

Rosenberg, K. V., R. D. Ohmart, W. C. Hunter, and B. W. Anderson. 1991. Birds of the lower Colorado River valley. University of Arizona Press. Tucson, AZ.

Rothstein, S. I., J. Verner, and E. Stevens. 1980. Range expansion and diurnal changes in dispersion of the Brown-headed Cowbird in the Sierra Nevada. Auk 97:253-267.

Ruth, J. T., D. R. Petit, J. R. Sauer, M. D. Samuel, F. A. Johnson, M. D. Fornwall, C. E. Korschgen, and J. P. Bennett. 2003. Science for avian conservation: priorities for the new millennium. Auk 120:204-211.

Saab, V. A., C. E. Bock, T. D. Rich, and D. S. Dobkin. 1995. Livestock grazing effects on migratory landbirds in western North America. Pages 311-353 *in* T. E. Martin and D. M. Finch (eds.). Ecology and Management of Neotropical Migratory Birds: a synthesis and review of critical issues. Oxford University Press, New York.

Saab, V. 1999. Importance of spatial scale to habitat use by breeding birds in riparian forests: a hierarchical analysis. Ecological Applications 9:135-151.

Sabo, J. L. and M. E. Power. 2002. River-watershed exchange: effects of riverine subsidies on riparian lizards and other terrestrial prey. Ecology 83(7):1860-1869.

Sacramento River Advisory Council. 1998. Draft Sacramento River Conservation Area Handbook. Red Bluff, CA.

Salata, L. 1980. Status and distribution of the least Bell's vireo, Camp Pendleton Marine Corps Base, 1980. Unpubl. Rept., U.S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA.

Salata, L. 1981. Least Bell's Vireo research, Camp Pendleton Marine Corps Base, San Diego County, California, 1981. Unpubl. Rept., Natural Resources Office, Camp Pendleton.

Salata, L. 1983. Status of the Least Bell's Vireo on Camp Pendleton, California: report on research done in 1983. Unpubl. Rept., U. S. Fish and Wildlife Service, Laguna Niguel, CA.

Sanders S. D. and M. A. Flett. 1989. Ecology of a Sierra Nevada population of Willow Flycatchers (*Empidonax traillii*), 1986-1987. California Department of Fish and Game, Wildlife Management Division, Nongame Bird and Mammal Section.

Sands, A. (ed.). 1977. Riparian forests in California: their ecology and conservation. Institute of Ecology Publication 15, University of California. Davis, CA.

Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Saunders, D. A., R. J. Hobbs, and C. R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5:18-32.

Sawin, R. S., M. W. Lutman, G. M. Linz, and W. J. Bleier. 2003. Predators on Red-winged Blackbird nests in eastern North Dakota. Journal of Field Ornithology 74(3):288.

Sawyer, J. O. and T. K. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society. Sacramento, California: 471pp.

Sawyer, J. and T. Keeler-Wolf. In prep. A Manual of California Vegetation; Second Edition. See http://www.dfg.ca.gov/whdab/pdfs/natcomlist.pdf for additional information.

Schneider, D. C. 2001. The rise of the concept of scale in ecology. BioScience 51:545-553.

Semlitsch, R. D. and J. R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Conservation Biology 17:1219-1228.

Shaffer, T. L. In press. A unifying approach to analyzing nest success. Auk.

Sherry, T. W., and R. T. Holmes. 1995. Summer versus winter limitation of populations: what are the issues and what is the evidence? Pp. 85-120 *in* T. Martin and D. Finch (eds.). Ecology and management of Neotropical migratory birds: synthesis and review of the critical issues. Oxford University Press, NY.

Sherry. T. W. and R. T. Holmes 2000. Demographic modeling of migratory bird populations: the importance of parameter estimation using marked individuals. Pp. 211-219 *in* R. Bonney, D.N. Pashley, R.J. Cooper, and L. Niles (eds). Strategies for Bird Conservation; Proceedings of the 3rd Partners in Flight Workshop 1995 October 1-5. USDA Forest Service RMRS-P-16, Ogden, Utah.

Sibley, D. A. 2000. The Sibley Guide to North American Birds. Alfred A. Knopf, Inc. 544pp.

Siegel, R. B. and D. F. DeSante. 1999. Version 1.0. The draft avian plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for

Bird Populations report to California Partners in Flight.
http://www.prbo.org/calpif/htmldocs/sierra.html.

Sisk, T. D., N. M. Haddad, and P. R. Ehrlich. 1997. Bird assemblages in patchy woodlands: modeling the effects of edge and matrix habitats. Ecological Applications 7:1170-1180.

Small, S. and G. Geupel. 1998. Songbird monitoring in the Point Reyes National Seashore: Results of the 1997 field season. Draft Progress Report to the National Park Service. Point Reyes Bird Observatory. Stinson Beach, CA.

Small, S. L. and T. Gardali. In prep. Regional population growth rates of Black-headed Grosbeaks nesting in California riparian forests. Condor.

Small, S., G. Geupel, N. Nur, A. Holmes, and T. Gardali. 1998. The health of riparian bird populations in central coastal California national parks. Presentation to The Wildlife Society, Western Section, February 1998. Sacramento, CA.

Small, S., J. DeStaebler, G. R. Geupel, and A. King. 1999. Landbird response to riparian restoration on the Sacramento River System: preliminary results of the 1997 and 1998 field season. A report of the Point Reyes Bird Observatory to The Nature Conservancy California and U.S. Fish and Wildlife Service. PRBO contribution # 909.

Small, S. L., N. Nur, A. Black, G. R. Geupel, D. Humple, and G. Ballard. 2000. Riparian bird populations of the Sacramento River system: results from the 1993-1999 field seasons. Point Reyes Bird Observatory, Stinson Beach, CA.

Small, S., T. Gardali, and J. DeStaebler. 2001. Habitat associations and species composition of riparian bird communities in the Sacramento Valley and Lassen Foothill tributaries: a report of the 2000 field season. A report of the Point Reyes Bird Observatory to The Nature Conservancy California, U.S. Fish and Wildlife Service, California Department of Parks and Recreation, and Sacramento River Partners. PRBO contribution # 962.

Smith, F. E. 1977. A survey of riparian forest flora and fauna in California. *In* A. Sands (ed.). Riparian forests in California: their ecology and conservation. Institute of Ecology Publication 15, University of California. Davis, CA.

Smith, D. S., A. B. Wellington, J. L Nachlinger, and C. A. Fox. 1991. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. Ecological Applications (1):89-97.

Sober, E. 1986. Philosophical Problems for Environmentalism in the Preservation of Species: the value of biological diversity. Bryan G. Norton (ed.). Princeton University Press, pp:173-194.

Soulé, M. E., D. T. Bolger, J. Wright, M. Sorice, and S. Hill. 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. Conservation Biology 2(1).

Stallcup, R. 1991. Cats: A heavy toll on songbirds, a reversible catastrophe. The Observer, Number 91, Spring/Summer. Point Reyes Bird Observatory. Stinson Beach, CA.

Stefani, R. A. 2000. The Swainson's Thrush survey in the Sierra Nevada bioregion. Final report for the challenge cost share agreement between University of California, Davis and USDA Forest Service, Tahoe National Forest. February 2000.

Stromberg, J. C. and D. T. Patten. 1990. Riparian vegetation instream flow requirements: a case study from a diverted stream in the eastern Sierra Nevada, California, USA. Environmental Management 14(2):185-194.

Stromberg, J. C. and D. T. Patten. 1992. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. Modroño 39(3):205-223.

Suarez, A. V., K. S. Pfennig, and S. K. Robinson. 1997. Nesting success of a disturbance-dependent songbird on different kinds of edges. Conservation Biology 11(4):928-935.

Szaro, R. C. and M. D. Jakle. 1985. Avian use of desert riparian island and its adjacent scrub habitat. Condor 87:511-519.

Tewksbury, J. J., S. J. Hejl, and T. E. Martin. 1998. Breeding productivity does not decline with increasing fragmentation in a western landscape. Ecology 79:2890-2903.

Tewksbury, J. J., T. E. Martin, S. J. Hejl, T. S. Redman, and F. J. Wheeler. 1999. Cowbirds in a western valley: effects of landscape structure, vegetation, and host density. Studies in Avian Biology 18:23-33.

Tewksbury, J. J., A. E. Black, N. Nur, V. A. Saab, B. D. Logan, and D. S. Dobkin. 2002. Effects of anthropogenic fragmentation and livestock grazing on western riparian bird communities. Studies in Avian Biology 25:158-202.

Temple, S. A. and J. A. Wiens. 1989. Bird Populations and environmental changes: can birds be bio-indicators? American Birds 43:260-270.

The Bay Institute of San Francisco, 1998. The Sierra to the Sea: the ecological history of the San Francisco Bay-Delta Watershed. www.bay.org.

Thompson, B. C., G. E. Knadle, D. L. Brubaker, and K. S. Brubaker. 2001. Nest success is not an adequate comparative estimate of avian reproduction. Journal of Field Ornithology 72:527-536.

Thompson, F. R. and D. E Burhans. 2003. Predation of songbird nests differs by predator and between field and forest habitats. Journal of Wildlife Management 67(2):408.

TNC (The Nature Conservancy). 1997. Central Coast Ecoregional Planning Project. Unpublished report, September 1997.

Trine, C. L. 1998. Wood Thrush population sinks and implications for the scale of regional conservation strategies. Conservation Biology 12(3):576-585.

Twedt, D. J., R. R. Wilson, J. L. Henne-Kerr, and D. A. Grosshuesch. 2002. Avian response to bottomland hardwood reforestation: the first 10 years. Restoration Ecology 10(4):645-655.

Uliczka, H., and P. Angelstam. 2000. Assessing conservation values of forest stands based on specialized lichens and birds. Biological Conservation 95(3):343-351.

USFWS (U.S. Fish and Wildlife Service). 1998. Draft recovery plan for the Least Bell's Vireo. U.S. Fish and Wildlife Service, Portland, OR. 139 pp.

USFWS (U.S. Fish and Wildlife Service). 2002. Southwestern Willow Flycatcher Recovery Plan. Albuquerque, New Mexico. i-ix+210pp., Appendices A-O.

Van Horne, B. 1983. Density as a misleading indicator of habitat quality. Journal of Wildlife Management 47:893–901.

Wake, D. B. 1991. Declining amphibian populations. Science 253:860.

Wake, D. B. 1998. Action on amphibians. Trends in Ecology and Evolution 13:379.

Warner, R. E., and K. M. Hendrix (eds.). 1984. California riparian systems: ecology, conservation, and management. University of California Press. Berkeley, CA.

Welsh, H. H. and L. M. Olliver. 1998. Stream amphibians as indicators of ecosystem stress: a case study from California's redwoods. Ecological Applications 8(4):1118-1132.

Whitt, M. B., H. H. Prince, and R. R. Cox, Jr. 1999. Avian use of purple loosestrife dominated habitat relative to other vegetation types in a Lake Huron wetland complex. Wilson Bulletin, 111(1):105-114.

Wiens, J. A. 1989. Spatial scaling in ecology. Functional Ecology 3:385-397.

Wiens, J. A. 1995. Habitat fragmentation: island v landscape perspectives on bird conservation. Ibis 137:97-104.

Wiens, J. A. 1999. The science and practice of landscape ecology. Pp. 371-383 *in* J. M. Klopatch and R.H. Gardner (eds.). Landscape Ecological Analysis. Springer- Verlag, New York.

Wiens, J. A., N. C. Stenseth, B. Van Horn, and R. A. Ims. 1993. Ecological mechanisms and landscape ecology. Oikos 66:369-380.

Winter, L. 1999. Cat predation on birds and other wildlife and the Cats Indoors! Campaign. Wildlife Rehabilitation 17:175-180.

With, K. A. and A. W. King. 2001. Analysis of landscape sources and sinks: the effect of spatial pattern on avian demography. Biological Conservation 100:75-88.

Wood, J., T. Gardali, and G.R. Geupel. 2001. Neotropical and Resident Songbird Populations in the Lower Creek Floodway Restoration Project: a progress report for the 2000 field season. PRBO contribution #810.

Woodbridge, B. 1991. Habitat selection by nesting Swainson's Hawks: a hierarchical approach. M.S. thesis, Oregon State University, 80 pp.

YCRCD (Yolo County Resource Conservation District). 1998. Bring farm edges back to life! Paul Robins (ed.). Yolo County Resource Conservation District. Woodland, CA.

Yong, W., D. M. Finch, F. R. Moore, and J. F. Kelly. 1998. Stopover ecology and habitat use of migratory Wilson's Warblers. Auk 115:829-842.

Personal Communications

Berry, W. Head of the Wildlife Management Branch of Assistant Chief of Staff/Environmental Security at Marine Corps Base Camp Pendleton, CA. 2003.

Clark, L. E. Placer County Planning Department, Assistant Director. October 31, 2003.

Danner, Sus. Coastal Watershed Council. 1999.

Halterman, Murrelet. University of Nevada, Reno. Cuckoo Project Director. Southern Sierra Research Station. 2003.

King, A. PRBO Conservation Science. 1999.

Rogers, Laurette. 1999.

Siegel, R. The Institute for Bird Populations. 2003.

Teresa, Sherry. Director, Center for Natural Lands Management. 1998.

Appendix A. How to Monitor Riparian Bird Populations

Adaptive management requires the periodic gathering of information to ascertain whether management actions are achieving desired results. The most comprehensive and rigorous way of collecting this information is through a strategic program of monitoring using standardized methods that can be compared between years and between regions. Restoration and land stewardship programs need to build in long-term monitoring programs to assess the effectiveness of their activities. Such data are necessary to determine the need for continued funding.

Research and Monitoring

If habitat restoration or management is undertaken to benefit wildlife species, wildlife monitoring becomes the ultimate measure of success. There are many reasons that bird monitoring should be adopted as a basic component of long-term stewardship in preserves with significant riparian habitats or significant bird populations:

- Birds are highly visible and monitoring is cost effective.
- Birds can show relatively quick response in abundance and diversity to restored habitats (3-5 years).
- Many Neotropical migrants are dependent on early successional development in riparian habitats; therefore, they are good indicators of the success of natural recruitment restoration on an ecosystem scale.
- As secondary consumers (i.e., insectivores), birds are sensitive indicators of environmental change.
- By managing for a diversity of birds, most other elements of biodiversity are conserved.
- Bird monitoring can prevent future listing of declining species by identifying problems and solutions early.
- Because of the increasing popularity of birdwatching, there is great potential for public participation in bird monitoring.
- Birds are tremendously important culturally and economically and their popularity can help raise awareness of land-stewardship needs.

Monitoring Strategically

Monitoring can be conducted at varying levels of intensity, depending on the objectives to be achieved and the resources available. The standardization of protocols is critical to comparing results across space and time. Many recent programs (Ralph et al. 1995, Martin et al. 1997, DeSante et al. 1999a) and publications (Ralph et al. 1993, Geupel and Warkentin 1995, DeSante et al. 1995, 1999b, Nur et al. 2000) have summarized methods, objectives, and implementing results.

Monitoring programs should always include an analysis plan and identification of issues or site-specific projects to be assessed. The primary purpose of site-specific monitoring is to assess the effects on wildlife of natural and anthropogenic stressors or disturbances in the environment. This knowledge is critical in determining the relative priority of identified conservation problems and in developing effective measures to address those problems.

Monitoring across many sites at varying scales can be analyzed to highlight broad changes or trends in species presence, diversity, abundance and productivity. Ideally, a series of reference sites with long-term monitoring, using most if not all protocols below, will be developed for each California bioregion. Other sites will be monitored more opportunistically, depending on the objectives of the landowner.

The following is a list of common monitoring regimes from least to most intensive.

- **Rapid assessment of habitat or designation of Important Bird Areas based on general vegetation characteristics and presence/absence of indicator species.**

Method: area search or point count as little as one census per site per year.

- **Determine breeding status, habitat association, restoration evaluation and/or evaluation of changes in management practices.**

Method: area search or point count two or more times per year for three years. For restoration evaluation every other year, surveys should continue for at least 10 years.

- **Determination of population health or source/sink status.**

Method: census combined with demographic monitoring for a minimum of four years.

- **Reference site.**

Method: point count census, constant effort mist netting and nest monitoring at a minimum of every other year for 10 years.

Long-term Monitoring

Long-term monitoring provides a wealth of useful information about bird populations. Long-term data are vital to deciphering the difference between a true population decline and a natural fluctuation in population size. In addition to parameters that can be determined by both short- and long-term monitoring (such as annual productivity, abundance, and diversity), patterns of variation in reproductive success and trends in abundance and diversity may also be described. Long-term monitoring is also the only method to monitor natural and human-induced changes in bird populations.

Monitoring Protocols

These are listed from least to most intensity of effort. All are described in detail in Handbook of Field Methods for Monitoring Landbirds (Ralph et al. 1993). Online support, field protocols, example data sheets, and data entry and management resources are supplied at http://www.prbo.org/tools (Ballard 2003).

Area Search

The Area Search, adopted from the Australian Bird Count, is a habitat specific, time constraint census method to measure relative abundance and species composition. It may also provide breeding status. While still quantitative, this technique is ideal for volunteers as it mimics the method that a birder would use while searching for birds in a given area, allowing the observer to track down unfamiliar birds.

Point Count

The point count method is used to monitor population changes of breeding landbirds. With this method, it is possible to study the yearly changes of bird populations at fixed points, differences in species composition between habitats, and assess breeding status and abundance patterns of species. The objective of point count vegetation assessment is to relate the changes in bird composition and abundance to differences in vegetation.

Mist Netting

Mist netting provides insight into the health and demographics of the population of birds being studied. Mist nets provide valuable information on productivity, survivorship, and recruitment. With these data, managers will have information on the possible causes of landbird declines or their remedies. This method is currently being used nationwide in the Monitoring Avian Productivity and Survivorship (MAPS) program (DeSante 1992).

Territory Mapping

Also known as "spot mapping," based on the territorial behavior of birds, where locations of birds are marked on a detailed map during several visits (a minimum of eight) in the breeding season. By counting the number of territories in an area, this method estimates the density of birds. Distribution of territories, species richness, and diversity are also documented. This is an excellent method for assessing areas with limited habitat. Standard methods are described by Robbins (1970) and used by The Cornell Laboratory of Ornithology's resident bird counts.

Nest Monitoring

Also called nest searching, this technique measures nesting success in specific habitats and provides information on trends in recruitment; measurement of vegetation associated with nests may identify habitat influences on breeding productivity. Examination of nests also allows collection of life-history data (e.g., clutch size, number of broods, numbers of nesting attempts), which provide important insight into vulnerability of species to decimation or perturbations (Martin and Geupel 1993).

Appendix B. How Birds Respond to Riparian Restoration

In measuring the success of habitat restoration/rehabilitation projects, there are two general levels of evaluation that can be undertaken. Measures of success for cultivated restoration projects include measurements of habitat, particularly survival, size, structure, etc., of regenerating vegetation or plantings. Cultivated measures provide two types of information:

- A picture of how closely restored habitats resemble the "reference-site ideal" for which one is striving.
- A measure of how closely the current restoration site resembles the intended project design.

However, for a measure of the actual benefits to wildlife, as well as the efficacy of a particular restoration design, measurements of wildlife response to restored habitats must be undertaken. Such measures may include all manner of wildlife monitoring techniques. Measuring demographic parameters, particularly reproductive success, are most likely the best measure of success (Martin 1993).

Riparian habitats are perhaps unique in California in that, provided that natural flooding and depositional processes remain, they can often regenerate quickly, providing significant benefits to wildlife in as little as two-three years. Natural recruitment restoration, in which habitat is allowed to regenerate naturally, as in a levee setback or flood bypass project, is probably the most effective and least costly form of restoration possible. However, when natural processes have been eliminated or altered, when non-native plants have become a dominant part of the vegetation, or when restoration outside the active floodplain is sought (i.e., floods occur less than one in four years), cultivated restoration is often employed, wherein intensive site preparation, collection of native-plant stock, and planting and maintenance of riparian vegetation takes place.

Kern River Preserve

Studies have shown that diversity and abundance (or density) can be misleading indicators of bird population health (e.g., Van Horne 1983); therefore, the goal of any restoration project should be ultimately to support populations with high productivity (i.e., high nest success on the breeding grounds). At the Kern River Preserve, 12 years of bird monitoring conducted by the Kern River Research Center in restored habitats suggest predictable patterns of response among bird species as riparian restoration sites regenerate and grow. Species diversity tends to increase significantly with the age of a restoration site; however, the best predictor of total bird species richness is mean tree height, followed by total foliage volume and mean quadratic diameter at breast height. Total foliage volume has been the best predictor of breeding bird density over the life of a riparian restoration site at the Kern River Preserve. In general, the richness and density of riparian obligate bird species increase with the age of the restoration plot. This does not mean, however, that managers should manage their sites or skew natural processes to prefer more mature sites over less mature sites. A mosaic of habitat ages is created naturally.

Patterns of response among individual bird species have also been found at the Kern River Preserve. Five general patterns have been identified: three that involve a positive trend in species population, one that demonstrates no trend, and one that involves a negative trend. A brief description of these patterns follows.

- Species occurring in small numbers before planting which gradually increase (for example, Northern Flicker, Mourning Dove, Nuttall's Woodpecker, Hairy Woodpecker, House Wren, Bushtit, Bewick's Wren, Brown-headed Cowbird, Bullock's Oriole, Spotted Towhee, Song Sparrow, and Lawrence's Goldfinch).

- Species not found before restoration that increase to the breeding population levels of natural forest sites (for example, Anna's Hummingbird, Yellow-billed Cuckoo, Black-chinned Hummingbird, Ash-throated Flycatcher, Western Kingbird, Western Scrub-jay, European Starling, Summer Tanager, and Lesser Goldfinch).

- Species found in low numbers before restoration that show a higher density subsequent to restoration than on natural forest sites (for example, Common Yellowthroat, Black Phoebe, Blue Grosbeak, Lazuli Bunting, and Red-winged Blackbird).

- Species found in small numbers before planting that show no trends as a result of restoration (for example, Downy Woodpecker, Western Wood-pewee, Willow Flycatcher, Tree Swallow, Oak Titmouse, White-breasted Nuthatch, Western Bluebird, American Robin, Yellow Warbler, and Yellow breasted Chat).

- Species that show a negative effect from restoration (for example, Horned Lark, Savannah Sparrow, and Western Meadowlark).

At the Kern River Preserve, restoration sites (with ages up to 12 years) averaged 18 to 22 species per plot, whereas natural forest sites averaged 41 species per plot. Much of the variation results from differences in structural diversity of vegetation. Additionally, natural forest sites show more diversity of habitats, with the interspersion of meadows, patches of mule fat, closed canopies of trees centuries old, and thickets of new growth (Nur et al. 1996).

Sacramento River

At a site restored by The Nature Conservancy, working in partnership with the U.S. Fish and Wildlife Service, PRBO found that in a newly restored riparian site along the Sacramento River bird species diversity increased by 73% from year two to year four of the restoration project. Revegetated sites ranging in age from four to 10 years supported species diversity comparable to mature riparian habitat. Moreover, habitat restoration will also benefit listed species, provided the needs of these species are taken into consideration during project implementation. Nine years after conducting the first riparian restoration at the Kern River Preserve, Yellow-billed Cuckoos nested on a habitat restoration site. Limited foraging use of restored areas began much sooner (after three years), but by the ninth year, restoration sites were used extensively for foraging. Willow Flycatchers began nesting in restored sites seven years after restoration.

Appendix C. Acronyms, Abbreviations, and Species Codes

List of Acronyms and Abbreviations

BBS:	Breeding Bird Survey
BLM:	U.S. Bureau of Land Management
BSOL:	Big Sur Ornithology Lab
CALFED:	CALFED Bay-Delta Program
Conservation Plan:	The California Partners in Flight Riparian Bird Conservation Plan
Corps:	U.S. Army Corps of Engineers
CalPIF:	California Partners in Flight
CDFG:	California Department of Fish and Game
DWR:	California Department of Water Resources
GIS:	Geographic Information Systems
HY:	hatch year
km:	kilometers
m:	meters
MAPS:	Monitoring Avian Productivity and Survivorship
NRCS:	Natural Resource Conservation Service
NSAs:	initiate nonstructural alternatives
PIF:	Partners in Flight
PRBO:	Point Reyes Bird Observatory
RHJV:	Riparian Habitat Joint Venture
USFS:	U.S. Forest Service
USFWS:	U.S. Fish and Wildlife Service
USGS:	U.S. Geological Service
VWS:	Ventana Wilderness Society
WHR:	Wildlife Habitat Relationships

List of Species Codes

BANS:	Bank Swallow
BHGR:	Black-headed Grosbeak
BLGR:	Blue Grosbeak
COYE:	Common Yellowthroat
LBVI:	Least Bell's Vireo
SOSP:	Song Sparrow
SPSA:	Spotted Sandpiper
SWHA:	Swainson's Hawk
SWTH:	Swainson's Thrush
TRES:	Tree Swallow
WAVI:	Warbling Vireo
WIFL:	Willow Flycatcher
WIWA:	Wilson's Warbler
YBCH:	Yellow-breasted Chat
YBCU:	Yellow-billed Cuckoo
YWAR:	Yellow Warbler

Appendix D. Scientific and Common Names

Plants

Common Name	*Latin Name*
Acacia	*Acacia dealbata*
Alder species	*Alnus spp.*
Alkali goldenbush	*Haplopappus acradenius*
Alkali sacaton	*Sporobolus airoides*
Arrowweed	*Pluchea sericea*
Baltic rush	*Juncus balticus*
Bent grass	*Agrostis spp.*
Bigleaf maple	*Acer macrophylum*
Black cottonwood	*Populus balsamifera*
Black locust	*Robinia pseudoacacia*
Black walnut	*Juglans californica*
Blue elderberry	*Sambucus mexicana*
Boxelder	*Acer negundo*
Buttonbush	*Cephalanthus occidentalis*
California Bay	*Umbellularia californica*
California blackberry	*Rubus ursinus*
California fan palm	*Washingtonia filifera*
California sycamore	*Platanus racemosa*
Cape ivy (German ivy)	*Delairea odorata*
Cattail	*Typha spp.*
Chokecherry	*Prunus virginiana*
Cocklebur	*Xanthium strumarium*
Common cattail	*Typha latifolia*
Common reed	*Phragmites australis*
Coyote willow	*Salix exigua*
Date palm	*Phoenix dactilifera*
Desert lavender	*Hyptis emoryi*
Dogwood	*Cornaceae spp.*
Douglas fir	*Pseudotsuga menziesii*
Edible fig	*Ficus carica*
Engelmann spruce	*Picea engelmannii*
English ivy	*Hedera helix*
Fremont cottonwood	*Populus fremontii*
Giant reed	*Arundo donax*
Himalayan blackberry	*Rubus himalaya*
Jeffrey pine	*Pinus jeffreyi*
Lodgepole pine	*Pinus contorta*
Mesquite	*Prosopis spp.*
Mojave seablight	*Suaeda torreyana*
Oatgrass	*Danthonia spp.*
Oregon ash	*Fraxinus latifolia*
Periwinkle	*Vinca major*
Poison oak	*Toxicodendron diversilobum*
Ponderosa pine	*Pinus ponderosa*
Purple loosestrife	*Lythrum salicaria*
Quailbush	*Atriplex lentiformis*
Red Fir	*Albies magnifica*

River bulrush	*Scirpus fluviatilis*
Rose species	*Rosa spp.*
Rush species	*Juncus spp.*
Russian olive	*Elaeagnus augustifolius*
Sagebrush species	*Artemesia spp.*
Sandbar willow	*Salix sessilifolia*
Sedge species	*Carex/Scirpus spp.*
Seep willow	*Baccharis glutinosa*
Serviceberry	*Amelanchier spp.*
Snowberry	*Symphoricarpos spp.*
Squaw waterweed	*Baccharis sergiloides*
Star thistle	*Centaurea spp.*
Sticky euphatorium	*Ageratina adenophora*
Tamarisk, salt cedar	*Tamarix chinensis*
Tasmanian blue gum	*Eucalyptus globulus*
Tule bulrush	*Scirpus acutus*
Valley oak	*Quercus lobata*
Velvet ash	*Fraxinus velutina*
Water Birch	*Betula occidentalis*
Western Juniper	*Juniperus occidentalis*
White alder	*Alnus rhombifolia*
White fir	*Abies concolor*
Wild grape	*Vitis californica*
Wild rose	*Rosa californica*
Willow species	*Salix spp.*
Wiregrass	*Juncus acutus*

Birds

American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Anna's Hummingbird	*Calypte anna*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Bank Swallow	*Riparia riparia*
Bewick's Wren	*Thryomanes bewickii*
Black Phoebe	*Sayornis nigricans*
Black-chinned Hummingbird	*Archilochus alexandri*
Black-crowned Night Heron	*Nycticorax nycticorax*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Brown-headed Cowbird	*Molothrus ater*
Bullock's Oriole	*Icterus bullockii*
Bushtit	*Psaltriparus minimus*
Clapper Rail (Light-footed)	*Rallus longirostris levipes*
Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
European Starling	*Sturnus vulgaris*
Golden-crowned Kinglet	*Regulus satrapa*
Hairy Woodpecker	*Picoides villosus*
Horned Lark	*Eremophila alpestris*
House Wren	*Troglodytes aedon*
Lawrence's Goldfinch	*Carduelis lawrencei*

Lazuli Bunting	*Passerina amoena*
Least Bell's Vireo	*Vireo bellii pusillus*
Lesser Goldfinch	*Carduelis psaltria*
Nuttall's Woodpecker	*Picoides nuttallii*
Oak Titmouse	*Baeolophus inornatus*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-necked Duck	*Aythya collaris*
Ruby-crowned Kinglet	*Regulus calendula*
Savannah Sparrow	*Passerculus sandwichensis*
Snowy Plover	*Charadrius alexandrinus*
Song Sparrow	*Melospiza melodia*
Spotted Towhee	*Pipilo maculatus*
Summer Tanager	*Piranga rubra*
Swainson's Hawk	*Buteo swainsoni*
Swainson's Thrush	*Catharus ustulatus*
Swainson's Thrush (Olive-backed)	*Catharus ustulatus swainsoni*
Swainson's Thrush (Russet-backed)	*Catharus ustulatus ustulatus, C. u. oedicus*
Tree Swallow	*Tachycineta bicolor*
Tricolored Blackbird	*Agelaius tricolor*
Warbling Vireo	*Vireo gilvus*
Western Bluebird	*Sialia mexicana*
Western Kingbird	*Tyrannus verticalis*
Western Meadowlark	*Sturnella neglecta*
Western Wood-pewee	*Contopus sordidulus*
White-breasted Nuthatch	*Sitta carolinensis*
Willow Flycatcher	*Empidonax traillii*
Willow Flycatcher (Little)	*Empidonax traillii brewsteri*
Willow Flycatcher (Southwestern)	*Empidonax traillii extimus*
Wilson's Warbler	*Wilsonia pusilla*
Wrentit	*Chamaea fasciata*
Yellow Warbler	*Dendroica petechia*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-billed Magpie	*Pica nuttalli*
Yellow-breasted Chat	*Icteria virens*

Mammals

Bobcat	*Felis rufus*
Coyote	*Canis latrans*
Domestic cat	*Felis catus*
Fox, Gray	*Urocyon cinereoargenteus*
Fox, Red	*Vulpes vulpes*
Opossum, Virginia	*Didelphis virginiana*
Raccoon	*Procyon lotor*
Riparian Brush Rabbit	*Sylvilagus bachmani riparius*
Skunk, Striped	*Mephitis mephitis*

Amphibians

Arroyo Southwestern toad	*Bufo microscaphus californicus*

Invertebrates

Katydid	Family *Tettigoniidae*
Sphinx moth	Family *Sphingidae*

Appendix E. Riparian and Semi-riparian Natural Communities from a Manual of California Vegetation, 2nd Edition (Sawyer and Keeler-Wolf in prep)

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
30.000.00	**SCRUB AND CHAPARRAL**					N	
33.000.00		Sonoran and Mojavean Desert Scrub				N	
33.200.00			Cheesebush Scrub		*Hymenoclea salsola*	N	
33.260.00				Sweetbush Riparian Scrub	*Bebbia juncea*	Y	
40.000.00	**GRASS & HERB DOMINATED COMMUNITIES**					N	
41.000.00		Native Grassland				N	
41.310.00				Knotweed-Echinochloa Riparian Grassland		N	
45.000.00		Meadows and Seeps not dominated by grasses				N	
45.500.00			Alkali Meadow			N	
45.550.00				Cocklebur Riparian Grassland	*Xanthium strumarium*	N	
45.560.00				Rush Riparian Grassland	*Juncus spp.*	N	
45.561.00				Common Rush Riparian Grassland	*Juncus effusus var. brunneus*	N	

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
5.562.00				Baltic Rush Riparian Grassland	*Juncus balticus*	N	
45.563.00				Cooper Rush Riparian Grassland	*Juncus cooperi*	Y	
45.565.00				Mexican Rush Riparian Grassland	*Juncus mexicanus*	N	
60.000.00	**RIPARIAN AND BOTTOMLAND HABITAT**					N	
61.000.00		Riparian Forest and Woodland				N	
61.100.00			Cottonwood and Aspen Woodlands and Forests		*Populus spp.*	N	
61.111.00				Aspen Upland and Riparian Forests and Woodlands		N	ASP
61.120.00				Black Cottonwood Riparian Forests and Woodlands	*Populus balsamifera*	Y	MRI
61.130.00				Fremont Cottonwood Riparian Forests and Woodlands	*Populus fremontii*	Y	VRI, DRI, MRI
61.200.00			Willow Riparian Forests and Woodlands		*Salix spp.*	N	
61.201.00				Arroyo Willow Riparian Forests and Woodlands	*Salix lasiolepis*	Y	DRI, VRI, MRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.202.00				Black Willow Riparian Forests and Woodlands	*Salix gooddingii*	Y	VRI, DRI
61.203.00				Hooker Willow Riparian Forests	*Salix hookeriana*	Y	VRI
61.204.00				Pacific Willow Riparian Forests	*Salix lucida ssp. lasiandra*	Y	DRI, VRI, MRI
61.205.00				Red Willow Riparian Forests	*Salix laevigata*	Y	VRI, DRI, MRI
61.206.00				Sitka Willow Riparian Forests	*Salix sitchensis*	Y	VRI, DRI
61.207.00				Mixed Willow Riparian Forests and Woodlands	*Salix spp.*	Y	
61.208.00				Southern Willow Scrub	*Salix spp.*	Y	
61.209.00				Narrow-leaf Willow Riparian Scrub	*Salix exigua*	N	VRI, DRI, MRI
61.210.00				Yellow Willow Riparian Scrub	*Salix lutea*	N	MRI
61.211.00				Gooding Willow Woodland	*Salix goodingii*	N	
61.300.00			Sycamore		*Platanus spp.*	N	VRI
61.310.00				California Sycamore	*Platanus racemosa*	Y	VRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.311.00				Central CA Sycamore Alluvial Woodland	*Platanus spp.*	Y	VRI
61.312.00				Southern Sycamore - Alder Riparian Woodland	*Platanus spp.-Alnus spp.*	Y	VRI
61.313.00				Foothill Sycamore Riparian Woodland	*Platanus spp.*	Y	VRI
61.314.00				Central Coast Cottonwood - Sycamore Riparian Woodland	*Populus spp.-Platanus spp.*	Y	
61.400.00			Alder Riparian Forest		*Alnus spp.*	N	
61.410.00				Red Alder	*Alnus rubra*	N	RDW, VRI, MRI
61.420.00				White Alder Forest and Woodland	*Alnus rhombifolia*	N	MRI
61.500.00			Desert Wash Riparian Woodland			N	
61.510.00				Mesquite Woodland	*Prosopis spp.*	Y	
61.512.00				Honey Mesquite Scrub	*Prosopis glandulosa*	Y	
61.513.00				Tornillo Scrub	*Prosopis pubescens*	Y	
61.520.00				Fan Palm Woodland	*Washingtonia filifera*	Y	POS
61.530.00				Blue Palo Verde - Ironwood - Smoke Tree Woodland	*Cercidium floridum-Olneya tesota-Psorothamnus spinosus*	Y	

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.540.00				Blue Palo Verde Woodland	*Cercidium floridium*	N	
61.550.00				Desert-willow Woodland	*Chilopsis linearis*	N	
61.560.00				Ironwood Woodland	*Olneya tesota*	N	
61.570.00				Smoke Tree Woodland and Scrub	*Psorothamnus spinosus*	N	
61.580.00				Desert Olive Scrub	*Forestiera pubescens*	Y	
61.800.00			Walnut		*Juglans spp.*	Y	
61.810.00				Hind's Walnut Unique Stands	*Juglans californica var. hindsii*	Y	
61.900.00			Mixed Riparian Forest and Woodland			Y	
61.910.00				Great Valley Mixed Riparian Forest		N	VRI
61.920.00				Southern Mixed Riparian Forest		Y	
61.930.00				Southern Riparian Forest		Y	
61.940.00				Mojave Riparian Forest		Y	DRI
61.950.00				Desert Dry Wash Woodland		N	DSW

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
61.960.00				Oregon Ash Riparian Forest	*Fraxinus latifolia*	Y	VRI, MRI
63.000.00		Low to High Elevation Riparian Scrub				N	
63.100.00			Scrub Willow		*Salix spp.*	N	
63.110.00				Narrowleaf Willow	*Salix exigua*	Y	VRI, MRI, DRI
61.111.00				Tealeaf Willow Riparian Scrub	*Salix planifolia*	N	
61.112.00				Sierra Willow Riparian Scrub	*Salix eastwoodiae*	N	MRI
61.113.00				Lemmon's Willow Riparian Scrub	*Salix lemmonii*	N	MRI
61.114.00				Dusky Willow Riparian Scrub	*Salix melanopsis*	N	MRI
61.115.00				Grayleaf Sierra Willow Riparian Scrub	*Salix orestera*	N	MRI
61.116.00				Arctic Willow Dwarf Scrub	*Salix arctica*	N	MRI
61.117.00				Snow Willow Dwarf Scrub	*Salix reticulata*	N	MRI
63.120.00				Sandbar Willow	*Salix sessifolia*	N	VRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
63.130.00				Southern Willow	*Salix spp.*	Y	
63.140.00				Great Valley Willow	*Salix spp.*	Y	VRI
63.150.00				Montane Wetland Shrub Habitat		Y	MRI
63.160.00				Subalpine Wetland Shrub Habitat		N	MRI
63.200.00			Alder Scrubs		*Alnus spp.*	N	
63.210.00				Mountain Alder Scrub	*Alnus incana*	Y	MRI
63.220.00				Sitka Alder Scrub	*Alnus viridis*	Y	MRI
63.300.00			Buttonbush Scrub		*Cephalanthus occidentalis*	Y	VRI
63.400.00			Elderberry Scrub and Savanna		*Sambucus spp.*	N	
63.410.00				Mexican Elderberry	*Sambucus mexicana*	N	VRI
63.510.00				Mulefat Scrub	*Baccharis salicifolia*	N	DRI, VRI
63.520.00				Emory Baccharis Scrub	*Baccharis emoryi*	N	DSW, DRI
63.530.00				Broom Baccharis Scrub	*Baccharis sergiloides*	Y	DSW, DRI
63.600.00			Birch Scrub		*Betula spp.*	N	
63.610.00				Water Birch Scrub	*Betula occidentalis*	Y	MRI

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
63.700.00				Arrow Weed Scrubs	*Pluchea spp.*	N	DSW
63.710.00				Arrow Weed Scrub	*Pluchea sericea*	N	DSW
63.800.00			Vegetation dominated by Tamarisk		*Tamarix spp.*	N	
63.810.00				Tamarisk Scrubs and Woodlands	*Tamarix spp.*	N	DSW, DRI
63.900.00			Southern Riparian Scrub			Y	
63.901.00				North Coast Riparian Scrub		N	MRI
63.902.00				Central Coast Riparian Scrub		N	MRI
63.903.00				Montane Riparian Scrub		N	MRI
63.904.00				Modoc-Great Basin Riparian Scrub		N	
63.905.00				Mojave Desert Wash Scrub		N	DSW
63.906.00				Himalayan Blackberry Scrub	*Rubus discolor*	N	CSC
63.907.00				California Rose Riparian Scrub	*Rosa californica*	N	SEW
63.908.00				Salmonberry Scrub	*Rubus spectabilis*	N	CSC

Code	Group	Subgroup	Formation	Alliance	Scientific Name	Rare	CWHR Type
70.000.00	**BROAD LEAFED UPLAND TREE DOMINATED**					N	
71.000.00			Oak Woodlands and Forests			N	
71.040.00				Valley Oak Forests and Woodlands	*Quercus lobata*	Y	VOW, VRI
71.060.00				Coast Live Oak Forest and Woodland	*Quercus agrifolia*	N	COW
80.000.00	**CONIFEROUS UPLAND FOREST AND WOODLAND**					N	
82.000.00			Coastal and Montane Douglas-fir Forests and Woodlands		*Pseudotsuga spp.*	N	
82.500.00				Douglas-fir - Tanoak Forest	*Pseudotsuga menziesii-Lithocarpus densiflora*	N	DFR, COW, MHW, MHC

EXHIBIT 9

science for a changing world

Distribution and Breeding Activities of the Least Bell's Vireo and Southwestern Willow Flycatcher at the San Luis Rey River, San Diego County, California

2006 Annual Data Summary

Prepared for:

State of California
Department of Transportation
District 11
San Diego, California

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

Distribution and Breeding Activities of the Least Bell's Vireo and Southwestern Willow Flycatcher at the San Luis Rey River, San Diego County, California

By James W. Rourke and Barbara E. Kus

U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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State of California
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San Diego Field Station
USGS Western Ecological Research Center
4165 Spruance Road, Suite 200
San Diego, CA 92101

Sacramento, California
2007

Cover photos: Tara Conkling (left) and Josephine Falcone (right).

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EXECUTIVE SUMMARY

Surveys and monitoring for least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) were conducted on the San Luis Rey River, San Diego County CA, between 1 April and 21 August 2006. Vireo surveys were conducted from Interstate 15 west approximately 6.5 km to Mission Road. Southwestern willow flycatchers were surveyed in the same area, as well as downstream between Sante Fe Road and a point approximately 1 km upstream on the San Luis Rey River (Guajome Regional Park).

Fifty-three territorial male least Bell's vireos were observed within the study area, 50 of which (94 percent) were confirmed as paired. Nine transient male vireos were also detected. Within the section of river consistently monitored since 2003, vireo numbers declined from 46 territories in 2005 to 31 in 2006. For the three years prior to 2006 the number of resident territorial males had remained relatively constant, varying from 40 to 46 territorial males.

Nesting activity at 99 nests within 43 vireo territories was monitored. Thirty-six percent of nests were successful, fledging at least one vireo young, while 64 percent failed. Sixty percent of vireo nests whose contents were observed were parasitized by brown-headed cowbirds (*Molothrus ater*). Nest predation and cowbird parasitism accounted for 66 and 21 percent of failures, respectively. However, biologists "rescued" parasitized nests by removing cowbird eggs shortly after they were laid, allowing some to fledge young. Without “rescuing” it is likely that nest success would have been only 15 percent. In total, 86 vireo young fledged from 35 nests, and pairs fledged on average 2.2 young by the end of the breeding season.

Thirteen least Bell's vireos banded prior to the 2006 breeding season were resighted within the study area. All had been banded as nestlings on the San Luis Rey River. Eight of the thirteen possessed a unique combination of color bands or were recaptured during the 2006 season and therefore could be identified to individual. Two of the eight were banded as nestlings outside of the study area and dispersed 14 and 4.9 km into the study area. All other uniquely color banded vireos fledged from and dispersed within the study area. The extent of their dispersal ranged from 0.8 to 4.4 km. Five other adult vireos that had been banded as nestlings with a single federal band were target netted, but attempts to recapture them were unsuccessful. Two additional adult vireos were captured in 2006 while target netting another bird in the territory and were banded with a unique color combination. Eighty-six nestlings were banded with a single dark blue numbered federal band during the 2006 breeding season.

Fourteen different plant species were used by least Bell's vireos as nest substrates, with 74 percent of nests built in *Salix lasiolepis*, *S. exigua,* or *Baccharis salicifolia*. Host plant species had no apparent effect on nest fate as the majority of successful and unsuccessful nests were built in the same species, in roughly the same proportions.

A single southwestern willow flycatcher pair and two transient willow flycatchers of unknown subspecies were documented on the San Luis Rey River within the upper study area during the 2006 breeding season. No flycatchers were documented within the lower study area. The pair built three nests, the first two of which failed because of cowbird parasitism. The third nesting attempt fledged two flycatcher young. The female of the pair was caught and color banded. Two nestlings were banded with a single silver federal band on the left leg.

INTRODUCTION

This report summarizes the results of least Bell's vireo (*Vireo bellii pusillus*, hereafter "vireo") and southwestern willow flycatcher (*Empidonax traillii extimus*, hereafter "flycatcher") monitoring conducted in 2006 along the San Luis Rey River in San Diego County, California. The primary objectives of this study were to: 1) document the abundance and distribution of least Bell's vireos and southwestern willow flycatchers, and 2) monitor nesting activity of the species within the study areas.

The least Bell's vireo is a small, migratory songbird that breeds in southern California and northwestern Baja California, Mexico from April through July. Historically abundant within lowland riparian ecosystems, vireo populations began declining in the late 1900's as a result of habitat loss and alteration associated with urbanization and conversion of land adjacent to rivers to agriculture, and by 1986 numbered just 300 territorial males statewide (Franzreb 1989, U.S. Fish and Wildlife Service 1998, RHJV 2004). Additional factors influencing the decline have been the expansion in range of the brown-headed cowbird (*Molothrus ater*), a brood parasite, to include the Pacific coast (U.S. Fish and Wildlife Service 1986; Franzreb 1989; Brown 1993; Kus 1998, 1999). In response to the dramatic reduction in numbers of the vireo in California, the California Fish and Game Commission listed the species as endangered in 1980, with the U.S. Fish and Wildlife Service (USFWS) following suit in 1986. Since listing, the vireo population in southern California has rebounded, largely in response to cowbird control, and habitat restoration and preservation. As of 2004, the statewide vireo population was estimated to be approximately 2,500 territories (USGS, unpublished data).

The southwestern willow flycatcher is one of four subspecies of willow flycatcher in the United States, with a breeding range including southern California, Arizona, New Mexico, extreme southern portions of Nevada, Colorado and Utah, and western Texas (Hubbard 1987, Unitt 1987). Similar to the vireo, the southwestern willow flycatcher has declined in recent decades in response to widespread habitat loss throughout its range and, possibly, cowbird parasitism (Wheelock 1912; Willett 1912, 1933; Grinnell and Miller 1944; Remson 1978; Garrett and Dunn 1981; Unitt 1984, 1987; Gaines 1988; Schlorff 1990; Whitfield and Sogge 1999). By 1993, the species was believed to number approximately 70 pairs in California (U.S. Fish and Wildlife Service 1993) in small disjunct populations. The southwestern willow flycatcher was listed as endangered by the State of California in 1992 and by the U.S. Fish and Wildlife Service in 1995.

Willow flycatchers in southern California co-occur within riparian systems with the least Bell's vireo. However, unlike the vireo, which has increased eight-fold in response to management alleviating threats, willow flycatcher numbers remain low (Kus and Whitfield 2005). Currently, the majority of southwestern willow flycatchers in California are concentrated in three sites: the South Fork of the Kern River in Kern County (Whitfield 2002), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Varanus Biological Services 2001), and Marine Corps Base Camp Pendleton in San Diego County (Kus and Kenwood 2006). Outside of these sites, southwestern willow flycatchers occur as small, isolated populations of one to half a dozen pairs (Kus et al. 2003). Data on the distribution and demography of the flycatcher, as well as identification of factors limiting the species, are critical information needs during the current stage of recovery planning.

STUDY AREAS AND METHODS

Study Areas and Surveys

Surveys and monitoring of least Bell's vireos were conducted on the San Luis Rey River, San Diego County, from Interstate 15 west approximately 6.5 km to Mission Road (Figure 1). Typically, the entire site was surveyed over a number of days, as surveys were often paired with nest monitoring to maximize the probability of detecting vireos. This methodology ensured the site was surveyed in its entirety every three to four weeks between 1 April and 31 July. Biologists followed standard survey techniques described in the Least Bell's Vireo Working Group and U.S. Fish and Wildlife Service's least Bell's vireo survey guidelines (U.S. Fish and Wildlife Service 2001).

The southwestern willow flycatcher study areas were located within the least Bell's vireo survey and monitoring area described above and between Sante Fe Road and a point approximately 1 km upstream on the San Luis Rey River (Figure 1). Four protocol surveys (Sogge *et al*. 1997) of each site were conducted from 18 May to 25 July to locate male flycatchers actively defending territories. Extra effort was made in areas occupied by flycatchers in previous years to ensure no flycatchers went undetected. Surveys were conducted by moving slowly through the riparian habitat while searching and listening for willow flycatchers. Observers walked along the edge(s) of the riparian corridor on the upland and/or river side where habitat was narrow enough to detect a bird on the opposite edge. In wider stands, observers traversed the habitat in a way that permitted detection of all birds throughout its extent.

