

A photograph of an offshore wind farm with several white wind turbines in a line across a blue sea under a clear sky. The foreground turbine is partially cut off on the left.

ENVISION

RATING SYSTEM FOR SUSTAINABLE INFRASTRUCTURE



ENVISION®



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INTRODUCTION

PURPOSE OF ENVISION®

The purpose of Envision® is to foster a dramatic and necessary improvement in the sustainability performance and resiliency of physical infrastructure. Envision provides the framework and incentives needed to initiate this systemic change. Envision is a decision making guide, not a set of prescriptive measures. As a planning and design guidance tool, Envision provides industry-wide sustainability metrics for all infrastructure types to help users assess and measure the extent to which their project contributes to conditions of sustainability across the triple bottom line.

Fundamentally, Envision is about supporting more sustainable choices in infrastructure development. The system provides a flexible framework of criteria and performance objectives to aid local decision makers and help project teams identify sustainable approaches during planning, design, construction, and operation. It then further guides owners, communities, and designers in collaborating to make more informed decisions about the sustainability of infrastructure.

WHAT IS ENVISION?

Envision is a sustainability rating system and planning guide for introducing sustainability considerations into infrastructure projects. Recognizing the serious need for infrastructure to incorporate issues of sustainability, Envision evaluates, grades, and gives recognition to infrastructure projects that make exemplary progress and contribute to a more sustainable future. In this regard Envision assesses not only individual project performance, but how well projects contribute to the efficiency and long-term sustainability of the communities they serve. Envision takes a holistic view of infrastructure development, evaluating projects in terms of their value to communities, effective use of funds, and contributions to conditions of sustainability. Perhaps most importantly, Envision not only asks, “Are we doing the project right?” but also, “Are we doing the right project?” Envision is available at no cost and can be used independently for self-assessments and as a decision making guide.

Recognition is an important component of increasing awareness and initiating systemic change. Envision offers an optional third-party verification and award for recognizing project achievements.

WHERE DOES ENVISION APPLY?

Envision is a holistic sustainability rating system for all types and sizes of civil infrastructure including the roads, bridges, pipelines, railways, airports, dams, levees, landfills, water treatment systems, and other components that make up civil works. Envision is not intended to evaluate human-occupied, interior, conditioned buildings, but can be used in conjunction with building rating systems. While initially developed for the U.S. and Canada, Envision can be adapted to other locations. Envision is being used by infrastructure owners, design teams, community groups, environmental organizations, constructors, regulators, and policy makers to improve the sustainability of infrastructure projects.

WHY USE ENVISION?

Envision fills the need for a holistic rating system for sustainable infrastructure design. It can be used on all types of infrastructure, and can be used in conjunction with sector-specific ratings systems.

A holistic approach is important because infrastructure performance optimization is accomplished at the community level. Community infrastructure development is subject to the resources and constraints of multiple departments and agencies, each with different schedules, agendas, mandates, budget cycles, and sources of funding. Rating systems that evaluate and recognize sustainable performance in a single infrastructure unit may miss the more important aspects of sustainable performance.

The use of Envision can benefit projects in numerous ways including:

- Long-term viability through increased resiliency and preparedness
- Lower costs through management and stakeholder collaboration
- Reduced negative impacts on the community and the environment
- Potential to save owners money over time through efficiency
- Credibility of a third-party rating system
- Increased public confidence and involvement in decision making



HOW DOES ENVISION WORK?

The Envision system is a family of tools covering all phases of a project's life cycle: planning, design, construction, operation, and deconstruction. This Envision Guidance Manual covers the use of the Envision rating system for the planning and design phase. The manual includes objectives and performance levels to guide the user through a project assessment. The Envision rating system may be paired with other Envision tools such as the Envision checklist. The checklist can be helpful early in project planning when specific performance data necessary for an in-depth assessment is still unknown. The checklist is a series of yes/no questions that familiarize users with the sustainability criteria used in the Envision rating system so they may be better addressed in the project.

Envision has 60 sustainability criteria (called 'credits') organized into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Sustainability ratings for infrastructure projects are established through a performance assessment that awards points for up to five levels of achievement within each credit. Additional points for innovative performance can be earned in each category. Projects that apply Envision and opt to go through ISI's independent, third-party review (called 'Verification') may be eligible for Envision awards.

USING ENVISION

There are many ways to use Envision to help guide planning, design, and construction projects to be more sustainable.

- Learn to use Envision more effectively with the Envision Sustainability Professional (ENV SP) training
- Review the Envision assessment criteria, and use these to establish and communicate project or organizational goals early
- Monitor and document progress in meeting Envision objectives
- Evaluate and recognize infrastructure that succeeds in incorporating sustainability throughout its project life

BACKGROUND

Envision was developed in joint collaboration between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure (ISI). ISI is a not-for-profit education and research organization founded by the American Public Works Association, the American Council of Engineering Companies, and the American Society of Civil Engineers.

SUSTAINABLE INFRASTRUCTURE

William J. Bertera, ISI President and CEO

The function of all infrastructure in organized societies, especially civil infrastructure, is to provide for personal security, establish a basis for public health, and institutionalize a quality of life equal to the expectations of those it serves. That same infrastructure also provides the basis for healthy economies and heavily influences the economic competitiveness and viability of whole communities, regions, and nations.

Population growth, changing weather patterns, the need to protect the environment that sustains all of life, depletion of scarce resources, and geopolitical considerations challenge our ability to continue to live and develop without a recognition that there are trade-offs associated with the decisions we make about resources and their use. Increasingly, our infrastructure, which characterizes our collective footprint on this planet, must reflect those considerations.

Recognizing that many of our resources are finite and that development has environmental, social, and economic consequences, we have come to realize that it is not enough to create infrastructure that is intelligently designed, well engineered, and competently constructed. It must also be sustainable. The new public mandate is to not only do the job right, but to do the right job in the first place.

This commitment to sustainability not only acknowledges the future generational responsibilities we incur when making decisions that meet our current requirements, but also the critical need to have infrastructure that is available and operational not only to compliment our daily lives, but especially in times of natural disaster. Resiliency plans without the infrastructure upon which they depend are of only marginal value.

The conversation about infrastructure investment is complicated and sustainable infrastructure sometimes more so. Public needs exceed public resources in most communities and priorities are often established on what seems most critical at the moment. Infrastructure investment, which can be expensive and take a long time to complete may be easily put off; sustainable infrastructure sometimes more so because it is often justified in terms of "doing the right thing".

It may be, but it is also good business for both the public and private sectors and can deliver economic, social, and environmental benefits in the process. The triple bottom line matters and it is going to matter even more in the decades to come. Envision helps us quantify those benefits and make them demonstrable at the critical point of procurement...when decision makers have the best chance to make good and lasting decisions.



BASIS OF ENVISION DESIGN

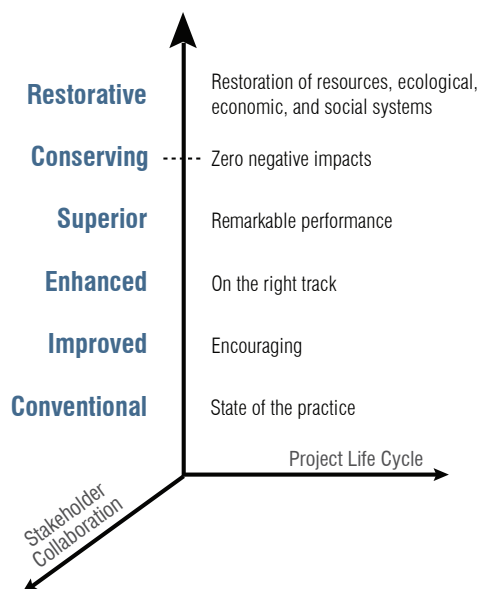
Envision is a system for rating infrastructure projects based on their overall contribution to the economic, environmental, and social aspects of sustainability. It establishes a unique holistic framework for sustainable project design, not only creating meaningful sustainable performance objectives but expanding opportunities for performance improvement. The Envision rating system incorporates the following elements:

- Social wellbeing is comprehensively addressed. As stated previously, Envision poses two questions: “Are we doing the project right?” and, more critically, “Are we doing the right project?” For instance, under Envision, a new highway might be designed with features that contribute to sustainable performance (e.g., preserving wildlife corridors, treating and infiltrating stormwater runoff, and incorporating recycled materials to construction). However, if that highway contributes to significantly greater traffic congestion and urban sprawl, its rating will be lower in terms of its overall contribution to sustainability.
- Changing conditions are accounted for. A consequence of working in a nonsustainable operating environment is that many of the standard project design assumptions and variables can and will change. Such changes include the cost and availability of critical materials and supplies such as fresh water and fuels. Also included are the evolving conditions under which the constructed works must operate. Climate change is creating a “new normal” in operating conditions. Envision creates incentives for identifying and incorporating these changing conditions and associated risks that may affect desired outcomes.
- Restoration of natural resources and ecosystems is an explicit level of achievement. While improving sustainable performance is an essential and immediate goal, long-term goals should be directed toward restoration where practical. Envision makes restoration an explicit goal as well as the highest category in its five levels of achievement. This is intended to reinforce the point that, to really contribute to sustainability, projects must do more than just make incremental improvements. These incremental improvements may have diminished negative impacts, but they do not contribute to the restoration of economic, environmental, and social conditions to sustainable levels.
- Long-term costs and risks are reduced. One of the Envision rating system credits covers the extent to which the infrastructure project avoids or eliminates traps and vulnerabilities that create higher legacy costs and risks. Infrastructure projects that commit the community to high fixed costs or create a heavy reliance on resources that could become scarce and/or very expensive score low in this credit. Likewise, projects that create or increase vulnerability to extreme weather events,