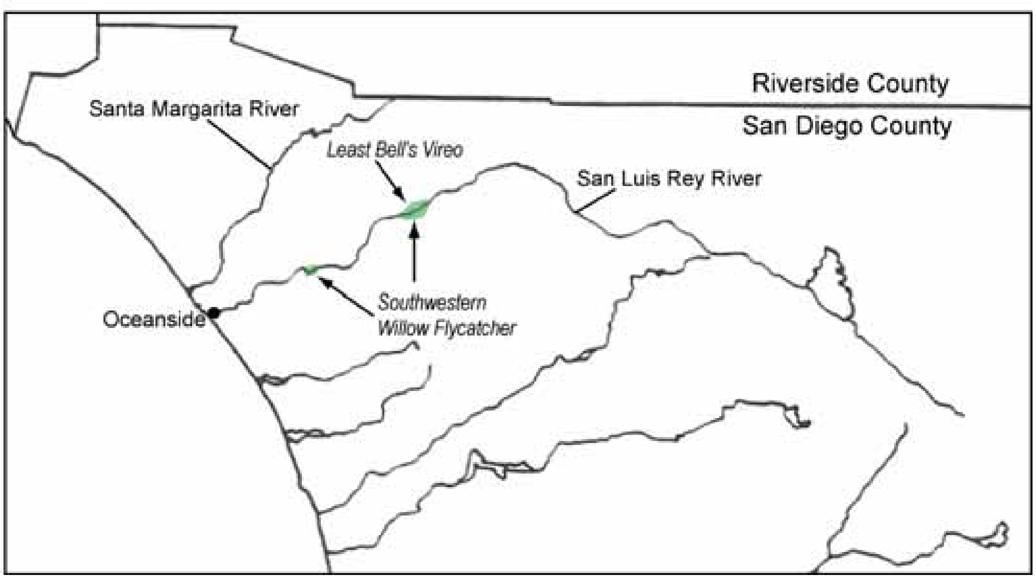


Figure 1. Location of least Bell's vireo and southwestern willow flycatcher study sites in San Diego County, California.

Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions. For each bird encountered (whether vireo or flycatcher), investigators recorded age (adult or juvenile), sex, breeding status (paired, unpaired, or undetermined), and whether the bird was banded. Birds were considered transients if they were detected in an area for less than three weeks. Bird locations were mapped on 1":12,000" aerial photographs as well as 1":24,000" USGS topographic maps, using a Garmin 12 Global Positioning System (GPS) unit with 1-15 m positioning accuracy to determine geographic coordinates (WSG84).

Nest Monitoring

Forty-three vireo territories and all flycatcher territories (1) were monitored to document breeding activity during the 2006 season. Pairs were observed for evidence of nesting, and their nests were located. Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds to nest sites; typically, there were three to five visits per nest. The first visit was timed to determine the number of eggs laid, the next few visits to determine hatching and age of young, and the last to band nestlings. Brown-headed cowbird eggs and nestlings were removed from host nests as they were found. Characteristics of nests, including height, host species, host height, and the distance nests were placed from the edge of the host plant, and to the edge of the vegetation clump in which they were placed were recorded following abandonment or fledging of young from nests for both focal species. For willow flycatchers only, to characterize a nest's placement within the riparian system the distance from each nest to the closest edge of riparian habitat and to surface water or moist soil were also recorded.

Banding

Least Bell's vireo nestlings were banded at 6-7 days of age with a single anodized dark blue aluminum numbered federal band on the left leg. Returning adult vireos previously banded with a single federal numbered band were target netted to learn their identity and banded with a unique combination of colored plastic and anodized metal bands.

Nestling southwestern willow flycatchers were banded at 7-10 days of age with an aluminum numbered federal band on the left leg. Unbanded adult flycatchers and returning flycatchers with a single federal band were target netted and banded with a unique combination of colored aluminum bands. Flycatchers were banded with a maximum of one band on each leg.

RESULTS

Least Bell's Vireo

<u>Population Size and Distribution</u>

Although least Bell's vireos had begun arriving at the study site by the first week in April, arrival of the majority of vireos was delayed considerably (Figure 2). Within the section of river monitored in both 2005 and 2006, between Gird Road and Interstate 15, surveys during the first week of April detected only two territories in 2006 compared to 30 in 2005. By 15 April, 19 territories had been established in 2006 while there had been 39 established in 2005. This lag in territory establishment continued throughout the 2006 breeding season, and it was not until mid-June 2006 that the number of territories detected in early April the preceding year was established. Vireo numbers in 2006 failed to achieve the numbers documented at the site in 2005 (see below).

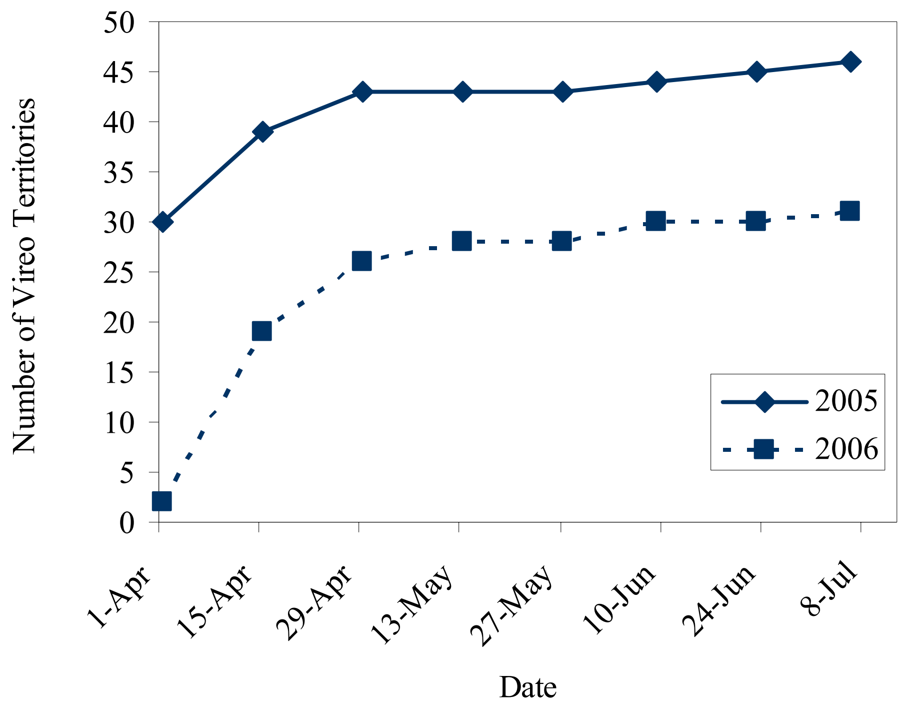


Figure 2. Territory establishment of least Bell's vireos at the San Luis Rey River in 2005 and 2006.

Within the entire study sites 53 territorial male least Bell's vireos were observed in 2006, 50 of which (94 percent) were confirmed as paired (Figure 3; Table 1). The only single male vireo was first observed at the site on 5 June after all other vireos had found mates. Through subsequent monitoring it was determined that this bird did not pair during the 2006 season. The breeding status of two territorial males was undetermined. Nine transient male vireos were also detected during the 2006 breeding season.

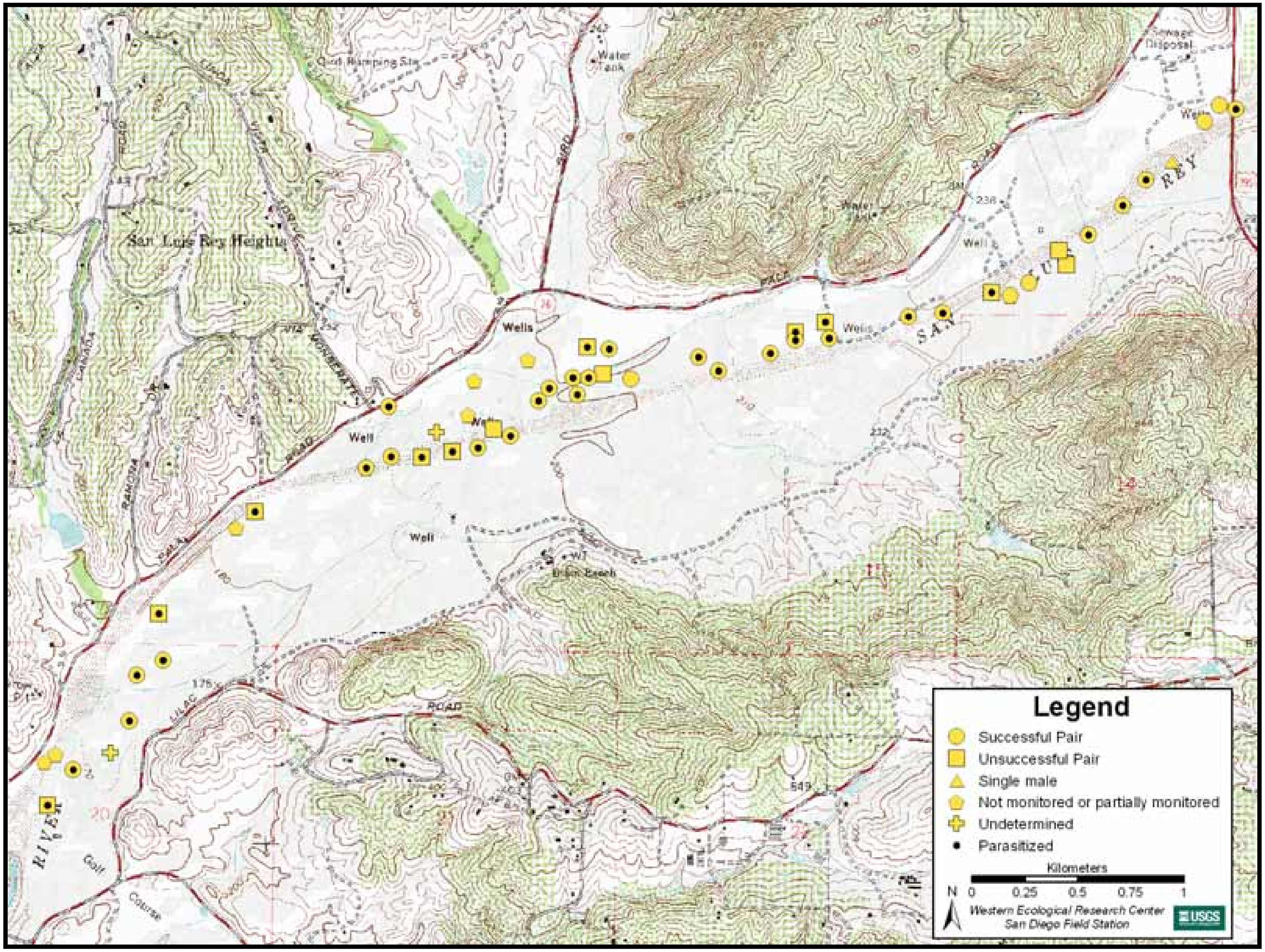


Figure 3. Least Bell's vireo locations and breeding status along the upper San Luis Rey River, 2006.

Table 1. Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2006.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest parasitized?	# BHCO eggs removed[b]	Comments
AVO	Pair	1	SUC	4	N	-	
		2	SUC	3	Y	2	
BBK	Pair	-	-	-	-	-	Not monitored.
BRN	Pair	1	PRE	0	Y	1	
		2	PRE	0	Y	1	
		3	PRE	0	Y	1	
		4	PAR	0	Y	0	Nest parasitized early in cycle and abandoned before BHCO egg could be removed.
CAS	Pair	1	SUC	4	Y	1	
		2	PRE	0	N	-	
CAT	Transient	-	-	-	-	-	Not detected after 6 April
CAC	Pair	1	SUC	2	Y	1	
CWB	Pair	1	OTH	0	N	-	Possible BHCO predation of egg(s).
		2	PRE	0	N	-	
		3	PAR	0	Y	1	
DDT	Pair	-	-	-	-	-	Not monitored.
DEW	Pair	-	-	-	-	-	Not monitored.
DME	Pair	1	PRE	0	Y	1	
		2	INC	0	-	-	Nest building begun, but not completed.
		3	PRE	0	Y	1	
		4	SUC	3	N	-	
DSH	Pair	1	SUC	2	Y	1	
		2	PRE	0	Y	1	
DOZ	Pair	1	PRE	0	N	-	
		2	SUC	3	Y	1	
EVR	Pair	1	PRE	0	N	-	
		2	PRE	0	Y	1	
		3	UNK	0	-	-	Depredated or abandoned prior to egg laying; eggs not confirmed in nest.
		4	PAR	0	Y	1	
ELV	Transient	-	-	-	-	-	Late season movement, first detected in July.
FEF	Pair	1	SUC	3	Y	1	
		2	PAR	0	Y	0	Nest parasitized early in cycle and abandoned before BHCO egg could be removed.
FLY	Pair	1	OTH	0	-	-	Nest drenched in storm and abandoned prior to egg laying. Territory partially monitored.
		2	PRE	0	Y	1	

Table 1 (*continued*). Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2006.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest parasitized?	# BHCO eggs removed[b]	Comments
FRK	Pair	-	-	-	-	-	Not monitored.
GAT	Transient	-	-	-	-	-	Late season movement, first detected in July.
GMP	Unknown	-	-	-	-	-	Not monitored.
HDZ	Pair	1	PRE	0	N	-	
JMS	Pair	1	PAR	0	Y	0	Nest parasitized during egg laying. BHCO egg left in nest until laying was complete, but was subsequently abandoned.
		2	PAR	0	Y	2	
LGL	Pair	1	PRE	0	N	-	
		2	PRE	0	N	-	
		3	PRE	0	N	-	
		4	SUC	2	Y	2	
LLT	Pair	1	UNK	0	-	-	Depredated or abandoned prior to egg laying; eggs not confirmed in nest.
		2	SUC	2	Y	1	
LOC106	Transient	-	-	-	-	-	Detected once on 11 May.
LOR	Transient	-	-	-	-	-	Not detected after 6 April.
LTO	Pair	1	PRE	0	N	-	
		2	SUC	4	N	-	
LKN	Pair	1	UNK	0	N	-	Depredated or abandoned prior to egg laying; eggs not confirmed in nest.
		2	SUC	2	N	-	
LUS	Pair	1	INC	0	-	-	Nest building begun, but not completed. Territory partially monitored.
MYD	Pair	1	INC	0	-	-	Nest building begun, but not completed.
		2	SUC	1	N	-	
NWB	Pair	1	PAR	0	Y	0	Four BHCO eggs laid in nest; all vireo eggs were removed by cowbird.
		2	SUC	1	N	-	
		3	SUC	2	Y	1	
NB2	Transient	-	-	-	-	-	Late season movement, first detected in July.
NKL	Unknown	-	-	-	-	-	Not monitored.
NOM	Pair	-	-	-	-	-	Not monitored.
OFT	Pair	1	PRE	0	N	-	
		2	SUC	3	Y	1	
PAC	Transient	-	-	-	-	-	Detected over a 10-day period in June.

Table 1 (*continued*). Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2006.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest parasitized?	# BHCO eggs removed[b]	Comments
PCK	Pair	1	PRE	0	Y	1	
		2	SUC	4	N	-	
		3	PRE	0	N	-	
PNY	Pair	1	UNK	0	N	-	Possible BHCO predation of nestlings.
		2	PRE	0	Y	1	
		3	UNK	0	Y	0	Possible BHCO predation of eggs. Nest parasitized late in cycle.
		4	PRE	0	Y	3	
PTG	Pair	1	PRE	0	N	-	
		2	PRE	0	N	-	
PGH	Pair	1	SUC	2	Y	1	
		2	PRE	0	N	-	
		3	SUC	4	Y	1	
PNT	Pair	1	SUC	3	N	-	
PSR	Pair	1	SUC	1+	-	-	Not monitored. Male observed with fledgling.
QTH	Pair	1	PAR	0	Y	0	Possible BHCO predation of eggs. Nest abandoned before BHCO egg could be removed.
		2	PRE	0	Y	1	
		3	PRE	0	N	-	
RTL	Pair	1	SUC	4	N	-	
		2	PRE	0	Y	1	
RAY	Pair	1	PRE	0	N	-	
		2	PRE	0	Y	2	
RDA	Pair	1	PRE	0	Y	1	
		2	PRE	0	Y	1	
		3	SUC	3	N	-	
RVO	Pair	1	PAR	0	Y	0	Nest too high to remove egg.
		2	SUC	1	N	-	
		3	PRE	0	N	-	
RKR	Pair	1	PAR	0	Y	1	
		2	SUC	1	Y	1	
		3	PRE	0	N	-	
RVR	Pair	1	PAR	0	Y	3	Vireo was incubating a clutch of 3 BHCO eggs when found.
		2	SUC	2	N	-	
SDP	Pair	1	PAR	0	Y	0	Nest abandoned before BHCO egg could be removed.
		2	SUC	1	Y	3	

Table 1 (*continued*). Status and nesting activities of least Bell's vireos at the San Luis Rey River, 2006.

Territory	Status	Nest	Nest fate[a]	# Young fledged	Nest parasitized?	# BHCO eggs removed[b]	Comments
SHW	Pair	1	SUC	1	Y	1	Territory partially monitored.
SSH	Pair	1	SUC	2	Y	1	
		2	PRE	0	Y	1	
SKN	Transient	-	-	-	-	-	Late season movement, first detected in July.
SPN	Pair	-	-	-	-	-	Not monitored.
SWT	Single	-	-	-	-	-	
TIN	Transient	-	-	-	-	-	Detected over an 18-day period in May.
TIR	Pair	1	SUC	2	Y	1	
TWB	Pair	1	PRE	0	N	-	Territory partially monitored.
VS1	Pair	1	PAR	0	Y	0	Nest found after abandonment.
		2	SUC	3	N	-	
WDG	Pair	1	PRE	0	Y	1	
		2	OTH	0	Y	2	Vireo clutch was infertile and never hatched.
WG2	Pair	1	INC	0	-	-	Nest building begun, but not completed.
		2	SUC	3	Y	1	
		3	SUC	3	Y	2	
WG3	Pair	1	SUC	3	N	-	
		2	PRE	0	Y	1	
WRF	Pair	1	PRE	0	N	-	
		2	PRE	0	Y	1	
		3	SUC	3	Y	1	

[a] Nest fate: INC = nest not completed; SUC = fledged at least one least Bell's vireo young; PRE = nest failure caused by predation event; PAR = failure/abandonment caused by brown-headed cowbird parasitism event; OTH = reason for nest failure known, such as substrate failure; UNK = reason for nest failure/abandonment unknown.
[b] Brown-headed cowbird (BHCO) eggs were removed from active nests in attempt to "rescue" nest.

Within the section of river consistently monitored since 2003, between Gird Road and Interstate 15, least Bell's vireo numbers declined from 46 territories in 2005 to 31 in 2006 (Figure 3). For the three years prior to 2006 the number of resident territorial males had remained relatively constant. In 2003 the reach contained 40 territorial male vireos. This number increased by six territories in 2004 and was unchanged in 2005.

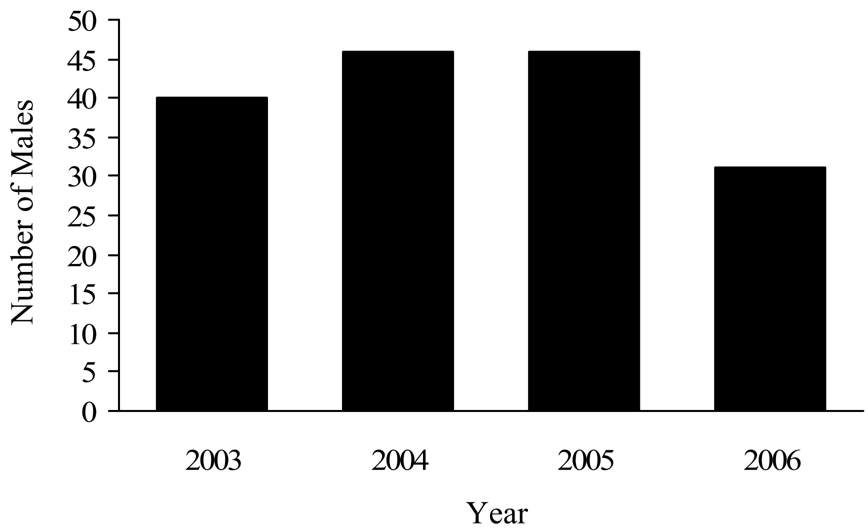


Figure 3. Number of singing male least Bell's vireos detected between Interstate 15 and Gird Road along the San Luis Rey River, 2003-2006.

Banded Birds

Thirteen least Bell's vireos banded prior to the 2006 breeding season were resighted within the study area (Table 2). All had been banded as nestlings on the San Luis Rey River. Eight of the thirteen possessed a unique combination of color bands or were recaptured during the 2006 season and therefore could be identified to individual. Two of the eight were females banded as nestlings in 2004. The female occupying PNT territory in 2006 was banded in 2004 outside of the study area, approximately 14 km downstream. In 2005, she dispersed into the study area, paired with a male in PNT territory, and fledged three young. The RTL female was also banded as a nestling outside the study area in 2004, approximately 4.9 km upstream. Her location in 2005 was unknown. All other uniquely color banded vireos, which were originally banded as nestlings, fledged from and dispersed within the study area. The extent of their dispersal ranged from 0.8 to 4.4 km. Three of these birds had been banded as nestlings in 2005 and were recaptured in 2006 and given unique color combinations. Five other adult vireos that had been banded as nestlings with a single federal Mdb band were target netted, but were not recaptured. Therefore, their age and natal locations were unknown. Two additional adult vireos were captured in 2006 while target netting another bird in the territory and were banded with a unique color combination. Eighty-six nestlings were banded with a single dark blue numbered federal band during the 2006 breeding season.

Table 2. Banded adult least Bell's vireos at the San Luis Rey River, 2006.

Territory	Sex	Band combination[a] Left leg	Right leg	Age[b]	Distance (km)[c]	Comments
DEW	M	Mdb	-	AHY	-	Banded prior to 2006 as a nestling.
ELV	M	DPDB / pupu	Mdb	1 yr	4.4	Banded as a nestling at the San Luis Rey River - DOZ territory.
HDZ	M	DPDB	Mdb	1 yr	1.7	Banded as a nestling at the San Luis Rey River - AIR territory.
LLT	M	pupu	BKBK / Mdb	AHY	-	Banded in 2006.
OFT	M	Mdb	LPBK	≥ 2 yrs	-	
PTG	M	Mdb	WHWH	AHY	-	Banded in 2006.
PNT	F	BWST / Mdb	-	2 yrs	14.0	Banded as a nestling at the San Luis Rey River - COL3 territory.
PSR	M	-	Mdb	AHY	-	Banded prior to 2006 as a nestling.
RTL	F	Mdb	PUWH / pupu	2 yrs	4.9	Banded as a nestling at the San Luis Rey River - EFO territory.
RAY	M	-	Mdb	AHY	-	Banded prior to 2006 as a nestling.
RVO	M	pupu	BYST / Mdb	1 yr	2.1	Banded as a nestling at the San Luis Rey River - GAT territory.
SSH	M	Mdb	LPLP	2 yrs	0.8	Banded as a nestling at the San Luis Rey River - GAT territory.
SPN	M	-	Mdb	AHY	-	Banded prior to 2006 as a nestling.
SWT	M	DPWH / pupu	Mdb	1 yr	3.0	Banded as a nestling at the San Luis Rey River - GME territory.
TIN	M	-	Mdb	AHY	-	Banded prior to 2006 as a nestling.

[a] Band colors: Mdb = dark blue numbered federal band; DPDB = plastic dark pink-dark blue split band; pupu = metal purple; BKBK = plastic black; LPBK = plastic light pink-black split; WHWH = plastic white; BWST = plastic blue-white striped; PUWH = plastic purple-white split; BYST = plastic black-yellow striped; LPLP = plastic light pink; DPWH = plastic dark pink-white split.
[b] Age: AHY = after hatch year.
[c] Dispersal distance from natal site to current location.

Nest Monitoring

Nesting activity was monitored in a total of 43 least Bell's vireo territories. Of these, 39 were "fully" monitored, meaning that all nests within the territory were found and documented during the breeding season (Table 3). Pairs within the remaining four territories were documented nesting; however, only a subset of their nests were found and monitored (= “partially monitored territories”). A total of 99 nests were monitored during the breeding season, however four nests were abandoned in the building stage and were excluded from nest success and productivity calculations. An additional four nests were known to have failed, but because the specific causes of failure were uncertain and/or it was uncertain whether eggs were laid in the nests, they were included in nest success calculations (n = 95), but excluded from productivity calculations (n = 91). One nest was drenched in a spring storm prior to eggs being laid and was subsequently abandoned; three other nests failed prior to eggs being confirmed in the nest and may have been depredated or abandoned (Table 1). Within fully monitored territories, pairs averaged 2.3 ± 0.8 (std) nesting attempts over the course of the 2006 breeding season, including four pairs that nested four times without fledging young.

Table 3. Number of least Bell's vireo territories and nests monitored, San Luis Rey River, 2006.

	Total number
Territories fully monitored	39
Nests in fully monitored territories	91
Nests in partially monitored territories	4
Completed nests per pair (fully monitored territories only)	2.3
Total # of nests monitored[a]	99

[a] Includes four nests that were abandoned during nest building (see Table 1. "INC" nests) and were excluded from nest success and productivity calculations.

Nest Success

Thirty-six percent (34/95) of all vireo nests monitored were successful, fledging at least one young (Table 4). Nest predation and brown-headed cowbird nest parasitism were believed to be the primary sources of nest failure, accounting for 66 and 21 percent of failures, respectively. Overall, 42 (40/95) and 14 (13/95) percent of completed vireo nests were lost to predation and cowbird parasitism, respectively. It is possible that predation may have accounted for as much as 45 percent of all nest failures as three completed nests failed prior to eggs being confirmed in the nest and could have been the result of predation. The affects of cowbirds on vireo nest success may have extended beyond parasitism as four least Bell's vireo nests showed signs of cowbird predation. In three instances, two in which the nests were parasitized and one in which it was not, vireo eggs were punctured and/or ejected from the nests, but the contents were not consumed. In the remaining instance, nestlings were ejected from an active, unparasitized nest. Some nestlings had lacerations and/or puncture marks on their heads.

Table 4. Fate of least Bell's vireo nests at the San Luis Rey River, 2006.

Nest Fate	Number[a]
Successful	34 (36)
Failed	
Predation	40 (42)
Parasitism	13 (14)
Other/Unknown	8 (7)
Total failed nests	61 (64)
Total completed nests[b]	95 (100)

[a] Numbers in parentheses are the percent of total nests.
[b] Does not include four nests abandoned during building.

In addition to the 13 nests that failed after receiving cowbird eggs, 42 other nests were documented as parasitized by the presence of cowbird eggs, yielding a total of 60 percent (55/91) of vireo nests whose contents were observed being parasitized. These nests remained active following the removal of cowbird eggs by nest monitors, and while half eventually failed to predation, 52 percent (20/42) subsequently fledged young. Had this intervention not occurred, it is likely that vireo nest success would have been only 15 percent (14/91), as vireo nestlings are unable to fledge in the presence of cowbird young.

To a small degree nest fate influenced the likelihood that pairs would renest. While 96 percent (27/28) of pairs whose initial nests failed attempted second nests, only 73 percent (8/11) of pairs renested after they had successfully fledged at least one young. During the course of the 2006 breeding season, 74 percent (29/39) of fully monitored pairs successfully fledged young. Four pairs fledged young from two separate nesting attempts.

Productivity

Average clutch size of non-parasitized nests was 3.5 ± 0.7 eggs per nest while that of parasitized nests, from which female cowbirds typically removed a host egg when depositing their own, was 1.9 ± 1.0 eggs per nest (Table 5). Overall, the average vireo clutch size at this site was 3.0 eggs per nest, 14 percent lower than that expected in the absence of parasitism. Fifty-three percent of all eggs hatched, while 57 percent (49/86) of nests documented with eggs eventually supported nestlings. In total, 64 percent (86/135) of nestlings successfully fledged from 35 nests in 2006, averaging over two young per pair.

Table 5. Reproductive success and productivity of nesting least Bell's vireos at the San Luis Rey River, 2006.

Parameter	Number
Nests with eggs	86
Eggs laid	255
Average clutch size:[a]	
Non-parasitized nests	3.5 ± 0.7 (std)
Parasitized nests	1.9 ± 1.0 (std)
Nests with hatchlings	49
Hatchlings	135
Hatching success:	
Eggs[b]	53%
Nests[c]	57%
Nests with fledglings	34
Fledglings	86
Fledgling success:	
Hatchlings[d]	64%
Nests[e]	69%
Fledglings per egg	0.3
Fledglings per nest[f]	0.91
Average number of young fledged per pair[g]	2.2 ± 1.8 (std)
Pairs fledging ≥ one young[g]	29 (74%)

[a] Based on 24 non-parasitized nests with a full clutch and 8 parasitized nests.
[b] Percent of all eggs that hatched.
[c] Percent of all nests with eggs in which at least one egg hatched.
[d] Percent of all nestlings that fledged.
[e] Percent of all nests with nestlings in which at least one young fledged.
[f] Based on 95 monitored nests.
[g] Based on 39 pairs whose territories were fully monitored.

Nest Characteristics

The placement of vireo nests that fledged young compared to those that did not fledge young were very similar. Successful and unsuccessful nests did not differ statistically in the height of the nest, the height of the host plant, the distance the nest was placed from the edge of the host, or from the edge of the vegetation clump (Table 6).

Table 6. Least Bell's vireo nest characteristics and results of two-sample unequal variance t-tests of successful vs. unsuccessful nesting attempts at the San Luis Rey River, 2006.

	Nest Fate				
Nest Characteristic	**Successful**	**Unsuccessful**	**df**	**t**	***P***
Average Nest Height (m)	0.9	1.0	79	-1.17	0.25
Average Host Height (m)	2.9	3.4	82	-1.10	0.28
Average Distance to Edge of Host (m)	0.4	0.4	75	0.64	0.52
Average Distance to Edge of Vegetation Clump (m)	2.5	2.0	57	0.56	0.58

Fourteen different plant species were used by least Bell's vireos as nest substrates during the 2006 breeding season, with 74 percent of nests built in *Baccharis salicifolia, Salix lasiolepis*, or *S. exigua* (Table 7). Host plant species had no apparent effect on nest fate as the majority of successful and unsuccessful nests were built in the same species, in roughly the same proportions. However, even though the numbers of nests placed in *Artemisia douglasiana*, *Quercus* sp., *Sambucus mexicana*, and *Toxicodendron* sp. were small (8 percent of nests), none successfully fledged young.

Table 7. Host plant species used by least Bell's vireos at the San Luis Rey River, 2006.

Host Species	**Successful**	**Unsuccessful**	**Total**
Baccharis salicifolia	12 (0.35)	12 (0.21)	24 (0.26)
Salix lasiolepis	7 (0.20)	17 (0.30)	24 (0.26)
S. exigua	6 (0.17)	14 (0.25)	20 (0.22)
Populus fremontii	3 (0.08)	3 (0.05)	6 (0.06)
Alnus rhombifolia	1 (0.02)	1 (0.01)	2 (0.02)
Arundo donax	1 (0.02)	1 (0.01)	2 (0.02)
Rubus ursinus	1 (0.02)	0 (0.00)	1 (0.01)
S. gooddingii	1 (0.02)	2 (0.03)	3 (0.03)
Tamarix sp.	1 (0.02)	0 (0.00)	1 (0.01)
Vitis californica	1 (0.02)	0 (0.00)	1 (0.01)
Artemisia douglasiana	0 (0.00)	1 (0.01)	1 (0.01)
Quercus agrifolia	0 (0.00)	1 (0.01)	1 (0.01)
Sambucus mexicana	0 (0.00)	2 (0.03)	2 (0.02)
Toxicodendron diversilobum	0 (0.00)	2 (0.03)	2 (0.02)

[a] Host species for one nest not known.

[b] Numbers in parentheses are proportions of total nests.

Southwestern Willow Flycatcher

Population Size and Distribution

A single southwestern willow flycatcher pair was documented on the San Luis Rey River adjacent to the eastern border of the upper study area during the 2006 breeding season (Figure 4). Two transient willow flycatchers of unknown subspecies were also documented within the upper study area. The first was observed on 24 May approximately 350 m east of Gird Road. The second was observed on 1 June, 1.6 km west of Interstate 15. After their initial detections, neither flycatcher was detected throughout the remainder of the breeding season. No flycatchers were documented within the lower study area.

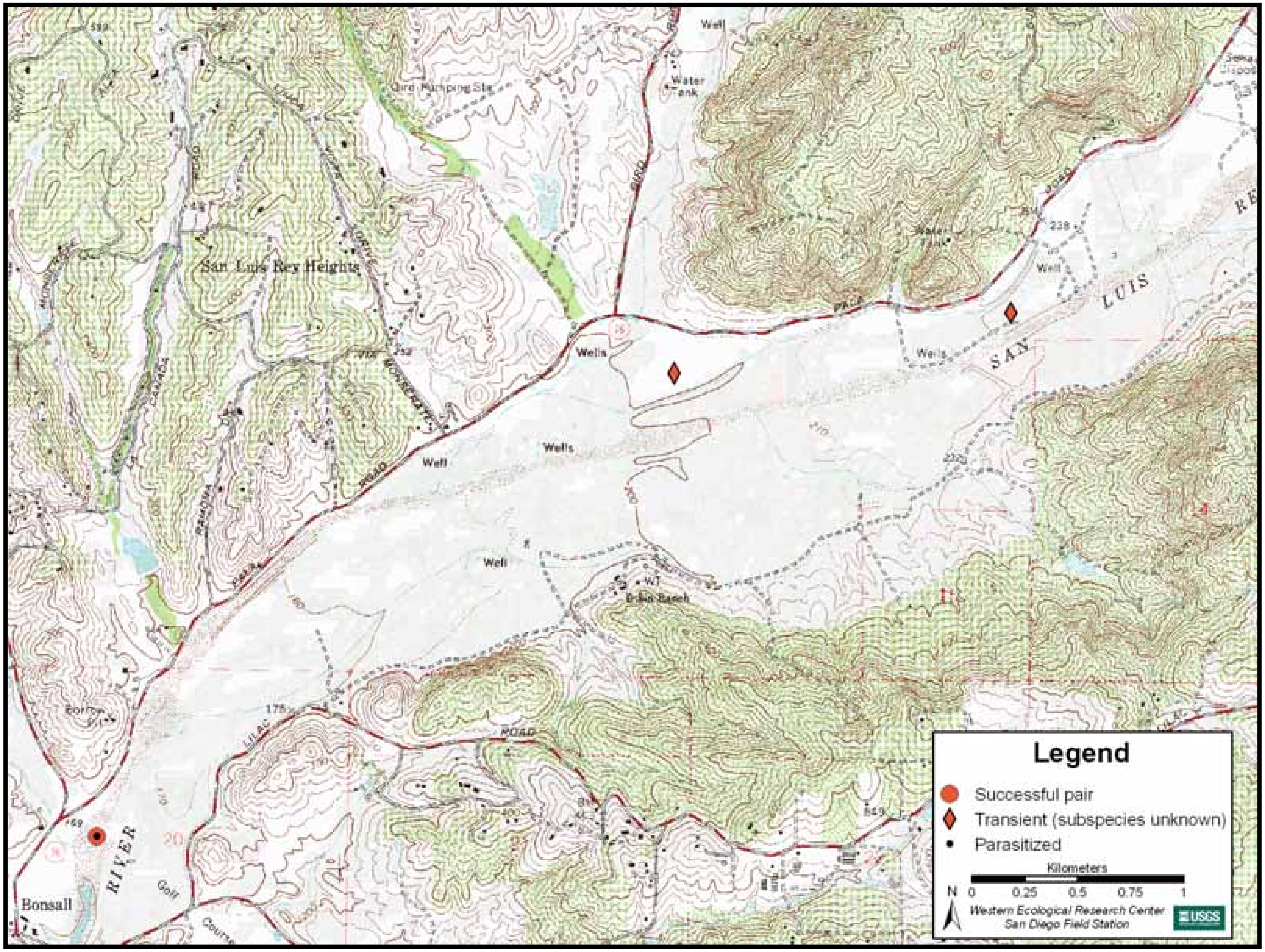


Figure 4. Southwestern willow flycatcher locations and breeding status along the upper San Luis Rey River, 2006.

Banded Birds

A single adult southwestern willow flycatcher was banded in 2006 (Table 8). The female of the pair occupying the WRRN territory was unbanded at the start of the breeding season. It was subsequently target netted, captured, and banded with a Msi:orre color combination. It is unknown whether the male flycatcher occupying the WRRN territory was banded. Numerous unsuccessful attempts were made to resight and/or capture the male. Two nestlings from the pair's third nesting attempt were also banded with a single federal Msi band on the left leg.

Table 8. Banded adult southwestern willow flycatchers at the San Luis Rey River, 2006.

		Band Combination[a]			
Territory	**Sex**	**Left Leg**	**Right Leg**	**Age**[b]	**Comments**
WRRN	F	Msi	orre	AHY	Banded as an adult in 2006.

[a] Band colors: Msi = silver numbered federal band; orre = metal orange-red split band.
[b] Age: AHY = after hatch year.

Nesting

The WRRN pair nested three times during the 2006 breeding season. The first nest was abandoned with one willow flycatcher and one brown-headed cowbird egg following the parasitism event. The second nest was also parasitized and contained one willow flycatcher and one cowbird egg when found. To avoid the possibility of abandonment associated with a change in egg volume, the cowbird egg was not immediately removed by nest monitors. The cowbird egg hatched prior to the flycatcher egg and the nestling was removed at two days of age. After removal, the pair continued to tend the nest and the female was observed incubating the remaining egg. Four days later, on day 18 of incubation, when the flycatcher egg still had not hatched it was examined and determined to be inviable. The egg was removed in an attempt to stimulate the pair to renest. The pair's third nest was found one week later, on 21 July. This nest was not parasitized and eventually fledged two flycatcher young.

Nest placement of the three nests built by the WRRN pair were very similar (Table 9). All nests were constructed within the same stand of monotypic *S. exigua* that ranged from 3-6 m in height. Nest height and host height were remarkably similar between nests, ranging from 2.2 to 2.5 m and 3.2 to 5.0 m in height, respectively. The distance between adjacent nests ranged from 55 to 70 m.

Table 9. Southwestern willow flycatcher nest characteristics and placement at the San Luis Rey River, 2006.

Parameter	WRRN Territory Nest 1	Nest 2	Nest 3
Nest Height (m)	2.2	2.5	2.2
Host Species	*S. exigua*	*S. exigua*	*S. exigua*
Host Height (m)	4.0	5.0	3.2
Distance (m) to:			
Edge of Host Plant	2.5	0.1	0
Vegetation Clump	2.5	3	15
Riparian Habitat	30	20	30
Surface Water/Moist Soil (Early Season)[a]	40	3	20
Surface Water/Moist Soil (Late Season)[b]	40	3	20

[a] Early season, 15 May to 15 June, corresponding with flycatcher arrival and territory selection.
[b] Late Season, 15 July to 15 August, corresponding with the end of flycatcher nesting.

DISCUSSION

One of the most striking features of the 2006 breeding season was a delay in the arrival of the majority of vireos at the breeding site. The late arrival of vireos observed on the San Luis Rey River was also documented throughout a large part of its range at other sites (Ferree and Kus 2007, Rourke and Kus 2007, J. Pike pers. comm.). Migration was delayed by at least two weeks compared to previous years. However, once vireos started arriving on site the rate of territory establishment was similar to other years (Figure 2). It is unclear why vireo arrival was delayed in 2006 or what effect, if any, the delay had on the overall population size.

Fifty-three resident male least Bell's vireos were observed within the upper study area during the 2006 breeding season. However, within the reach of river monitored over the past eight years, between Gird Road and Interstate 15, the population declined by 32 percent compared to the previous year. The cause of the decline is unknown, but parallels similar decreases in population size observed in other parts of the vireo’s range in 2006 (Rourke and Kus 2007). For example, at Marine Corps Base Camp Pendleton the overall least Bell’s vireo population declined by 13 percent from 2005 to 2006. Population declines were documented on 14 of the 23 drainages surveyed (61 percent) and ranged from 11 to 100 percent loss. Annual vireo productivity during the previous breeding season did not explain the observed decreases, as sites with high (e.g. 2.8 young per year, Santa Margarita River study sites, Camp Pendleton, Rourke and Kus 2006b) and low productivity (e.g. 1.6 young per pair, San Luis Rey River study site, Rourke and Kus 2006a) experienced population declines in 2006. Moreover, no change in the distribution of birds within the site was observed, as might be expected from a large scale change in habitat quality. The extent of the decline in the vireo population along the San Luis Rey River is unknown, as further downstream no decrease in vireo numbers was documented between 2005 and 2006 within another population of monitored vireos (Ferree and Kus 2007).

Brown-headed cowbird nest parasitism has fluctuated during the years since cowbird trapping was discontinued (1998), averaging 50% ± 20 (std) of vireo nests annually (1999-2005). Parasitism of vireo nests in 2006 (60%) was slightly higher than this average, but below the peak rate of 76% observed in 2004, and 68% documented in 2005. Seasonal productivity of vireos in 2006 was relatively high (2.2 young per pair), and comparable to that at sites in which cowbird parasitism has been effectively removed through trapping (e.g. 2.4 young per pair, Camp Pendleton, Rourke and Kus 2007). The high productivity at the San Luis Rey study site is largely attributable to the practice of removing cowbird eggs from vireo nests, which allowed roughly half of them eventually to fledge young . Without cowbird egg removal it is likely that no young would have fledged from parasitized nests. This would have reduced vireo productivity to 1.0 young fledged per pair, a value that may be more representative of vireo productivity on the San Luis Rey River as a whole in the absence of trapping and nest manipulation (removal of cowbird eggs). Although nest monitoring is a very intensive practice, monitors "rescuing" nests by removing cowbird eggs appears to be an effective method of countering the effects of nest parasitism (Kus and Whitfield 2005).

Rourke and Kus (2006a) speculated that the vireo population at the site may not be self sustaining and was likely supported by immigration from other population(s); the most probable being the vireo population on Marine Corps Base Camp Pendleton, 13 km distant. To date no vireos have been documented dispersing between the upper San Luis Rey River and the Base. However, given that the majority of the San Luis Rey River is not trapped for cowbirds, annual vireo productivity over a large portion of the River may be close to one young per pair. It is therefore a strong possibility that the vireo population is supported to some degree by immigration. In 2005, USGS initiated an intensive vireo banding and nest monitoring study on Camp Pendleton. Through this program, in conjunction with the existing banding and monitoring programs at the San Luis Rey River study site, we hope to collect data to understand the roles the San Luis Rey River and Marine Corps Base Camp Pendleton play in vireo persistence in San Diego County.

For the first time in eight years, southwestern willow flycatchers did not establish territories within the lower San Luis Rey study site. From 1999 to 2005 the population there fluctuated between one and six territories. In 2005, two pairs established territories and bred. Because of the small population size of southwestern willow flycatchers in southern California, the cause of the decline of this species in the study area is difficult to determine. However, because flycatchers typically demonstrate high site fidelity (USFWS 2002), two possible factors may explain their absence: 1) the death of individual flycatchers that previously nested within the study area, and 2) the dispersal of birds to sites containing more suitable habitat. The second factor is worth addressing further as it can be considered within a management context. The possible emigration of willow flycatchers from the study site is not unreasonable as habitat adjacent to the river was extensively altered and/or removed by heavy winter rains and spring flooding in 2005. Young trees with vertical structure preferred by flycatchers were uprooted and/or "laid over", forming dense thickets no longer suitable for nesting willow flycatchers. It is possible that some flycatchers that would have nested within the study area dispersed to other more suitable habitats within the San Luis Rey River or to nearby drainages. Three of the four flycatchers that nested within the lower San Luis Rey River study area in 2005 were banded, however, none were resighted in 2006.

In 2006, for the first time, a pair of southwestern willow flycatchers was documented nesting in the upper San Luis Rey study site. It is possible that at least one of the 2005 lower San Luis Rey flycatchers dispersed to colonize the upper site, 7.2 km distant. However, this could not be confirmed as the female at the upper San Luis Rey site was unbanded at the beginning of the 2006 breeding season, and the male's banding status remained undetermined throughout the 2006 season. It is also possible that the flycatchers at the upper site in 2006 were different birds than those nesting within the lower site in 2005. The flycatchers on the upper San Luis Rey River were located at the western survey limit of the site, in an area not surveyed since 2004. It is possible that one or more southwestern willow flycatchers had established territories within the upper portion of the San Luis Rey River in the intervening year as new habitat, like the patch of *S. exigua* where the WRRN territory was located, became established and matured.

LITERATURE CITED

Brown, B.T. 1993. Bell's vireo (*Vireo bellii*). *In* A. Poole, P. Stettenheim, and F. Gill [eds.], The Birds of North America, no. 47. The American Ornithologists' Union, Washington, D. C. and the Academy of Natural Sciences of Philadelphia.

Ferree, K. and B. E. Kus. 2007. Least Bell's vireos and southwestern willow flycatchers at the San Luis Rey River Flood Control Project area in San Diego County, California: breeding activities and habitat use. 2006 Data Summary. Prepared for RECON Environmental, Inc., San Diego, California.

Franzreb, K.E. 1989. Ecology and conservation of the endangered least Bell's vireo. Biological Report 89(1). U.S. Fish and Wildlife Service, Department of Interior. March 1989.

Gaines, D. 1988. Birds of Yosemite and the east slope. Artemesia Press, Lee Vining, California.

Garrett, K. and J. Dunn. 1981. Birds of southern California: status and distribution. The Artisan Press, Los Angeles.

Grinnell, J. and A. Miller. 1944. The distribution of the birds of California. Pac. Coast Avif. 27.

Hubbard, J.P. 1987. The status of the willow flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, NM.

Kus, B.E. 1998. Use of restored riparian habitat by the endangered least Bell's vireo (*Vireo bellii pusillus*). Restoration Ecology 6:75-81.

Kus, B.E. 1999. Impacts of brown-headed cowbird parasitism on the productivity of the endangered least Bell's vireo. Studies in Avian Biology 18:160-166.

Kus, B.E., P.P. Beck and J.M. Wells. 2003. Southwestern willow flycatcher populations in southern California: distribution, abundance, and potential for conservation. Studies in Avian Biology 26:12-21.

Kus, B.E. and K.E. Kenwood. 2006. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2005 Annual Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B. E. and M.J. Whitfield. 2005. Parasitism, productivity, and population growth: response of least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) to cowbird (*Molothrus* spp.) control. Ornithological Monographs 57:16-27.

Remson, J.V. Jr. 1978. Bird species of special concern in California. California Department of Fish and Game, Wildlife Management Division, Administrative Report 78-1.

RHJV (Riparian Habitat Joint Venture). 2004. Version 2.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian_v-2.pdf

Rourke, J. W. and Kus, B. E. 2006a. Distribution and breeding activities of the least Bell's vireo and southwestern willow flycatcher at the San Luis Rey River, San Diego County, California. 2005 Annual Report. Prepared for the State of California, Department of Transportation, District 11.

Rourke, J.W. and B.E. Kus. 2006b. Distribution, abundance and breeding activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California. 2005 Annual Report. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Rourke, J. W. and B. E. Kus. 2007. Distribution, abundance and breeding activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California. 2006 Annual Data Summary. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Schlorff, R.W. 1990. Status review of the willow flycatcher (*Empidonax traillii*) in California. Report to the Fish and Game Commission, State of California Resources Agency.

Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbitts. 1997. A southwestern willow flycatcher natural history summary and survey protocol. National Park Service/USGS Colorado Plateau Research Station, Northern Arizona University. NRTR-97/12.

Unitt, P. 1984. The birds of San Diego County. San Diego Society of Natural History.

Unitt, P. 1987. *Empidonax traillii extimus*: an endangered subspecies. Western Birds 18:137-162.

U.S. Fish and Wildlife Service. 1986. Final rule determining endangered status for the least Bell's vireo. Federal Register 51(85):16474-16482.

U.S. Fish and Wildlife Service. 1993. Proposal to list the southwestern willow flycatcher as an endangered species and to designate critical habitat. Federal Register 58:39495-39522.

U.S. Fish and Wildlife Service. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, Oregon. 139 pp.

U.S. Fish and Wildlife Service. 2001. Least Bell's vireo survey guidelines. Unpublished document prepared by the USFWS Carlsbad Office, Carlsbad, California. January 19, 2001. 3 pp.

U.S. Fish and Wildlife Service. 2002. Southwestern willow flycatcher recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Varanus Biological Services. 2001. Southwestern willow flycatcher field season 2000 data summary. Prepared for the US Bureau of Reclamation, Phoenix Office.

Wheelock, I.G. 1912. Birds of California: an introduction to more than three hundred common birds of the state and adjacent islands. A.C. McClurg and Company, Chicago, Illinois.

Willett, G. 1912. Birds of the Pacific slope of southern California. Pacific Coast Avifauna 7.

Willett, G. 1933. A revised list of the birds of southwestern California. Pacific Coast Avifauna 21.

Whitfield, M.J. and M.K. Sogge. 1999. Range-wide impact of brown-headed cowbird parasitism on the southwestern willow flycatcher (*Empidonax traillii extimus*). Studies in Avian Biology 18:182-190.