natural disasters, and/or economic conditions not only score low, but are viewed as being conceptually deficient.

- Life cycle considerations are addressed. Envision considers impacts over the entire project life. Several Envision credits require calculating impacts like energy, water, materials, or emissions consumed or produced by the project in all phases. This calculation is referred to as a life cycle assessment (LCA). While LCAs can take many forms Envision recognizes ‘streamlined’ or simplified LCAs that focus specifically on the calculations required for each credit. LCAs do not need to be prohibitively time consuming or expensive, rather they indicate that all phases of the project are considered in the calculations.
- Significant and relevant innovation is recognized and rewarded. “Innovation” is defined as exceptional performance in one or more credits. In this context, the term also refers to breaking recognized barriers to performance improvement and solutions that are scalable and/or transferrable to other infrastructure sectors. The Envision rating system recognizes that making real progress toward conditions of sustainability requires an overhaul of existing infrastructure, replacing old components with those that improve sustainable performance. Improvements are derived from the application of new and innovative approaches, methods, and technologies that raise the performance bar in one or more dimensions of sustainability.

LEVELS OF ACHIEVEMENT





ENVISION[®]



ENVISION[®] CREDIT LIST



QUALITY OF LIFE 13 Credits

1 PURPOSE

- QL1.1 Improve Community Quality of Life
- QL1.2 Stimulate Sustainable Growth & Development
- QL1.3 Develop Local Skills and Capabilities

2 WELLBEING

- QL2.1 Enhance Public Health and Safety
- QL2.2 Minimize Noise and Vibration
- QL2.3 Minimize Light Pollution
- QL2.4 Improve Community Mobility and Access
- QL2.5 Encourage Alternative Modes of Transportation
- QL2.6 Improve Site Accessibility, Safety & Wayfinding

3 COMMUNITY

- QL3.1 Preserve Historic and Cultural Resources
- QL3.2 Preserve Views and Local Character
- QL3.3 Enhance Public Space
- QL0.0 Innovate or Exceed Credit Requirements



NATURAL WORLD 15 Credits

1 SITING

- NW1.1 Preserve Prime Habitat
- NW1.2 Protect Wetlands and Surface Water
- NW1.3 Preserve Prime Farmland
- NW1.4 Avoid Adverse Geology
- NW1.5 Preserve Floodplain Functions
- NW1.6 Avoid Unsuitable Development on Steep Slopes
- NW1.7 Preserve Greenfields

2 LAND+WATER

- NW2.1 Manage Stormwater
- NW2.2 Reduce Pesticides and Fertilizer Impacts
- NW2.3 Prevent Surface and Groundwater Contamination

3 BIODIVERSITY

- NW3.1 Preserve Species Biodiversity
- NW3.2 Control Invasive Species
- NW3.3 Restore Disturbed Soils
- NW3.4 Maintain Wetland and Surface Water Functions
- NW0.0 Innovate or Exceed Credit Requirements



LEADERSHIP 10 Credits

1 COLLABORATION

- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Establish a Sustainability Management System
- LD1.3 Foster Collaboration and Teamwork
- LD1.4 Provide for Stakeholder Involvement

2 MANAGEMENT

- LD2.1 Pursue By-Product Synergy Opportunities
- LD2.2 Improve Infrastructure Integration

3 PLANNING

- LD3.1 Plan for Long-Term Monitoring & Maintenance
- LD3.2 Address Conflicting Regulations and Policies
- LD3.3 Extend Useful Life
- LD0.0 Innovate or Exceed Credit Requirements



CLIMATE AND RISK 8 Credits

1 EMISSIONS

- CR1.1 Reduce Greenhouse Gas Emissions
- CR1.2 Reduce Air Pollutant Emissions

2 RESILIENCE

- CR2.1 Assess Climate Threat
- CR2.2 Avoid Traps and Vulnerabilities
- CR2.3 Prepare for Long-Term Adaptability
- CR2.4 Prepare for Short-Term Hazards
- CR2.5 Manage Heat Island Effects
- CR0.0 Innovate or Exceed Credit Requirements