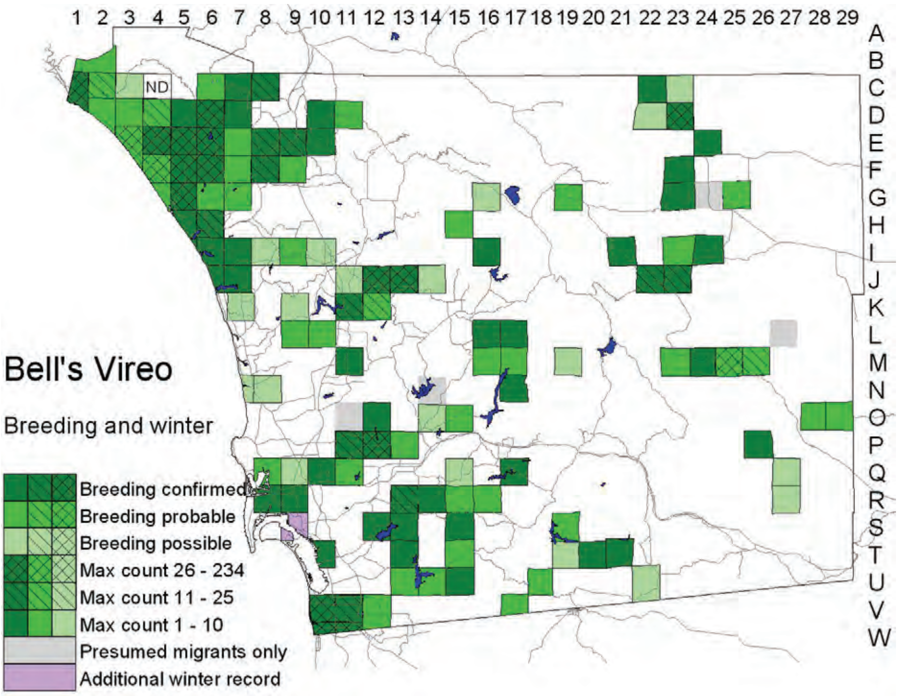
Whitfield, M.J. 2002. Southwestern willow flycatcher monitoring, and removal of brown-headed cowbirds on the South Fork Kern River, California in 2001. Final Report. Prepared for the U.S. Army Corps of Engineers, Sacramento District, Environmental Resources Branch (DACW05-01-P-0136).

EXHIBIT 10

Bell's Vireo *Vireo bellii*

Photo by Anthony Mercieca

Early in the 20th century, California's subspecies of Bell's Vireo was abundant. Then clearing of its riparian woodland habitat and parasitism by the invading Brown-headed Cowbird decimated it. By the early 1980s the population in the United States was down to about 300 pairs—about half in San Diego County. As a result, the California Department of Fish and Game listed the subspecies, the Least Bell's Vireo, as endangered in 1984, and the U.S. Fish and Wildlife Service followed suit in 1986. Listing



opened the door to protection of the vireo's habitat and widespread trapping of cowbirds, leading to a remarkable recovery: an increase by a factor of six in just 15 years (Kus 2002). Nevertheless, many threats remain; weaning the vireo from cowbird trapping in perpetuity will be a delicate experiment.

Breeding distribution: Riparian woodland supporting the Least Bell's Vireo typically has both a dense canopy, where the birds forage, and a dense understory, where they nest. The population is concentrated in the coastal lowland, especially along the Santa Margarita River, other creeks in Camp Pendleton, along the San Luis Rey River upstream to Pala (D11), and along Windmill and Pilgrim creeks, tributaries of the San Luis Rey. This area accounted for about 74% of the 1423 territorial males known in the county in 1996—and about 59% of California's total population, demonstrating that it is the core habitat for the entire subspecies (USFWS 1998). By 1998, the population in Camp Pendleton alone had increased to 1010 territorial males, though it dropped to 783 in 2000 (J. and J. Griffith, data courtesy of Camp Pendleton), and the birds spread along small side creeks as well as all the major ones. In the late 1990s, the vireos continued to recolonize sites in northwestern San Diego County where they had not been recorded up until 1996 (USFWS 1998), sometimes in fair numbers, as along Buena Vista Creek (H6; 15 territorial males in 1997, Kus and Beck 1998), Agua Hedionda Creek (I6; seven on 25 April 1999, P. A. Ginsburg), and in a side canyon north of San Marcos Creek at La Costa (J7; seven on 24 June 1998, M. Baumgartel).

Elsewhere in the coastal lowland, the major sites are the San Dieguito River from Lake Hodges east to San Pasqual (K11/K12/J12/J13; 104 territorial males in 1997, Kus and Beck 1998), the San Diego River from Interstate 805 to Santee (Q10/Q11/P11/P12; 55 territorial males in 1997, Kus and Beck 1998), the Sweetwater River from Sweetwater Reservoir to the Rancho San Diego/Cottonwood golf course (S13/R13/R14; 102 territorial males in 2001, P. Famolaro), Jamul and Dulzura creeks (U14/U15/T15; 24 territorial males in 1996, USFWS 1998), Otay River (V11/V12; about 19 territorial males in 1997, Kus and Beck 1998, C. W. Bouscaren), and the Tijuana River valley (V10/V11/W10/W11; 134 territorial males in 1997, Wells and Turnbull 1998). Spread away from the major centers has been less extensive in central and southern San Diego County than in the northwest, though it is still noticeable, with up to three territorial males in La Jolla Valley (L10) 7 May 2000 (K. J. Winter) and three in Sycamore Canyon (O12) 3 May 1998 (I. S. Quon).

In San Diego County's foothills, Bell's Vireo is scattered in small numbers at only a few sites, principally the San Diego River above El Capitan Reservoir (L17/M17; five territorial males in 1997, Kus and Beck 1998; N17; four, including a fledgling, 20 June 2000, D. C. Seals), Cottonwood Creek in Hauser Canyon (T20/T21; up to 11 territorial males and eight nesting pairs in 1998, J. M. Wells), and Cottonwood and Tecate creeks in Marron Valley (V17; eight on 12 June 2000, P. P. Beck). At most other foothill sites the species is irregular. For example, it was absent 1997–2002 from a section of Pine Valley Creek (R19) where six to eight territorial males persisted from the late 1980s to 1994 (Winter and McKelvey 1999, Kus et al. 2003b). Along Santa Ysabel Creek at Black Canyon (I16) Bell's Vireos occurred regularly from the early 1990s to 1998 (pair at nest 22 May, K. J. Winter) but were absent in 2002 (Kus et al. 2003b). From 1997 to 2003, during his intensive study of the Willow Flycatchers nesting along the San Luis Rey River below Lake Henshaw (F16/G16), W. E. Haas encountered only a single Bell's Vireo, 31 May 1999. Two observations during the atlas period 1997–2001 well away from previously reported sites were along Boulder Creek at Boulder Creek Road (M19; one singing male and one juvenile 29 June 1997. C. Jones) and along Buena Vista and San Ysidro creeks 2.1–2.4 miles east of Warner Ranch (G19; two singing males 25 June 2000, P. Unitt). At 3800 feet, one in Noble Canyon (O22) 10 and 26 July 2002 was at the highest elevation yet reported for Bell's Vireo in San Diego County (Kus et al. 2003b); the species was absent at that site during repeated surveys 1992–99.

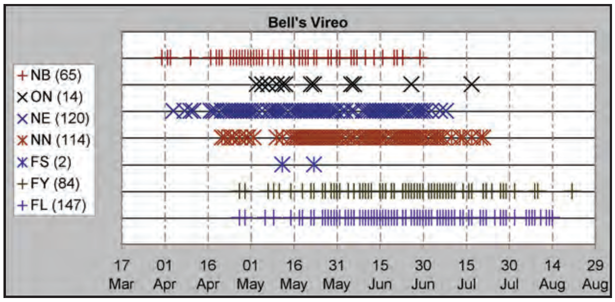
Oases in the Anza–Borrego Desert also contribute significantly to the population. The vireos there use thickets of mesquite as well as woodland dominated by willows.

In this region the important sites are along Coyote Creek, at both Middle Willows (C22; up to five territorial males 28 May 1998, P. D. Jorgensen) and Lower Willows (D23; 18 territorial males or pairs in 2000, Wells and Kus 2001; 31 in 2002, J. R. Barth), Borrego Palm Canyon (F23; up to seven territorial males 5–8 July 2001, L. J. Hargrove), along San Felipe Creek near Paroli Spring (I21; up to six singing males 16 June 2000, J. O. Zimmer), near Scissors Crossing (J22; about 17 territorial males or pairs in 2002, 20 in 2003, J. R. Barth), and in Sentenac Ciénaga and Canyon (J23; up to 17 territorial males 9 May 2001, R. Thériault; I23; up to five on 23 April 1997, P. K. Nelson), and along Vallecito Creek, near Campbell Grade (M23/M24; up to 17 territorial males 6 May 1998, R. Thériault) and near Vallecito Stage Station (M24/M25; counts of territorial males varying from 19 in 2002 to in 33 in 1996, M. C. Jorgensen, P. D. Jorgensen; Wells and Kus 2001).

Several smaller oases also support a few Bell's Vireos. Some of these were previously known: Sheep and Indian canyons (D22), Hellhole Canyon (G23), Yaqui Well (I24), Agua Caliente Springs (M26), and Carrizo Wash and Marsh (O28/O29). Our numbers at Agua Caliente were notably higher than previously reported, up to six territorial males 6 June 1998 (E. C. Hall). Other sites came to light as a result of field work for this atlas and may represent newly established territories: the Borrego Valley's mesquite bosque (G25), with one territorial male 27 April and 4 June 1998 and an apparent family group of four on 11 June 1998 (R. Thériault), Bow Willow Canyon (P26), with up to four territorial males 12 May 2000 and 19 May 2001, Jacumba Jim Canyon, elevation 1350 feet (Q27), with one on 13 May 2000, and Carrizo Canyon, elevation 1110 feet (R27), with one on 23 April 2000 (L. J. Hargrove). An unexpected site for nesting Bell's Vireos in the Borrego Valley was Ellis Farms, a commercial nursery (E24); three there 11 June 2001 included a singing male and a fledgling (P. D. Jorgensen).

Although Bell's Vireo is a characteristically riparian species, it uses upland scrub adjacent to riparian woodland regularly, foraging at distances up to 200 feet from the riparian edge and even nesting in the nonriparian habitat (Kus and Miner 1989). The use of such marginal habitats increases when, after an unusually wet winter, nearby riparian woodland is flooded and the upland habitat becomes unusually lush. In the wet El Niño year 1998, 8 of 31 territories along Pilgrim Creek (F6) were at the base of slopes in mustard that had grown to a height of 10 feet (B. E. Kus). That year, near Sweetwater Reservoir (S12), one pair nested in sage scrub 1 mile from riparian woodland and three others nested in a field dominated by mustard and exotic trees (P. Famolaro). The vireos persisted in these nonriparian territories near Sweetwater Reservoir for some years but eventually abandoned them.

Nesting: Many studies have addressed the Least Bell's Vireo's nesting (e.g., Franzreb 1987, Greaves 1987, Kus 1999, 2002). Typically, the birds nest at openings and edges where there is dense vegetation near the ground, placing the nest, on average, about 1 meter off the ground in a fork of slender twigs. On the coastal slope, willows



and mulefat predominate as nest sites (USFWS 1998); in the Anza–Borrego Desert, willows and mesquite predominate (Wells and Kus 2001). Even where cowbirds have been trapped almost to elimination, Bell's Vireos lose many nests to predation; of 25 nests videotaped by Peterson (2002, Peterson et al. 2004), 12 suffered predation, eight to scrub-jays and three to nonnative scavengers, two to Virginia opossums and one to Argentine ants. Along the Sweetwater River P. Famolaro has repeatedly observed nests destroyed by Argentine ants.

In San Diego County, Bell's Vireo's nesting season generally lasts from April to July, with egg laying from about 1 April to late June, rarely mid July. Around Sweetwater Reservoir, P. Famolaro has noted nests with eggs from 4 April to 8 July, nests with nestlings from 21 April to 21 July. On the basis of 34 nests followed in the Anza–Borrego Desert in 2000, Wells and Kus (2001) estimated egg laying to have taken place from 14 April to 16 June, peaking in late April. Our dates for fledglings ranged from 27 April to 21 August.

Migration: The Least Bell's Vireo usually arrives in San Diego County in the third week of March. During the atlas period our first dates varied from 13 March (1997) and 14 March (1998) to 29 March (2000) and 31 March (2001); arrival was notably late in the two latter years. Fall departure generally takes place from mid August to late September; stragglers in breeding habitat as late as October are rare. At the upper end of Sweetwater Reservoir, surveyed regularly, the latest date on record is 16 September 1998 (P. Famolaro).

Many Least Bell's Vireos have been banded, and these studies show the birds are highly site tenacious, usually returning in successive years to the same drainage basin, males nearly always to the same territory. Males generally maintain the same territory through a season; females sometimes move from male to male with successive nest attempts (Greaves 1987). But longer-distance dispersal is known on the basis of birds banded in San Diego County observed in Santa Barbara and Ventura counties and vice versa (Greaves and Labinger 1997, USFWS 1998). Among the more notable examples are of an adult female banded on the Santa Clara River that later nested along the Sweetwater River (P. Famolaro) and a young banded along the Santa Margarita River in summer 1987 that was seen in Carpenteria, Santa Barbara County, 24 August–1 September that same year (AB 42:138, 1988).

Sightings of migrant Bell's Vireos away from breeding habitat are rare, suggesting that most birds fly nonstop between nesting sites in southern California and their next stop in Mexico. In spring such migrants are most likely in the Anza–Borrego Desert, where records during the atlas period were of one in Borrego Springs (G24) 24 and 29 April 2000 (R. Thériault) and one in Fish Creek Wash (L27) 13 April 2000 (M. B. Mulrooney). Fall migrants have been noted at Point Loma (S7) 10 October 1988 (R. E. Webster, AB 43:169, 1989) and 16 October 1993 (G. McCaskie, AB 48:153, 1994).

Winter: Bell's Vireo essentially vacates the United States for the winter, but 13 winter occurrences are known for San Diego County. Eleven of these are near the coast. Unitt (1984) listed the first five; subsequently, winter records have been published from Carlsbad (I6) 2 February 1982 (E. Copper, AB 36:332, 1982), Coronado (S9) 19 January–3 March 1985 (D. R. Willick, AB 39:211, 1985) and 15 December 2001 (R. E. Webster, NAB 56:224, 2002), and the Tijuana River valley 27 January 1982 (C. G. Edwards, AB 36:332, 1982), 2 December 1990–5 January 1991, and 15 December 1990 (R. E. Webster, G. McCaskie, AB 45:322, 1991). Two winter records are from the Anza–Borrego Desert, of one at Yaqui Well (I24) 20 January 1984 (B. Wagner, AB 38:358, 1984) and one in the mesquite bosque 3.3 miles southeast of Borrego Springs 24 January 1984 (SDNHM 42925).

Conservation: Though Stephens (1919a) called the Least Bell's Vireo "common" in San Diego County, surveys of the best remaining habitat from 1978 to 1981 (Goldwasser et al. 1980, L. R. Salata) revealed only 61 territorial males. More thorough surveys in 1985 raised this to 223—76% of the population in the entire state (Franzreb 1987). Once the subspecies was listed as endangered by the California Department of Fish and Game in 1984 and the U.S. Fish and Wildlife Service in 1986, the regulatory mechanism allowing the species' recovery was in place. The vireo's subsequent history must be regarded as one of the greatest successes for the Endangered Species Act anywhere in the United States.

Arresting and reversing the loss of riparian woodland was critical to arresting and reversing the vireo's decline. Once the vireo was formally designated as endangered, section 404 of the Clean Water Act of 1977 obliged the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service to confer on any proposal to disrupt wetlands—and therefore Least Bell's Vireo habitat. As a result, the pace of the vireo's habitat loss, through the installation of reservoirs and the building of roads, housing, golf courses, and other commercial developments, slowed considerably. Designation in 1994 of about half of the habitat occupied by the vireo as "critical' under the Endangered Species Act helped as well. Once disturbance of many stands of riparian woodland was minimized, the vireo's habitat was able to spread through natural regeneration. Though noticeable at many places in San Diego County, this spread was most striking in the Tijuana River valley, where riparian woodland increased from almost none in the 1970s to extensive by the late 1990s and vireos increased from one territory in 1980 to 134 by 1997.

Bell's Vireos recolonize and nest successfully in adequately restored riparian woodland, more rapidly if the restored habitat is adjacent to mature habitat. They nested in restored habitat the first year in Mission Trails Regional Park, where previously occupied habitat was adjacent (Kus 1998), but took eight years to colonize revegetated shores of the San Diego River in Mission Valley, at a site surrounded by commercial development (P. Unitt).

Brood-parasitism by the Brown-headed Cowbird has also been critical to the vireo's decline. Soon after the cowbird invaded coastal southern California in the early 1900s, the vireo became a primary host (Hanna 1928). In the early 1980s, parasitism rates in San Diego County varied from 47% to 80%; few if any vireos fledge from parasitized nests (USFWS 1998). Even pairs that desert parasitized nests suffer significantly reduced success, as their subsequent nests are parasitized disproportionately often (Kus 1999, 2002).

Once trapping of cowbirds was instituted widely in the late 1980s, the rate of parasitism dropped, to 1% or less in intensively trapped Camp Pendleton (USFWS 1998). Kus (1999, 2002) noted an inverse association between the intensity of trapping and parasitism rate along the San Luis Rey River. It appears that cowbird trapping is most effective where many traps can be deployed and the cowbird population depressed over a wide region. The critical role of trapping in enabling the vireo's recovery is especially clear in Anza–Borrego Desert State Park, where the habitat has changed little while the vireo population has rebounded. In the Cleveland National Forest, however, where the vireos are scattered and rugged topography makes the traps difficult to deploy and monitor, trapping proved ineffective, parasitism rates remained high, and the vireo deserted two sites in the 1990s (Winter and McKelvey 1999).

Cowbird trapping, however successful, is a finger-in-the-dike approach to managing an endangered species. Ideally, habitat should be managed so as to be less attractive to cowbirds and the parasitism rate kept down to a level where the vireo (and other parasitism-sensitive species) can maintain themselves. Ideally, exposure to some level of parasitism would allow the vireo to persist while compelling it to evolve better defenses, if only an increased rate of deserting parasitized nests (Kus 2002). The cycle of flooding and regeneration has been broken by the dams built on most of San Diego County's rivers, allowing some riparian woodland to become senescent. Invasion of exotic plants, especially saltcedar and giant reed, threatens native riparian woodland. Some of the vireo's primary nest predators, especially the Western Scrub-Jay, are on the increase. In spite of the short-term success in recovering the Least Bell's Vireo, balancing conflicts until the vireo becomes self sustaining is a long-term challenge.

Taxonomy: The Least, *V. b. pusillus* Coues, 1866, is the drabbest of the four subspecies of Bell's Vireo; it has only a hint of olive color on the rump in fresh plumage, and that fades to gray by the time the birds return to their breeding range in spring. Identified by Phillips (1991), the January specimen from the Borrego Valley is *V. b. arizonae* Ridgway, 1903; it has the lower back and rump distinctly olive and the flanks vaguely yellowish. A Bell's Vireo at Point Loma 10 October 1988 was "felt to be of the nominate race" (R. E. Webster, AB 43:169–170, 1989). This subspecies, breeding in the Mississippi basin and the green extreme of the species, is likely in California as a rare vagrant but has not been confirmed with a specimen or photograph.

EXHIBIT 11

Distribution, Abundance, and Breeding Activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California

2005 Annual Report

Prepared for:

Assistant Chief of Staff, Environmental Security
U.S. Marine Corps Base Camp Pendleton

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

Distribution, Abundance, and Breeding Activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California

By James W. Rourke and Barbara E. Kus

U.S. GEOLOGICAL SURVEY
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2005 Annual Report

Prepared for:

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2006

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GALE A. NORTON, SECRETARY

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EXECUTIVE SUMMARY

Surveys for the endangered least Bell's vireo (*Vireo bellii pusillus*) were conducted at Marine Corps Base Camp Pendleton, California, between 1 April and 15 July 2005. All drainages containing riparian habitat suitable for vireos were surveyed three to seven times. A small number of other sites containing more marginal habitat were periodically checked throughout the season for vireos. Eight hundred and twenty-seven territorial male vireos were detected over 23 drainages. Ninety-two percent of all vireo territories occurred on the nine most populated drainages, with the Santa Margarita River containing 56 percent of all territories on Base. Seventy percent of all male vireos were confirmed as paired.

The majority of vireo territories (62 percent) occurred in habitat characterized as Willow Riparian. The second most commonly used habitat type, Riparian Scrub (dominated by *Baccharis salicifolia* and/or *Salix exigua*), was occupied by 19 percent of the population. An additional eight percent of birds occupied willow habitat co-dominated by cottonwoods (*Populus fremontii*) or sycamores (*Platanus racemosa*). Habitat characterized by upland vegetation was used by 10 percent of vireos, with the remaining 1 percent occupying territories composed entirely of non-native vegetation. However, exotic plants were found to be dominant or co-dominant in approximately 20 percent of all vireo territories. The primary exotic plants found in vireo territories were poison hemlock (*Conium maculatum*), black mustard (*Brassica nigra*), giant reed (*Arundo donax*), and tamarisk (*Tamarix* spp.).

Nesting activity was monitored in 62 territories within two Giant Reed Removal and two Reference monitoring areas. Nest success and productivity estimates of pairs breeding in Reference sites did not differ appreciably from those at Removal sites. Although nesting vireos at Removal sites exhibited a higher hatching rate (67% vs. 58%; percent of all eggs that hatched) and had higher hatching success (70 % vs. 59%, percent of nests with one or more hatchlings), average clutch size, average brood size, and the average number of young fledged per pair were not statistically different from the reference sites. A large proportion of vireos at both sites were successful in fledgling young from at least one nest as 93 percent (14/15) of Reference pairs and 85 percent (17/20) of Removal pairs, within fully monitored territories, fledged young. Successful and unsuccessful nests within Reference and Removal sites did not differ statistically in average nest height, height of their host plant, or the distance the nest was placed from the edge of the host plant. Sixty to seventy-four percent of nests were placed in *S. lasiolepis*, *Baccharis salicifolia* and *S. exigua*. An additional 15 percent of all monitored nests were placed in two exotic species, *C. maculatum* and *B. nigra*, reflecting the disturbed nature of many of the nest sites. Thirty-three percent (3/9) of the nests built in *C. maculatum* failed when the branch supporting the nest, or the entire nest substrate, gave way under the weight of the growing nestlings, dumping the young on the ground. Predation was believed to be the primary source of nest failure at both sites.

One hundred thirty-four least Bell's vireos were banded during the 2005 season. These included 36 adult vireos that were target netted and banded with a unique color combination; 96 hatch-year birds, 91 of which were banded as nestlings and five of which were incidentally caught while attempting to target net an adult vireo in a territory; and two vireos of undetermined age. Previously banded returning adult vireos ranged from two to seven years old.

INTRODUCTION

The least Bell's vireo (*Vireo bellii pusillus*; hereafter "vireo") is a small, migratory, songbird that breeds in southern California and northwestern Baja California, Mexico from April through July. Historically abundant within lowland riparian ecosystems, vireo populations began declining in the late 1900's as a result of habitat loss and alteration associated with urbanization and conversion of land adjacent to rivers to agriculture (Franzreb 1989, USFWS 1998, RHJV 2004). Additional factors contributing to the vireo's decline have been the expansion in range of the brown-headed cowbird (*Molothrus ater*), a brood parasite, to include the Pacific coast (USFWS 1986; Franzreb 1989; Brown 1993; Kus 1998, 1999), and the introduction of invasive exotic plant species, such as giant reed (*Arundo donax*), into riparian systems. By 1986 the vireo population in California numbered just 300 territorial males (USFWS 1986).

In response to the dramatic reduction in numbers of least Bell's vireos in California, the California Fish and Game Commission listed the species as endangered in 1980, with the U.S. Fish and Wildlife Service following suit in 1986. Since listing, the vireo population in southern California has rebounded, largely in response to cowbird control, and habitat restoration and preservation (Kus and Whitfield 2005). As of 2004, the statewide vireo population was estimated to be approximately 2500 territories (USGS, unpublished data), roughly a third of which occurred on Camp Pendleton.

Male least Bell's vireos arrive on breeding grounds in southern California in mid-March. Male vireos are conspicuous, and frequently sing their diagnostic primary song throughout the breeding season from exposed perches. Females arrive approximately 1-2 weeks after males and are more secretive, but are often seen early in the season traveling through habitat with the male. The female, with the male's help, builds an open cup nest in dense vegetation approximately one meter above the ground. Typical clutch size for least Bell's vireos average 3-4 eggs. Typically, the female and male incubate the eggs for 14 days, with young fledging from the nest at 11-12 days of age. It is not unusual for vireos to re-nest after a failed attempt provided ample time remains within the breeding season. Vireos rarely fledge more than one brood in a season. Nesting lasts from early April through July, but adults and juvenile birds remain on the breeding grounds into late September/early October before migrating to their wintering grounds in southern Baja California, Mexico.

The purpose of this study was to document the status of least Bell's vireo at Marine Corps Base Camp Pendleton in San Diego County, California. Specifically, our goals were to (1) determine the size and composition of the Bell's vireo population at the Base, (2) characterize habitat used by vireos, (3) band a subset of vireos to facilitate the estimation of vireo survivorship and movement in future years, and (4) assess the short-term effects of giant reed removal on vireo fecundity, nest success, and productivity by establishing nest monitoring plots in areas that had recently undergone giant reed removal and at reference sites in which giant reed was removed five to eight years earlier, between 1997 and 2000. These data, when combined with data from other years, will inform natural resource managers about the status of this endangered species at Camp Pendleton, and guide modification of land use and management practices as appropriate to ensure the species' continued existence.

This work was funded by the Assistant Chief of Staff, Environmental Security, Resources Management Division, Marine Corps Base Camp Pendleton, California.

STUDY AREAS AND METHODS

Field Surveys

All of Camp Pendleton's major drainages, and several minor ones supporting riparian habitat, were surveyed for vireos between 1 April and 15 July 2005. Field work was conducted by Luke Caldwell, Douglas Chamblin, Robert Chapman, Daniel Evans, Dana Kamada, Kerry Kenwood, Barbara Kus, Michelle Rogne, James Rourke, Helen Sofaer, Khara Strum, and Michael Wellik. The specific areas surveyed are as follows:

1. ***Santa Margarita River***:
    a. Between Interstate 5 upstream to the confluence with De Luz Creek, including all riparian habitat within Stagecoach Canyon and Ysidora Basin east of Vandegrift Road (Figures 1, 2).
    b. From the confluence with De Luz Creek upstream to the Base boundary (Figure 2).

2. ***De Luz Creek***, between the confluence with the Santa Margarita River and the Base boundary (Figure 1).

3. ***Roblar Creek***, between the confluence with De Luz Creek and a point approximately one kilometer upstream (Figure 1).

4. ***Lake O'Neill/Fallbrook Creek*****:**
    a. All riparian habitat around Lake O'Neill (Figure1).
    b. Between Lake O'Neill and the Base boundary with the Fallbrook Naval Weapons Station (Figure 1).

5. ***Basilone and Roblar Roads***, a small patch of habitat straddling Basilone Road at the intersection of Basilone and Roblar Roads (Figure 1).

6. ***22 Area,*** all riparian habitat within the 22 Area, east of Vandegrift Road and the Supply Depot (Figure 2).

7. ***Pueblitos Canyon***, between Vandegrift Road and a point approximately 2.5 kilometers upstream (Figure 2).

8. ***Newton Canyon***, between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Figure 2).

9. ***Cockleburr Canyon***, between the Pacific Ocean and a point 0.25 kilometers east of Interstate 5 (Figure 2).

10. ***French Creek***, between the Pacific Ocean and the Edson Range Impact Area (Figure 2).

11. ***Aliso Creek***, between the Pacific Ocean and 0.5 kilometers upstream of the electrical transmission lines (Figure 2).

12. ***Hidden Canyon***, between Interstate 5 and Stuart Mesa Road (Figure 3).

13. ***Las Flores Creek (within Las Pulgas Canyon)***:
    a. Between Stuart Mesa Road and the high voltage electrical transmission lines (Figure 3).
    b. Between the Pacific Ocean and Stuart Mesa Road, and from the high voltage electrical transmission lines upstream to the Zulu Impact Area point, approximately 0.75 kilometers upstream of Basilone Road (Figure 3).

14. ***Piedra de Lumbre Canyon***, between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Figure 3).

15. ***Horno Canyon***, between Old Highway 101 and the upstream limit of riparian habitat (Figure 3).

16. ***San Onofre Creek***:
    a. From the Pacific Ocean to the south fork/north fork confluence, and upstream on the south fork to Basilone Road (Figures 3, 4).
    b. From Basilone Road upstream to the access road to range 219 (Figure 4).

17. ***San Mateo Creek***:
    a. From the Pacific Ocean upstream to San Mateo Road, including habitat south of the creek and south and east of the agricultural fields (Figures 4).
    b. From San Mateo Road upstream to the Yankee training area boundary (Figure 4). Road closures resulting from flooding prevented surveys being conducted upstream to the Base boundary as stipulated by the Scope of Work.

18. ***Cristianitos Creek***, between the confluence with San Mateo Creek and the Base boundary (Figure 4).

19. ***Talega Canyon***, between the confluence with Cristianitos Creek and a point approximately 6.5 kilometers upstream (Figure 4).

20. Pilgrim Creek:

a. Between the southern Base boundary and Vandegrift Boulevard, including the two side drainages east of Pilgrim Creek (Figure 5).
b. From Vandegrift Boulevard upstream to the limit of riparian habitat (Figure 5).

21. Windmill Canyon, from the Base boundary passed the golf course to the upstream extent of habitat (includes both the 2004 Windmill Canyon and Horse Pasture sites) (Figure 5).

22. Ysidora Basin to Windmill Canyon, between Upper Ysidora Basin and Windmill Canyon/ Pueblitos Canyon (Figure 5).

23. De Luz Homes Habitat, patches of habitat adjacent to the De Luz Homes development (Figure 5).

The majority of drainages were surveyed from three to seven times at least ten days apart. A small number of locations containing suitable vireo habitat were surveyed one to two times to check for vireo occupancy. Sites surveyed seven times throughout the breeding season were: Santa Margarita River (1a), Lake O'Neill/Fallbrook Creek (4a), Las Flores Creek (13a), and Pilgrim Creek (20a). Sites surveyed six times included: De Luz Creek, Aliso Creek, Las Flores Creek (13b), San Onofre Creek (16a), San Mateo Creek (17b,), and Cristianitos Creek. Sites surveyed three times were: Santa Margarita River (1b, road closures and inaccessibility resulting from flooding caused the upper half of the site to be surveyed only once), Lake O'Neill/Fallbrook Creek (4b), 22 Area, Pueblitos Canyon, Newton Canyon, French Creek, Hidden Canyon, Piedra de Lumbre Canyon, San Onofre Creek (16b), San Mateo Creek (17b), Pilgrim Creek (20b), and Windmill Canyon. Sites checked one or two times for vireos included: Basilone and Roblar Roads, Ysidora Basin to Windmill Canyon, and De Luz Homes Habitat.

Biologists followed standard survey techniques described in the Least Bell's Vireo Working Group and USFWS least Bell's vireo survey guidelines (USFWS 2001). Observers moved slowly (1-2 km per hour) through the riparian habitat while searching and listening for vireos. Observers walked along the edge(s) of the riparian corridor on the upland and/or river side where habitat was narrow enough to detect a bird on the opposite edge. In wider stands, observers traversed the habitat to detect all birds throughout its extent. Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions.

For each bird encountered, investigators recorded age (adult or juvenile), sex, breeding status (paired, unpaired, undetermined, or transient), and whether the bird was banded. Birds were considered transients if they were not detected on two or more consecutive surveys after an initial detection. Vireo locations were mapped on 1":12,000" aerial photographs as well as 1":24,000" USGS topographic maps, using a Garmin 12 Global Positioning System (GPS) unit with 1-15 m positioning accuracy to determine geographic coordinates (WSG84). Dominant native and exotic plants were recorded, and percent cover of exotic vegetation estimated using cover categories of <5%, 5-50%, 51-95%. and >95%, Overall habitat type was specified according to the following categories:

Mixed willow riparian: Habitat dominated by one or more willow species including *Salix gooddingii, S. lasiolepis,* and *S. laevigata,* with *Baccharis salicifolia* as a frequent co-dominant.

Willow-cottonwood*:* Willow riparian habitat in which *Populus fremontii* is a co-dominant.

Willow-sycamore*:* Willow riparian habitat in which *Platanus racemosa* is a co-dominant.

Sycamore-oak: Woodlands in which *P. racemosa* and *Quercus agrifolia* occur as co-dominants.

Riparian scrub: Dry and/or sandy habitat dominated by *S. exigua* or *B. salicifolia,* with few other woody species.

Upland scrub: Disturbed coastal sage scrub adjacent to riparian habitat.

Non-native: Sites vegetated exclusively with non-native species such as *Arundo donax* and *Tamarix ramosissima*.

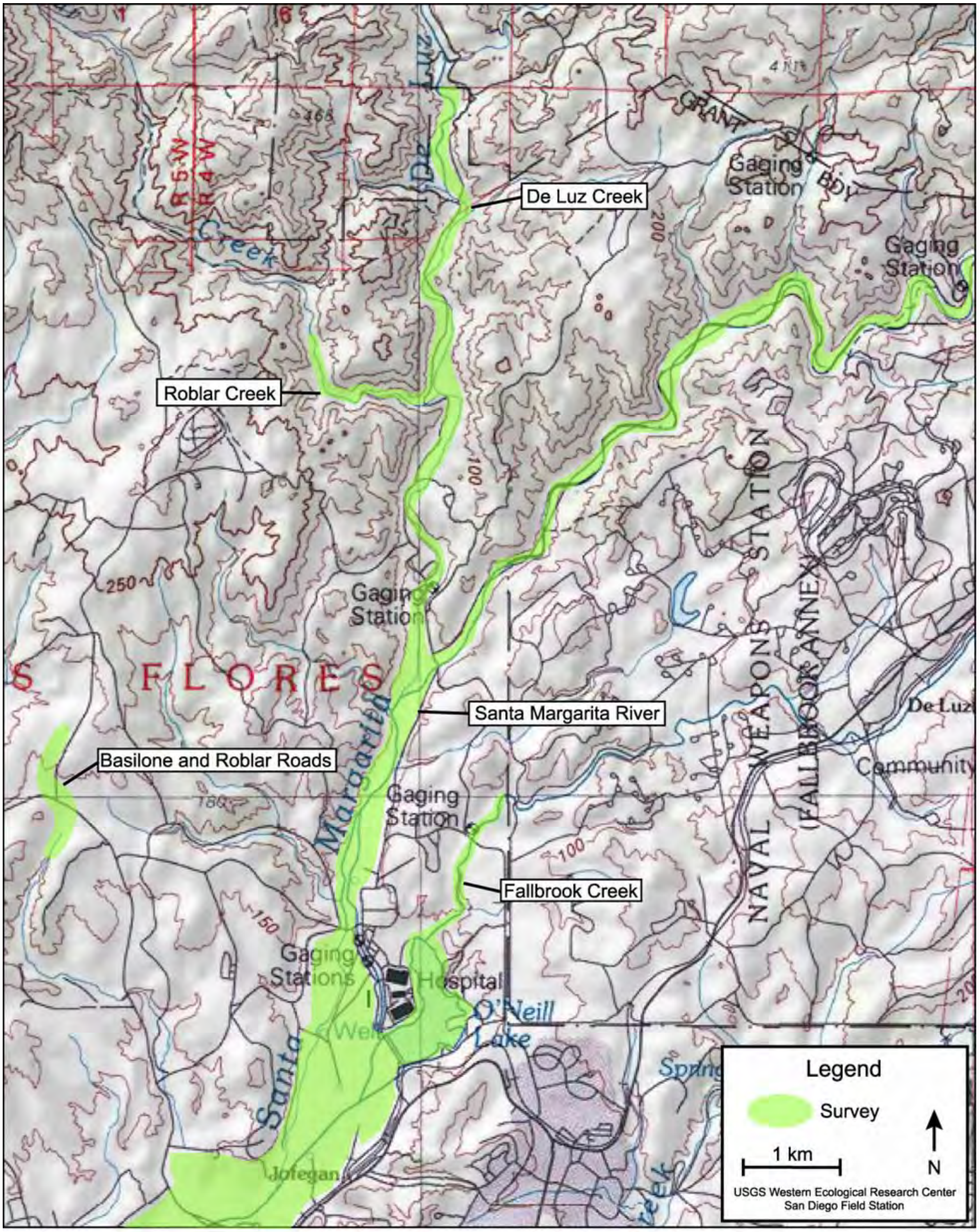

Figure 1. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Upper Santa Margarita River, Fallbrook Creek, De Luz Creek, Roblar Creek, and Basilone and Roblar Roads.

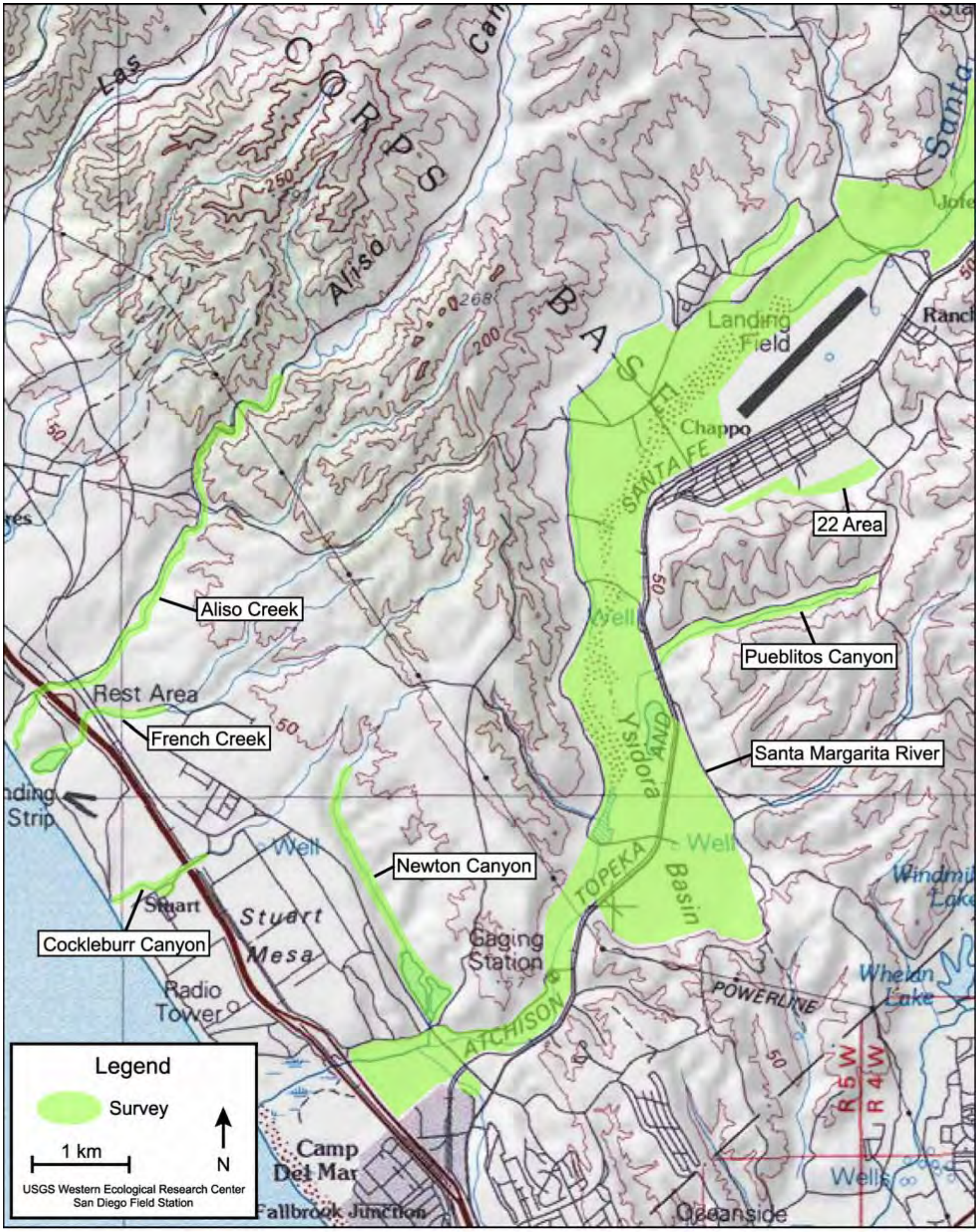

Figure 2. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Lower Santa Margarita River, 22 Area, Pueblitos Canyon, Newton Canyon, Cockleburr Canyon, French Creek, and Aliso Creek.

Figure 3. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: San Onofre Creek South Fork, Horno Canyon, Piedra de Lumbre Canyon, Las Flores Creek, and Hidden Canyon.

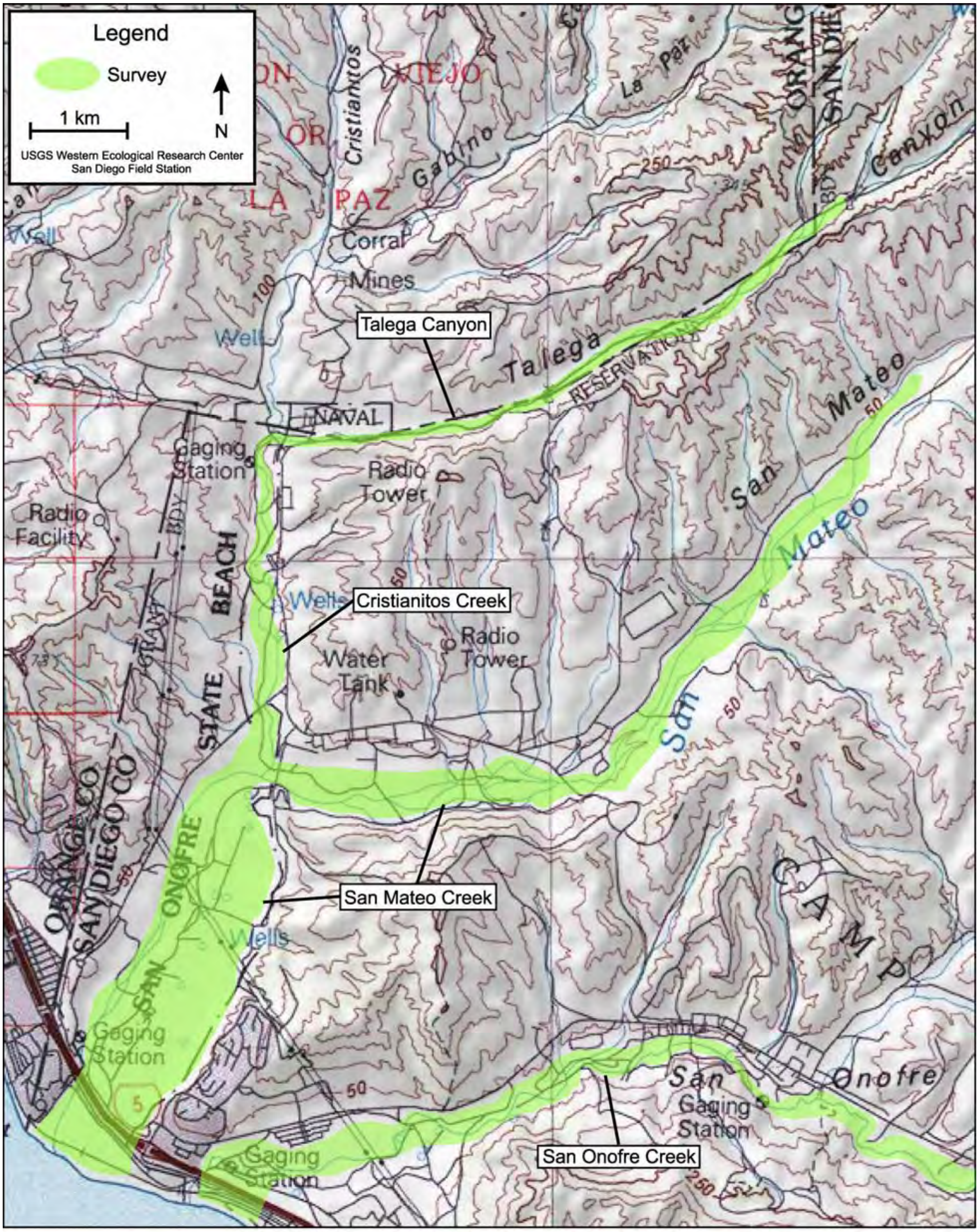

Figure 4. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Talega Canyon, Cristianitos Creek, San Mateo Creek, and San Onofre Creek.

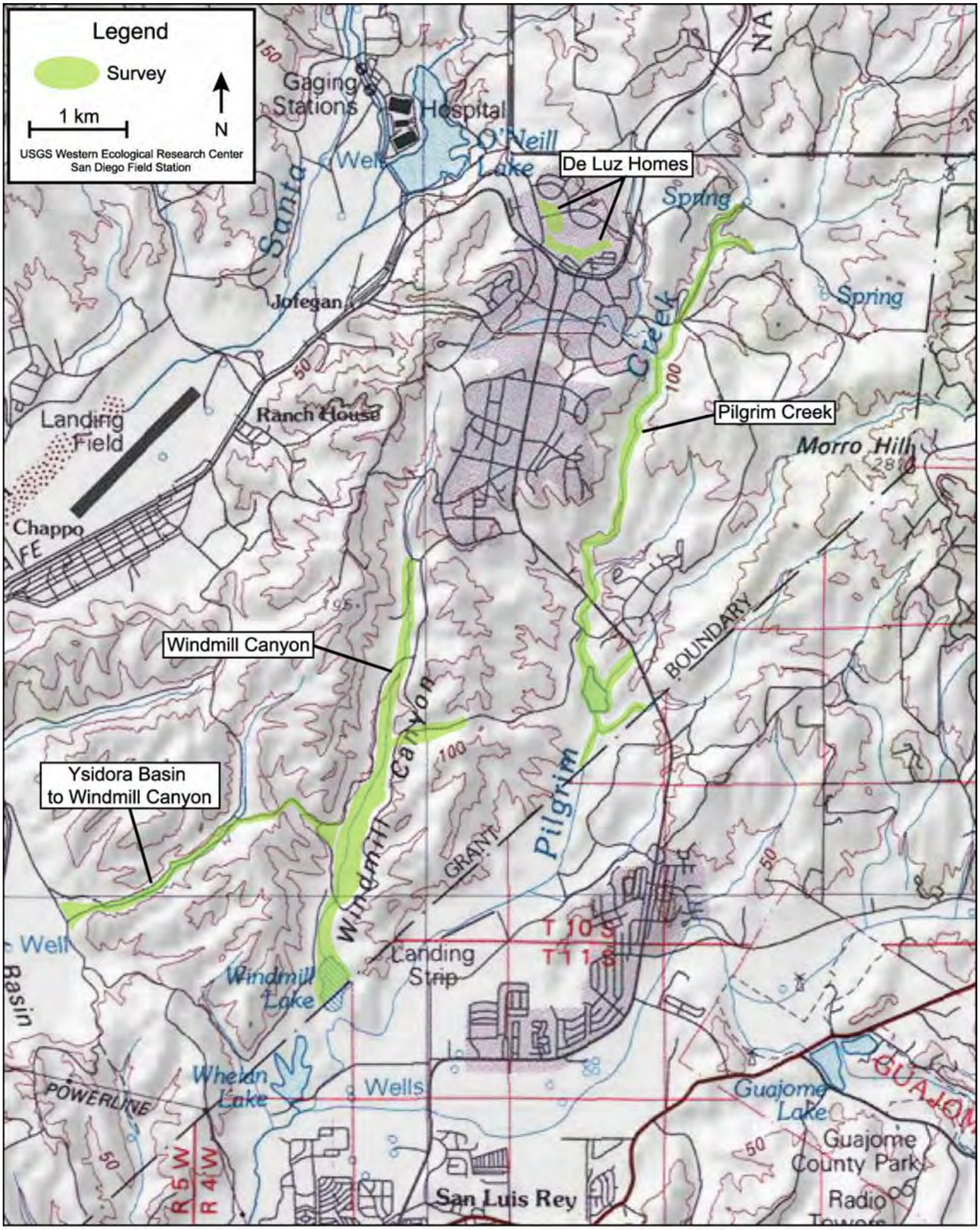

Figure 5. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Windmill Canyon, Ysidora Basin to Windmill Canyon, Pilgrim Creek, and habitat adjacent to De Luz Homes.

Nest Monitoring

We monitored least Bell's vireo nests to evaluate the effects of giant reed removal on nest success and productivity. Giant reed is a highly invasive, non-native plant within riparian systems in southern California. Originally introduced for bank stabilization in the 1800's, giant reed has become a major component of many riparian systems, becoming the dominant vegetation within streams and rivers. As part of a riparian restoration effort, Marine Corps Base Camp Pendleton has been removing large quantities of giant reed on the Santa Margarita River. Areas that have recently undergone giant reed removal tend to consist of small patches of native woody plants surrounded by large areas of bare earth. These open areas are typically populated by native and non-native herbaceous plants until the appropriate conditions arise that allow for the establishment of native woody species, such as *B. salicifolia, S. exigua, S. gooddingii, S. lasiolepis*, and *S. laevigata*. We established four monitoring areas: two sites within locations in which giant reed was removed historically and the native vegetation recovered (hereafter referred to as "Reference" sites), and two sites in areas where giant reed had been removed within the previous three years (hereafter "Removal" sites; Figure 6).

Thirty-eight pairs in Reference sites and 24 pairs in Removal sites were monitored throughout the season and all nesting activity documented. Pairs were observed for evidence of nesting, and their nests were located. Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds to nest sites; typically, there were four to six visits per nest. The first visit was timed to determine the number of eggs laid, the next few visits to determine hatching and age of young, the next to band nestlings (see below), and the last to confirm fledging. Characteristics of nests, including height, host species, and host height were recorded following abandonment or fledging of nests.

Banding

The primary goal of banding least Bell's vireos on Camp Pendleton is: 1) to better understand adult vireo site fidelity within a potential source population, 2) to investigate natal dispersal on Base, and the role Camp Pendleton young play in potentially supporting vireo populations off Base, and 3) to understand how giant reed removal affects vireo demography. Nestlings from monitored nests were banded at 5-8 days of age with a single anodized gold numbered federal band on the right leg. A limited number of adult vireos within monitoring and prospective giant reed removal sites were captured in mist nets and banded with a unique combination of colored plastic and anodized metal bands. Adults previously banded with a single numbered federal band were target netted to determine their identity, and their original band was supplemented with other bands to generate a unique color combination. If the adult was originally banded on Base, either an anodized gold or orange plastic band was incorporated into the combination to designate Camp Pendleton as the bird’s site of origin.

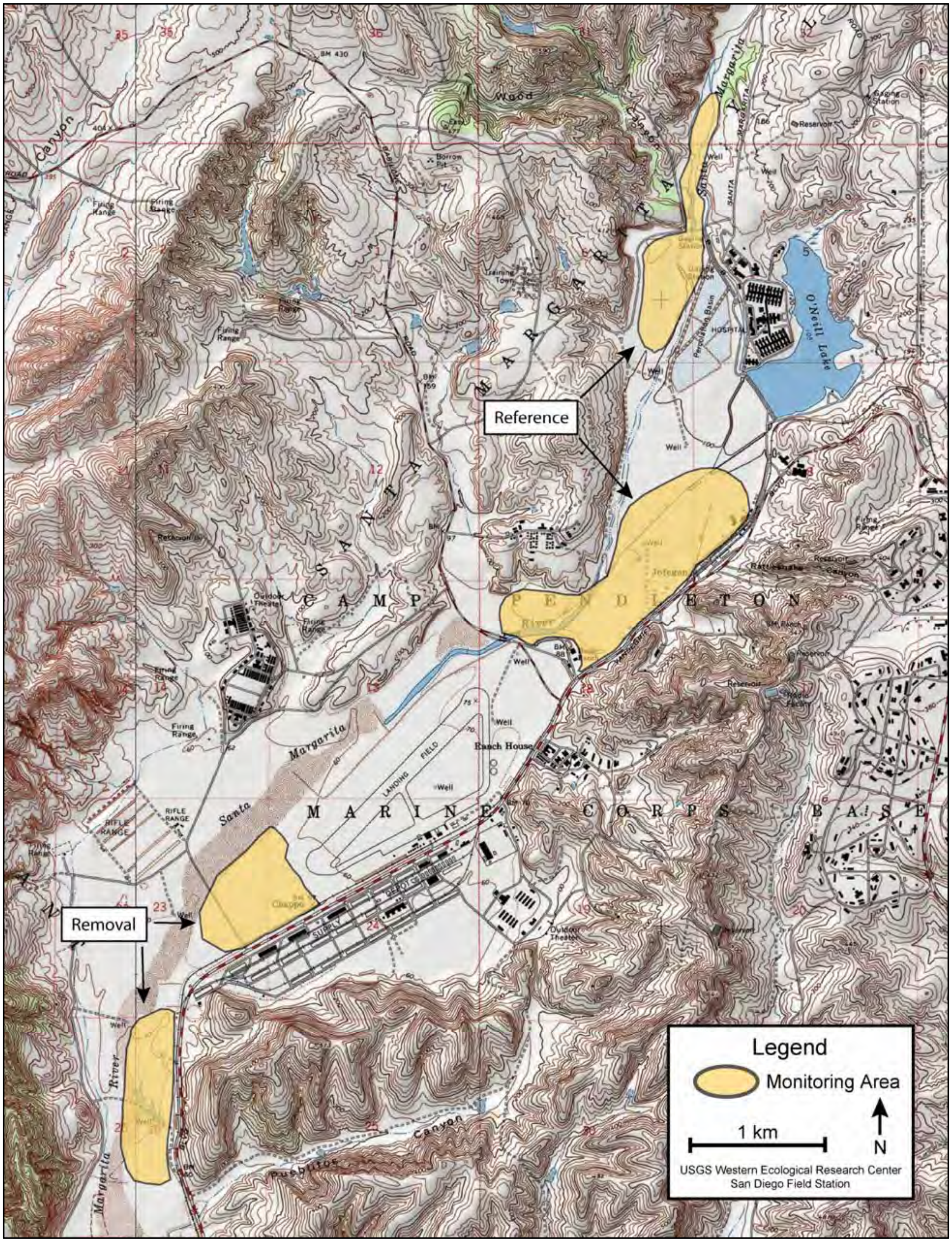

Figure 6. Location of least Bell's vireo nest monitoring areas on Marine Corps Base Camp Pendleton, 2005.

RESULTS

Population Size and Distribution

Eight hundred and sixty-seven least Bell's vireo sites were identified during Base-wide surveys (Table 1, Figures 7-25). This included 827 territorial male vireos, 70 percent of which were confirmed as paired, and 40 transients. Transient vireos were observed on 13 of the 23 (56%) drainages/sites surveyed. Ninety-two percent of all vireo territories occurred on the nine most populated drainages (i.e., Santa Margarita River, Las Flores Creek, San Mateo Creek, San Onofre Creek, Pilgrim Creek, Aliso Creek, Lake O'Neill/Fallbrook Creek, De Luz Creek, and

Table 1. Number and distribution of least Bell's vireos at Camp Pendleton, 2005.

Drainage/Survey Site	Known Pairs	Single/ Status Unknown	Transient	Territories
Santa Margarita River:				
I-5 to De Luz Creek	335	113	17	448
De Luz Creek to Base Boundary	1	13	0	14
De Luz Creek	14	4	2	18
Roblar Creek	0	0	0	0
Lake O'Neill/Fallbrook Creek	7	13	4	20
Basilone-Roblar Roads	0	2	0	2
22 Area	8	2	1	10
Pueblitos Canyon	5	0	1	5
Newton Canyon	7	1	1	8
Cockleburr Creek	1	1	0	2
French Canyon	4	2	0	6
Aliso Creek	15	6	2	21
Hidden Canyon	6	2	0	8
Las Flores Creek:				
Pacific Ocean to Stuart Mesa Rd	1	0	0	1
Stuart Mesa Rd to Power Lines	21	23	2	44
Power Lines to Zulu Impact Area	31	9	1	40
Piedre de Lumbre Canyon	5	3	2	8
Horno Canyon	1	0	0	1
San Onofre Creek:				
Pacific Ocean to Basilone Rd	0	3	0	3
Basilone Rd to Access Rd to Range 219	32	17	1	49
San Mateo Creek				
Pacific Ocean to San Mateo Rd	38	10	3	48
San Mateo Rd to Yankee Training Area	3	5	1	8
Cristianitos Creek	3	3	1	6
Talega Canyon	1	0	0	1
Pilgrim Creek:				
Base Boundary upstream to Vandegrift Blvd	24	4	0	28
Vandegrift Blvd to upstream riparian limit	4	4	1	8
Windmill Canyon	7	5	0	12
Ysidora Basin to Windmill Canyon	0	4	0	4
De Luz Homes	2	2	0	4
Total	576	251	40	827

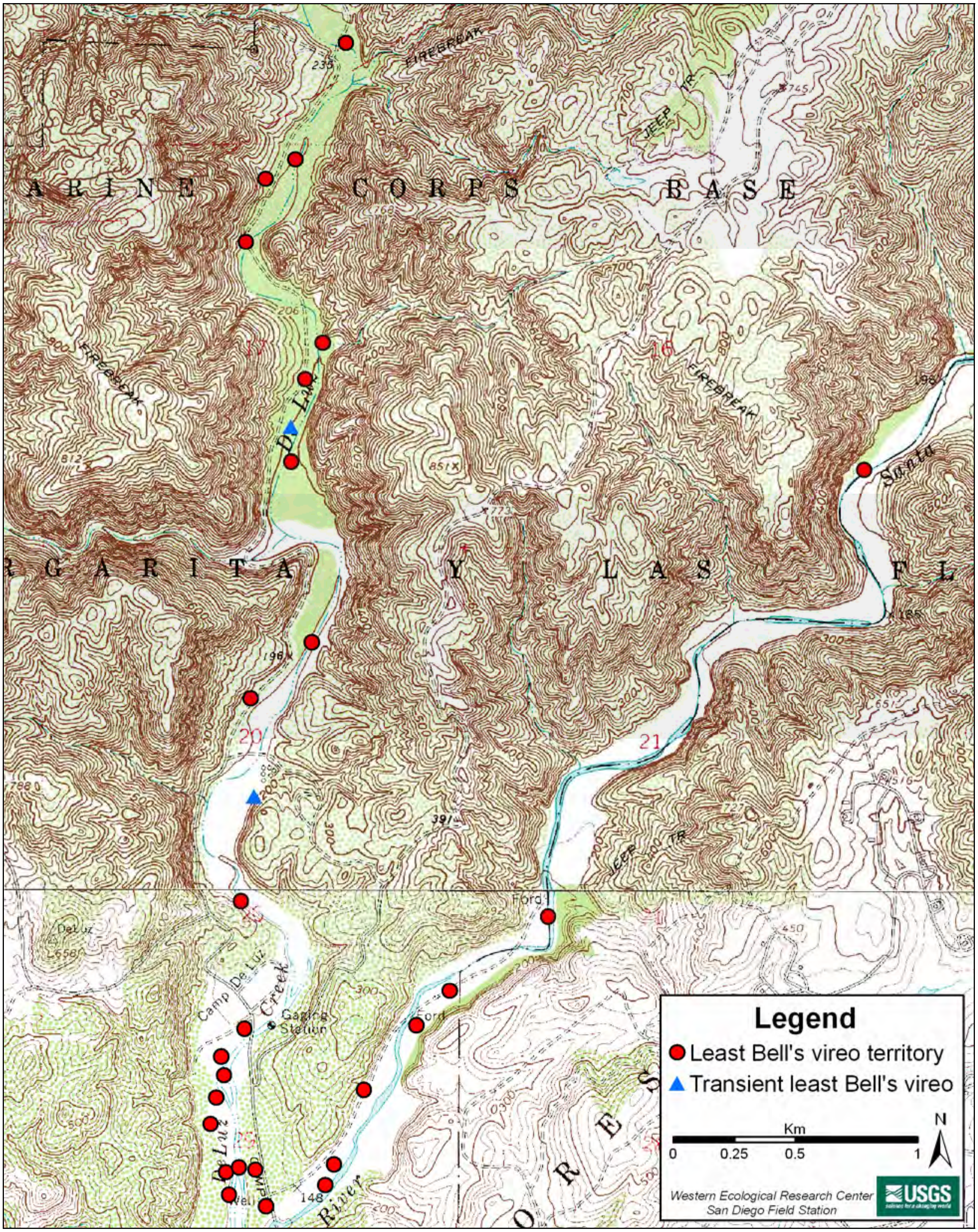

Figure 7. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Upper Santa Margarita River, De Luz Creek, and Roblar Creek.

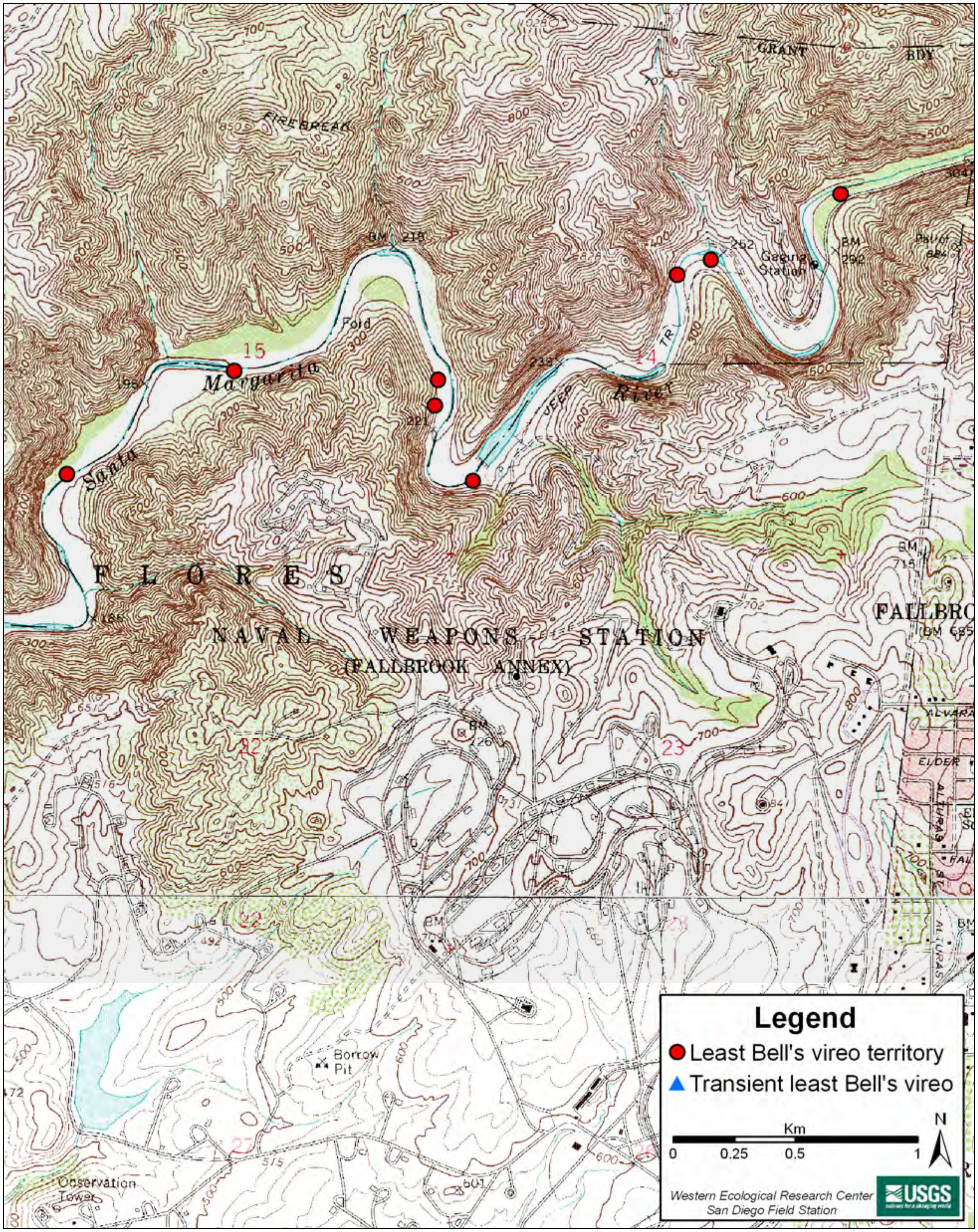

Figure 8. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Upper Santa Margarita River.

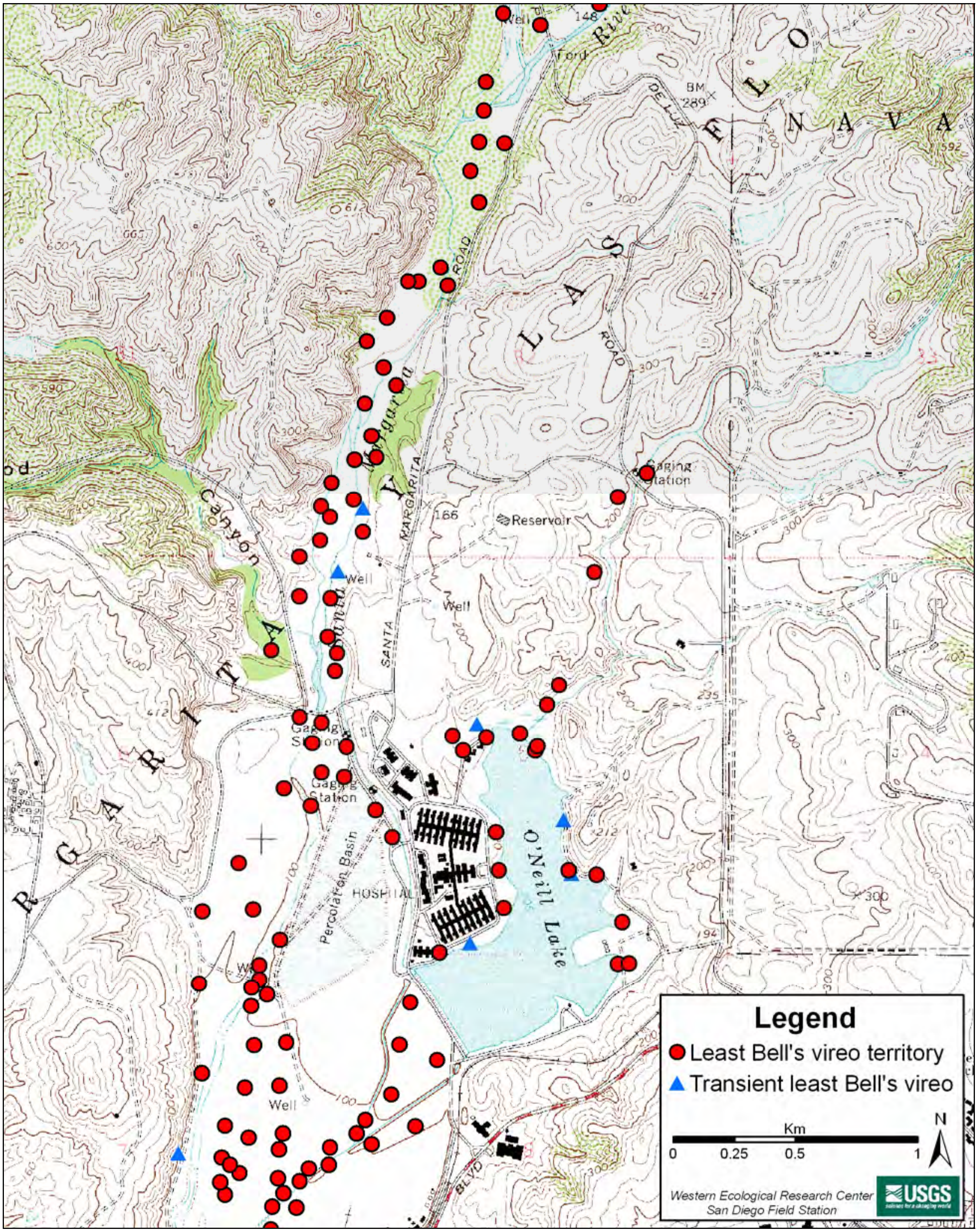

Figure 9. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Lake O'Neill, Fallbrook Creek, and Santa Margarita River.

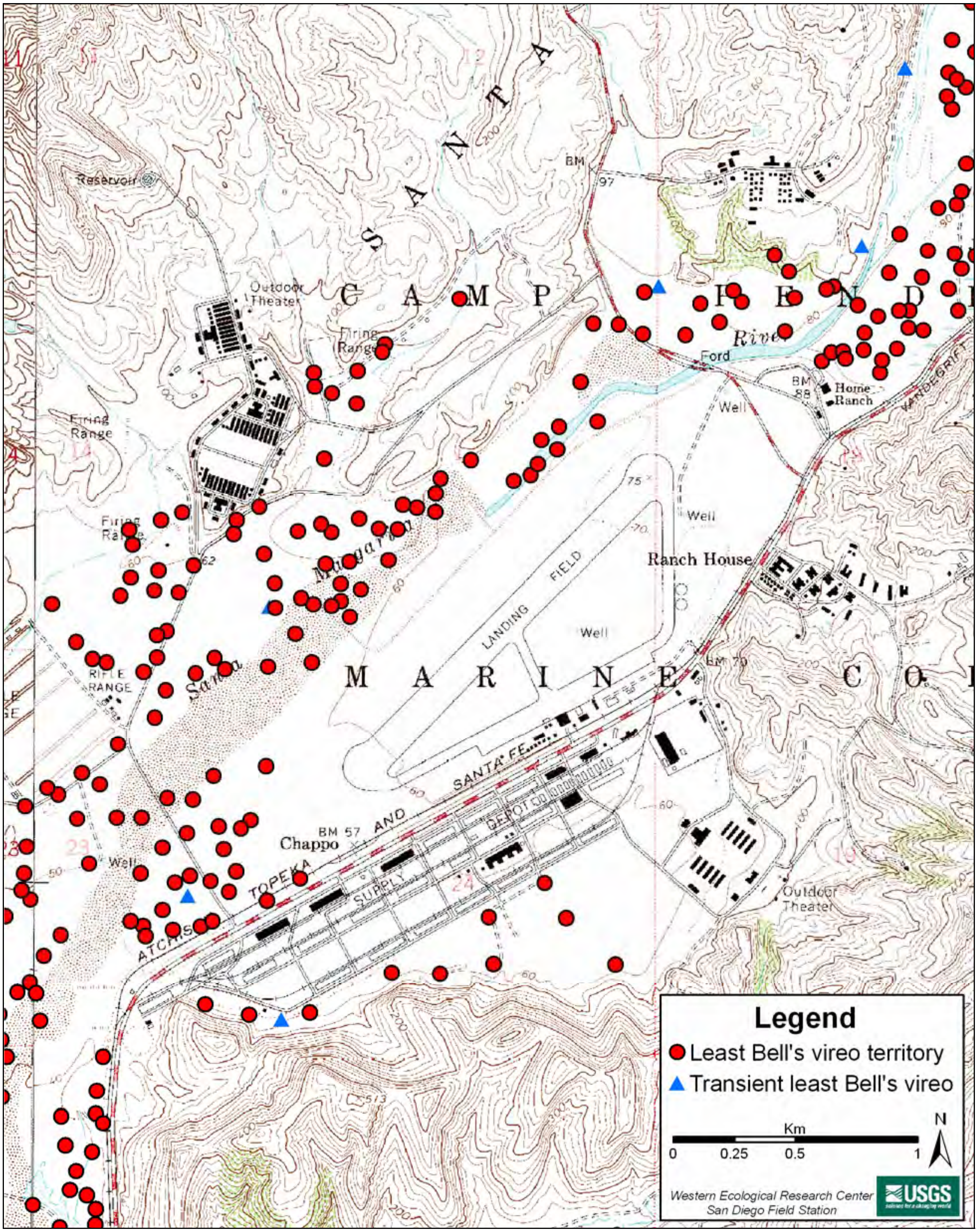

Figure 10. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Air Station, Santa Margarita River, and Area 22.

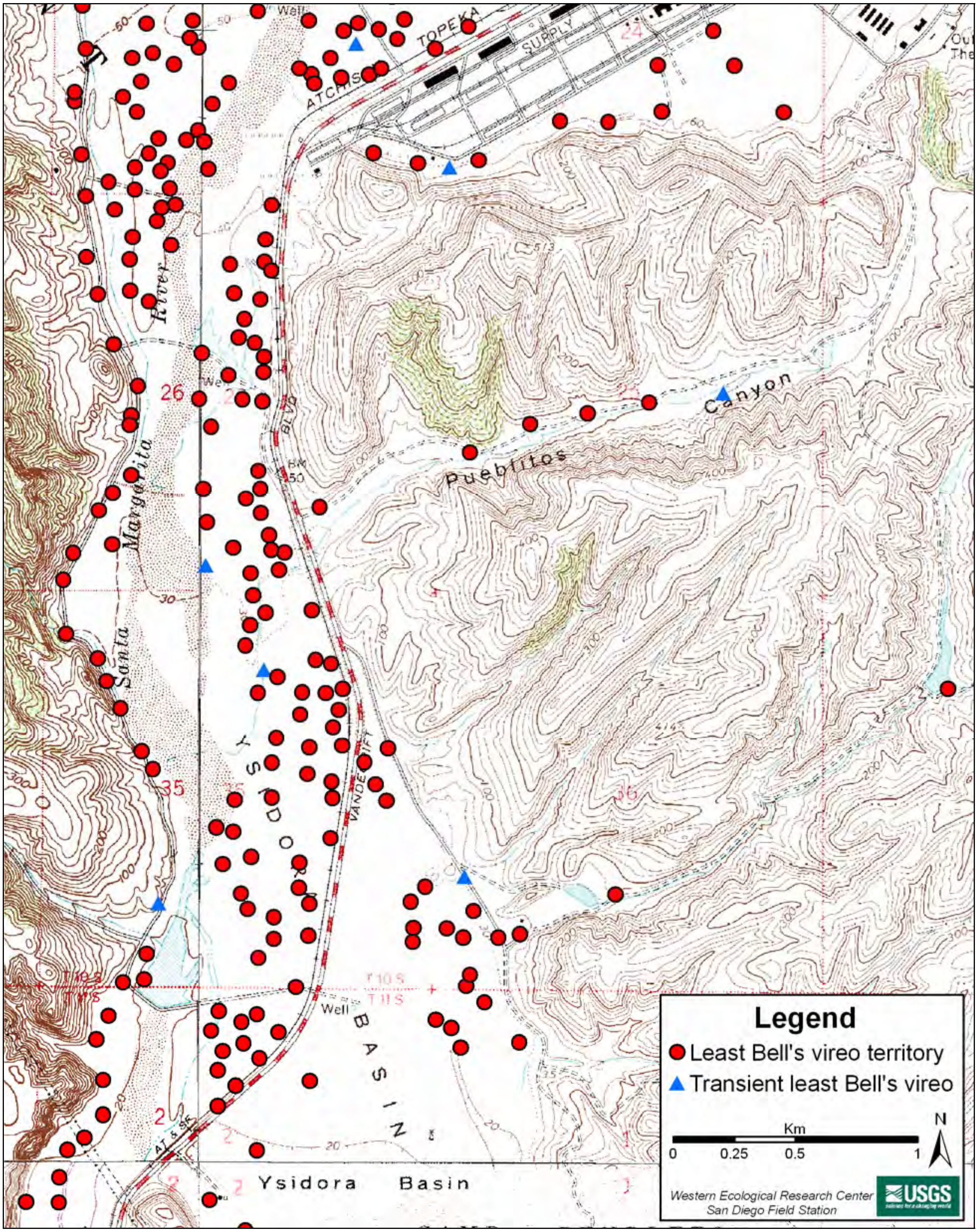

Figure 11. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Ysidora Basin, Santa Margarita River, Puebilitos Canyon, and Ysidora Basin to Windmill Canyons.

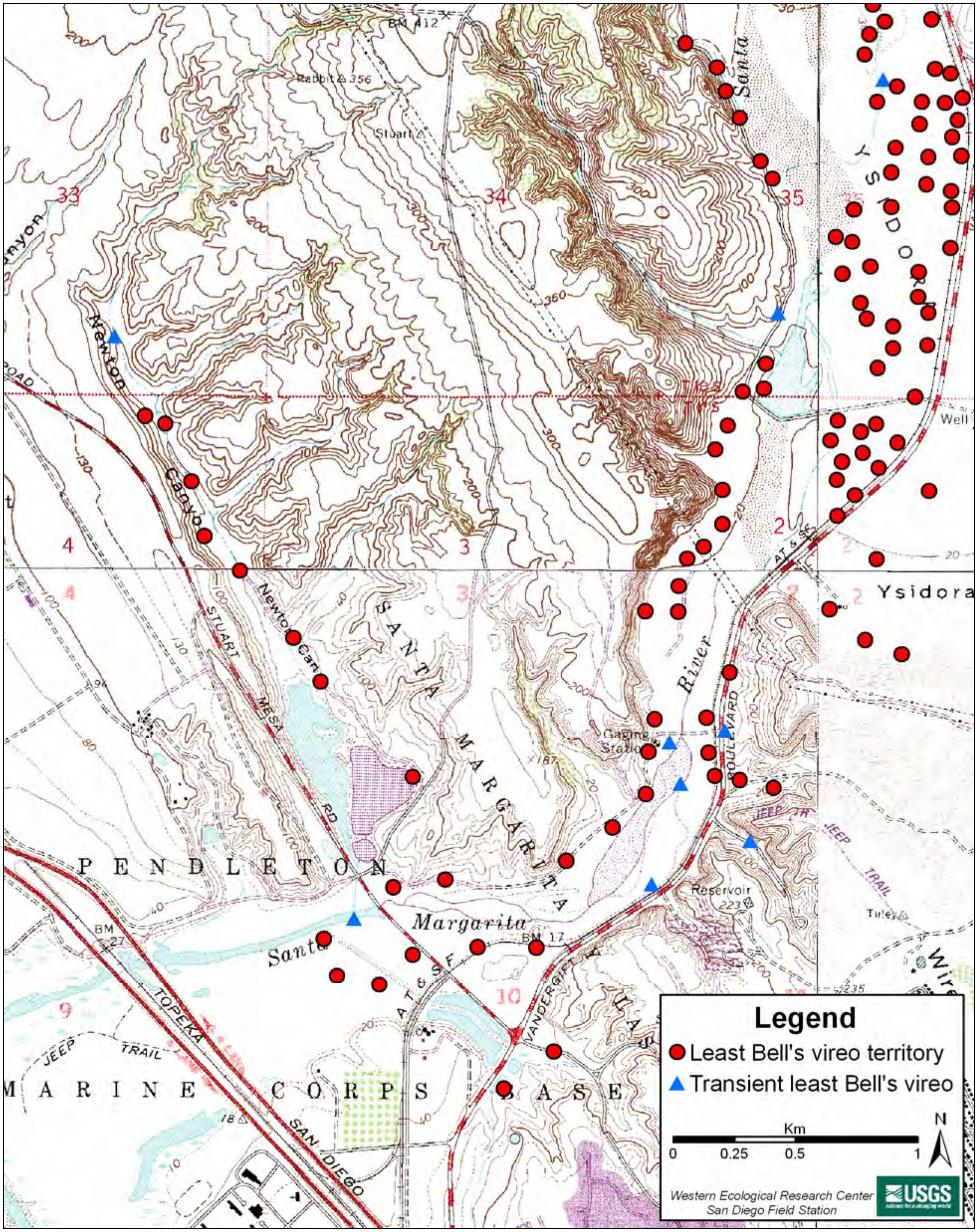

Figure 12. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Lower Santa Margarita River and Newton Canyon.

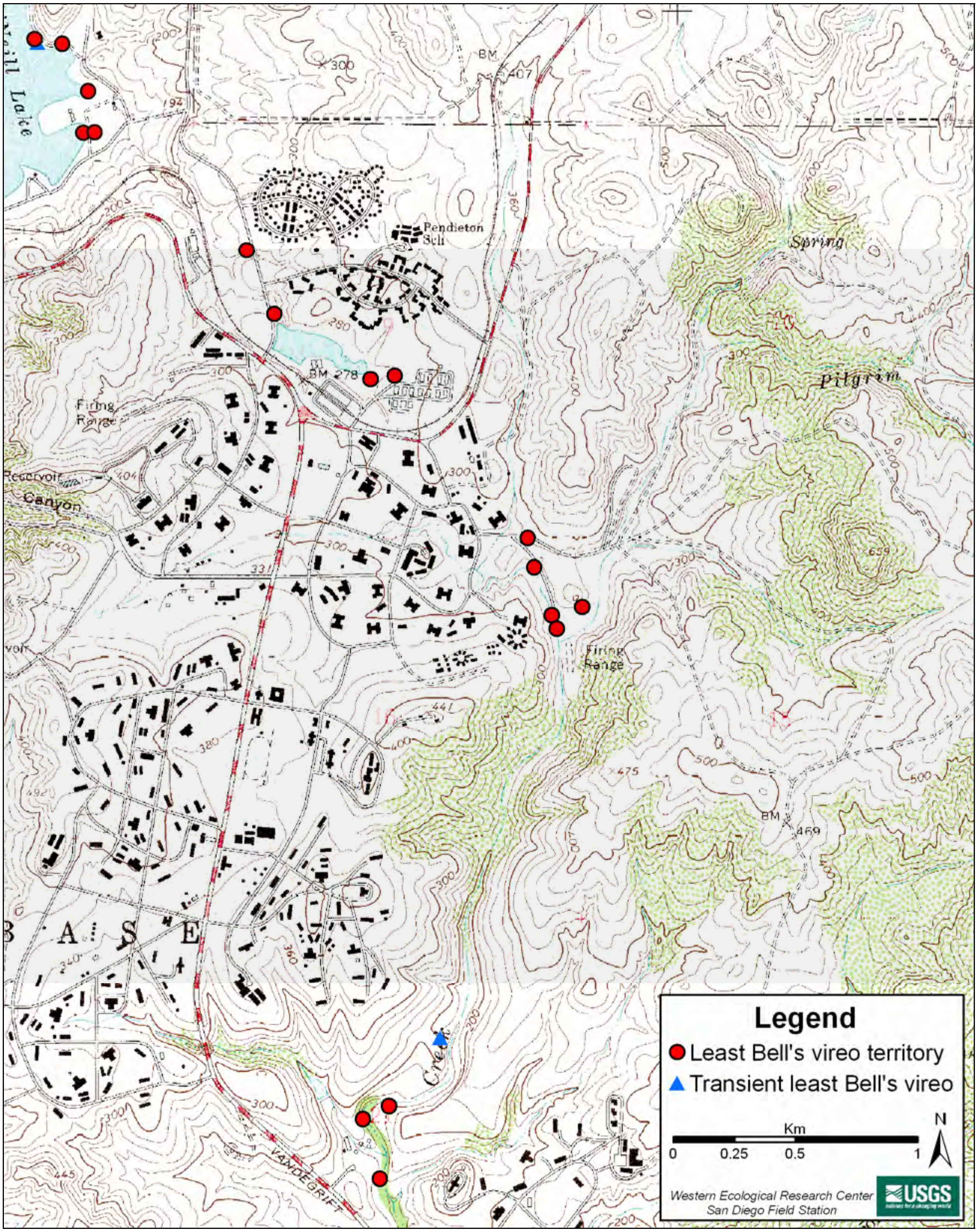

Figure 13. Locations of least Bell’s vireo at Marine Corps Base Camp Pendleton, 2005: Upper Pilgrim Creek, De Luz Homes Habitat, and Lake O'Neill.

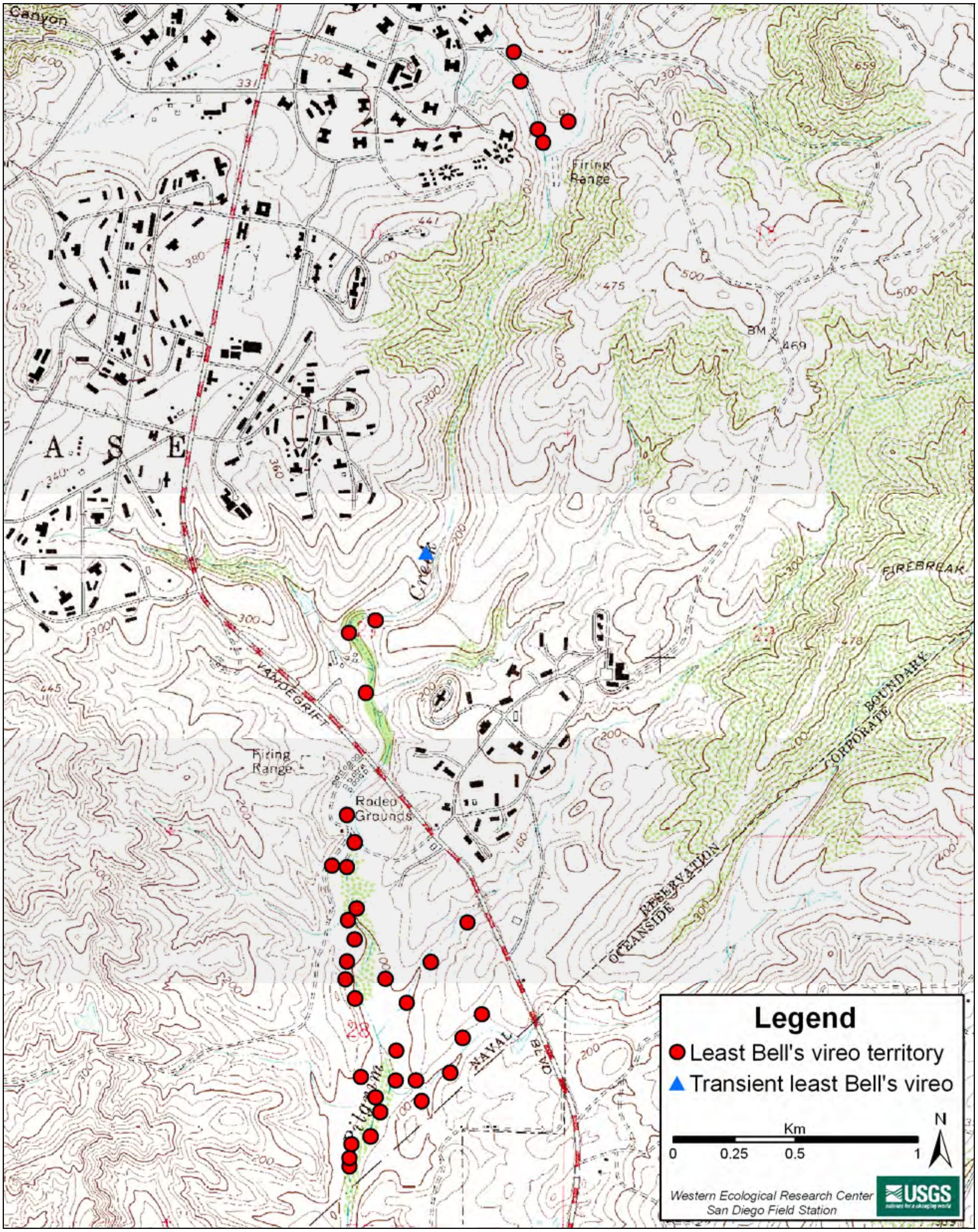

Figure 14. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Lower Pilgrim Creek.

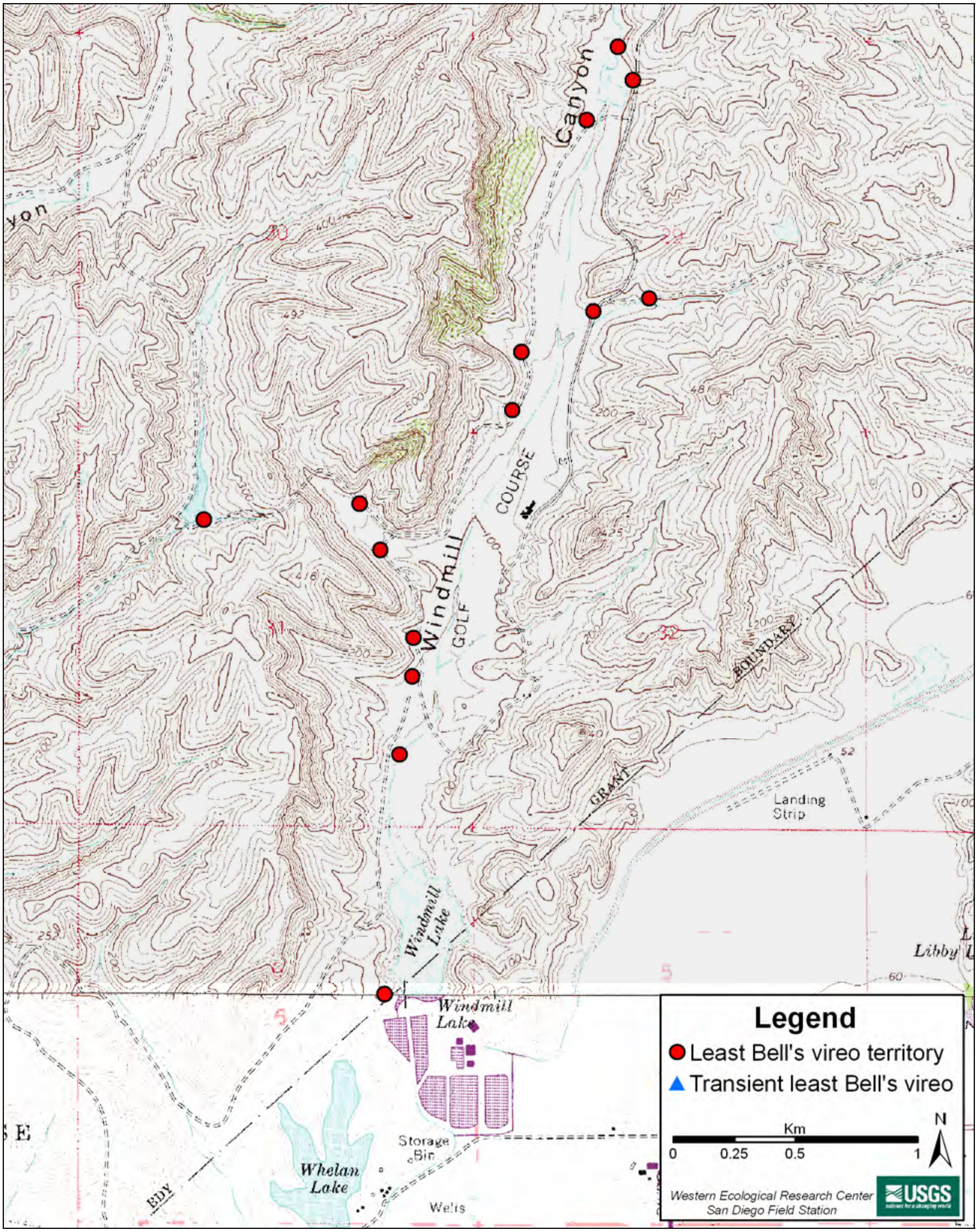

Figure 15. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Windmill Canyon and Ysidora Basin to Windmill Canyon.

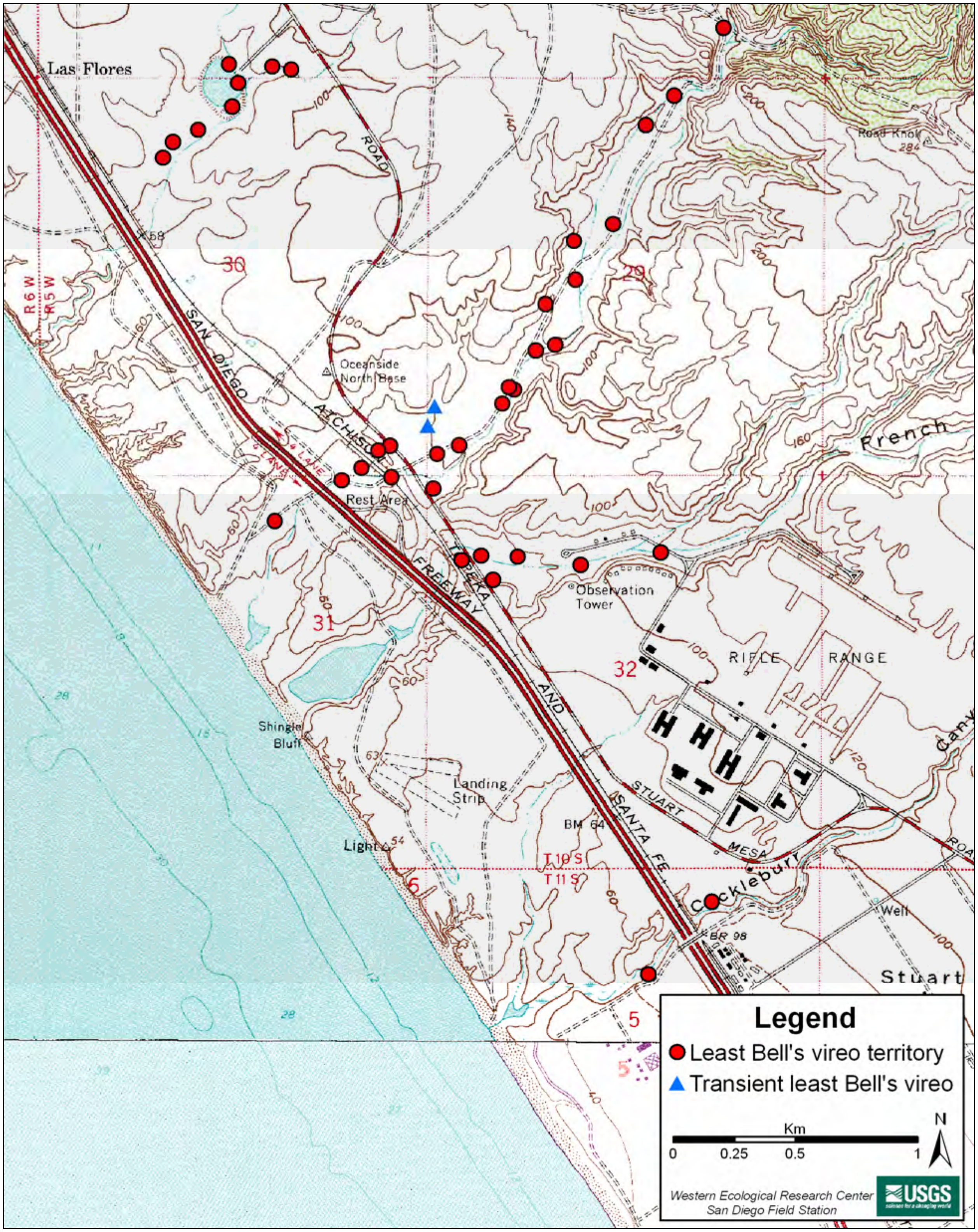

Figure 16. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Cockleburr Canyon, French Creek, Aliso Creek, and Hidden Canyon.

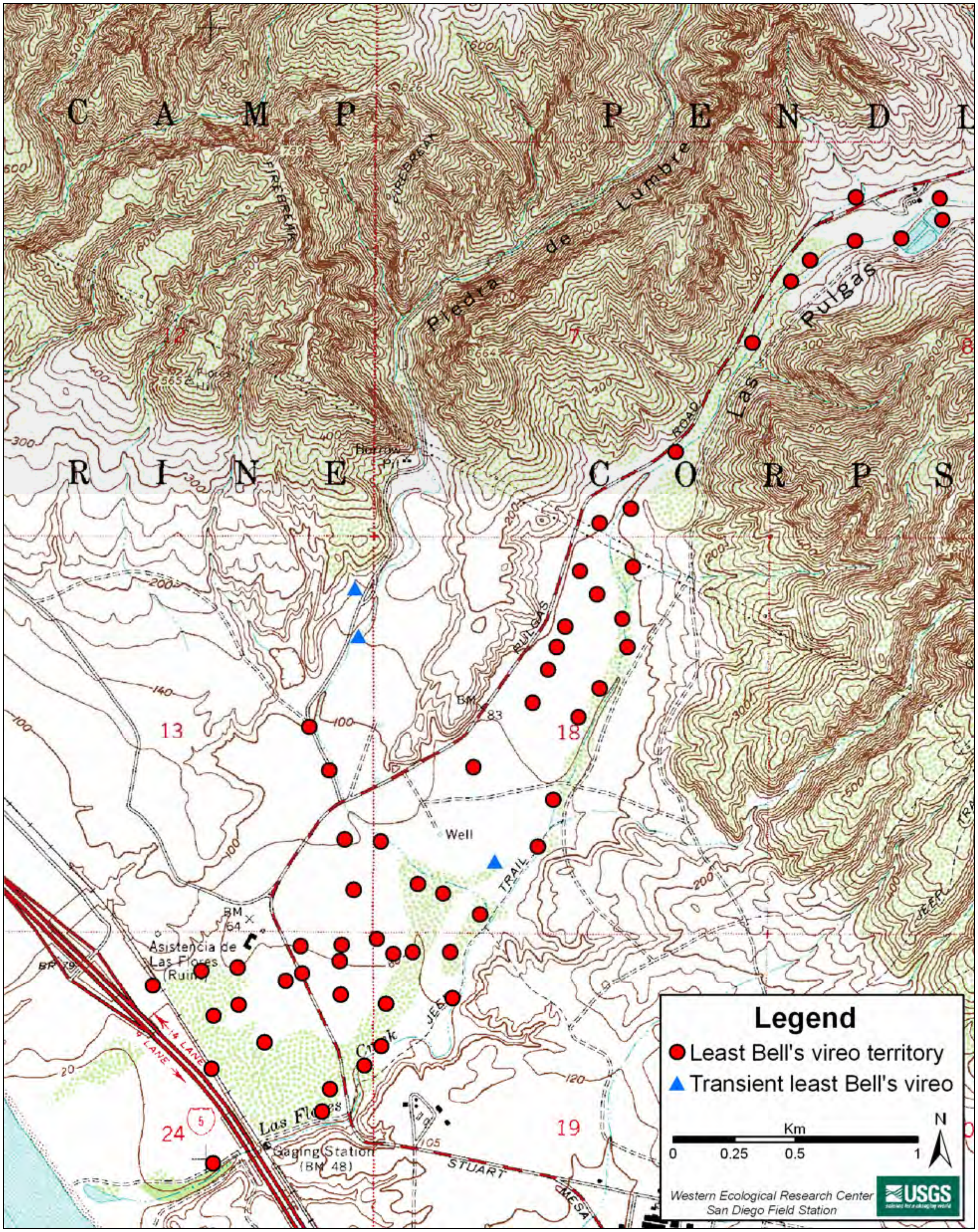

Figure 17. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Lower Las Flores Creek.

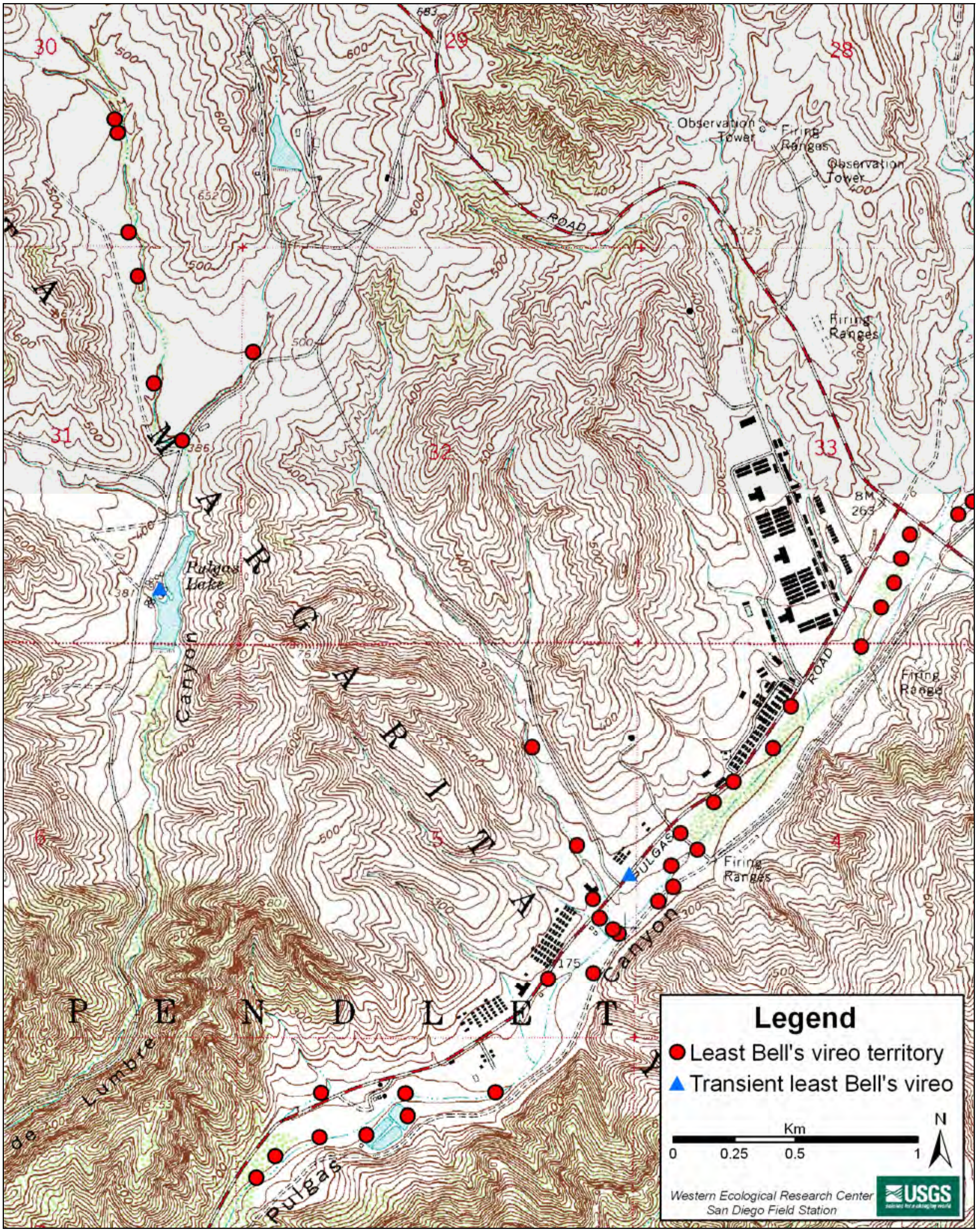

Figure 18. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Piedra de Lumbre Canyon and Las Flores Creek.

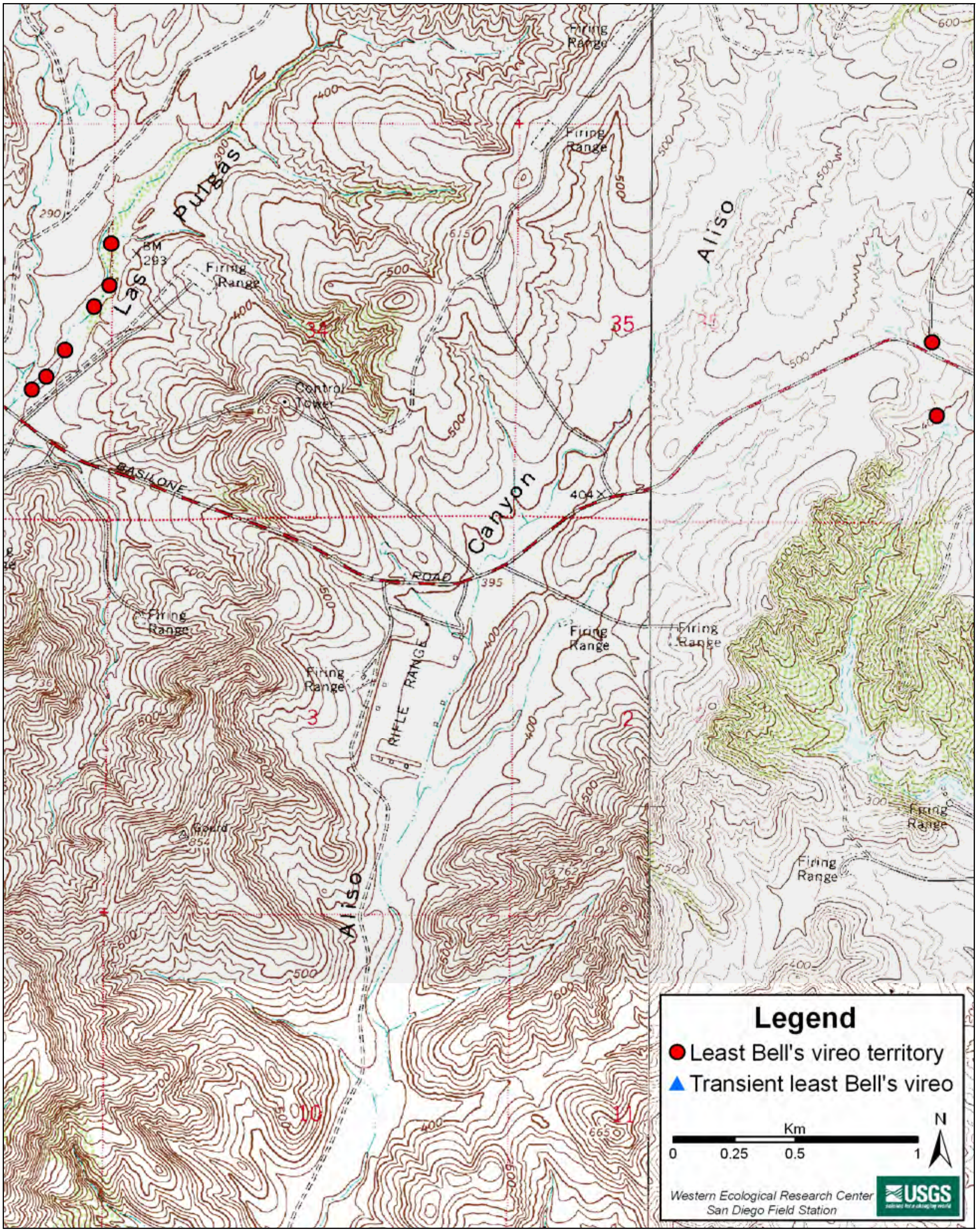

Figure 19. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Upper Las Flores Creek and Basilone and Roblar Roads.

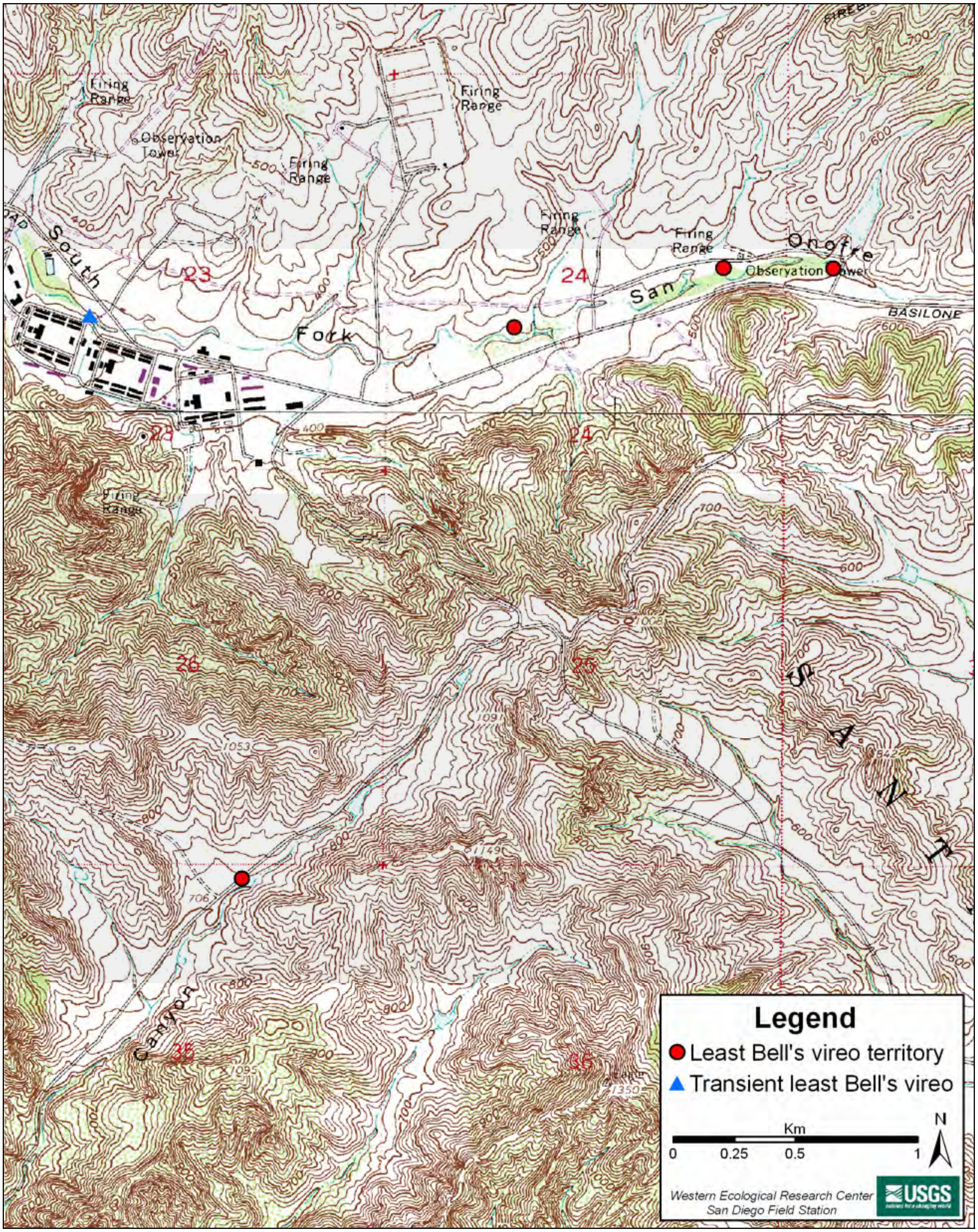

Figure 20. Locations of least Bell’s vireo at Marine Corps Base Camp Pendleton, 2005: Upper San Onofre Creek and Horno Canyon.

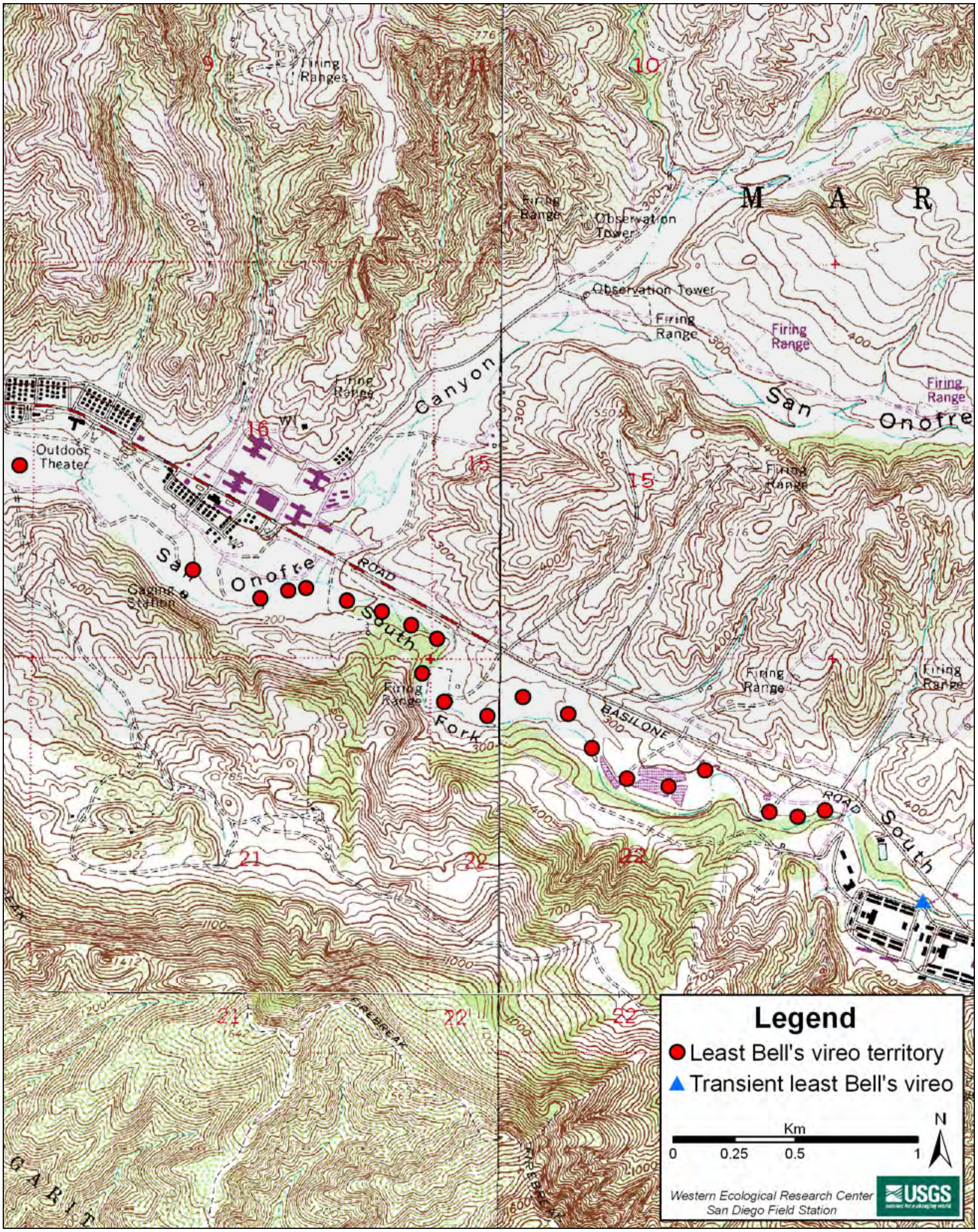

Figure 21. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: San Onofre Creek.

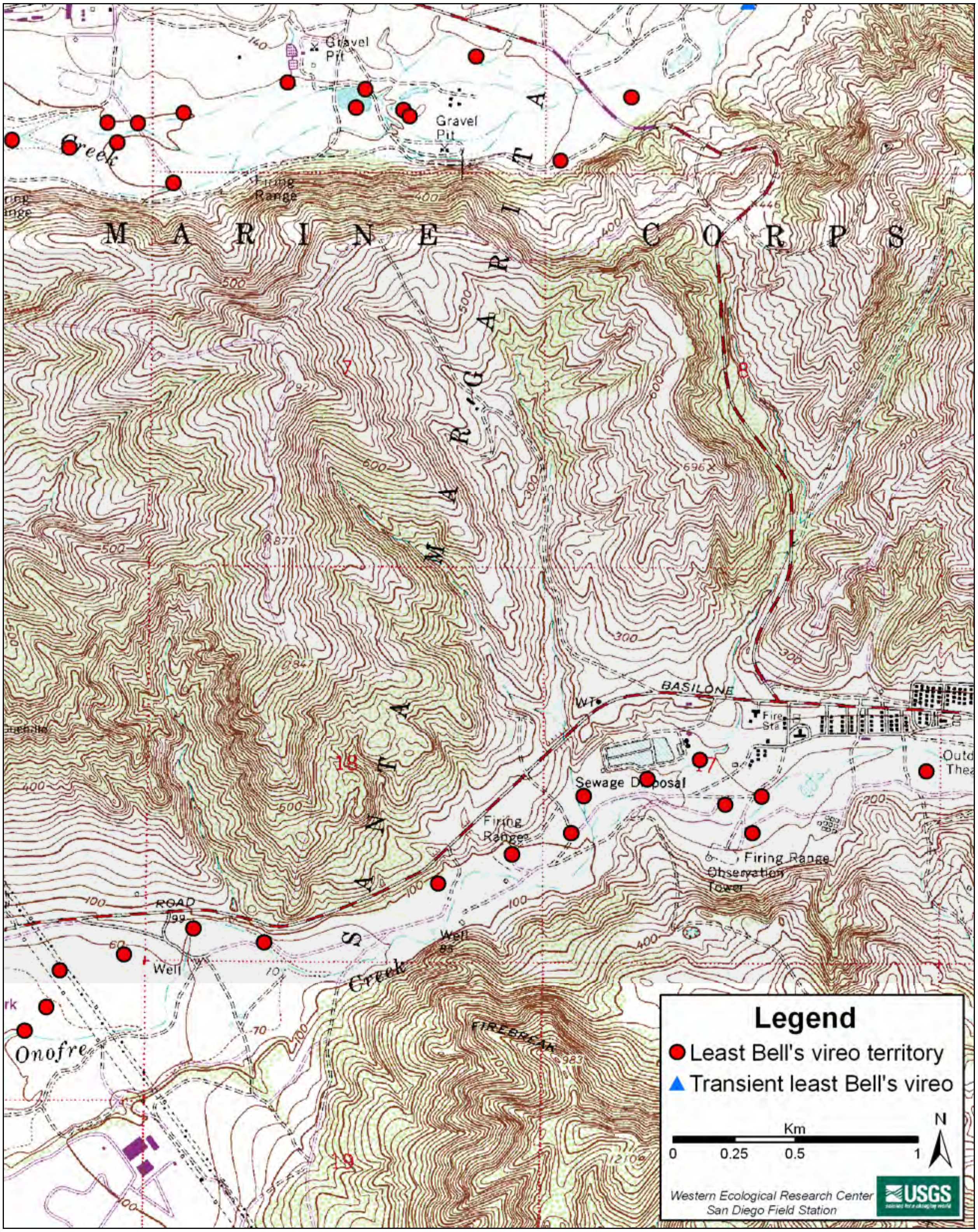

Figure 22. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: San Onofre Creek and San Mateo Creek.

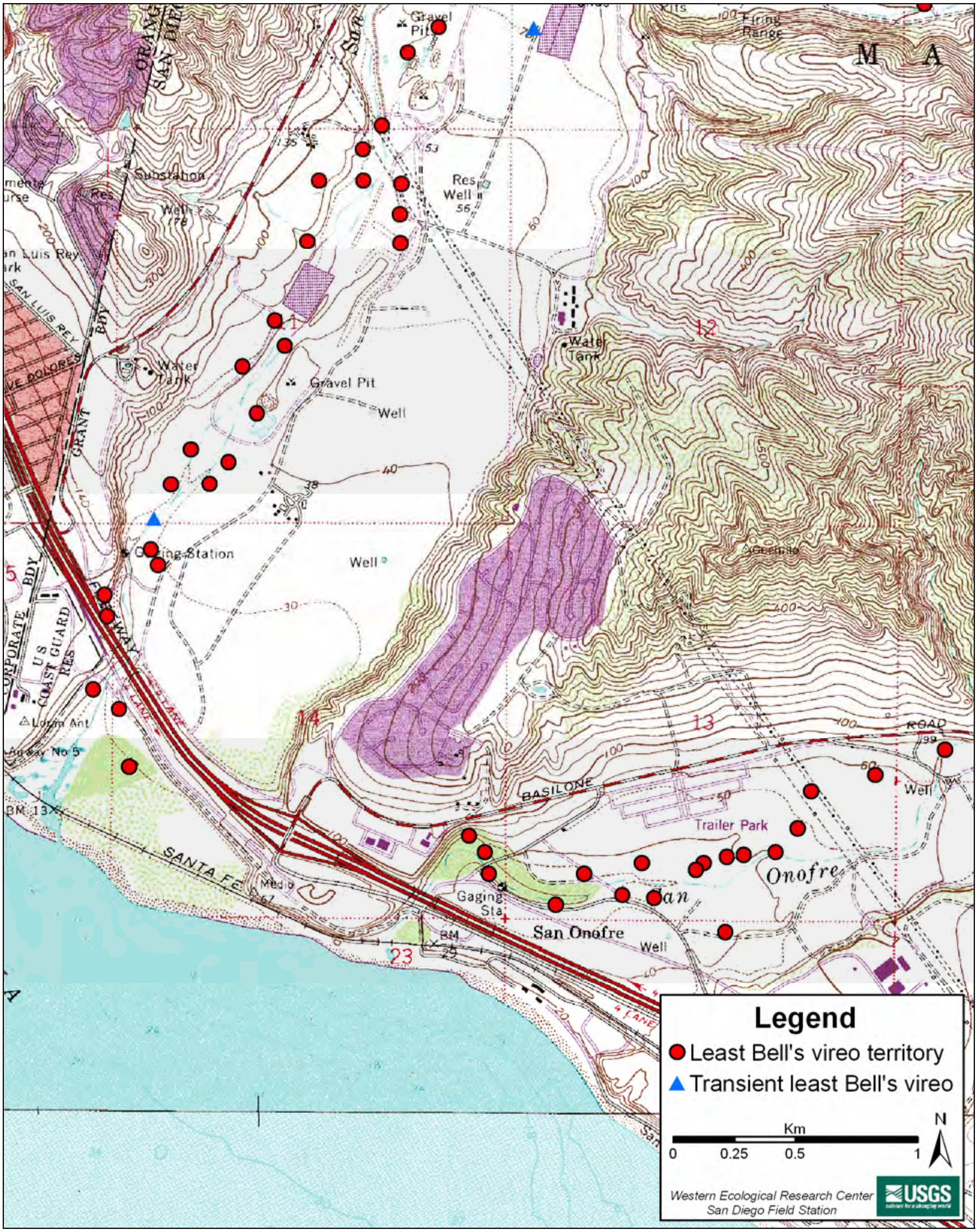

Figure 23. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Lower San Onofre Creek and Lower San Mateo Creek.

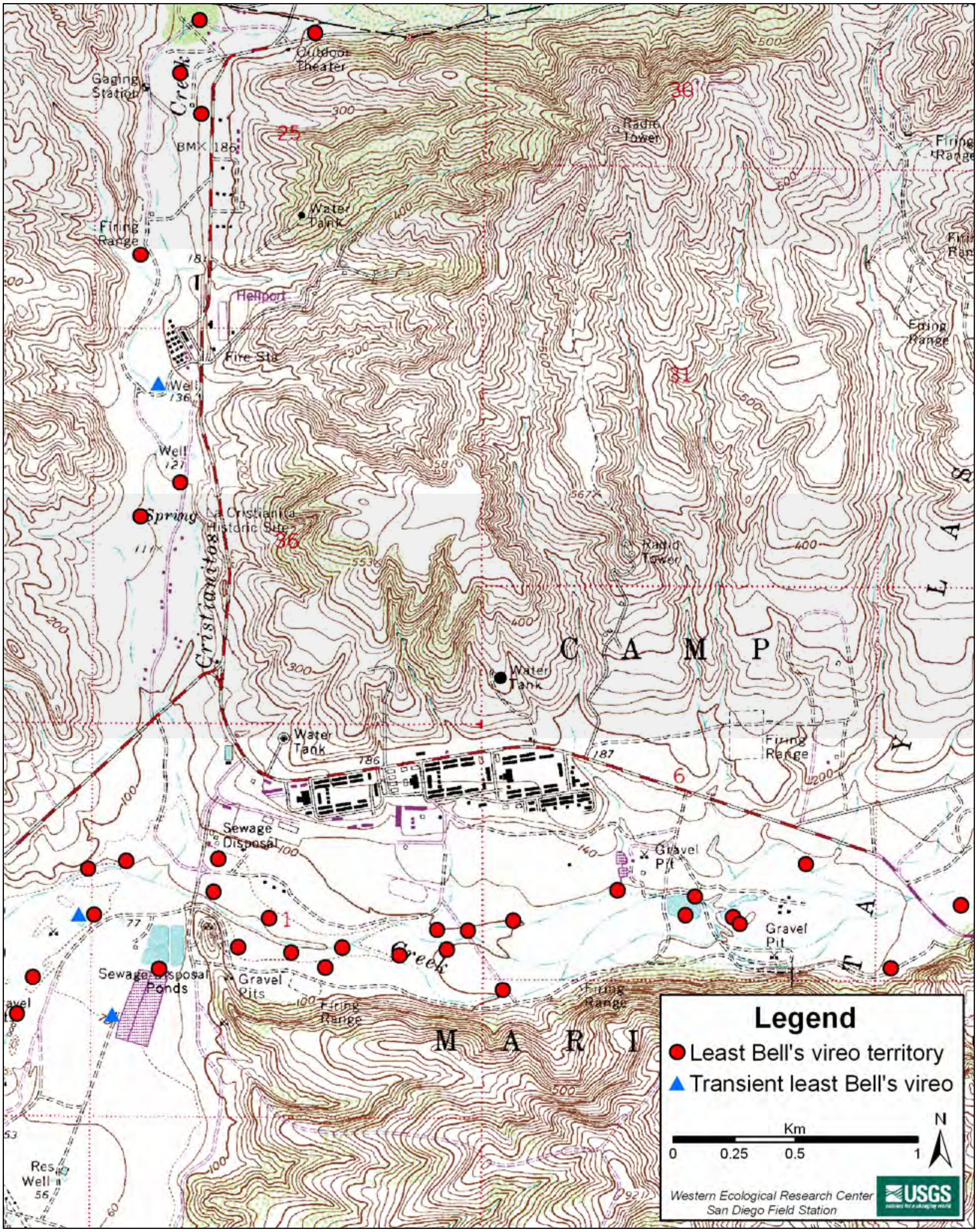

Figure 24. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: San Mateo Creek and Cristianitos Creek.

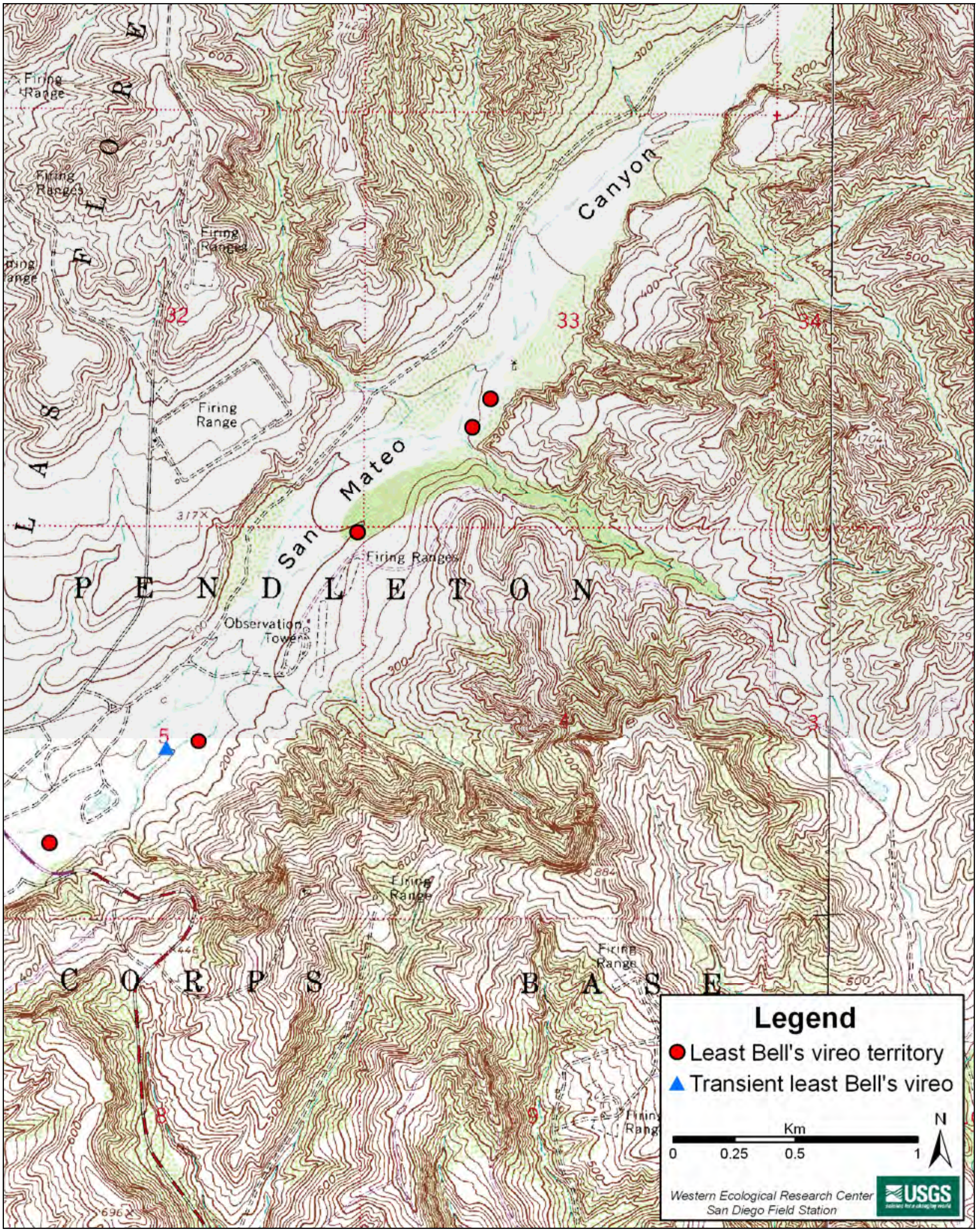

Figure 25. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Upper San Mateo Creek.

Windmill Canyon), with the majority of vireo territories occurring along the Santa Margarita River, the largest expanse of riparian vegetation on Base (Tables 1, 2). The remaining fourteen drainages/sites each contained ten or fewer territories.

Least Bell's vireo numbers were remarkably similar to those from 2004 (Table 2). Of the nine most populated drainages, the Santa Margarita River showed the greatest numeric increase (32 territories), increasing by seven percent over the 2004 population. Lake O'Neill/Fallbrook Creek showed the greatest percent increase, 25 percent, increasing by four territories. The drainages with the largest percentage decrease in population size were Windmill Canyon and De Luz Creek, decreasing by 40 and 31 percent, respectively. The site with the largest numeric loss in vireo numbers was San Mateo Creek, losing 12 territories. Comparing sites that were surveyed in both 2004 and 2005, the vireo population remained virtually stable, increasing by eight territories or one percent.

Table 2. Number of territorial males at Camp Pendleton, by drainage, in 2004 and 2005.

	Number of Territorial Males		
Drainage	**2005[a]**	**2004[b]**	**Percent Change**
Santa Margarita River[c]	472	440	+7%
De Luz Creek	18	26	-31%
Roblar Creek	0	1	-100%
Lake O'Neill/Fallbrook Creek	20	16	+25%
Pueblitos Canyon	5	3	+67%
Newton Canyon	8	9	-11%
Cocklebur Creek	2	0	-
French Canyon	6	5	+20%
Aliso Creek	21	21	0%
Hidden Canyon	8	5	+60%
Las Flores Creek	85	84	+1%
Piedre de Lumbre Canyon	8	5	+60%
Horno Canyon	1	0	-
San Onofre Creek	52	56	-7%
San Mateo Creek	56	68	-18%
Cristianitos Creek	6	8	-25%
Talega Canyon	1	0	-
Pilgrim Creek	36	37	-3%
Windmill Canyon	12	20	-40%
Ysidora Basin to Windmill Canyon	4	8	-50%
De Luz Homes	4	5	-20%
Total	825	817	

[a] 2005 sites not listed: Basilone-Roblar Roads (2 males); 2005 total = 827 territories.
[b] 2004 sites not listed: Tuley Canyon (2 males), and Vandegrift Hills (1), Kilo 1/ Kilo 2 Hills (2); 2004 total = 822 territories
[c] Includes vireo territories detected within the 22 Area.

Habitat Characteristics

Vireos used a number of different habitat types ranging from willow-dominated thickets along stream courses to upland vegetation along roads and channel margins (Table 3). The majority of vireo territories occurred in habitat characterized as Willow Riparian, with 62 percent of the males in the study area found in this habitat. An additional eight percent of birds occupied willow habitat co-dominated by cottonwoods or sycamores. The second most commonly used habitat type, occupied by 19 percent of the population, was Riparian Scrub, dominated by *B. salicifolia* and/or *S. exigua*. Ten percent of the vireos used more upland habitats including areas dominated by a mix of sycamores and oaks (2 percent of total) or other upland vegetation (8 percent).

Table 3. Habitat types used by least Bell's vireos at Camp Pendleton, 2005.

	Number of Territories			
Habitat Type	**>50% Native**	**>50% Exotic**	**Total[a]**	**Percent of Total**
Mixed Willow	462	50	512	62%
Willow/Cottonwood	7	0	7	1%
Willow/Sycamore	49	8	57	7%
Riparian Scrub	101	55	156	19%
Sycamore/Oak	11	3	14	2%
Upland Scrub	32	31	63	8%
Non-native	0	13	13	1%
Total	662	160	822	100%

[a] Percent exotic vegetation was not measured in five territories.

Two percent of vireo territories (13/827; nine territories on the Santa Margarita River, three on San Mateo Creek, and one on San Onofre Creek) were placed in habitat vegetated almost entirely with non-native vegetation (Table 3), and an additional 147 territories (18 percent) were in areas where exotic species such as *A. donax, Conium maculatum, Brassica nigra,* and *Tamarix* spp. made up 50 percent or more of the habitat. Cover of exotic vegetation

Table 4. Number and proportion of least Bell's vireo territories dominated or co-dominated by exotic vegetation, by drainage.

	Territories dominated or co-dominated by exotics	
Drainage	**Number**	**Proportion**
Piedra de Lumbre Canyon	8	1.00
Horno Canyon	1	1.00
Windmill Canyon	8	0.67
San Mateo Creek	37	0.66
Newton Canyon	5	0.63
Cristianitos Creek	3	0.50
Ysidora Basin to Windmill Canyon	1	0.25
San Onofre Creek	12	0.23
Santa Margarita River	78	0.17
O'Neil Lake/Fallbrook Creek	3	0.15
De Luz Creek	1	0.06
Aliso Creek	1	0.05
Las Flores Creek	2	0.02
Total	160	

was greatest in Piedra de Lumbre Canyon, Windmill Canyon, San Mateo Creek, and Newton Canyon where more than half of all vireo territories were located in habitat dominated or co-dominated by exotic vegetation (Table 4).

Banded Birds

Fifteen least Bell's vireos banded prior to the 2005 breeding season were resighted on Base in 2005 (Table 5). Six were originally banded off Base on Pilgrim Creek (Kus *et al.* 2004) and one had been banded on the San Luis Rey River (Kus unpubl. data). One of the remaining eight vireos was recaptured and was determined to have been originally banded at the Santa Margarita River Monitoring Avian Productivity and Survivorship (MAPS) Station (Kus and Beck 1998). The remaining seven were not recaptured, but were most likely banded at the same MAPS station because of their proximity to the MAPS area. Adult birds of known age ranged from two to seven years old.

Table 5. Banded least Bell's vireos at Camp Pendleton, 2005.

Drainage Sex	**Band Combination**[a] Left Leg	Right Leg	Natal Site	Age[b]	Comments
Pilgrim Creek					
M	Mbk	YEYE	Pilgrim Creek - off Base	2 yrs	Natal site Pilgrim Creek H1 Pink Flag territory. Target netted.
M	Mbk	-	Pilgrim Creek - off Base	AHY	Resighted south of rodeo grounds.
F	Mbk	-	Pilgrim Creek - off Base	AHY	Resighted south of rodeo grounds.
Santa Margarita River					
M	-	DGOR/Mgo	Santa Margarita River	7 yrs	Natal site Santa Margarita MAPS station. Msi band worn; rebanded with Mgo band. Target netted.
M	Mbk	WHWH	Pilgrim Creek - off Base	2 yrs	Natal site Pilgrim Creek Inlet 3E territory. Target netted.
M	DPWH/Mbk	-	Pilgrim Creek - off Base	2 yrs	Natal site Pilgrim Creek Golf Course territory. Target netted.
F	Mbk	-	Pilgrim Creek - off Base	AHY	Resighted within Ysidora Basin.
F	Mdb	-	San Luis Rey River	AHY	Resighted adjacent to the Air Station.
F	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
F	-	Msi	?	AHY	Resighted north of the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted north of the Santa Margarita MAPS Station.
M	Msi	-	?	AHY	Resighted north of the Santa Margarita MAPS Station.

Table 5 (*continued*). Banded least Bell's vireos at Camp Pendleton, 2005.

Drainage / Sex	Band Combination[a] Left Leg	Right Leg	Natal Site	Age[b]	Comments
F	ORPU/Mgo	-	?	AHY	Banded in 2005.
F	PUPU	Mgo	?	AHY	Banded in 2005.
F	WHWH/Mgo	-	?	AHY	Banded in 2005.
M	-	BKBK/Mgo	?	AHY	Banded in 2005.
M	-	LPLP/Mgo	?	AHY	Banded in 2005.
M	-	PUPU/Mgo	?	AHY	Banded in 2005.
M	BKBK	Mgo	?	AHY	Banded in 2005.
M	BKBK/Mgo	pupu	?	AHY	Banded in 2005.
M	BYST/Mgo	-	?	AHY	Banded in 2005.
M	DPWH/Mgo	pupu	?	AHY	Banded in 2005.
M	LPLP/Mgo	pupu	?	AHY	Banded in 2005.
M	Mgo	DGOR/pupu	?	AHY	Banded in 2005.
M	Mgo	DPWH/pupu	?	AHY	Banded in 2005.
M	Mgo	LPBK	?	AHY	Banded in 2005.
M	Mgo	LPBK/pupu	?	AHY	Banded in 2005.
M	Mgo	PUWH	?	AHY	Banded in 2005.
M	Mgo	PUWH/pupu	?	AHY	Banded in 2005.
M	Mgo	YEYE	?	AHY	Banded in 2005.
M	Mgo	YEYE/pupu	?	AHY	Banded in 2005.
M	OROR/Mgo	pupu	?	AHY	Banded in 2005.
M	ORPU/Msi	pupu	?	AHY	Banded in 2005.
M	PUPU/Mgo	pupu	?	AHY	Banded in 2005.
M	PUWH/Mgo	-	?	AHY	Banded in 2005.
M	PUWH/Mgo	pupu	?	AHY	Banded in 2005.
M	WHWH/Mgo	pupu	?	AHY	Banded in 2005.
M	YEPU/Mgo	-	?	AHY	Banded in 2005.
M	YEYE/Mgo	pupu	?	AHY	Banded in 2005.
U	-	LPBK/Mgo	?	AHY	Banded in 2005.
U	OROR/Msi	pupu	?	AHY	Banded in 2005.
U	Mgo	BKBK/pupu	?	AHY	Probable adult female. Banded 2005.
U	-	ORPU/Mgo	?	AHY	Banded in 2005.
U	BYST/Mgo	pupu	?	AHY	Banded in 2005.
U	DGOR/Mgo	pupu	?	AHY	Banded in 2005.
U	LPBK/Mgo	pupu	?	HY?	Possible hatch year bird, caught while target netting adult in territory.
U	-	OROR/Mgo	Santa Margarita	HY	Caught while target netting adult.
U	LPBK/Mgo	-	Santa Margarita	HY	Caught while target netting adult.
U	Mgo	ORPU	Santa Margarita	HY	Caught while target netting adult.
U	ORPU	Mgo	Santa Margarita	HY	Caught while target netting adult.
U	WHWH/pupu	Mgo	Santa Margarita	HY	Caught while target netting adult.

[a] Band colors: Mbk = black numbered federal band; Mdb = dark blue numbered federal band; Msi = silver numbered federal band; Mgo = gold numbered federal band; YEYE = plastic yellow; ORPU = plastic orange-purple split; PUPU = plastic purple; pupu = metal purple; WHWH = plastic white; BKBK = plastic black; DGOR = plastic dark green-orange split; BYST = plastic blue-yellow striped; DPWH = plastic dark pink-white split; LPLP = plastic light pink; LPBK = plastic light pink-black split; PUWH = plastic purple-white split; OROR = plastic orange; YEPU = plastic yellow-purple split.

[b] Age: AHY = after hatch year, HY = hatch years.

A total of 134 least Bell's vireos were banded during the 2005 season. These included 36 adult vireos that were target netted and banded with a unique color combination, 96 hatch-year birds, 91 of which were banded as nestlings with a single gold numbered federal band and five that were incidentally caught while attempting to target net an adult vireo in a territory, and two vireos of undetermined age.

Nest Monitoring

Nesting activity was monitored in a total of 62 territories within the Giant Reed Removal and Reference monitoring areas (Table 6, Figures 26-29, Appendix 1). Of these, 35 territories were "fully" monitored, indicating that all nests within the territory were found and documented during the breeding season. Pairs within the remaining 27 territories were documented nesting; however, only a subset of nests by a pair were found and monitored. A total of 98 nests were monitored during the breeding season, 66 of which came from fully monitored territories. Within fully monitored territories, pairs in the Reference and Removal sites each averaged 1.9 nesting attempts over the course of the 2005 breeding season. One Removal pair was documented building on two occasions, but never completed either nest.

Table 6. Number of least Bell's vireo territories and nests monitored, Camp Pendleton, 2005.

	Nest Monitoring Area Type	
	Reference	**Removal**
Territories fully monitored	15	20
Nests in fully monitored territories	29	37
Completed nests per pair (fully monitored territories)	1.9	1.9
Total # of nests monitored	55	43

Fully monitored pairs at Reference and Removal sites were equally likely to re-nest after their initial attempt as 71 percent of pairs at Reference sites attempted a second nest, compared to 68 percent of pairs at Removal sites ($\chi^2_{0.05,1}$ = 2.69, P = 0.10). Nest fate influenced the likelihood that pairs would re-nest. One hundred percent of Reference and Removal pairs whose initial nests failed attempted second nests, compared to only 33 percent of Reference and 14 percent of Removal pairs re-nesting after a successful first attempt. During the course of the 2005 breeding season 93 percent of Reference pairs and 85 percent of Removal pairs fledged young. Five Reference and three Removal pairs initiated three nesting attempts, and only a single Removal pair initiated four nesting attempts in 2005.

Nest success of pairs breeding in Reference sites did not differ appreciably from those at removal sites, as 45 percent (25/55) of Reference nests and 47 percent (20/43) of Removal nests successfully fledged young. Causes of nest failure were similar between Reference and Removal sites. Predation was believed to be the primary source of nest failure at both sites, although no predation events were witnessed (Table 7). Predation accounted for 77 (23/30) and 87 (20/23) percent of nest failures at Reference and Removal sites, respectively. Overall, 42 and 46 percent, respectively, of completed vireo nests were lost to predation. No nests were directly lost to parasitism; however two instances of possible brown-headed cowbird nest predation were

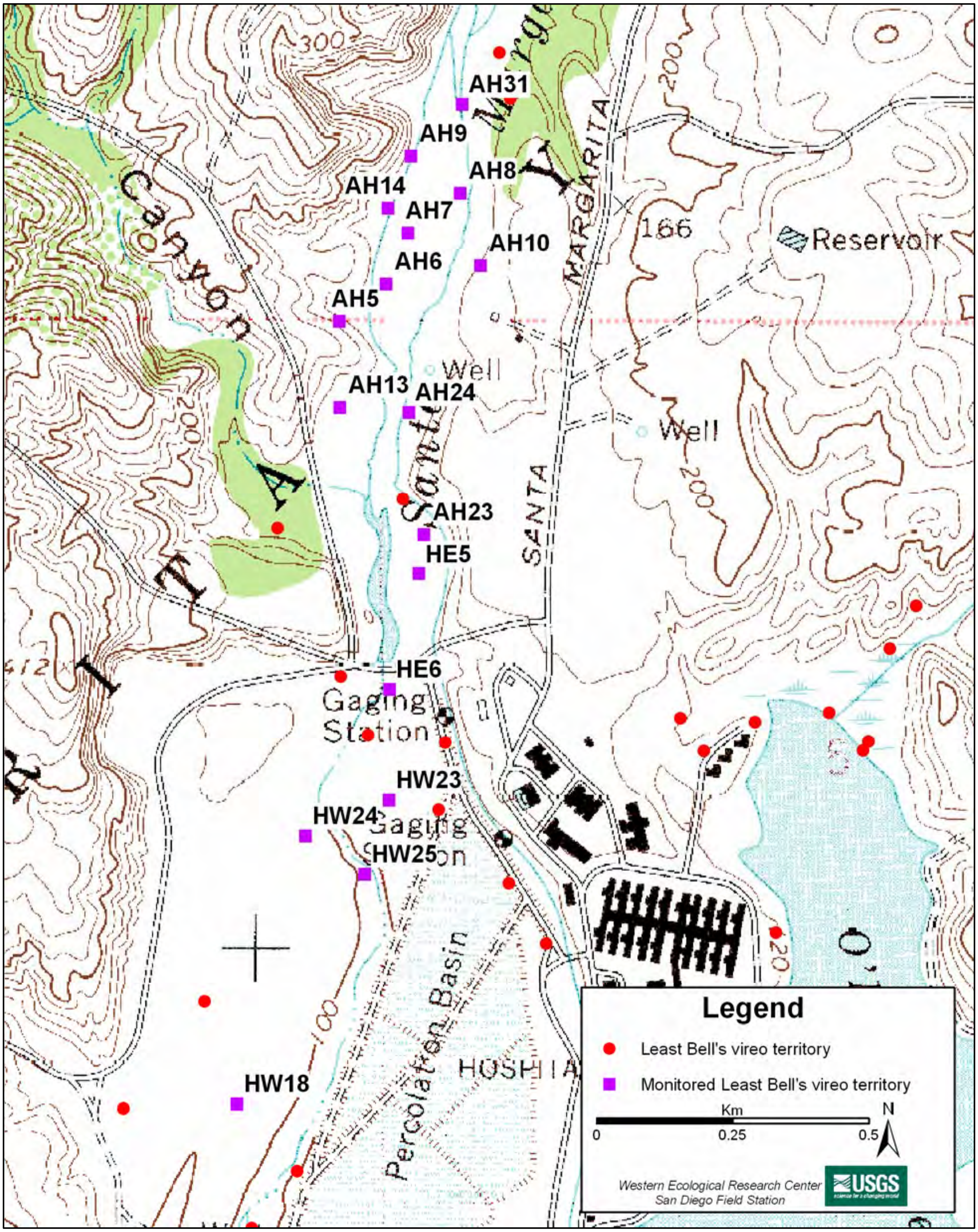

Figure 26. Locations of monitored least Bell's vireo territories at the Above Hospital reference site, Marine Corps Base Camp Pendleton, 2005.

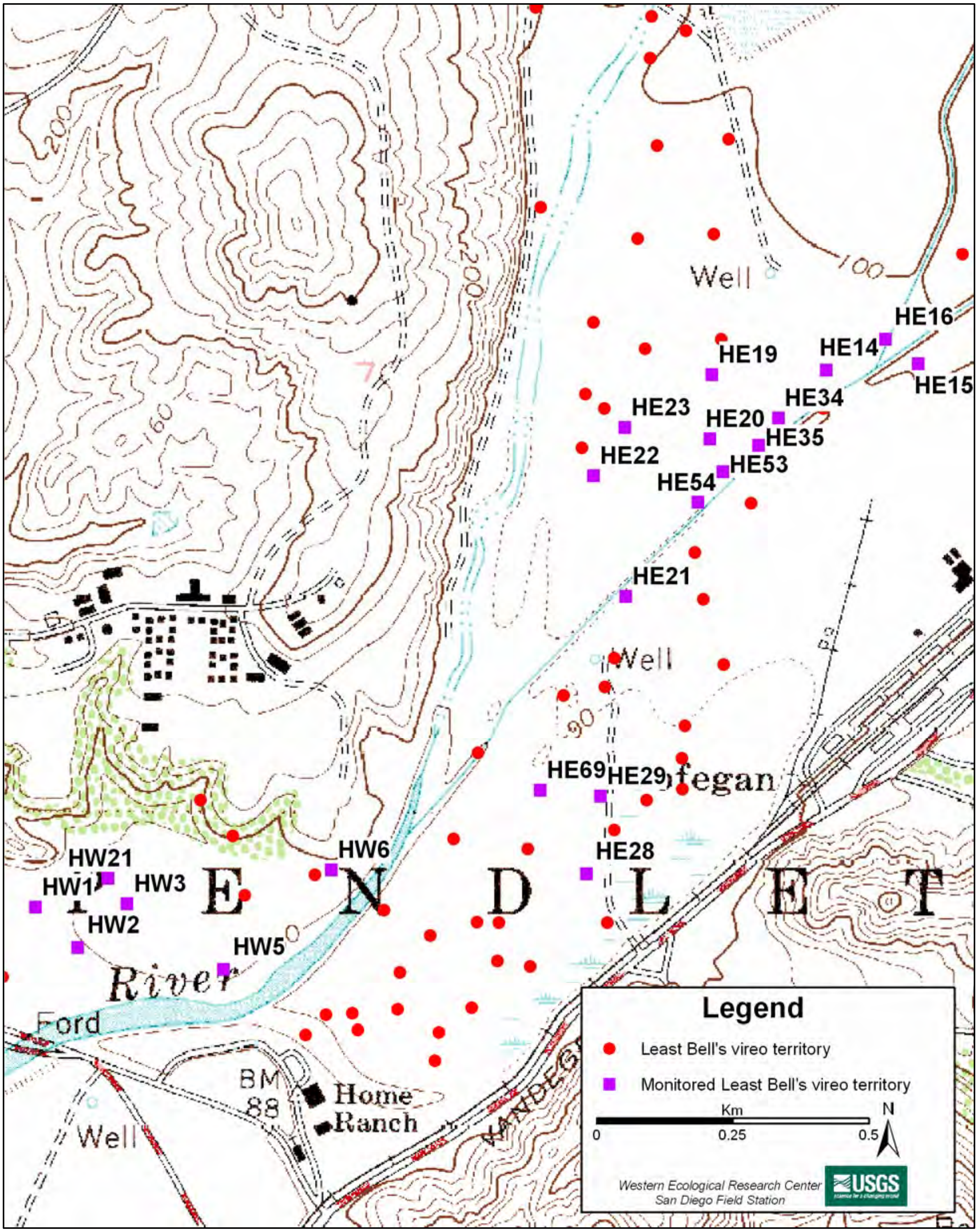

Figure 27. Locations of monitored least Bell's vireo territories at the Below Hospital reference site, Marine Corps Base Camp Pendleton, 2005.

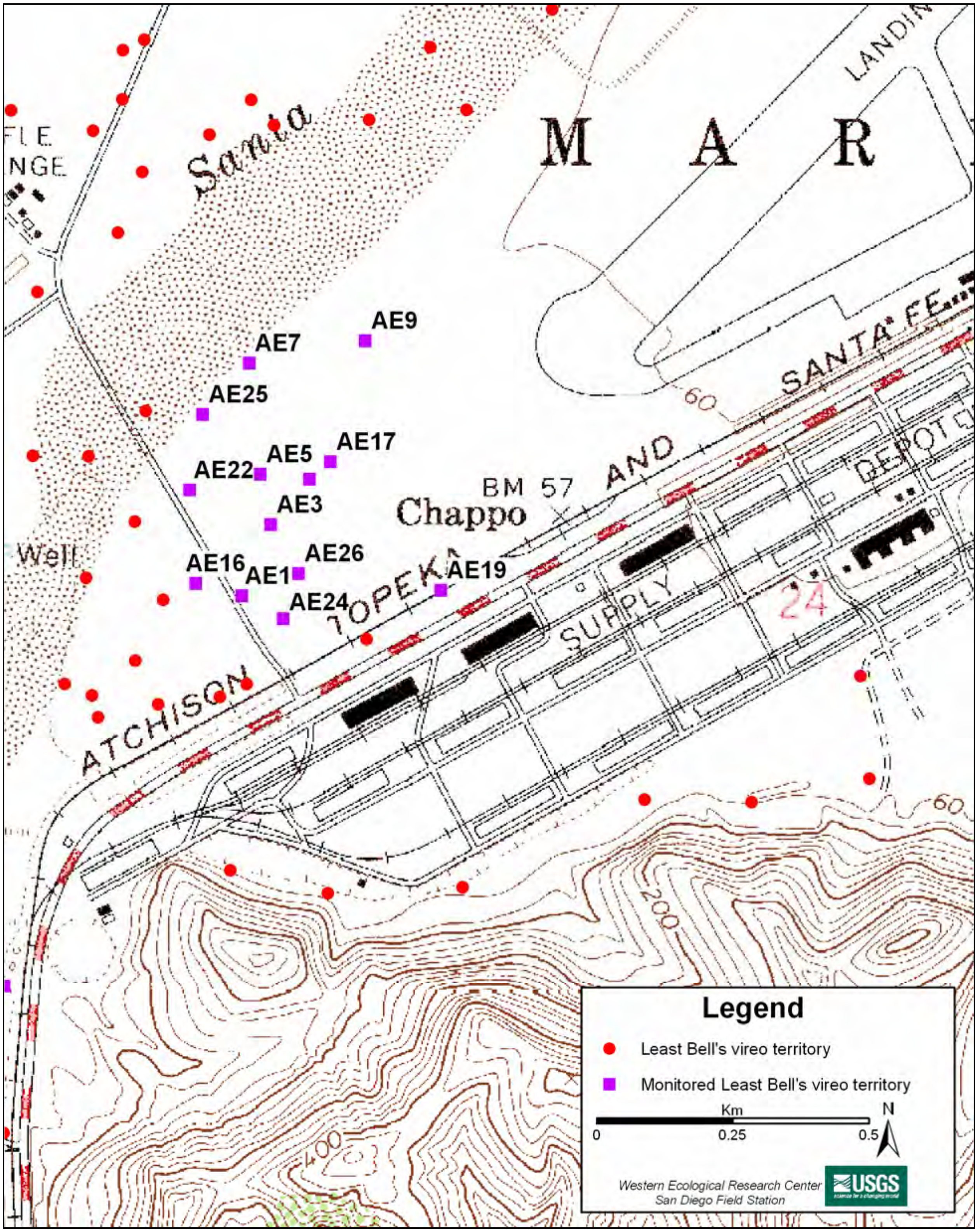

Figure 28. Locations of monitored least Bell's vireo territories at the Air Station giant reed removal site, Marine Corps Base Camp Pendleton, 2005.

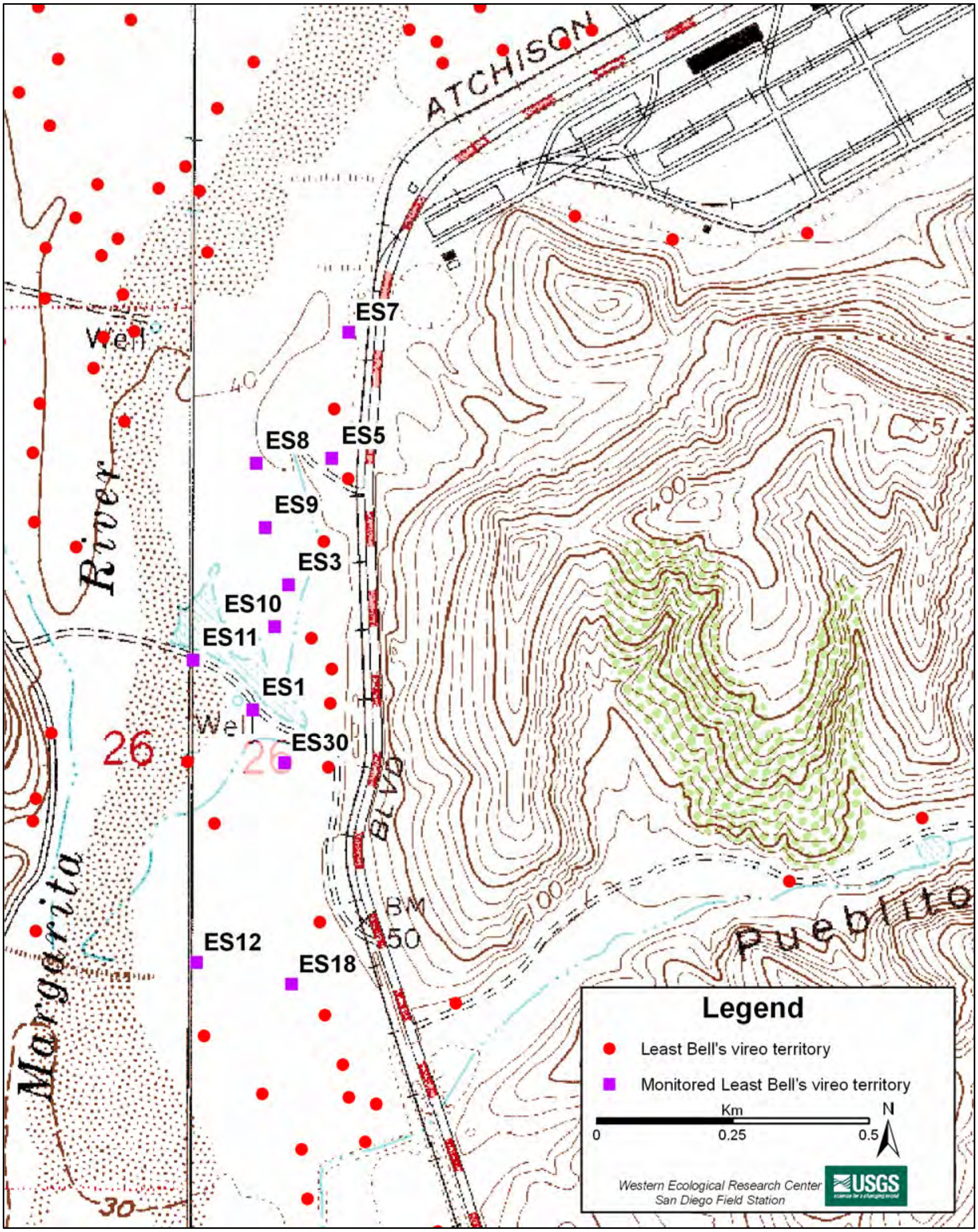

Figure 29. Locations of monitored least Bell's vireo territories at the Seep giant reed removal site, Marine Corps Base Camp Pendleton, 2005.

documented. One monitored nest was found with a punctured egg, and two eggs from a second nest were found on the ground with punctures, but were not consumed. An additional source of nest failure was linked to the use of the exotic plant *C. maculatum* as a nesting substrate by Bell's vireos. Thirty-three percent (3/9) of the nests built in *C. maculatum* failed when the branch supporting the nest, or the entire nest substrate, collapsed dumping the eggs and/or young on the ground. Nest substrate failure also caused the loss of one nest built in *S. lasiolepis* when the branch supporting the nest gave out. Finally, the cause of failure of four nests was unknown. It is possible that they could have been depredated in the egg stage or abandoned prior to egg laying, as they failed during the time eggs should have been laid and no eggs were observed in the nest.

Table 7. Cause of failure of least Bell's vireo nests, Camp Pendleton, 2005.

	Number of Nests		
Cause of Failure	**Reference**	**Removal**	**Total**
Predation	23	20	43
Parasitism	0	0	0
Other/Unknown	7	3	10
Total Completed Nests	55	43	98

Productivity

Productivity of least Bell's vireos nesting at the Reference and Removal sites differed in some aspects (Table 8), but overall productivity measures were very similar. For example, although nesting vireos at Removal sites exhibited a higher hatching rate (67% vs. 58%; percent of all eggs that hatched) and had higher hatching success (70 % vs. 59%, percent of nests with one or more hatchlings), average clutch size, average brood size, and the average number of young fledged per pair were not statistically different. A large proportion of vireos at both sites were successful in fledgling young from at least one nest as 93 percent (14/15) of Reference pairs and 85 percent (17/20) of Removal pairs within fully monitored territories fledged young.

Table 8. Reproductive success and productivity of nesting least Bell's vireos at Reference and Giant Reed Removal sites, Camp Pendleton, 2005.

	Total Number	
Parameter	**Reference**	**Removal**
Nests with eggs	49	37
Eggs laid	156	120
Average clutch size[a]	3.7 ± 0.6 (std)	3.6 ± 0.6 (std)
Nests with hatchlings	29	26
Hatchlings	87	80
Average brood size[b]	3.1 ± 1.0 (std)	3.2 ± 0.6 (std)
Hatching success:		
Eggs[c]	58%	67%
Nests[d]	59%	70%
Nests with fledglings	23	20
Fledglings[e]	66	56
Fledgling success:		
Hatchlings[f]	76%	70%
Nests[g]	79%	77%
Fledglings per nest	1.2	1.3
Average number of young fledged per pair[h]	2.8 ± 1.3 (std)	2.5 ± 1.3 (std)
Pairs fledgling ≥ one young[i]	14 (93%)	17 (85%)

[a] Based on 31 Reference and 27 Removal non-parasitized nests with a full clutch. (Two-sample *t*-test: $t_{0.05, 55} = 2.00$, $P = 0.43$).
[b] Based on 22 Reference and 17 Removal non-parasitized nests known to have a full brood. (Two-sample *t*-test: $t_{0.05, 37} = 2.03$, $P = 0.89$).
[c] Percent of all eggs that hatched.
[d] Percent of all nests with eggs in which at least one egg hatched.
[e] Excludes two Reference nests that were not found, but fledgling(s) were detected.
[f] Percent of all nestlings that fledged.
[g] Percent of all nests with nestlings in which at least one young fledged.
[h] Based on 15 Reference and 20 Removal pairs who were monitored fully, two of which did not nest. (Two-sample *t*-test: $t_{0.05, 33} = 2.03$, $P = 0.43$).
[i] Based on pairs whose territories were monitored fully.

Nest Characteristics

Successful and unsuccessful nests within Reference and Removal sites did not differ statistically in average nest height, height of the host plant, or the distance the nest was placed from the edge of the host (Table 9). However, differences in nest placement were observed between nests built within Reference and Giant Reed Removal sites. Vireo nests at Removal sites were placed significantly higher above ground than nests at Reference sites (Table 9), which corresponded with an average higher host plant height. Although only marginally significant, nests at Removal sites were placed roughly 30 percent deeper within hosts than nests at Reference sites.

Table 9. Least Bell's vireo nest characteristics and results of two-sample unequal variance t-tests of successful vs. unsuccessful nesting attempts at Reference and Giant Reed Removal sites, Camp Pendleton, 2005.

Nest Characteristic	Nest Fate		df[a]	*t*[b]	*P*[c]
	Successful	Unsuccessful			
Reference Site					
Average nest height (m)	0.65	0.71	46	-1.03	0.31
Average host height (m)	2.58	2.83	50	-0.51	0.61
Average distance to edge of host (m)	0.46	0.48	44	-0.12	0.91
Removal Site					
Average nest height (m)	0.91	0.92	30	-0.10	0.92
Average host height (m)	2.96	3.67	37	-1.33	0.19
Average distance to edge of host (m)	0.85	0.55	23	1.44	0.16
Overall	**Reference**	**Removal**			
Average nest height (m)	0.68	0.92	67	-4.42	< 0.0001
Average host height (m)	2.71	3.32	88	-1.64	0.10
Average distance to edge of host (m)	0.47	0.69	59	-1.83	0.07

[a] df = degrees of freedom (sample size – 1)
[b] *t* = two-sample unequal variance t-test test statistic
[c] *P* = P-value (the probability of observing a test statistic as extreme as, or more extreme than the one observed).

Vireos at Reference and Removal sites were comparable in their selection of host species, with 60-74 percent of nests placed in *S. lasiolepis*, *B. salicifolia* and *S. exigua* (Table 10). Vireos at the Removal sites placed proportionately fewer nests in *B. salicifolia* and proportionately more in *S. lasiolepis* than did birds at the Reference sites, probably a reflection of the relative availability of those species at each site. An additional nine plant species and one dead plant were used as nest support by vireos, including three herbaceous exotic species. Fourteen percent of all nests were placed in two of the exotic species, *C. maculatum* and *B. nigra*, reflecting the disturbed nature of many of the nest sites.

Table 10. Host plant species used by least Bell's vireos at Reference and Giant Reed Removal sites, Camp Pendleton, 2005.

	Reference			Removal		
Host Species[a]	**Successful**	**Unsuccessful**	**Total**[b]	**Successful**	**Unsuccessful**	**Total**[b]
Baccharis salicifolia	6	4	10 (0.19)	1	1	2 (0.05)
Salix lasiolepis	5	11	16 (0.31)	9	14	23 (0.53)
Brassica nigra	3	1	4 (0.08)	1	0	1 (0.02)
Rosa californica	2	0	2 (0.04)	0	0	0 (0.00)
S. exigua	2	3	5 (0.10)	5	2	7 (0.16)
Toxicodendron spp.	2	0	2 (0.04)	0	1	1 (0.02)
Vitis californica	2	2	4 (0.08)	1	0	1 (0.02)
Conium maculatum	1	3	4 (0.08)	1	4	5 (0.12)
Erechtites spp.	1	0	1 (0.02)	0	0	0 (0.00)
Salix goodinggii	0	0	0 (0.00)	1	1	2 (0.05)
Sambucus mexicana	0	1	1 (0.02)	1	0	1 (0.02)
Artemisia californica	0	2	2 (0.04)	0	0	0 (0.00)
Dead	0	1	1 (0.02)	0	0	0 (0.00)

[a] The host species for one nest within a Reference site was not recorded.
[b] Numbers in parentheses are proportions of total nests.

DISCUSSION

Data indicate a possible vireo carrying capacity on Marine Corps Base Camp Pendleton between 700 and 1000 territories which is most likely influenced by the annual variability in a number of biotic and abiotic factors, such as changes in precipitation, temperature, and prey availability. Over the past 11 years, the vireo population on Base has fluctuated between a low of 696 territories in 1995 to a high of 1011 territories in 1998 (Griffith Wildlife Biology 2004). From 1998 to 2003 the vireo population steadily declined to 718 territories. In 2004, the population increased to 823 territories, and has appeared to stabilize. Least Bell's vireo abundance in 2005 on Base was very similar to the 2004 estimate as it differed by only eight territories (825 territories in 2005 vs. 817 in 2004) when sites surveyed in both years were compared.

The primary difference between the 2004 and 2005 vireo populations was not in abundance but in the slight change in distribution of birds on Base. For example, in 2005 the population on De Luz Creek decreased by 31 percent (8 territories), while San Mateo Creek decreased by 18 percent (12 territories). In contrast, the Lake O'Neill/Fallbrook Creek site increased by 25 percent (4 territories) and the population on the Santa Margarita River increase by 7 percent, or 32 territories. This redistribution of vireos is probably a reflection of the heavy winter rains and spring flooding that scoured numerous drainages, altering or removing suitable vireo habitat and causing birds to vacate previously occupied areas and settle in novel sites on other drainages. The scouring caused by spring flooding most likely reduced the amount of high quality habitat within many rivers as vireos were documented nesting in "atypical" habitats dominated by such species as black mustard (*B. nigra*), poison hemlock (*C. maculatum*) and thistle (*Cirsium* spp.), or in areas set back from the main river channel. We were not able to definitively document the redistribution and dispersal of vireos between drainages as few birds were banded prior to the 2005 breeding season. Continued color banding initiated in 2005 to investigate dispersal on and off Base will provide a better understanding of vireo habitat use in dynamic riparian systems.

Nest success and productivity were similar between Giant Reed Removal and Reference nest monitoring sites. Predation was the primary cause of nest failure in Reference and Removal sites, accounting for 42-46 percent of all nest losses. Productivity at both sites was high, with vireos fledging more than two young per pair. Average clutch size, average brood size, and the average number of young fledged per vireo pair in Reference and Removal sites did not differ statistically, indicating no apparent difference in productivity between vireos nesting in Reference and Giant Reed Removal sites in 2005. From these results it appears that in the short term vireos, nesting in Giant Reed Removal sites were not adversely affected by removal operations. However, 2005 was an extremely wet year and these results may be atypical. Winter/spring rains fostered the growth of herbaceous plants forming dense vegetation patches, and subsequently comprising large portions of many vireo territories. Only through continued monitoring will we determine if vireo productivity in Reference and Giant Reed Removal sites will remain similar in years experiencing more typical levels of precipitation.

The prevalence of exotic vegetation on Base was widespread and is a potential issue of concern since its impact(s) on least Bell's vireo abundance and distribution is not well known. The use of exotics by least Bell's vireos was extensive, with 15 percent of all monitored nests built in exotic plants and approximately 33 percent of nests built in poison hemlock failing when the host plant gave way. Exotic plants were a dominant component of at least one vireo territory within all drainages containing vireos and were also a dominant component of approximately 20 percent of all vireo territories Base-wide. Currently, Camp Pendleton has implemented programs to remove the exotics giant reed and perennial pepperweed (*Lepidium latifolium*) from riparian systems. However, it is only through continued nest monitoring that we will be able to answer the question whether particular exotic species adversely affect least Bell's vireo nest success, productivity, and ultimately species recovery.

LITERATURE CITED

Brown, B. T. 1993. Bell's vireo (*Vireo Bellii*). *In* A. Poole, P. Statenheim, and F. Gill [eds.], The Birds of North America, no. 47. The American Ornithologists' Union, Washington, D. C. and the Academy of National Sciences of Philadelphia.

Franzreb, K. E. 1989. Ecology and Conservation of the endangered least Bell's vireo. Biological Report 89(1). U.S. Fish and Wildlife Service, Department of Interior. March 1989.

Griffith Wildlife Biology. 2004. The status of the least Bell's vireo at Marine Corps Base Camp Pendleton in 2004. Unpublished draft report for Assistant Chief of Staff, Environmental Security, Camp Pendleton, California, by Jane C. Griffith and John T. Griffith, Griffith Wildlife Biology, Calumet, Michigan.

Kus, B. E. 1998. Use of restored riparian habitat by the endangered least Bell's vireo (*Vireo bellii pusillus*). Restoration Ecology 6:75-81.

Kus, B. E. 1999. Impacts of brown-headed cowbird parasitism on the productivity of the endangered least Bell's vireo. Studies in Avian Biology 18:160-166.

Kus, B. E. and P.P. Beck. 1998. Neotropical migratory bird monitoring study at Marine Corps Base Camp Pendleton, California. Fourth annual progress report, 1998. Prepared for the U.S. Marine Corps, Environmental and Natural Resources Office, Camp Pendleton, CA. 45 pp.

Kus, B.E., B. Peterson, and M. Wellik. 2004. Pilgrim Creek restoration project: bird community and vegetation structure. 2003 Annual Report. Prepared for the State of California Department of Transportation, District 11, San Diego, California.

Kus, B. E. and M.J. Whitfield. 2005. Parasitism, productivity, and population growth: response of least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (Emp*idonax trailii extinus*) to cowbird (*Molothrus* spp.) control. Ornithological Monographs 57:16-27.

RHJV (Riparian Habitat Joint Venture). 2004. Version 2.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian_v-2.pdf

U.S. Fish and Wildlife Service. 1986. Final rule determining endangered status for the Least Bell’s Vireo. Federal Register 51(85):16474-16482.

U.S. Fish and Wildlife Service. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, OR. 139 pp.

U.S. Fish and Wildlife Service. 2001. Least Bell's vireo survey guidelines. Unpublished document prepared by the USFWS Carlsbad Office, Carlsbad, California. January 19, 2001. 3 pp.

APPENDIX 1

Status and nesting activities of least Bell's vireos at Marine Corps Base, Camp Pendleton, 2005.

Reference Site Territories					
Territory	**Nest**	**Monitoring[a]**	**Nest Fate[b]**	**# Fledged**	**Comments**
AH5	1	F	PRE	0	
	2		PRE	0	
	3		SUC	3	
AH6	1	F	PRE	0	
	2		SUC	1	
AH7	2		OTH	0	Substrate failure. Nest built in *S. lasiolepis*
	1	F	SUC	3	
AH8	1	F	PRE	0	
	2		SUC	4	
AH9	1	F	SUC	1	
AH10	1	F	SUC	3	
AH13	-	F	-	-	Pair did not nest
AH14	1	F	SUC	3	
	2		PRE	0	
AH23	1	F	UND	0	Cause of failure unknown
	2		PRE	0	
	3		SUC	3	
AH24	1	P	SUC	4	
AH31	1	P	PRE	0	
	2		PRE	0	
HE5	1	P	UND	0	Cause of failure unknown
HE6	1	P	SUC	3	
HE14	1	F	UND	0	Possible brown-headed cowbird predation, egg punctured
	2		UND	0	Possible brown-headed cowbird predation, two eggs on ground and punctured
	3		SUC	3	
HE15	1	F	PRE	0	
	2		PRE	0	
	3		SUC	4	
HE16	1	F	PRE	0	
	2		PRE	0	
	3		SUC	2	
HE19	1	P	SUC	1	
HE20	1	P	OTH	0	Substrate failure. Nest built in *C. maculatum*
	2		SUC	-	Nest not found. Adults observed feeding 1 fledging.

Status and nesting activities of least Bell's vireos at Marine Corps Base, Camp Pendleton, 2005.

Territory	Nest	Monitoring[a]	Nest Fate[b]	# Fledged	Comments
Reference Site Territories					
HE21	1	P	SUC	-	Nest not monitored. Adults observed feeding 1 fledging.
HE22	1	P	SUC	2	
HE23	1	P	SUC	2	
HE28	1	F	SUC	4	
HE29	1	P	UND	0	Cause of failure unknown
HE34	1	P	PRE	0	
HE35	1	P	PRE	0	
HE53	1	P	PRE	0	
HE54	1	P	PRE	0	
	2		PRE	0	
HE69	1	P	SUC	3	
HW1	1	P	PRE	0	
HW2	1	F	PRE	0	
	2		SUC	4	
HW3	1	P	PRE	0	
HW5	1	F	SUC	4	
HW6	1	P	INC	0	Nest building was initiated, but the nest was never completed.
	2		PRE	0	
HW18	1	P	SUC	2	
HW21	1	P	PRE	0	
HW23	1	P	SUC	3	
HW24	1	P	SUC	4	
HW25	1	P	PRE	0	
Giant Reed Removal Site Territories					
AE1	1	F	OTH	0	Substrate failure. Nest built in *C. maculatum*.
	2		SUC	3	
AE3	1	F	PRE	0	
	2		SUC	2	
AE5	1	F	PRE	0	
	2		PRE	0	
	3		SUC	2	
AE7	1	F	SUC	3	
AE9	1	F	PRE	0	
	2		SUC	3	
AE16	1	F	PRE	0	
	2		PRE	0	
AE17	1	F	SUC	3	
AE19	1	F	SUC	2	
AE22	1	F	PRE	0	
	2		SUC	4	

Status and nesting activities of least Bell's vireos at Marine Corps Base, Camp Pendleton, 2005.

Giant Reed Removal Site Territories					
Territory	**Nest**	**Monitoring[a]**	**Nest Fate[b]**	**# Fledged**	**Comments**
AE23	1	F	SUC	3	
AE24	1	F	PRE	0	
	2		PRE	0	
	3		SUC	2	
AE25	1	F	PRE	0	
	2		SUC	2	
AE26	1	F	OTH	0	Substrate failure. Nest built in *C. maculatum*.
	2		PRE	0	
	3		SUC	3	
ES1	1	F	INC	0	Nest building was initiated, but the nest was never completed.
	2		INC	0	Nest building was initiated, but the nest was never completed.
ES3	1	F	PRE	0	
	2		SUC	3	
ES5	1	F	SUC	4	
ES7	1	P	SUC	3	
ES8	1	F	SUC	3	
	2		SUC	1	
ES9	1	F	PRE	0	
	2		PRE	0	
	3		PRE	0	
	4		PRE	0	
ES10	1	F	PRE	0	
	2		SUC	4	
ES11	1	F	SUC	2	
ES12	1	P	PRE	0	
	2		PRE	0	
ES18	1	P	PRE	0	
	2		UND	0	Cause of failure unknown
ES30	1	P	SUC	4	

[a] Monitoring: F = fully monitored territory; P = partially monitored territory

[b] Nest Fate: Nest fate: INC = nest never completed; OTH = reason for nest failure known, such as substrate failure; PAR = failure/abandonment caused by brown-headed cowbird parasitism event; PRE = nest failure caused by predation event; SUC = fledged at least one least Bell's vireo young; UND = reason for nest failure/abandonment unknown.

EXHIBIT 12

LEAST BELL'S VIREOS AND SOUTHWESTERN WILLOW FLYCATCHERS IN PRADO BASIN OF THE SANTA ANA RIVER WATERSHED, CA

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ABSTRACT. Multiple partnerships have led to a program of resource management in southern California's largest coastal watershed. Annual grants and a perpetual endowment built with mitigation money have paid for 500 acres of habitat restoration, through control of invasive giant reed (*Arundo donax*) in part and successful management of beleaguered species. Populations of endangered least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) were studied and managed for the nineteenth consecutive year in the Prado Basin and environs during the 2004 breeding season. Data were taken on status, distribution, breeding chronology, reproductive success, and nest site characteristics. Additionally, brown-headed cowbirds (*Molothrus ater*) were surveyed and removed from vireo and flycatcher territories. Four hundred and thirteen of 590 territorial male vireos detected in the Prado Basin were found to be paired in 2004, producing a minimum of 767 fledglings. This compares with 339 pairs recorded in 2003, 312 pairs in 2002, and just 19 pairs in 1986. One thousand three hundred and fifty three cowbirds were removed from vireo and flycatcher habitat during the nesting season, following the fall/winter removal of 6,527 cowbirds from adjacent cattle operations. Cowbird parasitism rates of vireo nests have decreased from 39% in 1986 and 57% in 1993, to a near record low of 5% in 2004. Six vireo nests were manipulated, cowbird eggs and young were removed, resulting in two vireo fledglings that almost certainly would not have survived. Seventy-nine percent of 306 vireo nests were placed in willows (*Salix* spp. – 4 species) and mulefat (*Baccharis salicifolia*). Successful breeding by willow flycatchers in 2004 was documented in two of 5 home ranges, with one case of polygny. Numerous other sensitive avian species have benefited from the habitat restoration and management efforts. For example, a minimum of 500 pairs of yellow warblers (*Dendroica petechia*) were estimated in the 4,500 ha (11,120 ac) study area. However, for the third consecutive year, no western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) was detected.

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INTRODUCTION

The Santa Ana River Watershed Program. The waterways in the watershed of the Santa Ana River have been greatly altered and the floodplain reduced for flood control and other human induced purposes. As a result, riparian habitat and the diversity of wildlife it supports have been reduced to unsustainable levels for some species. This led to the listing under State and Federal Endangered Species Acts of those species most intimately dependent upon southern California's riparian systems.

The habitat degradation continues today with the edge effects associated with the adjacency and encroachment of the growing human population. One of the most immediate threats to the remaining riparian habitat is its invasion and destruction by giant reed (*Arundo donax*). This bamboo-like grass occupies more than half of the floodplain formerly vegetated by willows and other native wetland species. Giant reed has little redeeming value as wildlife food or for secure nest sites. It forms impenetrable thickets, carries fire, consumes several times more water than native habitat, interferes with flood control, produces massive quantities of debris that costs millions of dollars to clean off the coast, and driven by floods has caused bridge failure.

The Santa Ana River Watershed Program was initiated to restore the natural functions of the river. The current foci are control of giant reed and other invasives, restoration of habitat and beleaguered species, and investing the public. The principal partners include the Santa Ana Watershed Association of Resource Conservation Districts (the 5 RCDs in the watershed), the Orange County Water District, U.S. Fish and Wildlife Service, Regional Water Quality Control Board, county flood control agencies, Army Corps of Engineers, and many land owners and other agencies. Annual activities are funded in part with the proceeds of an endowment and through competitive grants. The endowment is being built with mitigation money from water development projects on the river. The program supporters recognize the ongoing need to counter-manage the effects of the burgeoning human population in order to recover endangered resources and perpetuate southern California's wildlife heritage.

Least Bell's Vireo. The Least Bell's Vireo (*Vireo bellii pusillus* [Coues]; "vireo") is a small, insectivorous bird of the family Vireonidae. This vireo was described by Dr. Elliot Coues (1903) and aspects of its life history are summarized in a recovery plan and final rule (U.S. Fish and Wildlife Service 1986a, 1986b).

Vireos typically occupy "[l]ow riparian growth either in the vicinity of water or in dry parts or river bottoms. The center of activity is within a few feet of the ground, in the fairly open twigs canopied above by the foliage of willows and cottonwoods. Foraging cruises may take the birds higher into the trees but territorial interest, with song perches and nest sites, is in the lowest stratum of vegetation. Nests frequently are placed along the margins of bushes or on twigs projecting into pathways. Most typical plants frequented are willows, guatemote [mulefat], and wild blackberry. Less commonly live and valley oaks, wild grape, poison oak and sumac in the margins of water courses are visited and may be nested in. On the desert slopes mesquite and arrowweed in canyon locations may be occupied" (Grinnell and Miller 1944).

The vireo was formerly described as common to abundant in riparian habitats from Tehama County, California to northern Baja California, Mexico (Grinnell and Storer 1924; Willett 1933; Grinnell and Miller 1944; Wilbur 1980). The vireo currently occupies a small fraction of its former range (Goldwasser *et al.* 1980; United States Fish and Wildlife Service 1986) and is a rare and local species. Grinnell and Miller (1944) noted that declines in southern California and the Sacramento-San Joaquin Valley coincided with increased cowbird parasitism. Numbers continued to decline until about 1986 when only 300 pairs were documented throughout the U. S. range (U. S. Fish and Wildlife Service 1986; RECON 1988).

The vireo's dramatic decline (Salata 1986; U. S. Fish and Wildlife Service 1986) has been attributed to the combined effects of the widespread loss of riparian habitat and brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) (Garrett and Dunn 1981). The Least Bell's Vireo was listed as an endangered species by California in 1980 and by the U.S. Fish and Wildlife Service in 1986. Critical habitat was designated for the vireo in February 1994, including most of our study area. The enactment of protective measures and subsequent management led to steadily increasing vireo numbers and by 2000, there were approximately 2000 territorial male vireos (U.S. Fish and Wildlife Service, unpublished data).

Although known to be present along the middle reaches of the Santa Ana River much earlier (Goldwasser 1978), field studies of the vireo commenced in 1983 (Zembal *et al.* 1985; Zembal 1986) and continued annually (Hays 1986, 1987, 1988, 1989; Hays and Corey 1991; Pike and Hays 1992; The Nature Conservancy 1993a, 1993b, 1994, 1995, 1996, 1997; Pike and Hays 1998, 1999,2000; Pike *et al.*2001, 2002, 2003). This paper summarizes the results of intensive study and management, mostly since 1986.

Southwestern Willow Flycatcher. The Southwestern Willow Flycatcher (*Empidonax traillii extimus* [Phillips]) is a relatively small, insectivorous songbird. It is a recognized subspecies of the Willow Flycatcher (*Empidonax traillii*). Although previously considered conspecific with the Alder Flycatcher (*Empidonax alnorum*), the Willow Flycatcher is distinguishable from that species by morphology (Aldrich 1951), song type, habitat use, structure and placement of nests (Aldrich 1953), eggs (Walkinshaw 1966), ecological separation (Barlow and MacGillivray 1983), and genetic distinctness (Seutin and Simon 1988). The Southwestern Willow Flycatcher is one of five subspecies of the Willow Flycatcher currently recognized, primarily by differences in color and morphology (Hubbard 1987; Unitt 1987; Browning 1993).

The breeding range of the Southwestern Willow Flycatcher includes the southern third of California, southern Nevada, Arizona, New Mexico, and western Texas (Hubbard 1987; Unitt 1987; Browning 1993). The species may also breed in southwestern Colorado, but nesting records are lacking. Records of breeding in Mexico are few and confined to extreme northern Baja California and Sonora (Unitt 1987; Howell and Webb 1995). Willow Flycatchers winter in Mexico, Central America, and northern South America (Phillips 1948; Ridgely 1981; AOU 1983; Stiles and Skutch 1989; Ridgely and Tudor 1994; Howell and Webb 1995). They are generally gone from breeding grounds in southern California by late August (The Nature Conservancy 1994) and are exceedingly scarce in the United States after mid-October (Garrett and Dunn 1981).

Southwestern Willow Flycatchers occur in riparian habitats along watercourses where dense growth of willows *(Salix* sp.), *Baccharis*, arrowweed (*Pluchea* sp.), buttonbush (*Cephalanthus* sp.) and other wetland plants provide dense thickets. Nests are built in thickets, 4-7 meters (13-23 feet) or more in height. Occupied habitat is usually canopied in willows or cottonwoods (Phillips 1948; Grinnell and Miller 1944; Whitmore 1977; Hubbard 1987; Unitt 1987; Whitfield 1990; Brown 1991; and U.S. Fish and Wildlife Service, 1993, 1995). The subspecies of Willow Flycatcher generally prefer nesting sites with surface water nearby (Bent 1960; Stafford and Valentine 1985; and Harris *et al.* 1986) and in the Prado Basin they virtually always nest near surface water or saturated soil (e.g., The Nature Conservancy 1994).

Like the vireo, the Southwestern Willow Flycatcher has suffered extensive loss, degradation, and modification of essential riparian habitat due to grazing, flood control projects, urban developments, and other land use changes (Klebenow and Oakleaf 1984; Taylor and Littlefield 1986; and Dahl 1990). Estimated losses of wetlands between 1780 and the 1980's in the Southwest are: California 91%; Nevada 52%; Utah 30%; Arizona 36%; New Mexico 33%; and Texas 52% (Dahl 1990).

This species is also impacted by brood parasitism by cowbirds (Unitt 1987; Ehrlich *et al.* 1992; U.S. Fish and Wildlife Service 1993, 1995). Parasitism rates of Southwestern Willow Flycatcher nests have recently ranged from 50 to 80 percent in California (Whitfield 1990; M. Whitfield and S. Laymon, unpublished data), to 100% in the Grand Canyon in 1993 (U.S. Fish and Wildlife Service 1993). Mayfield (1977) thought that a species or population might be able to survive a 24% percent parasitism rate.

Willett (1933) considered the Willow Flycatcher to be a common breeder in coastal southern California. Unitt (1987) concluded that these birds were once fairly common in the Los Angeles basin, the San Bernardino/Riverside area, and San Diego County. More recently, *E. t. extimus* was documented only in small, disjunct nesting groups (e.g., Unitt 1987, U.S. Fish and Wildlife Service 1995). Status reviews done prior to State or Federal listing of the flycatcher considered extirpation from California to be possible, even likely, in the foreseeable future (Garrett and Dunn 1981; Harris *et al.* 1986). Unitt (1987) then reported the known population in California to be 87 pairs and estimated the total population of the subspecies to be under 1000 pairs, more likely 500. A total of only 104 pairs was recorded in California in 1996 (U.S. Fish and Wildlife Service, unpublished data).

With the decline in flycatcher numbers on the South Fork of the Kern River, only two California populations consisting of 15 or more pairs have been relatively stable in recent years, that being along the San Luis Rey River and the Santa Margarita River. Of eight other nesting groups known in southern California, all but one consisted recently of six or fewer nesting pairs (Unitt 1987, Fish and Wildlife Service, unpublished data).

The Southwestern Willow Flycatcher was listed as endangered on February 27, 1995 (59 *Federal Register* 10693) and critical habitat, which includes much of the Prado Basin, was designated for the species in 1997 (62 *Federal Register* 39129 and 44228). Breeding Willow Flycatchers were also State listed as endangered in California and Arizona.

Reported herein are the results of study and management of the vireo and flycatcher, mostly since 1986 in the Prado Basin and environs.

STUDY AREA

The Prado Basin is located behind Prado Dam about 40 miles from the Pacific Ocean. The dam was constructed for flood control on the Santa Ana River in 1941. The approximate center of the study area, 33 degrees and 55 minutes north latitude and 117 degrees and 38 minutes west longitude, is located about 70 kilometers east of Los Angeles and eight kilometers north of the City of Corona in the northwestern-most corner of Riverside County, California.

The climate is typically Mediterranean and consists of warm, dry summers and cool, wet winters. The weather during the most recent study period, March-September, 2004 was typical: early mornings were generally cool (approximately 13 degrees Celsius) in spring, increasing by about 3 degrees in later months, and ranging 29 to 35 degrees in midday. Winds typically began blowing around 10 a.m. and often reached a magnitude of Beaufort category four, or about 20 miles per hour by noon. Winds thereafter frequently continued unabated until sundown. Early mornings were occasionally cloudy or foggy and were frequently partly cloudy.

Prado Basin comprises some 4,500 ha (Zembal *et al.* 1985) including approximately 2,400 ha of wetland habitats (U. S. Fish and Wildlife Service 1986). Willow woodlands, freshwater marshes, and ponds dominate the Basin. However, understory is scarce in the lower elevations due to prolonged inundation. In addition, large tracts of willow woodland habitat have been invaded, degraded or destroyed by non-native plants, particularly giant reed (*Arundo donax*). Other potentially conflicting land uses in the Basin environs include: urban development, parks, an airport, livestock grazing, dairy farming, agriculture, oilfield operations, industry, and war games. In addition, much of the Basin is leased to hunting club operators for waterfowl, pheasant, and dove hunting, shooting sports, sportsmen's fairs, and dog training.

METHODS

Searches and monitoring visits were conducted almost daily for Least Bell's Vireos and Southwestern Willow Flycatchers in the Basin and environs, 9 March – 6 October 2004 for over 2,900 field-hours. Initially we concentrated in areas where vireos and flycatchers occurred in prior years, but suitable habitat over the entire accessible study area was eventually surveyed. The majority of the field time was spent at sites occupied in 2002 and 2003.

All individual birds or pairs were noted during each visit to each section of the Basin. Data were taken on bird location, movement, behavior, food preferences, nest placement, sex, and age. Singing vireos were identified as males. Non-singing, adult vireos were deemed to be females if they were either: 1) in the company of non-threatening males; or 2) conspicuously engaging with impunity in breeding behaviors within the boundaries of well-defended and well-defined home ranges. Fledgling young were identified on the bases of their plumages, behaviors, and vocalizations.

Nests of the endangered birds were intrusively monitored, although great care was taken to minimize visits, scent cues for predators, habitat damage, trailing, and disturbance. Nests were located from a distance when possible and the contents were checked with a mirror. Data were taken on reproductive timing and success, cowbird parasitism, and depredation. Cowbird eggs were removed or replaced with infertile ones and young cowbirds were removed. The eggs were taken with adhesive tape to avoid human contact with, and scent on the nest or contents. Nest monitoring was conducted as prescribed in memoranda and permits from the State and Federal wildlife agencies. However, no nest visits were conducted if: 1) there was a chance of inducing a nest "explosion" or premature departure by nestlings; 2) approaching the nest would result in habitat destruction or trailing; or 3) no additional significant information or benefit to the occupants would result from the visit.

Once fledglings had left a nest site or a nest was otherwise emptied or abandoned, data were taken on nest dimensions, placement, height above the ground, and supporting plant species. Unsuccessful nests were carefully examined for signs of parasitism or other disturbance. Nests were assumed depredated if all eggs or unfledged young were destroyed or removed. Cowbird parasitism events were classified as such only if a cowbird egg(s) or pieces were found in, or below, the affected nest.

Habitat management included trapping and removing cowbirds, 26 March - 6 August. Trapping continued through the winter season with at least four traps. Twenty modified Australian crow traps were deployed adjacent to habitats occupied by breeding vireos and flycatchers for a total of 1,883 trap-days. Each trap measured approximately 6' by 6' by 8' and superficially resembled a chicken coop (see Hays 1988). Cowbirds, attracted by live decoy cowbirds, ad libitum food and water, entered the traps through slots in the center of the traps' upper surfaces. Traps were checked 6-10 times per week, all non-target birds were released immediately, and cowbirds were humanely dispatched.

Several other beleaguered avian species occupied the Basin with the vireo and flycatcher and were studied opportunistically. Specific effort was made to census the Western Yellow-billed

Cuckoo (*Coccyzus americanus occidentalis*), a species designated as endangered by the State of California.

The standard definitions used herein of terms pertaining to avian breeding biology are those recommended by the Least Bell's Vireo Working Group: Adult, "an after hatch year bird"; Complete nest, "a nest built by a pair; capable of receiving young"; Expected fledglings, "number of nestlings seen on the last visit"; Failed nest, "a nest which had eggs but produced no known fledged young"; False or bachelor nest, "an incomplete nest built by a lone male"; Incomplete nest, "a nest built by a pair; abandoned prior to completion"; Juvenile, "a fledgling which has been out of the nest more than 14 days"; Known fledged young, "a fledgling seen out of the nest"; Manipulated nests, "... e.g., cowbird egg removed"; Presumed failure, "... apparently complete nest that did not receive an egg; no powdery pin feathers seen in the nest; adults seen without fledglings..."; Presumed successful (nest), "... powdery pin feathers seen in the nest; nest intact"; Productivity or breeding success (population), "the number of known fledglings divided by the number of known breeding (nesting) pairs..."; Successful nest, "a nest which fledged at least one known young"; Successful pair, "produced one [or more] successful nests".

Lastly, because "territory" has connotations not addressed in this study, we primarily use the broader term "home range" herein. "Territorial males", however, is commonly used in written reports of the vireo and retained herein, as well.

RESULTS AND DISCUSSION

Least Bell's Vireo. The first returning male vireo was detected on 15 March during the third focused survey of the season. By 31 March, a record 135 male vireos had been detected. This compares with 57 males being found by this date in 2003, and only 18 in 2002. By contrast, in 1998, 95 vireo males had been discovered by 31 March.

As in previous years, nearly all of the males discovered by 31 March were in home ranges that were occupied in 2003. Thus, the majority of vireos detected in the first few weeks of the season appeared to be 'returnees' and the majority thereafter was in previously unoccupied locales (Hays and Corey 1991; The Nature Conservancy 1993). Given the high degree of site tenacity exhibited by adult ("after second-year") male vireos (Pike and Hays 2000; Salata 1986), most of these "late" arrivals were probably first-time breeders. If so, second-year males comprised the most commonly represented age class in the breeding population.

The first female vireo was detected on 22 March, and a notable 127 were tallied by 16 April. In 2003, 95 females were detected by 16 April. By contrast, in 1999, the first female vireo was also detected on 22 March, but by 16 April only 5 had been discovered.

The first nest of the 2004 season was likely begun on 31 March. Nest building has been rarely observed during March, but in 1995 at least 13 nests were begun in March. Nestling young were first observed on 23 April and the first fledgling was found on 3 May. In 1991 – 1996, and 1998 – 2001, the last nests of the seasons were completed 2 –8 July. In 2002, the last completed nest was noted on 30 June; however, in 2003 and 2004, the last completed nests were 4 July and 3 July, respectively. Extreme dates for last completed nests within the Basin are 23 June in 1997 and 18 July in 1990. Vireos had departed the Basin by about 17 September 2004, when only one male could be found. However, there have been 4 probable instances of vireos over-wintering in the Basin (The Nature Conservancy 1994, 1995; Pike and Hays 1998). Exceptions as noted above notwithstanding, average arrival dates for our vireos were more than a month earlier than documented for the eastern subspecies and fall departures were quite similar (Barlow 1962; Garrett and Dunn 1981; Salata 1986, 1987; Hays 1987, 1988; Robbins 1991; Pike and Hays 1992).

Four hundred and thirteen pairs of Least Bell's Vireos, 177 unpaired males, and a minimum of 767 fledged young were detected in Prado Basin in 2004 (Table 1). The vireos were loosely congregated at 5 locales in 9 clusters. Further, as in 2001and 2002 (Pike *et al*. 2001, 2002), numerous additional vireos located along the Santa Ana River that would have been counted in the Basin tally in previous years were instead monitored by Riverside-Corona and Inland Empire West Resource Conservation District biologists in 2004. Nonetheless, the number of vireo males detected in 2004 easily surpasses all previous recruitment levels recorded within the Prado Basin (Table 1). This increase is all the more dramatic, recognizing that only 25 territorial males were detected in the Basin and environs in 1983 and only 20 were found in 1987 (Hays 1987). Significant recovery of the state's largest subpopulation on the Santa Margarita River (Salata 1987) and of the Prado subpopulation have been ascribed to effective wildlife management (Pike and Hays 2000).

One of the benefits of the expanding vireo population has been the colonization of adjacent unoccupied areas. For example, no vireo pairs were observed in the 12 km of habitat in Orange County just below Prado Dam during comprehensive surveys in 1986 and 1987 (Marsh 1987). They were at least uncommon there as recently as 1970. However, as the vireo population began recovering in the Prado Basin, vireos slowly spread throughout adjacent Orange County. By 2002, a minimum of 83 vireo males was detected there (Doug Willick, pers.comm.). Further, in 2002, in the stretch of river just below Prado Dam where only one vireo pair was detected during surveys in 1991 (Marsh 1991), there were 28 territorial males detected and 26 pairs of vireos fledged 56 young (Hoffman and Zembal 2002).

It should be noted that this is true expansion of the local, Prado population. Site fidelity is extremely strong in the vireo and of the hundreds of vireos banded at other locations, relatively few have been observed at Prado. Those that were include three color-banded males detected in the Basin during the 1992 breeding season, a male and a female in 1993, a male in 1994, and a female in 1995. All 7 were marked as nestlings in San Diego County: 2 were born on Marine Corps Base, Camp Pendleton; 2 came from the San Luis Rey River; and 3 fledged along the San Diego River. From 1996-2004, only six additional banded male vireos were detected. One of these males was present in a West Basin home range every breeding season from 1997 to 2002. Two other males found in 2002 had apparently been banded in Ventura County locales.

Table 1. Least Bell's Vireo status and distribution, Prado Basin, California, and environs, 1983-2004

SUBPOPULATION	**1983**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
SOUTH BASIN "Prado Dam" in Hays (1987)	0/0/0**[a][b]**	0/0/0	7/6/10+ **[c]**	9/8/30	8/8/40	13/11/50	17/15/70	27/23/57	30/29/69	35/30/101	43/36/78	35/32/87	42/32/78	49/41/96	38/27/73	38/30/59	39/31/ 64	45/24/ 38	50/33/ 68	52/34/60
CENTRAL BASIN "West Basin/Santa Ana River" in Hays (1986)	0/0/0	2/2/1	3/3/1+	1/0/0	0/0/0	2/1/2	3/3/11	7/7/19	4/2/5 **[d]**	18/12/20	17/8/14 **[d]**	21/12/7	26/11/13	27/20/27	34/17/17	32/20/31	38/21/ 31	42/25/ 64	43/29/ 59	57/46/77
NORTH BASIN "Mill Creek/South Santa Ana River" in Hays (1986)	4/--/--**[e]**	9/9/15+	10/7/21	13/11/37	11/8/27	9/7/29	7/5/17	10/10/21	16/13/21	23/19/22	28/2056	49/31/63	57/42/63	64/47/78	74/53/131	84/68/192	94/72/ 167	86/68/ 148	111/ 87/ 199**[h]**	165/121/273
WEST BASIN/ CHINO CREEK	0+/0+0+	2+/0+/0+**[f]**	--/--/--	11/7/12+	12/10/27+	16/16/40+	31/31/60	48/44/98	62/57/118	71/58/123	69/52/108 **[g]**	71/62/76	79/65/134	102/85/143	99/67/151	110/97/249	197/ 156/ 348	190/ 146/ 281	177/ 143/ 284**[g]**	244/168/293
TEMESCAL CREEK (Prado Basin Reach)	12/--/--	8/8/4+	5/4/7	5/5/9	5/5/8	7/7/21	12/10/25	17/15/29	22/20/31	36/29/59	50/41/94	54/46/77	57/43/106	70/85/143	63/42/84	57/43/80	62/45/ 89	54/38/ 55	55/39/ 61	72/44/64
TOTAL	16/0/ 0	21/19/20+	25/20/ 39+	39/31/88+	36/31/102	47/42/142	70/64/183	109/ 99/ 224	134/ 121/ 365	183/ 148/ 325	207/ 157/ 350	230/ 183/ 310	261/ 193/ 394	312/ 278/ 487	308/ 206/ 456	321/ 258/ 611	430/ 325/ 699	417/ 301/ 586	436/ 331/ 671	590/413/767

[a] Entries correspond to numbers of territorial males/pairs/'known fledged young' for designated time and locale.
[b] All data in 1983 per Zembal *et al.* (1985).
[c] The "+" symbol indicates that actual count may have been somewhat higher; field census efforts were started late or were otherwise deemed to be incomplete.
[d] Numbers apparently decreased due to habitat damage resulting from an alteration in the course of the Santa Ana River.
[e] The "--" symbol indicates that no data were available.
[f] Data derived from Corps of Engineers surveys.
[g] Numbers decreased due to water retention behind the dam and resultant inundation of vireo habitat associated with Chino Creek.
[h] Numbers likely increased due to displacement of vireos from adjacent inundated areas due to water retention behind the dam.

Table 2. Least Bell's Vireo Status And Management, Prado Basin, CA, 1986-2004.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
A. Number of territorial males	19	26	37	36	47	70	112	138	188	217	249	274	345	336	357	444	429	447	590
B. Number of pairs	19	20	30	31	42	64	99	123	149	164	195	201	270	224	281	336	312	339	413
C. Number of fledged young observed [a]	20	39	88	102	142	183	224	247	327	355	318	410	450	489	649	718	598	688	767
D. Projected total recruitment of vireo young [b]	34	52	110	115	154	230	283	295	417	508	410	500	621	582	843	907	811	846	1115
E. Average number of fledglings per pair (C/B)	1.1	2.0	2.9	3.3	3.4	2.9	2.3	2.0	2.2	2.2	1.7	2.0	1.7	2.2	2.3	2.1	1.9	2.0	1.9
F. Projected number of fledglings per pair (D/B)	1.8	2.6	3.7	3.7	3.7	3.6	2.9	2.4	2.8	3.1	2.1	2.5	2.3	2.6	3.0	2.7	2.6	2.5	2.7
G. Rate of nest depredation	25%	41%	19%	26%	23%	36%	47%	41%	40%	41%	39%	40%	45%	36%	25%	34%	37%	40%	35%
H. Rate of cowbird nest parasitism [c]	39%	16%	32%	20%	36%	32%	29%	57%	36%	21%	35%	19%	13%	15%	8%	13%	7%	4%	5%
I. Numbers of cowbirds removed from study area	858	911	694	652	704	726	865	513	1068	888	1025	1314	2333	2860	2595	2785	2468	1810	1353
J. Number of cowbirds trapped in study area [d]	816	911	694	652	704	725	865	513	1068	888	1024	1312	2322	2839	2587	2780	2468	1810	1353
K. Number of trap days (1 operative trap in the field for 1 day=1 trap day)	725	826	790	704	859	924	909	1138	1091	1351	2060	2396	2265	2562	2623	2353	2769	2527	1883
L. Average number of cowbirds trapped per trap day (J/K)	1.1	1.1	0.9	0.9	0.8	0.8	1.0	0.5	1.0	0.7	0.5	0.5	1.0	1.1	1.0	1.2	0.9	0.7	0.7
M. Number of person hours in the field	650	800	800	715	850	900	1200	1240	1260	1350	2350	2200	2500	2100	2500	2600	2800	3000	2900

[a] Given the substantial increase in the number of breeding vireo pairs in recent years, a decision was made to place a high priority on nest monitoring and the removal of cowbird eggs at the expense, perhaps, of obtaining definitive fledgling counts. Therefore, a significant number of fledglings were not counted and are thus not represented in the recruitment totals reported in this category.

[b] Projected totals reflect the assumption that the average reproductive productivity of all pairs was equal to that of those select pairs that were regularly monitored throughout an entire breeding season. However, these totals may be somewhat inflated because well-monitored pairs tend to be in areas with cowbird traps and benefit from the removal of cowbird eggs and nestlings whenever present. In addition, the 1986 projection reflects the assumption that juveniles seen late in the breeding season fledged from unmonitored nests (the Fish and Wildlife Service suspended nest visitation privileges from early July of 1986 until the end of the breeding season.) In any case, the authors believe that the data reported in this category best estimates the total recruitment of the local vireo population.

[c] Reported data probably exceed the projected basin-wide average for each of the breeding seasons designated. The monitoring of nests has always been most intense in those locales (e.g., West Basin) where adult cowbirds have been most abundant.

[d] Totals reported from 1996-2004 reflect the number of cowbirds trapped and removed through early August (typically 2-4 August) of each respective season. Trapping was conducted after those dates during all nine years (see text). Four traps likely will continue in operation throughout the 2004-2005 fall and winter seasons.

Least Bell's Vireos typically nest in dense riparian understory dominated by mulefat (*Baccharis salicifolia*), willows, mugwort (*Artemisia douglasiana*), *Bidens* spp., mexican tea (*Chenopodium ambrosioides*), Hooker's evening primrose (*Oenothera hookeri grisea*), and stinging nettle (*Urtica holosericea*), among others (Wilbur 1980; Gray and Greaves 1981; Goldwasser 1981; Salata 1984, 1987; United States Fish and Wildlife Service 1986; Pike and Hays 2000). Extremely dense near-nest vegetation in the Prado Basin has occasionally precluded close examination of a nest (Pike and Hays 2000).Of the 306 nests that were examined in 2004, 88 (29%) were suspended in mulefat, 124 (41%) in black willow, 25 (8%) in arroyo willow (*Salix lasiolepsis*), and 14 (5%) in gum trees (*Eucalyptus* spp.). Overall, 51% (155 of 306) of vireo nests were placed in willows. On average, 52% (N=1,851) of all nests examined in the Basin, 1987-2004 were placed in willows and 36% (N=1,289) were in mulefat. Since 1987, 3,551 nests have been found in a minimum of 44 species of plants. Surprisingly, 150 of these nests have been placed in non-native gum trees and 28 in giant reed.

Nest cover was similar on the Santa Margarita River, Camp Pendleton where approximately 59% of 394 nests, 1981-1987 were located in willows (largely arroyo willow and sandbar willow, *Salix hindsiana*) (Salata 1987) and in the Gibraltar Reservoir Watershed of Santa Barbara County where 101 (47%) of 216 nests were also in willows (Gray and Greaves 1981). However, the vireo's preponderant use of black willow and mulefat was unique for the Prado Basin. The most inundation-tolerant of the willows is the black willow, which dominates the riparian habitat in Prado Basin because of the regularity of pooled water therein (Zembal et al. 1985). In some areas in the lower Basin there is little else growing that could provide suitable structure for nest support and cover. However, the consistent use of mulefat is disproportionate to its availability. Mulefat is not abundant in the Basin and occurs scattered in local stands (Zembal et al. 1985).

In years with heavy, late rainfall, water is conserved in Prado Basin and vireo habitat is inundated. Understory is submerged, and particularly if the water level varies, some of the vireos are forced into marginal habitat on the higher edges of their home ranges. In addition, given the strong breeding site fidelity of vireos (Pike and Hays 2000), some vireo males or pairs may elect to remain in territories that are substantially flooded for most, or even all, of the breeding season (Pike *et al.* 2003). Further, when a large volume of water is retained for a prolonged span of time, as occurred in 1998 (Pike and Hays 1998), the adverse affect on near-ground willow foliage can extend into subsequent breeding seasons. As regrowth and regeneration of lower elevation willows steadily progresses, as during the drier seasons from 1999 - 2002, nesting vireos increasingly gravitate to these sites. Thus, while only 20% of vireo nests were found in black willows in 1998 (Pike and Hays 1998), the percentages gradually increased to the record high of 53% tallied in 2002 (Pike *et al.* 2002).

Vireo nests in the Prado Basin are often placed at the lower edge of a horizontal belt of dense foliage volume at about 1 m from the ground (Zembal 1986). Mean nest heights were measured in 1990 and 1989 of 1.18 m and 1.13 m, respectively that are higher than the corresponding values of 0.87, 0.64, and 0.99 m reported from other areas (Wilbur 1980; Gray and Greaves 1981; and Salata 1987, respectively). Moreover, a 2004 nest in the Prado Basin was estimated at being 4.6 m above the ground and a 1995 nest was measured at about 4.3 m above ground, two of the highest of any vireo nest reported for any area. Other exceptional nest heights include 3.94 m in 1987, located within 10 m of the highest nest found during the 1988 breeding season at 2.32 m; two nests at 3.7 m and 3 m in 2004; 3.54 m in 1992 following an unsuccessful nest by the same pair located about 2 m above ground; and 6 nests at 2.1 to 2.9 m, 1995 – 2000. A 1998 nest was measured at 2.69 m above pooled water and may have exceeded 4m above ground.

The vireos have frequently used synthetic materials in their nests. In 1995, 179 nests were examined for content after they were abandoned. About 60% (107 of 179) of the nests contained thin, pliable plastics or papers, primarily on nest bottoms, and only 40% (72 of 179) included natural materials exclusively. Of the 107 nests containing synthetics, 89% (95) primarily used white plastic, and 11% (12) mostly contained other materials, usually clear plastic or white paper. Along Temescal Creek, where trash is very abundant, white plastics were incorporated into 88% (49 of 56) of all nests.

The mean clutch size was 3.6 eggs (N=195 clutches) in the Prado Basin in 2004 and 3.7 for 2,205 nests, 1986 – 2004. This is higher than reported for San Diego County sites with an average clutch size of 3.3 eggs in 303 clutches, 1981 – 1987 on the Santa Margarita River (Salata 1987), and an average of 3.4 eggs in 61 clutches on the Sweetwater River (Kus and Collier 1988). Barlow (1962) reported an average clutch size of 3.39 (N=25) for a population of *V. b. bellii* in northeastern Kansas. However, Greaves (1987) also reported an average clutch size of 3.7 for the Gibraltar Reservoir population during the 1987 breeding season.

In 1999, the mean clutch size in 97 nests found within the Basin in April and May was a high 3.88. Only 12 nests contained three eggs and no nest contained only two eggs. However, the vireos laid fewer eggs per nest during the second half of the breeding season. The average clutch in 62 nests in June and July, 1999 was 3.4, with 21 three-egg nests and 4 two-egg nests.

Although it is often difficult to document that nests containing two eggs represent completed clutches, only 57 two-egg nests have ever been found in Prado Basin. In contrast, 28 two-egg nests were found on the Santa Margarita River by 1987 (Salata 1987). In addition, 10 nests in the Basin have contained 5 vireo eggs but no five-egg nests were observed by Salata (1987). In one instance in the Basin, a 5-egg clutch with a cowbird egg was found in the home range of a male that was associated with two females over a 4-day period (Pike and Hays 1992).

A minimum of 767 fledged vireo young were produced in the Basin in 2004 (Table 2), an 11% increase from 2003 (Pike *et al*. 2003). Reproductive success was a relatively high 59% (164 of 280). This compares to the 60% recorded in 2001 (Pike *et al*. 2001), the 57% in both 2003 (Pike *et al*. 2003) and 2002 (Pike *et al*. 2002), and 41% in 1998 (Pike and Hays 1998).

The average number of fledglings per breeding pair (2.1) in 2004 is below the (2.3) average in 2003 (Pike *et al*. 2003). The highest productivity detected in the Basin was during 1988-1991 when the fledglings-per-pair average was 3.1. This apparent decline in productivity may be partly attributable to the substantial increase in the vireo population since 1989 and our diminished ability to track all nests closely enough to document all fledglings. However, any actual decline in productivity per pair may be associated with increased population density and reduced nesting attempts.

There was a minimum of 2.4 nests per pair in 1988 (Hays 1988), 2.1 nests in 1989 (Hays 1989), and 2.7 nests in 1990 (Hays and Corey 1991). However, in 1996 only 1.8 nests were built per well-monitored pair (The Nature Conservancy 1996), then 1.7 nests in 1997 (The Nature

Conservancy 1997), and by 1999 and 2000, the average number of nests built per pair was down to 1.3 and 1.2, respectively. Interestingly, the vireos even arrived an average of two weeks earlier in 2000 than in 1999. With adequate time available for multiple renests, the very high reproductive success rate of 70% in 2000 (Table 2) may have contributed to the observed decline in reproductive persistence. In 2004, the average was again1.2 nests per pair.

Eighteen of 31 pairs (58%) fledged young from two or three nests in 1989 (Hays 1989), 36 of 42 pairs (86%) fledged from two or three nests in 1990 (Hays and Corey 1991), and 23 of 64 pairs (36%) fledged from two or three nests in 1991 (Pike and Hays 1992). Whereas, from 1999-2001, only 4% of pairs in each season fledged from two nests (Pike *et al*. 2001). In year 2004, 11 of 401 pairs (3%) fledged from two nests. Additionally, in 1990 and 1991, young were fledged from third, fourth, or fifth nesting attempts in at least 15 and 16 home ranges, respectively. From 1996 to 2001 this occurred in just 7,5, 6, 5, 4, and 6 home ranges, respectively. While eight vireo pairs fledged from their third nesting attempt during the 2003 season (Pike *et al*. 2003), this occurred in only 2 home ranges in 2004. Finally, a minimum of four home ranges accommodated 4 or 5 nests in 1991, and just two home ranges accommodated 4 nests in both 1997 and 1998. Since then, only one home range in 2003 has accommodated four nests (Pike *et al*. 2003).

Although two vireo pairs built five nests each during both the 1993 and 1994 seasons, no known pairs have built five nests since. Fifth (or sixth) nesting attempts within a given home range are exceedingly rare elsewhere as well (Greaves *et al.* 1988; Kus and Collier 1988; Salata 1983a,b). Although the average number of vireo nests produced per pair in 1998 (1.75) was low for the Basin, it was similar to averages for other locales. For instance, 1.6 nesting attempts/pair (21 pairs and 34 nests) in the Gibraltar Reservoir area of Santa Barbara County in 1988 (Greaves *et al.* 1988) and 1.7 nests per pair (19 pairs and 33 nests) in 1987 (Greaves 1987). Similarly, vireos on the Sweetwater River in 1987 produced an average of 1.5 nests per pair (Kus and Collier 1988).

Vireos on the Santa Margarita River apparently rarely renest if successful in their first breeding attempt of the season (Larry Salata, pers. comm.). Conversely, vireos in the Prado Basin, 1986-1991 invariably renested after successfully fledging from their first nest. However, 4 pairs in the Basin did not renest in 1992 after fledging three young from their first nests (The Nature Conservancy 1993a) and 13 pairs in 1994 failed to renest after fledging 3 or 4 young each on their first attempts in May. Similarly, in 2000, of the 43 pairs that produced 4 fledglings from their first nesting attempt in May or early June, only 1 (2%) renested. Furthermore, all 10 of the pairs that fledged from two nests in 2000 had fledged only one or two young from their initial nesting effort.

Table 3. Least Bell' Vireo nest placement preferences, Prado Basin, 1987-2004.

Number of Plants Containing Nests

Plant Species	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Totals
Black Willow (*Salix gooddingii*)	11 (37%)	30[a] (63%)	14 (40%)	25 (36%)	27 (24%)	27 (17%)	56 (22%)	62[b] (26%)	43 (17%)	82[c] (32%)	69[c] (29%)	52[c,d] (20%)	71 (33%)	88 (37%)	124[a] (43%)	149[g] (53%)	105[g] (38%)	124 (41%)	1159 (33%)
Arroyo Willow (*Salix lasiolepsis*)	0	3 (6%)	2 (2%)	1 (1%)	6 (5%)	16 (10%)	57 (23%)	50 (21%)	55 (22%)	53 (21%)	52[a] (22%)	48[c] (18%)	18[a] (8%)	32 (13%)	20 (7%)	24 (9%)	15[h] (5%)	25 (8%)	477 (13%)
Red Willow (*Salix laevigata*)	0	0	0	0	5 (5%)	2 (1%)	7 (3%)	4 (2%)	7 (3%)	2 (1%)	3 (1%)	1 (<1%)	6 (3%)	2 (1%)	7 (2%)	8 (3%)	7 (3%)	4 (1%)	65 (2%)
Sandbar Willow (*Salix exigua*)	0	0	0	0	4 (4%)	0	3 (1%)	3 (1%)	2 (1%)	3 (1%)	4 (2%)	2 (1%)	2 (1%)	6 (3%)	2 (1%)	2 (1%)	2 (1%)	2 (1%)	37 (1%)
Yellow Willow (*Salix lucida* ssp. *lasiandra*)	0	0	0	0	0	0	0	3 (1%)	1 (<1%)	0	1 (<1%)	0	1 (<1%)	0	0	0	0	0	6 (<1%)
Unidentified willow species	3 (10%)	0	1 (3%)	0	0	0	0	1 (<1%)	0	1 (<1%)	0	0	2 (1%)	0	0	0	0	0	7 (<1%)
Fremont Cottonwood (*Populus fremontii*)	0	0	0	0	0	1 (1%)	1 (<1%)	1 (<1%)	0	0	0	0	0	0	1 (<1%)	0	0	0	4 (<1%)
Mulefat (*Baccharis salicifolia*)	15 (50%)	15 (31%)	15 (43%)	41 (59%)	53 (48%)	95 (60%)	82 (32%)	88[e] (37%)	99 (40%)	102 (40%)	96 (40%)	108 (42%)	85 (40%)	68 (28%)	93[a] (32%)	63[h] (22%)	83 (30%)	88 (29%)	1289 (34%)
Coyote Bush (*Baccharis pilularis*)	0	0	0	0	1 (1%)	4 (3%)	0	0	0	0	0	1 (<1%)	0	0	2 (1%)	0	1 (<1%)	0	9 (<1%)
Gum (*Eucalyptus* sp.)	1 (3%)	0	1 (3%)	0	9 (8%)	3 (2%)	32 (13%)	7 (3%)	22 (9%)	5 (2%)	3 (1%)	13 (5%)	6 (3%)	2 (1%)	7 (2%)	9 (3%)	16 (6%)	14[f] (5%)	150 (4%)
Giant Reed (*Arundo donax*)	0	0	1 (3%)	0	0	0	0	1 (<1%)	2 (1%)	2 (1%)	2 (1%)	4 (2%)	3 (1%)	3 (1%)	1 (<1%)	4 (1%)	3 (1%)	2 (1%)	28 (1%)

Table 3. Least Bell' Vireo nest placement preferences, Prado Basin, 1987-2004 (Continued).

Number of Plants Containing Nests

Plant Species	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Totals
Cocklebur (*Xanthium strumarium*)	0	0	1 (3%)	1 (1%)	0	0	0	1 (<1%)	0	0	0	0	0	2 (1%}	1 (<1%)	1 (<1%)	0	0	7 (<1%)
Elderberry (*Sambucus mexicana*)	0	0	0	1 (1%)	2 (2%)	3 (2%)	4 (2%)	2 (1%)	6 (2%)	2 (1%)	1 (<1%)	10 (4%)	5 (2%)	9 (4%)	6 (2%)	4 (1%)	11 (4%)	15 (5%)	81 (2%)
Wild Grape (*Vitis girdiana*)	0	0	0	0	1 (1%)	1 (<1%)	1 (<1%)	1 (<1%)	3 (1%)	0	0	4 (2%)	4 (2%)	9[f] (4%)	3 (1%)	4 (1%)	4 (1%)	6 (2%)	41 (1%)
Stinging Nettle (*Urtica holosericea*)	0	0	0	0	2 (2%)	0	0	0	0	1 (<1%)	0	0	0	0	2 (1%)	0	0	0	5 (<1%)
Blackberry (*Rubus* sp.)	0	0	0	0	1 (1%)	0	1 (<1%)	0	2 (1%)	0	2 (1%)	0	0	1 (<1%)	2 (1%)	2 (1%)	1 (<1%)	4 (1%)	16 (<1%)
Thistle (*Cirsium* sp.)	0	0	0	1 (1%)	0	0	0	0	1 (<1%)	0	0	0	0	3 (1%)	0	1 (<1%)	2 (1%)	2 (1%)	10 (<1%)
California Pepper (*Schinus molle*)	0	0	0	0	0	1 (<1%)	0	0	0	0	1 (<1%)	1 (<1%)	0	1 (<1%)	0	0	2 (1%)	3 (1%)	8 (<1%)
Chinese Elm (*Ulmus parvifolia*)	0	0	0	0	0	1 (<1%)	0	0	0	0	0	0	0	0	1 (<1%)	1 (<1%)	0	0	3 (<1%)
Sunflower (*Helianthus annuus*)	0	0	0	0	0	1 (<1%)	3 (<1%)	5 (2%)	0	0	0	0	1 (<1%)	0	2 (1%)	1 (<1%)	0	0	13 (<1%)
Mustard (*Brassica* sp.)	0	0	0	0	0	1 (<1%)	0	2 (1%)	0	2 (1%)	2 (1%)	7 (3%)	2 (1%)	4 (2%)	7 (2%)	0	5 (2%)	5 (2%)	37 (1%)
Tree Tobacco (*Nicotiana glauca*)	0	0	0	0	0	1 (<1%)	1 (<1%)	0	0	0	1 (<1%)	1 (<1%)	0	0	0	0	1 (<1%)	0	5 (<1%)

Table 3. Least Bell' Vireo nest placement preferences, Prado Basin, 1987-2004 (Continued).

Number of Plants Containing Nests

Plant Species	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Totals
Unidentified (dead material)	0	0	0	0	0	1 (<1%)	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)
California Sagebrush (*Artemisia californica*)	0	0	0	0	0	0	2 (1%)	0	0	0	0	1 (<1%)	0	1 (<1%)	1 (<1%)	0	0	0	5 (<1%)
Toyon (*Heteromeles arbutifolia*)	0	0	0	0	0	0	1 (<1%)	0	1 (<1%)	0	0	1 (<1%)	0	1 (<1%)	0	0	0	0	4 (<1%)
Cherry (*Prunus* sp.)	0	0	0	0	0	0	1 (<1%)	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)
California Walnut (*Juglans californica*)	0	0	0	0	0	0	1 (<1%)	0	1 (<1%)	0	0	0	0	0	1 (<1%)	1 (<1%)	1 (<1%)	1[i] (<1%)	5 (<1%)
Tamarisk (*Tamarix chinensis*)	0	0	0	0	0	0	0	2 (1%)	3 (1%)	1 (<1%)	1 (<1%)	0	2 (1%)	0	2 1%	4 (1%)	4 (1%)	1 (<1%)	17 (<1%)
Broad-leaved Peppergrass (*Lepidium latifoliuim)*	0	0	0	0	0	0	0	1 (<1%)	0	0	0	0	0	1 (<1%)	0	1 (<1%)	1	0	4 (<1%)
Mexican Tea (*Chenopodium ambrosioides*)	0	0	0	0	0	0	0	1 (<1%)	1 (<1%)	0	0	0	0	0	0	0	0	0	2 (<1%)
Arizona Ash *(Fraxinus velutina*)	0	0	0	0	0	0	0	1 (<1%)	0	0	0	1 (<1%)	0	3 (1%)	0	0	0	1 (<1%)	7 (<1%)
Box Elder (*Acer negundo* ssp. *californicum*)	0	0	0	0	0	0	0	0	1 (<1%)	0	0	0	0	0	1 (<1%)	3 (1%)	3 (1%)	4 (1%)	10 (<1%)
Brazilian Pepper (*Schinus terebinthifolius*)	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	0	0	0	0	0	0	1 (<1%)

Table 3. Least Bell' Vireo nest placement preferences, Prado Basin, 1987-2004 (Continued).

Number of Plants Containing Nests

Plant Species	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Totals
Castor Bean (*Ricinus communis*)	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	0	0	0	0	0	1 (<1%)
Wild Radish (*Raphanus sativus*)	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	0	0	1 (<1%)	0	2 (<1%)
Poison Hemlock (*Conium maculatum*)	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	3 (1%)	0	0	2 (<1%)	2 (1%)	3 (1%)	11 (<1%)
Western Sycamore (*Platanus racemosa*)	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	1 (<1%)	0	1 (<1%)	0	3 (<1%)
Olive (*Olea europaea*)	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	1 (<1%)	0	0	0	1 (<1%)	2 (1%)	5 (<1%)
Australian Pepper (*Schinus polygamus*)	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	0	0	0	0	1 (<1%)
Curly Dock (*Rumex crispus*)	0	0	0	0	0	0	0	0	0	0	0	0	0	3 (1%)	1 (<1%)	0	0	0	4 (<1%)
Wlld Rose (*Rosa californica*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	1 (<1%)	0	2 (<1%)
Clematis (*Clematis ligusticifloia*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	0	1 (<1%)
Western Ragweed (*Ambrosia psilostachya*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	0	1 (<1%)

Table 3. Least Bell' Vireo nest placement preferences, Prado Basin, 1987-2004 (Continued).

Number of Plants Containing Nests

Plant Species	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Totals
Coast Live Oak (*Quercus agrifolia*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	1 (<1%)
Bush Mallow (*Malacothamnus fasciculatus*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	1 (<1%)
Common Sow Thistle (*Sonchus oleraceus*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (<1%)	0	1 (<1%)
TOTALS	30	48	35	70	111	158	253	236	250	257	239	260	212	239	290	281	276	306	3551

[a] One nest also attached to a strand of Stinging Nettle (*Urtica holosericea*).
[b] One nest also attached to a strand of Western Ragweed (*Ambrosia psilostachya*).
[c] One nest also attached to Wild Grape (*Vitis girdiana*).
[d] One nest also attached to a strand of Mulefat (*Baccharis salicifolia*)
[e] One nest also attached to a strand of Mexican Tea (*Chenopodium ambrosioides)*
[f] One nest also attached to Black Willow (*Salix gooddingii)*
[g] One nest also attached to Broad-leaved Peppergrass (*Lepidium latifolium)*
[h] One nest also attached to Blackberry (*Rubus* sp.)
[i] One nest also attached to Poison Hemlock (*Conium maculatum*)

In recent years, a number of unprecedented, breeding-related events have occurred in the Prado Basin. For example, in 1998 a nest on Temescal Creek containing 4 eggs on 3 May was found empty, depredated, but intact by 18 May. The affected pair moved to an adjacent area to renest. Then, by 29 May a second clutch of 4 eggs had been laid in the original nest by another, newly detected pair. Unfortunately, the nest was depredated for a second time. In 2001, another depredated nest that had been left empty and intact by 14 June was found to contain 4 eggs from the same vireo pair on 28 June. Once again, however, this nest was depredated. In 2003, a nest that had been used to fledge 4 vireo young in early May, was found to contain three eggs of the same pair on 25 June. In 2002, a Mill Creek pair that had failed on an initial nesting attempt, successfully raised young on the next attempt by reusing an intact, year 2001 nest. In 2004, a complete nest from the previous season was strangely incorporated into a new nest, with the mouth of the old, leaning nest being grafted onto the side of the new one. Lastly, a nest discovered in the South Basin in 1998 that had just fledged a vireo, still contained a large Brown-headed Cowbird nestling. Evidently this nest had been parasitized after incubation was well advanced. Otherwise, the likelihood of a vireo nestling surviving the competition with a much larger cowbird nestling would be extremely remote. This is the only observation of a vireo successfully fledging from a nest in the Basin that simultaneously contained a cowbird nestling.

Finally, a unique nesting predicament presented itself in 2002. The depredation of an adult female vireo at Mill Creek resulted in a detached nest containing four 5-day old nestlings landing upright in the vegetative substrate below. Prolonged observation revealed that the surviving vireo male was neither feeding nor brooding the young, either while the nest remained on the ground or after it had been replaced very near its original location. It was eventually determined that the best hope of survival for the nestlings was to individually place them in the nests of other vireo pairs. It was decided that candidate host nests should contain fewer than four nestlings and, ideally, that host nestlings should be of a similar age. Two of the Mill Creek nestlings were placed in two nests fitting these criteria, and one of the nestlings eventually fledged along with the 'foster' siblings. The remaining two nestlings were placed in an East Basin nest containing two older nestlings. Although the new arrivals were again apparently accepted by the vireo hosts, one nestling was evidently too weak to survive and the other was depredated on the nest subsequent to the fledging of the older 'foster' siblings.

Increasing breeding success and recruitment in the Prado Basin vireo population over the past 18 breeding seasons is probably due in large part to the active management program. Data collected in the Basin prior to the initiation of management efforts (Zembal *et al.* 1985; Zembal 1986) corroborate Jones' (1985) observations of extremely low reproductive success rates in 1984 at the unmanaged San Luis Rey, San Diego, and Sweetwater River sites. Jones (1985) reported an overall reproductive success of 14% for these three populations and average fledging rates of 0.25, 0.17, and 0.50 fledglings per nesting pair for the San Luis Rey, San Diego, and Sweetwater River locales, respectively. In the absence of effective cowbird control programs, cowbird parasitism rates ranged as high as 80% at these San Diego County sites (Jones 1985), to 77% (Zembal 1986) and even 100% (Zembal *et al.* 1985) in the Prado Basin.

By 6 August 2004, 1,353 (542 males, 614 females, 197 juveniles) Brown-headed Cowbirds had been trapped and removed from vireo and flycatcher habitats in the Prado Basin. This signifies a 25% decrease from the 1,810 removed in year 2003 (Pike *et al*. 2003), and is, in fact, the lowest total trapped since 1995 (Table 2). In addition, it follows the 27% decrease in trapped cowbird numbers when comparing year 2003 totals with those of year 2002 (Pike *et al*. 2003). Nonetheless, rather than a reflection of diminished success at trapping cowbirds in the Basin, it is instead regarded as evidence that years of increasingly effective trapping has likely resulted in the attrition of local, and possibly resident, cowbird numbers. In previous years, declines of this magnitude in trapped cowbird numbers coincided with dramatic increases in the cowbird parasitism rate of vireos. For example, average declines in trapped numbers of 24% and 41%, respectively, in 1988 and 1993, accompanied a virtual doubling of the vireo parasitism rates (Table 2). Conversely, in 2003, a decrease of 658 fewer trapped cowbirds from year 2002 coincided with a drop to 4% in the parasitism rate (Pike *et al*. 2003). In 2004, an additional decrease of 457 trapped cowbirds from the previous year coincided with a parasitism rate of 5% (11 of 243). Together, these parasitism rates are the lowest recorded since management and study began in 1986 (Table 2). Further, given the significant decline in numbers of adult (after second-year) cowbird males documented during recent breeding seasons (Pike *et al*. 2003) combined with the recent closure of numerous dairies in the nearby Chino basin, the data suggest that the local breeding populations of Brown-headed Cowbirds is to some degree being depleted.

A maximum of 20 traps were operated at any one time within the Basin in 2004. The most effective traps, by far, were those placed within four dairy operations. Cumulatively, these four traps captured 1,040 cowbirds. This accounts for 77% of all cowbirds removed during the 2004 breeding season. By contrast, sixteen ‘field traps’ (*i.e*., those situated in or near riparian habitat in close proximity to nesting vireos) accounted for the removal of only 313 cowbirds. Interestingly, the most effective of the ‘field’ traps was actually the holding pen adjacent to the OCWD office where large numbers of cowbirds were temporarily housed. Between 26 April and 23 May, this trap inadvertently captured an additional 91 cowbirds. Since 1986, 62,837 cowbirds have been trapped or otherwise collected in the Prado Basin.

Off-season cowbird trapping at dairies was first begun in August 1996 with the maintenance of two traps by OCWD personnel. This was the first time that trapping was conducted during the winter season and in locales removed from riparian habitats. During the first two winters of operation, a minimum of 5,682 cowbirds was removed. Five to six dairy traps were operated during the fall and winter of 2003/2004 and accounted for the removal of 6,527 cowbirds. Although it is not currently known what percentage of the wintering cowbird population remains to breed locally, continued winter trapping and a continuation of the eight-year decline in the parasitism rate of vireo nests may provide a partial answer.

Among 45 banded cowbirds discovered in the Basin through 2001, only 8 were females and most were banded in Riverside and San Diego Counties from about 76 km to 161 km away. A female and second-year male were recaptured in the Basin 4 days after they were banded on the coast, 40 km distant. The long-range record was a female banded in Ridgefield, Washington and recaptured in the Basin 2 months later on 18 April 1999.

Although the rate of cowbird parasitism of vireo nests has ranged from 4% to 57% within the Prado Basin since 1986, the rate declined significantly after the commencement of the cowbird trapping effort (Chi-square 2 x 2 contingency table; statistic = 20.3 [Yates correction factor applied]; $p < 0.00001$). It was also determined in 1996 that the parasitism rate for vireo nests on the fringes of the Basin, well removed from cowbird traps, was 85%. Basin-wide, the combined parasitism rate for vireo nests was 35% in 1996 (The Nature Conservancy 1996).

Based upon the current study and data collected elsewhere (Pitelka and Koestner 1942; Mumford 1952; Barlow 1962; Salata 1983a,b, 1984, 1986, 1987a, 1987b; Jones 1985; United States Fish and Wildlife Service 1986), we conclude that the Prado Basin population of vireos would have been subjected to much higher rates of cowbird parasitism and reproductive failure in the absence of an effective management program (Hays 1986, 1987, 1988, 1989, 1990; Hays and Corey 1991, Pike and Hays 1992, The Nature Conservancy 1993a, 1993b, 1994, 1995, 1996, 1997; Pike and Hays 1998, 1999, and 2000; Pike *et al*. 2001,2002,2003). Other recent, published accounts of the efficacy of cowbird trapping programs as part of comprehensive vireo and flycatcher management efforts corroborate this fundamental assumption (Kus 1999, Whitfield and Sogge 1999, and Whitfield *et al.* 1999).

Cowbirds are extremely plentiful in the Prado Basin, compared to many other sites managed for endangered birds. The adjacent cattle, dairy, and agricultural operations are conducive of a huge cowbird population and cowbird management is a relatively recent tool. Consequently, trapping techniques have been refined and improved over the course of this study. Optimum trapping results apparently are achieved if: 1) the appropriate ratio of male and female cowbirds are used in the decoy population; 2) field traps are placed in open areas immediately adjacent to occupied vireo habitats; 3) traps are placed in favored proximate cowbird feeding and roosting sites; and 4) the traps are free from disturbance. First, a maximum yield of female cowbirds is achieved if females comprise the large majority of the decoy population. We recommend the use of 4 or 5 females and 1 or 2 vocal males in a modified Australian crow trap, measuring 6' X 6' X 8'. Secondly, field traps should be positioned in the open, near riparian habitat but not enveloped in it. Third, as noted previously, significant decreases in cowbird parasitism can apparently be achieved by trapping in locales where cowbirds congregate, such as horse stables or dairy operations. Lastly, the traps must remain as undisturbed as possible (Hays 1986).

In addition to an ongoing effort to improve the methodology of removing cowbirds from the Prado Basin, an effort to age to the degree possible the population of male cowbirds captured in the traps was begun in 1996 and continued in 2004. Per Pyle (1997), "second-year males" were distinguished by pale brown to grayish greater underwing coverts, which contrast greatly with the adjacent blacker feathers. By contrast, those males with blackish greater underwing coverts showing only moderate contrasts between adjacent feathers were identified as "after second-year" males (*i.e*., adults) (Pyle 1997). As the prebasic molt in juvenile Brown-headed Cowbirds can rarely be complete, males with wholly blackish greater underwing coverts but also showing brownish, contrasty feathers on the upperparts were excluded from the data base (Pyle 1997; *pers. obs*.). The aging of male cowbirds was once again terminated on 11 July after it had become apparent that feather molt had obscured previously observed (and readily apparent) plumage differences. In 2003, of the 314 male cowbirds that could be reliably aged, 12% (38) were judged to be adults and 88% (276) were judged to be second-year birds. In 2004, of 235 males, 11% (27) were judged to be adults and 89% (208) were judged to be second-year birds This compares with years 1996 and 1997, when the recorded percentages for adult males were 29% and 30%, respectively (The Nature Conservancy 1997). The data thus suggest that well over half as many adult male cowbirds are currently being found in the Basin during the vireo

Table 4. Least Bell's Vireo reproductive success and breeding biology data, Prado Basin Study Area, 2004.

A. Number of pairs 413
B. Number of breeding (nesting) pairs 366
C. Number of breeding pairs that were well-monitored
throughout the breeding season 142
D. Number of `known fledged young' (a) 767
E. Number of `known fledged young' produced by pairs
monitored throughout the breeding season 385
F. Average number of fledglings produced per breeding pair (<u>minimum</u>; D/B; = `productivity or breeding success') 2.1
G. Average number of fledglings produced by pairs monitored
throughout the breeding season (E/C). 2.7
H. Number of nests that were discovered 306
I. Number of nests that were regularly monitored or"tracked" 280
J. Number of "tracked" nests that
were successful [%= J/I x 100]..164 [59%]
K. Number of "tracked" nests that
were depredated [%= K/I x 100] . ... 97 [40%]
L. Number of "tracked" nests that were parasitized by cowbirds [%= L/243 x 100]{b} ....11 [5%]
M. Number of nests that failed as a result of reproductive failure{c}……………………………….....13
N. Average clutch size (N=195) ……...…………………………………………..………………… 3.6
O. Number of cowbird eggs found in or near vireo nests 12
P. Number of cowbird nestlings removed from "tracked" nests 2
Q. Number of cowbird young fledged by vireos 0
R. Number of `manipulated', parasitized nests 6
S. Number of `successful, manipulated' nests [%=S/R x 100]...1 [17%]
T. Number of vireos fledged from `manipulated', parasitized nests..2

{a} This is minimum recruitment corresponding to Least Bell's Vireo Working Group definition of `known fledged young'.
{b} Thirty-seven of the 280 "tracked" nests were depredated before it could be determined if they had been parasitized. Therefore, these 37 nests were excluded from the calculation of the rate of cowbird parasitism.
{c} Three nests failed as a result of a fire in West Basin.

breeding season than occurred as recently as 1997. Notably, this span of time coincides with the advent of year-round trapping in dairy operations and, concurrently, the lowest percentages for cowbird parasitism rates since studies began (Table 2). It is believed that the continuation of this study in forthcoming years will yield additional useful data regarding the long-term impact of trapping efforts on the demographics and reproductivity of the cowbird population within the Prado Basin and environs.

At least 35% (97 of 280) of all well tracked nests were predated during the 2004 breeding season. As nest contents are not checked on a daily basis, it is not always possible to determine at what stage of the nesting cycle predation occurred. Nonetheless, it was evident that 31% (16 of 52) of the nests were predated during the incubation phase, while 69% (36 of 52) of the nests were predated during the nestling phase. As in previous years, most of the depredated nests found were intact and relatively undisturbed. Of 91 depredated nests, only 12 (13%) were on the ground or severely damaged, and another 8 (9%) remained suspended with some damage to the nest and/or branch support. The cumulative evidence suggests that snakes, avian predators, and, especially, small rodents (Salata 1987b), not large mammalian predators, are the primary nest predators in the Basin (Pike and Hays 2000).

Mice and rats are probable nest predators based upon droppings left in depredated nests, small neat holes in nest bottoms, and nests being domed over (Hays 1986; The Nature Conservancy 1993a, 1997; Pike and Hays 2000). Further, a mound of adult vireo feathers was found below a recently depredated nest which contained a rat dropping in 2001. In 2003, two additional depredated nests were found with rodent droppings on the rim. A lack of evidence precludes an understanding of the amount of nest depredation for which reptiles are responsible. However, five species of snakes have been found in or near occupied vireo habitats. Additionally, in 2000, a Southern Alligator Lizard (*Elgaria multicarinata*) was detected on a branch directly above a recently depredated, intact vireo nest (Pike and Hays 2000).

The Greater Roadrunner (*Geococcyx californianus*), American Crow (*Corvus brachyrhynchos*), and Western Scrub-Jay (*Aphelocoma californica*) have been considered as the likeliest avian predators of vireo nests and fledglings. Among these three, the Greater Roadrunner is suspected of being responsible for the largest number of depredated nests. Crows, although plentiful in the Basin, most frequently hunt in more open habitat and are rarely observed in the riparian vegetation at the low height of a vireo nest. Scrub jays, although fairly common along much of the Santa Ana River, are only rarely found within the Basin, and then only around the periphery. Roadrunners on the other hand, are common throughout the Basin and have been implicated in repeated depredation events (Hays 1988). In 1991, for example, a roadrunner was probably responsible for the disappearance of two fledglings from a vireo home range and was observed pursuing the third, and only remaining fledgling of that brood (Pike and Hays 1992).

Southwestern Willow Flycatcher. Five Southwestern Willow Flycatcher home ranges were detected in the Prado Basin in 2004. This follows the record nine flycatchers recorded during the 2003 season (Pike *et al*. 2003). The first two male Willow Flycatchers of the season were detected on the extremely early date of 30 April. The additional 3 male flycatchers were detected between 6 - 12 May. The last flycatcher of the season was noted on 7 September.

All of the male flycatchers detected were in home ranges that were occupied during the previous season. Breeding was confirmed in 3 of the home ranges and two of the breeding attempts were successful, resulting in a total of four fledglings. This was only the nineteenth and twentieth times that successful flycatcher breeding has been documented in the Basin.

All known flycatcher territories in the Basin have been in close proximity to water-filled creeks or channels. In addition, territories have usually consisted of overgrown clearings containing varying amounts of nettles with a few to many moderately tall, often dense, willows. Of the 4 nests found in 2004, one was placed in stinging nettles (*Urtica holosericea*), one in tamarisk (*Tamarix chinensis*), and 2 in black willow (*Salix gooddingii*). Overall, of the twenty-nine nests discovered from 1996-2004, 13 (45%) have been found in willows, with 8 (32%) of these being in arroyo willow (*Salix lasiolepsis*). Interestingly, a total of 9 (31%) nests have been found in tamarisk, despite the fact that tamarisk is relatively scarce in those areas that the flycatchers have bred. The heights of 29 nests have ranged from 0.61 m to 4.27 m, with an average of 1.86 m. Although flycatcher home ranges have been detected nearly throughout the surveyed portions of the Basin, successful breeding prior to 1991 had been detected just once in the North Basin. Since then, successful breeding has been documented 19 times, with all but one of these nestings occurring in two particular locales in the South Basin and one locale in the West Basin. In 2003, an additional flycatcher pair fledged two young along Mill Creek in the North Basin.

As occurred in a South Basin territory in 2003 (Pike *et al*. 2003), it was discovered that a flycatcher male had paired with two females simultaneously within a Mill Creek territory in 2004. Neither pairing successfully produced young. This represents only the third time that bigyny among Willow Flycatchers has been recorded in the Basin (The Nature Conservancy 1996). Polygyny has previously been documented as a breeding strategy occasionally utilized by this species (Prescott 1986a; Sedgwick and Knopf 1989).

Given that 5 territorial Southwestern Willow Flycatchers produced just four young in 2004, and only 40 fledged young were observed over the past 16 breeding seasons, the continued presence of this species in the Basin remains tenuous, at best.

Other Sensitive Avian Species. For the third consecutive year, no state-endangered Western Yellow-billed Cuckoo was found in the Prado Basin during 2004.

Yellow-billed Cuckoos have not been a primary focus of this study. They are extremely secretive and little has been learned of the size, behavior, or reproductive success of this small population. However, prior to 1995, the small local population appeared somewhat stable, with 3 (Zembal 1985) to 7 (Hays 1987) cuckoos being recorded annually. Then, in 1995, a widespread portion of the Basin was inundated in the spring and since then, only one or two cuckoos has usually been detected each year. Hopefully, the fact that, once again, no cuckoo was recorded in 2004 doesn’t signify that the Western Yellow-billed Cuckoo has been extirpated from the Prado Basin and environs.

Several other species designated by the California Department of Fish and Game as "Bird Species of Special Concern" (Remsen 1978) bred or attempted to breed within the Prado Basin and environs. Included among these were the Least Bittern (*Ixobrychus exilis*), Burrowing Owl (*Speotyto cunicularia*), Cooper's Hawk (*Accipiter cooperi*), Yellow Warbler *(Dendroica petechia*), Yellow-breasted Chat (*Icteria virens*) and White-faced Ibis (*Plegadis chihi*). These and several other local breeders, including the Common Ground Dove (*Columbina passerina*), Marsh Wren (*Cistothorus palustris*), Swainson's Thrush (*Catharus ustulatus*), Blue Grosbeak (*Guiraca caerulea*), and Lazuli Bunting (*Passerina amoena*) have declined in southern California as a result of habitat destruction and brood parasitism by the Brown-headed Cowbird (Garrett and Dunn 1981).

Many of these species may benefit from the management program that has been focused upon the vireo and flycatcher. For example, Yellow Warblers breed in proximity to the vireos and were also quite scarce in the Basin in the early 1980s (Zembal *et al*.1985). It is believed that fewer than 15 pairs occurred in the Basin as recently as 1987. However, a 1992 survey revealed 75 -100 pairs, and the 2004 estimate was 500 pairs.

The vireo population itself has increased from 19 to a high of 413 pairs over the course of this study, giving hope that this species may some day be recovered in this watershed. However, there is no reason to believe that the vireo would continue to prosper without these management efforts and little hope for the many other imperiled species receiving no effort. Most other vireo populations in the state are declining, maintaining, or just moderately increasing. Other than Prado, only the populations on the Santa Margarita and San Luis Rey Rivers have sustained significant increases in size due to intensive management since the Least Bell's Vireo was Federally listed.

The management of wildlife in southern California is lagging far behind critical needs. Many environmental advocates are busy trying to get land set aside and as important as those efforts are, they are very slow because of the great complexities and land costs. In the meantime the effects of so many millions of people cohabiting is eroding habitat carrying capacity and long term viability to such a daily degree that the potential for recovery and persistence of a full, intact southern California wildlife heritage is in question. The Santa Ana River Watershed Program and other similar programs demonstrate that wildlife management works for some species. Whether or not it will work for entire ecosystems remains to be determined over a very long period of time. The longer it takes us to prioritize habitat and wildlife restoration to the degree necessary to get on with ecosystem reparation, the less likely are the chances for ultimate success.

LITERATURE CITED

Aldrich, J. 1951. A review of the races of the Traill's flycatcher. Wilson Bulletin 63: 192-197.

Aldrich, J.W. 1953. Habitats and habitat differences in two races of Traill's Flycatcher. Wilson Bulletin 65: 8-11.

American Ornithologists' Union. 1983. Checklist of North American Birds, Sixth Edition. American Ornithologists' Union. Printed by Allen Press, Lawrence, Kansas. 877 pages.

Barlow, J. 1962. Natural History of the Bell Vireo, *Vireo bellii* Audubon. Univ. of Kansas Publ. Mus. of Nat. Hist. 12 (5): 241-296.

Barlow, J. and W. MacGillivray. 1983. Foraging and habitat relationships of the sibling species Willow Flycatcher (*Empidonax traillii*) and Alder Flycatcher (*E. alnorum*) in southern Ontario. Canadian Journal of Zoology 61: 1510-1516.

Bent, A. C. 1960. Life Histories of North American Birds. Volume II, Land Birds. Harper and Brothers, New York. 555 pp.

Brown, B.T. 1991. Status of nesting Willow Flycatchers along the Colorado River from Glen Canyon Dam to Cardenas Creek, Arizona. Endangered Species Report No. 20. U.S. Fish and Wildlife Service, Ecological Services, Phoenix, Arizona.

Browning, M.R. 1993. Comments on the taxonomy of *Empidonax traillii* (Willow Flycatcher). Western Birds 24: 241-257.

Coues, E. 1903. Key to North American Birds. Fifth Edition. The Page Company, Boston.

Dahl, T.E. 1990. Wetland Losses in the Unites States, 1780s to 1980s. U.S. Department of the Interior; U.S. Fish and Wildlife Service; Washington, D.C. 13 pp.

Ehrlich, P., D. Dobkin, and D. Wheye. 1992. Birds in Jeopardy. Stanford University Press, Stanford, California; 259 pages.

Garrett, K. and J. Dunn. 1981. Birds of southern California: status and distribution. Los Angeles Audubon Society. 408 pp.

Goldwasser, S. 1978. Distribution, reproductive success, and impact of nest parasitism by Brown-headed Cowbirds on Least Bell's Vireos. State of California, the Resources Agency; California Department of Fish and Game, Sacramento. Fed. Aid Wildl. Rest. W-54-R-10; Nongame Will. Prog. Job W 1.5.1; Final (unpublished) Report.

Goldwasser, S. 1981. Habitat requirements of the Least Bell's Vireo. State of California, the Resources Agency; California Department of Fish and Game, Sacramento. Unpublished report.

Goldwasser, S., D. Gaines and S. Wilbur. 1980. The Least Bell's Vireo in California: a de facto endangered race. American Birds 34: 742-745.

Gray, V. and J. Greaves. 1981. The riparian forest as habitat for the Least Bell's Vireo (*Vireo bellii pusillus*). Paper presented at the California Riparian Systems Conference, University of California, Davis; September, 1981.

Greaves, J. 1987. Least Bell's Vireos at the Gibraltar Reservoir in Santa Barbara County, California in 1987. Unpublished report prepared for the Office of Endangered Species, U. S. Fish and Wildlife Service, U. S. Forest Service, and the California Department of Fish and Game.

Greaves, J., M.V. Gray, and T. Olson. 1988. Status of the Least Bell's Vireo in the Gibraltar Reservoir Area during 1988. Unpublished report prepared by Dames and Moore for the City of Santa Barbara, Department of Public Works.

Grinnell, J. and T. Storer. 1924. Animal life in the Yosemite. University of California Press, Berkeley.

Grinnell, J. and A. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna Number 27: 1-608.

Harris, J., S. Sanders, and M. Flett. 1986. The status and distribution of the Willow Flycatcher in California, 1986. California Department of Fish and Game, Wildlife Management Division; Administrative Report 88-1. Sacramento, California.

Hays, L. 1986. The status and management of the Least Bell's Vireo within the Prado Basin, California, during 1986. Unpublished report, California State University, Long Beach Foundation.

Hays, L. 1987. The status and management of the Least Bell's Vireo within the Prado Basin, California, during 1987. Unpublished report, California State University, Long Beach Foundation.

Hays, L. 1988. The status and management of the Least Bell's Vireo within the Prado Basin, California, during 1988. Unpublished report, California State University, Long Beach Foundation.

Hays, L. 1989. The status and management of the Least Bell's Vireo within the Prado Basin, California, 1986-1989. Unpublished report, California State University, Long Beach, California.

Hays, L. and K. Corey. 1991. The status and management of the Least Bell's Vireo within the Prado Basin, California, 1986-1990. Unpublished report, California State University, Long Beach Foundation, Long Beach, California.

Hoffman, S., and R. Zembal. 2002. The status and management of the Least Bell's Vireo and Southwestern Willow Flycatcher in selected sites in the Santa Ana River Watershed. Unpublished report prepared for the Orange County Water District and U.S. Fish and Wildlife Service.

Howell, S.N.G. and S. Webb. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford University Press; Oxford (Great Britain).

Hubbard, J.P. 1987. The Status of the Willow Flycatcher in New Mexico. Report prepared for the New Mexico Department of Game and Fish.

Jones, B. 1985. A report on the status of the Least Bell's Vireo on the San Diego, Sweetwater, and San Luis Rey Rivers, San Diego County, California. Unpublished Report.

Klebenow, D.A. and R.J. Oakleaf. 1984. Historical avifaunal changes in the riparian zone of the Truckee River, Nevada. Pages 203-209 *in*: California Riparian Systems, R.E. Warner and K.M. Hendrix, eds. University of California Press, Berkeley, California.

Kus, B. E. 1999. Impact of Brown-headed Cowbird parasitism on productivity of the endangered Least Bell's Vireo. Studies in Avian Biology 18: 160-166.

Kus, B. E. and G. C. Collier. 1988. Status and Management of the Least Bell's Vireo at the Sweetwater River, San Diego County, California, 1987. Unpublished report, San Diego State University, San Diego, California.

.

Marsh, K. 1987. Santa Ana River Canyon Resource Management Plan. Report submitted to the County of Orange, General Services Agency and Environmental Management Agency. Environmental Impact Report Biological Assessments, Silverado, California.

Marsh, K., S. Loe, J. Pike, and P. Bloom. 1991. Lower Santa Ana River Canyon biological resource inventory and management recommendations. Report prepared for Orange County Environmental Management Agency flood control design.

Mayfield, H. 1977. Brown-headed cowbird: agent of extermination? American Birds 31: 107-113.

Mumford, R. 1952. Bell's Vireo in Indiana. Wilson Bulletin 64:224-233.

Nature Conservancy, The. 1993a. The status and management of the Least Bell's Vireo in the Prado Basin, California, 1986-1992. Unpublished report prepared for the Orange County Water District, Corps of Engineers, California Department of Fish and Game, and U.S. Fish and Wildlife Service.

Nature Conservancy, The. 1993b. The status and management of the Least Bell's Vireo in the Prado Basin, California, 1986-1993. Unpublished report prepared for the Orange County Water District, Corps of Engineers, California Department of Fish and Game, and U.S. Fish and Wildlife Service.

Nature Conservancy, The. 1994. Status and Distribution of the Least Bell's Vireo in the Prado Basin, California, 1986-1994. Unpublished report prepared for the Orange County Water District, County of Orange, California Department of Fish and Game, Corps of Engineers, and U.S. Fish and Wildlife Service.

Nature Conservancy, The. 1995. Status and Distribution of the Least Bell's Vireo in the Prado Basin, California, 1986-1995. Unpublished report prepared for the Orange County Water District, County of Orange, California Department of Fish and Game, Corps of Engineers, and U.S. Fish and Wildlife Service.

Nature Conservancy, The. 1996. Status and Distribution of the Least Bell's Vireo in the Prado Basin, California, 1986-1996. Unpublished report prepared for the Orange County Water District, County of Orange, California Department of Fish and Game, Corps of Engineers, and U.S. Fish and Wildlife Service.

Nature Conservancy, The. 1997. Status and Distribution of the Least Bell's Vireo in the Prado Basin, California, 1986-1996. Unpublished report prepared for the Orange County Water District, County of Orange, California Department of Fish and Game, Corps of Engineers, and U.S. Fish and Wildlife Service.

Phillips, A.R. 1948. Geographic variation in *Empidonax traillii*. Auk 65: 507-514.

Pike, J. and L. Hays. 1992. The Status and Management of the Least Bell's Vireo within the Prado Basin, California, 1986-1991. Unpublished report, California State University, Long Beach Foundation and U.S. Fish and Wildlife Service, Laguna Niguel, California.

Pike, J. and L. Hays. 1998. Status and Distribution of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Prado Basin, California, 1986-1998. Unpublished report prepared for the Orange County Water District, County of Orange, California Department of Fish and Game, Corps of Engineers, and U.S. Fish and Wildlife Service.

Pike, J. and L. Hays. 1999. Status and Distribution of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Prado Basin, California, 1986-1999. Unpublished report prepared for the Orange County Water District, County of Orange, California Department of Fish and Game, Corps of Engineers, and U.S. Fish and Wildlife Service.

Pike, J. and L. Hays. 2000. Status and Distribution of the Least Bell’s Vireo and Southwestern Willow Flycatchers in the Prado Basin, California, 1986-2000. Unpublished report prepared for the

Orange County Water District, County of Orange, California Department of Fish and Game,
Corps of Engineers, and U.S. Fish and Wildlife Service.

Pike, J., D. Pellegrini, L. Hays, and R. Zembal, 2001. Least Bell's Vireos and Southwestern Willow Flycatchers in Prado Basin of the Santa Ana River Watershed, CA. Unpublished report prepared for the Orange County Water District and U.S. Fish and Wildlife Service.

Pike, J., D. Pellegrini, L. Hays, and R. Zembal, 2002. Least Bell's Vireos and Southwestern Willow Flycatchers in Prado Basin of the Santa Ana River Watershed, CA. Unpublished report prepared for the Orange County Water District and U.S. Fish and Wildlife Service.

Pike, J., D. Pellegrini, L. Hays, and R. Zembal, 2003. Least Bell's Vireos and Southwestern Willow Flycatchers in Prado Basin of the Santa Ana River Watershed, CA. Unpublished report prepared for the Orange County Water District and U.S. Fish and Wildlife Service.

Pitelka, F. and E. Koestner. 1942. Breeding behavior of the Bell's Vireo in Illinois. Wilson Bulletin 54: 97-106.

Prescott, D.R.C. 1986a. Polygyny in the Willow Flycatcher. Condor 88: 385-386.

RECON (Regional Environmental Consultants). 1988. Draft Comprehensive Management Plan for the Least Bell's Vireo. Unpublished report submitted to the San Diego Area of Governments (SANDAG); San Diego, California.

Remsen, V. 1978. Bird species of special concern in California. The Resources Agency, California Department of Fish and Game. Project W-54-R-9, Report 78-1.

Ridgely, R.S. 1981. A Guide to the Birds of Panama. Princeton University Press, Princeton, New Jersey. 404 pp.

Ridgely, R.S. and G. Tudor. 1994. The Birds of South America. Volume II. The Suboscine Passerines. University of Texas Press, Austin. 814 pp.

Robbins, S.D. 1991. Wisconsin Birdlife. Population and Distribution. Past and Present. University of Wisconsin Press, Madison. 702 pp.

Rothstein, S., J. Verner and E. Stevens. 1984. Radio-tracking confirms a unique diurnal pattern of spatial occurrence in the Brown-headed Cowbird. Ecology 65 (1): 77-88.

Salata, L. R. 1983a. Status of the Least Bell's Vireo on Camp Pendleton, California. Report on research done in 1982. U.S. Fish and Wildlife Service Contract Report No. 11100-0145-82, Laguna Niguel, California. 73pp.

Salata, L. R. 1983b. Status of the Least Bell's Vireo on Camp Pendleton, California. Report on research done in 1983. U.S. Fish and Wildlife Service Contract Report No. 10181-9373, Laguna Niguel, California. 73pp.

Salata, L. R. 1984. Status of the Least Bell's Vireo on Camp Pendleton, California. Report on research done in 1984. Prepared for U.S. Marine Corps, Natural resources Office, Camp Pendleton, California by the U.S. Fish and Wildlife Service, Division of Ecological Services, Laguna Niguel, California. 54pp.

Salata, L. 1986. Status of the Least Bell's Vireo at Camp Pendleton, California in 1985. Unpublished report, Sweetwater Environmental Biologists, Spring Valley, California.

Salata, L. 1987a. Status of the Least Bell's Vireo at Camp Pendleton, California in 1986. Unpublished report, Sweetwater Environmental Biologists, Spring Valley, California.

Salata, L. 1987b. Status of the Least Bell's Vireo at Camp Pendleton, California in 1987. Unpublished report, Sweetwater Environmental Biologists, Spring Valley, California.

Sedgwick, J.A., and F.L.Knopf. 1989. Regionwide polygyny in Willow Flycatchers. Condor 91: 473-475.

Seutin, G. and J. Simon. 1988. Genetic variation in sympatric Willow Flycatchers (*Empidonax traillii* and alder flycatchers (*Empidonax alnorum*). Auk 105: 235-243.

Stafford, M.D. and B.E. Valentine. 1985. A preliminary report on the biology of the Willow Flycatcher in the central Sierra Nevada. California-Nevada Wildlife Transactions.

Stiles, F.G. and A.F. Skutch. 1989. A Guide to the Birds of Costa Rica. Cornell University Press, Ithaca, New York. 511 pp.

Taylor, D.M. and C.D. Littlefield. 1986. Willow Flycatcher and yellow warbler response to cattle grazing. American Birds 40: 1169-1173.

Unitt, P. 1987. *Empidonax traillii extimus*: an endangered subspecies. Western Birds 18 (3): 137-162.

U.S. Fish and Wildlife Service. 1986a. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Least Bell's Vireo, Final Rule, United States Fish and Wildlife Service, Washington, D.C.

U.S. Fish and Wildlife Service. 1986b. Draft Least Bell's Vireo Recovery Plan. Endangered Species Office, Region 1, Portland, Oregon.

U.S. Fish and Wildlife Service. 1993. Notice of 90-day Petition Finding; Southwestern Willow Flycatcher (*Empidonax traillii extimus)*.Federal Register 57: 39664-39668.

U.S. Fish and Wildlife Service. 1995. Endangered and Threatened Wildlife and Plants; Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher (Federal Register 59: 10693-10715), February 27, 1995.

Walkinshaw, L.H. 1966. Summer biology of Traill's flycatcher. Wilson Bulletin: 78: 31-46.

Whitfield, M.J. 1990. Willow Flycatcher reproductive response to brown-headed cowbird parasitism. Master's Thesis, California State University, Chico; Chico, California.

Whitfield, M.J. and M. K. Sogge. 1999. Range-wide impact of Brown-headed Cowbird parasitism on the Southwestern Willow Flycatcher (*Empidonax traillii extimus*). Studies in Avian Biology 18: 182-190.

Whitfield, M.J., K.M. Enos, and S.P. Rowe. 1999. Is Brown-headed Cowbird trapping effective for managing populations of the endangered Southwestern Willow Flycatcher? Studies in Avian Biology 18: 260-266.

Whitmore, R.C. 1977. Habitat partitioning in a community of passerine birds. Wilson Bulletin 89: 253-265.

Wilbur, S. 1980. Status report on the Least Bell's Vireo. Unpublished report, U. S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Willett, G. 1933. Revised list of the birds of southwestern California. Pacific Coast Avifauna 21: 1-204.

Zembal, R. 1984. Santa Margarita River Project, San Diego County, California. Fish and Wildlife Coordination Act Report, United States Fish and Wildlife Service, Laguna Niguel, California. 91 pp. plus appendices (267 pp.)

Zembal R. 1986. The Least Bell's Vireo in the Prado Basin and environs, 1985. Unpublished report, U. S. Fish and Wildlife Service, Laguna Niguel, California.

Zembal, R., K. Kramer, and R. Bransfield. 1985. Survey of Vegetation and Vertebrate Fauna in the Prado Basin and the Santa Ana River Canyon, California. Unpublished report, U.S. Fish and Wildlife Service, Laguna Niguel, California.

EXHIBIT 13

Use of Restored Riparian Habitat by the Endangered Least Bell's Vireo (*Vireo bellii pusillus*)

Barbara E. Kus

Abstract

A primary objective of riparian restoration in California is the creation of habitat for endangered species. Four restoration sites in San Diego County were monitored between 1989 and 1993 and evaluated for their suitability as nesting habitat for *Vireo bellii pusillus* (Least Bell's Vireo), a state and federally endangered obligate riparian breeder. Vegetation structure at each site was quantified annually and compared to a model of canopy architecture derived from Least Bell's Vireo territories in natural habitat. Vireo use of restored habitat was documented through systematic surveys and nest monitoring. By 1993, only one site in its entirety met the habitat suitability criteria of the model, but portions of each site during all years did so. Differences between sites in the time required to develop suitable habitat—well-developed layered vegetation from the ground to under 8m in height)—were attributable largely to variation in annual rainfall. Vireos visited restoration sites to forage as early as the first growing season, but they did not establish territories or nest there until at least part of the site supported suitable habitat as determined from the model. Placement of territories and nests coincided with patches of dense vegetation characteristic of natural nesting areas. Occupation of restored sites was accelerated by the presence of adjacent mature riparian habitat, which afforded birds nest sites and/or foraging habitat lacking in the planted vegetation. Vireos nesting in restored habitat achieved success comparable to that of vireos nesting in surrounding natural habitat, and there was no evidence that productivity was reduced in created areas. These findings indicate that creating nesting habitat for this target species is feasible and suggest that the critical components of vireo nesting habitat have been captured in both the design and quantitative assessment of restoration sites.

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Introduction

Riparian habitat in the southwestern United States has undergone serious declines during the last several decades, prompting efforts to create and restore woodlands throughout their historical distribution (Anderson & Ohmart 1982, 1985). One of the primary objectives of riparian restoration in southern California is to provide suitable habitat for endangered species. Although riparian habitat in this arid region is unparalleled in the diversity and abundance of wildlife it supports, thus warranting protection on this basis alone, it is the presence of endangered species that provides the legal impetus for mitigating habitat losses through restoration.

Most of the riparian restoration in San Diego County has been driven by the requirement to mitigate for the loss of habitat supporting *Vireo bellii pusillus* (Least Bell's Vireo), a state and federally endangered migratory songbird. This obligate riparian breeder was once abundant throughout California but declined in the face of widespread habitat destruction and parasitism by *Molothrus ater* (Brown-headed Cowbird). By 1986 the state population numbered just 300 pairs, roughly 80% of which occurred in San Diego County (U.S. Fish and Wildlife Service 1988; Regional Environmental Consultants 1989).

Considerable advances have occurred over the last ten years in the technical aspects of the design and implementation of restoration sites (Baird 1989; Baird & Rieger 1989; Hendricks & Rieger 1989). But successful habitat restoration involves considerably more than the establishment of native vegetation in a natural setting and requires consideration of several perspectives. Biologically, the goal of restoration is to create self-sustaining ecosystems functionally equivalent to those being replaced (Jordan et al. 1987). Legally, the stated objective of a restoration project may be more narrowly defined—for example, to create habitat capable of supporting a particular target species. Regulatory agencies are faced with the challenge of determining when the restoration has been successful in achieving its goal, as well as with identifying specific success criteria and methods for the quantitative measurement and evaluation of site performance. Implementing parties desire to achieve compliance with mitigation requirements through means that are not only economically efficient but quick, particularly when project construction is dependent on successful "up-front" habitat replacement.

Sufficient time has now passed to allow evaluation of current restoration practices in light of these various considerations. I summarize five years of monitoring data collected at four restoration sites ranging in size from 3 to 18 ha and in age from three to five years. Each of these sites was established prior to development that resulted in the loss of Least Bell's Vireo habitat, and the presence of nesting vireos was identified as the criterion for successful mitigation. I describe quantitatively the development of riparian vegetation at each site and evaluate its suitability as nesting habitat by comparing it to a habitat-based model derived from measurements of vireo territories in natural riparian habitat. I then detail vireo use of restored sites, linking it to vegetation structure, and I consider the power of the model in identifying suitable nesting habitat. Finally, I compare the reproductive success and productivity of vireos nesting in restored and natural habitats.

Study Areas

Three restoration sites along the San Luis Rey River and one on the San Diego River in San Diego County, California, were monitored between 1989 and 1993. The Oceanside and Bonsall sites, named after the municipalities in which they are located, are each 3-ha sites planted in early 1989 by the California Department of Transportation as partial mitigation for highway construction activities along the San Luis Rey River. The Bonsall site was constructed adjacent to mature cottonwood-willow habitat bordering the river, whereas the Oceanside site was isolated from existing riparian vegetation by approximately 100 m until 1991, when a small clump of *Salix* sp. (willow) developed outside the fence enclosing the planted site. Both sites were planted with a combination of 1-, 5-, and 15-gallon container nursery stock as well as transplanted trees, and they were seeded with several annuals (Baird 1989; Baird & Rieger 1989). Species were selected to mimic natural vireo habitat (Hendricks & Rieger 1989) and included a mix of *Salix lasiolepis* (arroyo willow), *S. gooddingii* (black willow), *S. hindsiana* (sandbar willow), *S. laevigata* (red willow), *Baccharis glutinosa* (mulefat), *Populus fremontii* (Fremont's cottonwood), and *Platanus racemosa* (sycamore). The third San Luis Rey River site, near Whelan Lake, is a 4-ha site planted by the U.S. Army Corps of Engineers in 1989 with cuttings and transplanted mature willows. Establishment of this site was a condition for removal of native vegetation within the vicinity of a flood-control project, and the restoration site was comparatively isolated from mature habitat during most of the study period.

The Mission Trails site borders the San Diego River within a regional park of the same name. Established by the California Department of Transportation in 1990, the site supports 18 ha of riparian vegetation planted in the manner developed for the Bonsall and Oceanside sites. The restored habitat spans mature habitat along the river and is treated here as two sites, north (13 ha) and south (5 ha).

Methods

Vegetation Measurement

Data describing vegetation structure were collected annually at each restoration site, commencing with the first year (growing season) after planting at the Mission Trails sites, the second year after planting at the Oceanside site, and the third year after planting at the Bonsall and Whelan sites. Sampling was conducted during August and September after breeding activity of birds at the sites had ended.

Vegetation was measured at points marked with permanent stakes along transects arrayed to provide uniform coverage of planted vegetation at each site. Between 13 and 28 points per hectare were sampled across sites. Foliage volume at 1 m height intervals was estimated by the "stacked cube" method, developed specifically to characterize canopy architecture in structurally diverse riparian habitat. Field workers recorded percent cover of vegetation, by species, within $2 \times 2 \times 1$ m sampling volumes "stacked" vertically high between the ground and the top of the canopy above the point. Four 2 m lengths of PVC pipe were placed on the ground to define the quadrat boundaries, and connectible lengths of PVC, marked at 1-m intervals, were used to determine height within the canopy. Percent cover was scored in the field by a modified Daubenmire (1959) scale, with cover classes <1, 1–10, 11–25, 26–50, 51–75, 76–90, and >90%. For analysis, cover codes were converted to class midpoints, which were then used to quantify vegetation structure at each sampling point, blocks of selected adjacent points, and each site as a whole.

Bird Surveys

Data on the occurrence of vireos at the restoration sites were drawn from comprehensive bird surveys conducted regularly since site inception at all but the Whelan sites (Kus 1989*c*). Between 1989 and 1991, surveys were conducted weekly during the breeding season (April-July) and biweekly during the rest of the year. A year-round biweekly schedule of surveys was adopted at the Bonsall and Oceanside sites in 1992.

Observers followed established routes designed to provide coverage of the entire site and recorded the age, sex, behavior, and location of every vireo detected.

Vireo Nesting Activity and Territory Delineation

Nesting activity of vireos using the restoration sites was monitored as part of a larger long-term study of vireos throughout the San Luis Rey and San Diego drainages (Kus 1989*a*, 1989*b*, 1991*a*, 1991*b*, 1991*c*, 1991*d*, 1992*a*, 1992*b*, 1993*a*, 1993*b*, 1994). Surveys were initiated in mid-March each year to determine the number, location, and breeding status (paired or unpaired) of singing males. Surveys were concentrated on a 32-km stretch of the San Luis Rey River and a 5-km stretch of the San Diego River. Once pairs were located, they were observed for evidence of nesting. Nests were located and monitored throughout the period that they were active to determine clutch size, hatching success, and fledgling success. Territories were visited through early August, and an attempt was made to determine the number and fate of all nests produced by each pair.

Territories were depicted on aerial photographs (scale, 1″ = 50′ (for Mission Trails) and 1″ = 500′ (for San Luis Rey) of each study site by plotting and connecting the locations of boundary disputes between neighboring males and each male's outermost singing perches.

Vireo Habitat Suitability Model

A model quantifying vegetation structure of vireo nesting habitat was developed with data from 10 territories in mature habitat along the San Diego River and 11 territories along the Sweetwater River in southern San Diego County (Miner 1989; Newman 1993). At the time the data were collected (1987), these drainages supported two of the densest populations of vireos in California, suggesting a high degree of habitat suitability. They also included sites studied by Hendricks and Rieger (1989) to develop restoration-site planting designs.

Between 24 and 32 points per territory were sampled by the stacked cube method described earlier (Miner 1989; Newman 1993). Average cover at 1-m height intervals was then calculated for each territory. Because the San Diego and Sweetwater territories did not differ significantly, they were combined, and cover at each height was averaged over the 21 territories.

The model was developed as a tool for evaluating whether sites unoccupied by vireos supported habitat suitable for nesting; that is, did the site fall within the range of habitat structure found within the vireo nesting territories? The criteria established for making this determination required that average cover at each height in the site under consideration fall within two standard deviations of the corresponding averages for known vireo nesting habitat, a range representing the 95% confidence interval of each mean (Snedecor & Cochran 1976). Sites failing to meet these criteria were considered unsuitable as nest sites for vireos.

Results

Vegetation Structure of Vireo Nesting Habitat

Nesting vireos use a subset of available riparian habitat characterized by a well-developed and layered canopy extending from the ground to heights as high as 15 m (Fig. 1). Typically, foliage density is highest within 1–2 m of the ground, the range within which vireos place their nests, and tapers off with increasing canopy height.

Development of Vegetation at the Restoration Sites

Although survival of planted vegetation was generally high, the three San Luis Rey sites exhibited little increase in foliage cover during the first four years of growth, 1989–1992 (Fig. 1). In fact, foliage volume declined at the lower canopy heights as establishing plants dropped leaves and died back. Planted trees and shrubs grew slightly in height but did not develop sufficient lateral growth to create the dense understory characteristic of vireo nesting habitat. A similar pattern was observed over the first two years of growth at the Mission Trails sites. In 1993, however, vegetation structure at all of the sites changed dramatically in the wake of record-breaking winter rainfall and persistent flooding in San Diego County. Average foliage cover doubled at the Oceanside site over the previous year and increased by 45–70% at the other sites.

By 1993, only one site met the model-derived criteria defining nesting habitat suitability, although other sites came close (Fig. 1). The Oceanside site, after five years of growth, supported a riparian stand with the density and vertical stratification typical of vireo nesting territories. The other 5-year-old sites, Whelan and Bonsall, also supported tall, dense vegetation but did not meet the cover criteria at all canopy heights as did the Oceanside site. The vegetation at Whelan differed from vireo nesting habitat in the slight lack of cover within 1 m of the ground, whereas the woodland at Bonsall lacked sufficient cover in the mid-canopy range.

The Mission Trails sites, in their third growing season by 1993, supported riparian habitat with tall canopies and dense foliage at some but not all canopy heights. Relative to the model, vegetation at the south site lacked density at heights below 5 m, whereas that at the north site was relatively sparse between 3 and 5 m, and marginally so at 0–1 m.

Although most sites in their entirety did not meet the model's suitability criteria, portions of all sites in each year did so. Vegetation development was not homogeneous within sites, and it was evident early on that foli-

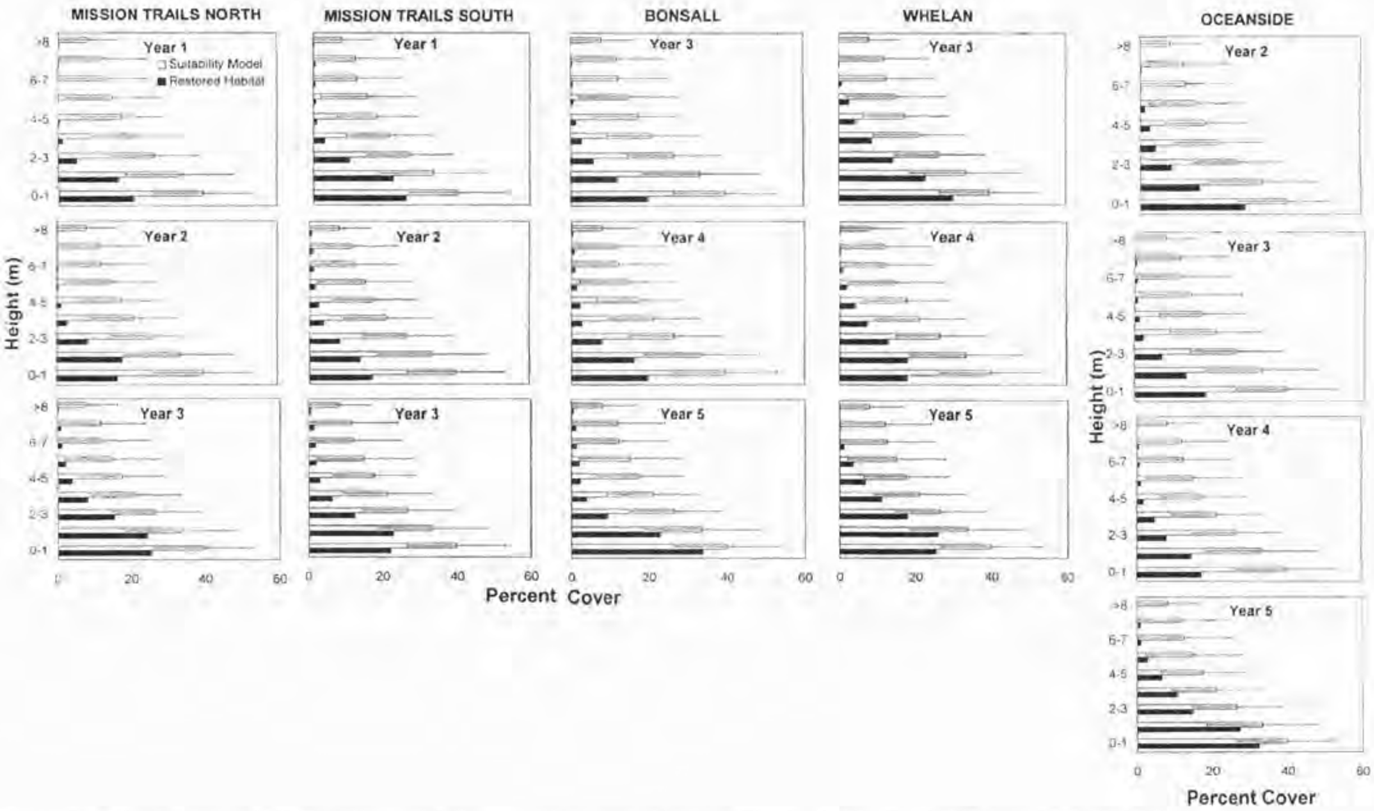

Figure 1. Developmentof foliage cover at riparian restoration sites relative to habitat suitability model. Model represents means ± 2 SD; bars bracket range of cover defined as suitable nesting habitat.

age structure was patchy with regard to canopy density and height. Dense patches, identified for analysis by inspection of the cover data, were tested for conformance with the model by evaluating blocks of contiguous sampling points along transects. Points were sequentially added or deleted until the limits of the block meeting the habitat suitability criteria were determined. The blocks were then mapped for each site and year and were assessed with regard to use by vireos, providing an additional and more conservative test of the habitat suitability model (Fig. 2). In some cases, patches were in conformance with the model at all but one or two height classes. Typically, these were patches that were suitably dense but had failed to attain the canopy height characterizing vireo nesting habitat or, conversely, were suitably tall but lacked sufficient understory. These patches meeting some but not all cover criteria were mapped in a manner distinguishing them from patches meeting all criteria, and their use by vireos was evaluated (Fig. 2).

Use of Restoration Sites by Least Bell's Vireos

Vireo use of the restoration sites was classified into four types: (1) foraging by adults and/or fledglings outside their nesting territories; (2) incorporation of restored habitat into a territory centered in adjacent mature habitat, with nesting confined to the mature habitat; (3) incorporation of restored habitat into a territory centered in adjacent mature habitat, including placement of nests in the planted vegetation; and (4) establishment of a territory entirely within the restored habitat. The degree of habitat suitability required to support each use was expected to increase from type 1 to type 4.

Use of restored habitat for foraging was the earliest type of use observed at the sites, commencing during the first year of growth at the Oceanside, Bonsall, and Mission Trails sites and occurring each year subsequent to that (Table 1). Fledglings from nearby territories, usually accompanied by a parent, were the most common visitors to the restoration sites; migrants in passage also occasionally appeared at the sites for a few days.

Vireos did not establish territories in restored habitat, either partially or entirely, until at least part of the site met the criteria of nesting habitat suitability. Colonization of the Oceanside site did not occur until the site was 4 years old, whereupon an unpaired male occupying existing habitat adjacent to the site incorporated part of the restored habitat into his territory. The following year, by which time the entire site was judged suitable for vireos,

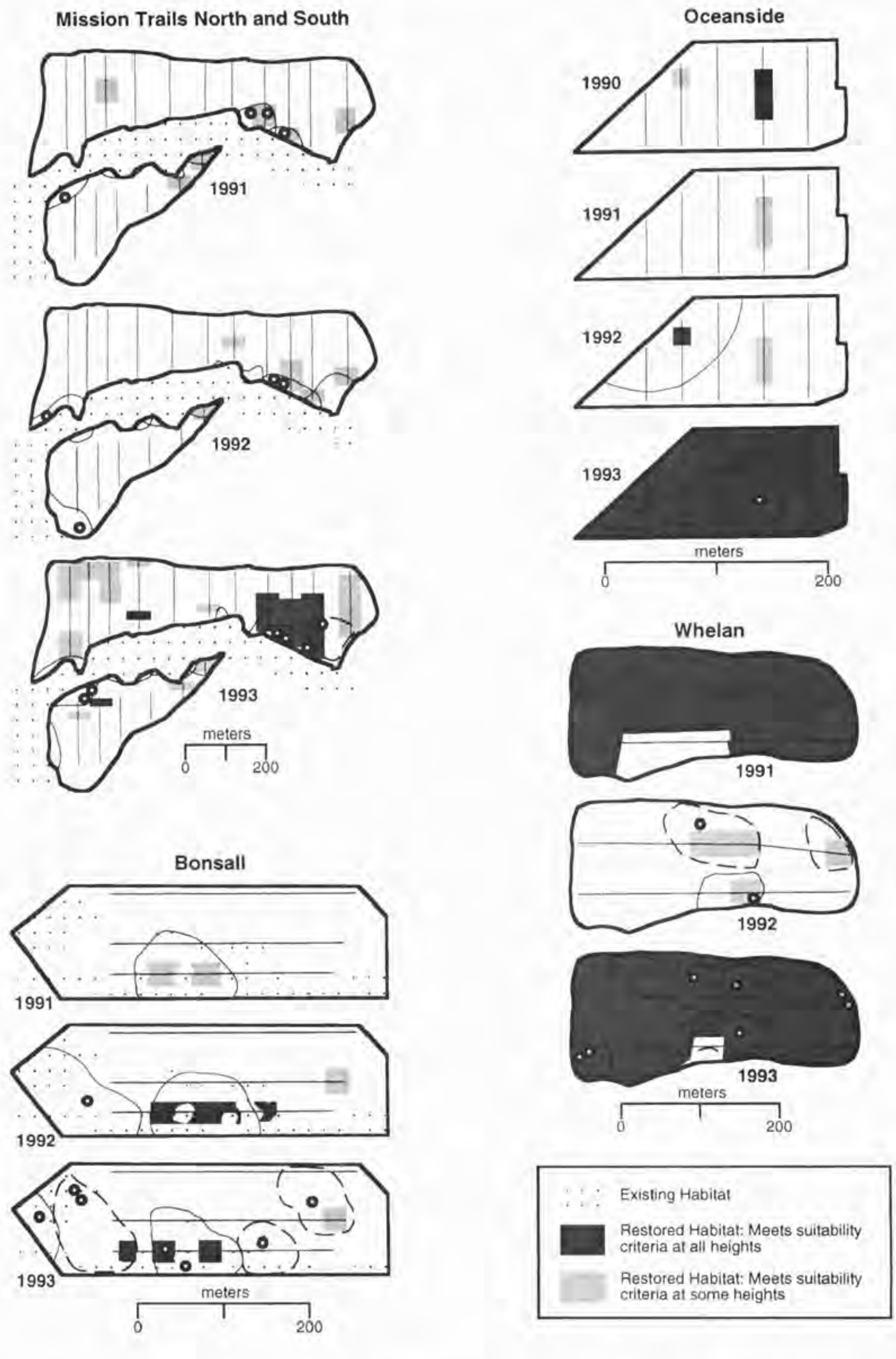

Figure 2. Location of Least Bell's Vireo territories relative to suitable habitat availability at restoration sites. Solid line reflects territory extending into adjacent mature habitat; portion of territory outside restoration site not shown. Broken line reflects territory entirely within restoration site. Circles denote nests. Lines traversing site are vegetation transects. Mapped blocks do not identify the actual patch boundaries, just the portion intersecting a vegetation transect.

a pair occupied this same territory, while a second pair established a territory and nested entirely within the restored habitat. Similarly, vireos did not establish territories at Whelan until four years after planting.

In contrast, colonization of the Bonsall and Mission Trails sites occurred much earlier, during the second year at the former and the first year at the latter. Moreover, vireos used these young sites as nesting habitat, placing nests in planted vegetation. In all cases, however, vireos occupied territories centered in the extensive mature habitat bordering each of these sites, and nest sites were within a few meters of the edge of this mature habitat. It was not until the fifth year at the Bonsall site and the third year at the north Mission Trails site that vireos established territories strictly within the boundaries of the planted vegetation.

The use of individual restoration sites by territorial vireos was closely linked to the distribution of patches of structurally suitable nesting habitat (Fig. 2). All of the initial colonizers of the Whelan site in 1992 centered territories on patches of tall, dense vegetation. The following year, when nearly the entire site was considered suitable vireo habitat, these patches continued to serve not only as territory cores but nest sites as well. Similarly, the two patches of suitable or near-suitable habitat present from the second year on at the Oceanside site were incorporated into territories when the site was eventually colonized. As at Whelan, one of these patches encompassed the location of the only vireo nest constructed within the site as of 1993.

Until 1993, all vireo territories at the Bonsall and Mission Trails sites occurred along the margins fringed by natural habitat; nevertheless, they too coincided with the patches of well-developed planted vegetation identified along sampling transects (Fig. 2). Both of the territories established in the interior of the Bonsall and Mission Trails sites in 1993 were centered on patches, and, although not depicted in Figure 2, the patches of high-quality habitat in the northeast section of the north Mission Trails site were colonized by a nesting pair in 1994 (B. E. Kus, unpublished data).

Reproductive Success of Vireos Nesting in Restored Habitat

Vireos nesting at restoration sites successfully fledged young during each year they were present (Table 2). Comparing vireos using restored sites to pairs nesting in natural habitat produced no evidence that vireos were less productive in restored vegetation, at least along the San Luis Rey River. Although sample sizes for the early years are small, vireos nesting at the Oceanside, Bonsall, and Whelan sites consistently fledged as many young per nest and per pair as did birds in nearby mature habitat. The pattern at the San Diego River is less clear and is complicated by the exceptionally high pair productivity documented in 1993 for pairs nesting in natural habitat in the study region (Kus 1994). Although the four vireo pairs nesting at the Mission Trails site that year performed less well by comparison, they achieved a level of productivity higher than that observed for either group during the previous two years.

Discussion

All of the restoration sites monitored in this study eventually supported nesting Least Bell's Vireos, providing the first evidence that it is possible to create suitable nesting habitat for this endangered species. Sites differed in the length of time required to reach this goal, however, making it possible to identify factors influencing vireo use of restored habitat. Some of these factors, such as proximity to existing vireo habitat, are subject to human control; others, such as annual rainfall, are not. Predicting with any great precision the time needed for a particular site to be colonized by vireos is therefore not possible, but the range in characteristics of the sites monitored here and the climatic background against which they were studied suggest that, in the coastal lowlands of southern California, 3–5 years is sufficient to develop habitat with the features that allow nesting vireos to be supported entirely within restored sites.

What factors influence vireo use and colonization of restored habitat? Foraging, the earliest and most extensive form of vireo use observed, occurred well before sites met the model's criteria for habitat structure, indicating that this use can occur independently of the presence of suitable nesting habitat and is thus by itself not a good indicator of habitat quality. Williams (1993), in a study monitoring terrestrial arthropods at the Ocean-

Table 1. Habitat suitability and use of restored sites by Least Bell's Vireo.

	Year 1			*Year 2*			*Year 3*			*Year 4*			*Year 5*		
	Habitat Suitability			*Habitat Suitability*			*Habitat Suitability*			*Habitat Suitability*			*Habitat Suitability*		
Site	*All*	*Part*	*Vireo Use*	*All*	*Part*	*Vireo Use*	*All*	*Part*	*Vireo Use*	*All*	*Part*	*Vireo Use*	*All*	*Part*	*Vireo Use*
OC	—	—	F	No	Yes	F	No	Yes	F	No	Yes	F, 1T	Yes		F, 1T, $1T_e$
BO	—	—	F	—	—	F, $1T_n$	No	Yes	F, $1T_n$	No	Yes	F, $2T_n$	No	Yes	F, 2T, $2T_n$, $1T_e$
WH	—	—	None	—	—	None	No	Yes	None	No	Yes	F, $1T_n$, $2T_e$	No	Yes	F, $5T_e$
MTS	No	Yes	F, 3T, $2T_n$	No	Yes	F, 4T, $1T_n$	No	Yes	F, 4T, $1T_n$						
MTN	No	Yes	F, $2T_n$	No	Yes	F, 2T, $2T_n$	No	Yes	F, 1T, $3T_n$, $1T_e$						

Sites: OC, Oceanside; BO, Bonsall; WH, Whelan; MTS, Mission Trials south; MTN, Mission Trails north. Habitat suitability reflects whether all or part of the site was judged suitable for nesting vireos. Vireo use: F, foraging outside territory; T, territory encompassing restored vegetation; T_n, nesting in restored vegetation; T_e, territory entirely within restored vegetation.

Table 2. Reproductive success of Least Bell's Vireos in restored and natural habitats.

		Year							
		1990		1991		1992		1993	
Drainage	*Parameter*	*Restored*	*Natural*	*Restored*	*Natural*	*Restored*	*Natural*	*Restored*	*Natural*
San Luis Rey	No. of pairs	1	33	1	41	4	68	9	76
	No. of nests	2	51	1	71	7	123	11	117
	Nest success (%)	50	47	100	51	57	46	82	40
	No. of fledglings/nest	2.0	1.3	4.0	1.4	1.9	1.3	2.5	1.0
	No. of fledglings/pair	4.0	2.0	4.0	2.4	3.3	2.3	3.0	1.6
San Diego	No. of pairs			4	23	3	21	4	24
	No. of nests			5	40	4	45	6	55
	Nest success (%)			20	43	75	36	50	62
	No. of fledglings/nest			0.4	1.1	1.5	1.0	1.5	2.1
	No. of fledglings/pair			0.5	1.9	2.0	2.2	2.3	4.8

Sources: Kus 1989*a*, 1989*b*, 1991*a*, 1991*b*, 1991*c*, 1991*d*, 1992*a*, 1992*b*, 1993*a*, 1993*b*, 1994.

side restoration site, documented the presence of likely vireo prey as early as year 1, and by year 2 found no significant difference in the abundance of large prey between the restored site and a nearby natural reference site. Use of young restoration sites by foraging vireos confirms the availability of prey and may be determined largely by the proximity of vireo territories to restoration sites.

Establishment of territories within restored habitat depended on a combination of two factors, the structure of planted vegetation and the site's proximity to natural habitat. The presence of existing habitat along the margins of planted sites reduced the time required for vireo colonization to occur relative to sites lacking an extensive fringe of mature habitat. Presumably this was because vireos using "hybrid" territories were not reliant on planted vegetation to meet all of their habitat requirements, as were birds occupying territories entirely within restoration sites. But the placement of territories spanning restoration site borders was not independent of the structure of planted vegetation. Vireo territories along the margins of the Bonsall and Mission Trails sites coincided with patches of well-developed vegetation, suggesting that expansion of a territory beyond the limits of natural habitat required the availability of structurally suitable planted vegetation nearby. This is supported by the observation that vireos nesting along the San Diego River incorporated restored areas into their territories only when they included patches of suitable habitat; otherwise territories were confined to the natural habitat.

The best and strongest evidence that restoration has achieved its objective is the presence of successfully nesting vireos supported entirely by restored vegetation. This use is clearly influenced by vegetation structure. The model presented here provided a good reference with which to evaluate habitat suitability at the restored sites, and vireo use of sites was consistent with the habitat-quality determinations based on the model. These findings indicate that the model captured critical components of vireo nesting habitat structure, specifically the need for dense cover within the nest height zone (0–2 m) and the presence of a dense and layered canopy wherein vireos concentrate foraging (Miner 1989). The success with which the model identified the existence of these conditions makes it useful as a standard against which to evaluate, and potentially correct, restoration site performance when Least Bell's Vireos are the target species.

Why did some restoration sites develop rapidly while others progressed slowly? Not surprisingly for a flood-adapted ecosystem, the answer probably lies in the response of vegetation at all sites to the high rainfall prior to the 1993 growing season, breaking a 5-year period of drought. Extensive flooding occurred along both the San Luis Rey and San Diego drainages, recharging soil nutrients and water and ultimately promoting a surge of vegetation growth in the spring. As a result of favorable growing conditions, the Mission Trails sites developed in three years a woodland that took the San Luis Rey River sites five years to achieve. Unpredictability in the timing and amount of annual rainfall characterizes the southern California climate, adding to the uncertainty with which restoration site performance can be predicted and generalized.

Further evidence of the limiting effect of water availability on vegetation development comes from the north Mission Trails sites, where virtually all of the patches of dense habitat occur along small natural drainage channels traversing the site, or within the portion of the site subject to regular flooding from the adjacent river.

Continued research and monitoring will be necessary to further refine our understanding of the factors influencing vegetation development and use of restored riparian habitat by vireos, and to guide modification of restoration practices as appropriate. The results of this study, however, indicate that restoration holds great promise as a means of reversing the century-long trend of riparian habitat loss in this state, and it has the potential to figure prominently in the recovery of this habitat's endangered inhabitants.

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LITERATURE CITED

Anderson, B. W., and R. D. Ohmart. 1982. Revegetation for wildlife enhancement along the lower Colorado River. U.S. Bureau of Reclamation, Boulder City, Nevada.

Anderson, B. W., and R. D. Ohmart. 1985. Riparian revegetation as a mitigation process in river and stream restoration. Pages 47–79 in J. A. Gore, editor. The restoration of rivers and streams. Butterworth Publishers, Boston, Massachusetts.

Baird, K. 1989. High quality restoration of riparian ecosystems. Restoration and Management Notes 7:60–64.

Baird, K. L., and J. P. Rieger. 1989. A restoration design for Least Bell's Vireo habitat in San Diego County. Pages 462–467 in D. L. Abell, technical coordinator. Proceedings of the California Riparian Systems Conference on protection, management, and restoration for the 1990's, 22–24 September 1988, Davis, California. General technical report PSW-110.

Daubenmire, R. F. 1959. Canopy coverage method of vegetation analysis. Northwest Science 33:43–64.

Hendricks, B. J., and J. P. Rieger. 1989. Description of nesting habitat for the Least Bell's Vireo in San Diego County. Pages 285–291 in D. L. Abell, technical coordinator. Proceedings of the California Riparian Systems Conference on protection, management, and restoration for the 1990's, 22–24 September 1988; Davis, California. General technical report PSW-110.

Jordan, W. R., III, M. E. Gilpin, and J. D. Aber. 1987. Restoration ecology. Cambridge University Press, Cambridge, United Kingdom.

Kus, B. E. 1989*a*. Status of the Least Bell's Vireo at the San Luis Rey River, San Diego County, California, 1989. Interagency report #11B351.24. State of California Department of Transporation, District 11, San Diego, California.

Kus, B. E. 1989*b*. Status of the Least Bell's Vireo at the West San Luis Ray River, San Diego County, California, 1989. Project #DACW0989M2291. U.S. Army Corps of Engineers, Los Angeles District, California.

Kus, B. E. 1989*c*. Bird use of natural and restored riparian woodlands at the San Luis Rey River, San Diego County, California. Interagency report #11B351. State of California Department of Transportation, District 11, San Diego, California.

Kus, B. E. 1991*a*. Distribution and breeding status of the Least Bell's Vireo at the San Luis Rey River, San Diego County, California, 1990. Interagency report #11B351.24. State of California Department of Transportation, District 11, San Diego, California.

Kus, B. E. 1991*b*. Status of the Least Bell's Vireo at the West San Luis Rey River, San Diego County, California, 1990. Project #DACW0990M0313. U.S. Army Corps of Engineers, Los Angeles District, California.

Kus, B. E. 1991*c*. Distribution and breeding status of the Least Bell's Vireo at the San Luis Rey River, San Diego County, California, 1991. Interagency report #11B351.24. State of California Department of Transportation, District 11, San Diego, California.

Kus, B. E. 1991*d*. Status of the Least Bell's Vireo at the West San Luis Rey River, San Diego County, California, 1991. Project #DACW0991M0327. U.S. Army Corps of Engineers, Los Angeles District, California.

Kus, B. E. 1992*a*. Distribution and breeding status of the Least Bell's Vireo at the San Diego River, San Diego County, California, 1990–1991. Interagency report #11B351.24. State of California Department of Transportation, District 11, San Diego, California.

Kus, B. E. 1992*b*. Status of the Least Bell's Vireo at the West San Luis Rey River, San Diego County, California, 1992. Project #DACW0992M0338. U.S. Army Corps of Engineers, Los Angeles District, California.

Kus, B. E. 1993*a*. Distribution and breeding status of the Least Bell's Vireo at the San Luis Rey River, San Diego County, California, 1992–1993. Interagency report #11B351. State of California Department of Transportation, District 11, San Diego, California.

Kus, B. E. 1993*b*. Breeding activities of the Least Bell's Vireo at the west San Luis Rey River, San Diego County, California, 1993. Project #DACW0993M0452. U.S. Army Corps of Engineers, Los Angeles District, California.

Kus, B. E. 1994. Distribution and breeding activity of the Least Bell's Vireo at the San Diego River, 1992–1993. Interagency report #11B351.24. State of California Department of Transportation, District 11, San Diego, California.

Miner, K. L. 1989. Foraging ecology of the Least Bell's Vireo, *Vireo bellii pusillus*. M.S. thesis. San Diego State University, San Diego, California.

Newman, J. M. 1993. Relationships between territory size, habitat structure and reproductive success in the Least Bell's Vireo, *Vireo belli pusillus*. M.S. thesis. San Diego State University, San Diego, California.

Regional Environmental Consultants. 1989. Comprehensive species management plan for the Least Bell's Vireo. Prepared for the San Diego Association of Governments, San Diego, California.

Snedecor, G. W., and W. G. Cochran. 1976. Statistical methods. The Iowa State University Press, Ames.

U.S. Fish and Wildlife Service. 1988. Least Bell's Vireo recovery plan. Portland, Oregon.

Williams, K. S. 1993. Use of terrestrial arthropods to evaluate restored riparian woodlands. Restoration Ecology 1:107–116.