RESOURCE ALLOCATION 14 Credits

1 MATERIALS

- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA1.5 Divert Waste from Landfills
- RA1.6 Reduce Excavated Materials Taken Off Site
- RA1.7 Provide for Deconstruction and Recycling

2 ENERGY

- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA2.3 Commission and Monitor Energy Systems

3 WATER

- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems
- RA0.0 Innovate or Exceed Credit Requirements

NAVIGATING CREDITS

● **Levels of Achievement:** Brief description of the requirements necessary to meet each level of achievement. Levels increase in their contribution toward sustainability.

● **Intent:** The purpose of the credit.

● **Credit Title and Identification Number:** Includes the two-letter code identifying the category, and a number identifying the credit.

QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE

INTENT:

Improve the net quality of life of all communities affected by the project and mitigate negative impacts to communities.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Internal focus. The project team has located and reviewed the most recent community planning information. Some, but not systematic, outreach to stakeholders and decision makers has taken place. Some relatively easy, but not particularly important or meaningful, changes made to the project. No serious adverse community effects are caused by the project. (A, B, C, D)	(5) Community linkages. More efforts to locate, review, assess, and incorporate the needs, goals, and plans of the host community to the project. Most potential negative adverse impacts of the project on the host community are reduced or eliminated. Key stakeholders are involved in the project decision-making process. (A, B, C, D)	(10) Broad community alignment. All community plans are reviewed and verified through stakeholder input. The project team works to achieve good project alignment with community plans, recognizing that the scope of the project is a limiting factor. Potential negative impacts on nearby affected communities are reduced or eliminated. (A, B, C, D)	(20) Holistic assessment and collaboration. The project makes a positive contribution to the quality of life of the host and nearby affected communities. The project team makes a holistic assessment of community needs, goals, and plans, incorporating meaningful stakeholder input. Project meets or exceeds important identified community needs and long-term requirements for sustainability. Remaining adverse impacts are minimal, mostly accepted as reasonable trade-offs for benefits achieved. The project has broad community endorsement. (A, B, C, D, E)	(25) Community renaissance. Through rehabilitation of important community assets (e.g., upgraded and extended access, increased safety, improved environmental quality, and additional infrastructure capacity) the project substantially reinvigorates the host and nearby communities. Working in genuine collaboration with stakeholders and community decision makers, the project owner and the project team scope the project in a way that elevates community awareness and pride. Overall quality of life in these communities is markedly elevated. (A, B, C, D, E, F)

DESCRIPTION

This credit addresses the extent to which the project contributes to the quality of life of the host and affected communities. This determination is based on how well the project team has identified, incorporated, and addressed community needs, goals, and objectives into the project. Relevant community plans are assumed to be a viable expression of those needs, goals, objectives, and aspirations. In a real sense, they are the community's expression of their desired quality of life.

Communication and interactions with community stakeholders are essential to reaffirm and improve the assessment. The project team works closely with community stakeholders to identify and address issues and concerns. When operational, the completed project is expected to contribute to the efficiency and effectiveness of community infrastructure while having minimal impact on the environment. Its benefits should be seen as equitably distributed throughout the community.

A project designed to benefit one community may have adverse effects on others. The purpose of this credit is to recognize projects that provide significant benefits to affected communities and reduce or eliminate negative impacts. Because positive effects on all dimensions of performance may not be practical, the credit seeks a net positive impact.

If the project team can show that the affected community (or communities) has an existing project assessment and approval process that verifies that the project is in concert with community goals and objectives and that the project has gone through that process successfully, then that success will constitute achievement of this credit. The level of achievement will be

determined by the project team and is a function of the comprehensiveness of the process, the extent to which community stakeholders are engaged in collaborative dialogue (rather than merely outside input to the process), and the degree to which improvements were made and/or adverse impacts mitigated.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team locates and reviews community plans, looking for possible project fit/flows. The team complies with local regulations and policies for stakeholder involvement.

Performance Improvement: Give increased attention to community needs, goals, and plans as they relate to the project. Increase the thoroughness and participatory engagement by which community goals and plans are incorporated into the project. Give additional consideration to existing conditions and look for opportunities to rehabilitate community assets. Achieve strong endorsement by stakeholders and community leaders.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team identified and taken into account community needs, goals, and issues?

1. Lists and examples of documents obtained and reviewed; minutes of meetings with key stakeholders, community leaders, and decision makers; letters; and memoranda.

● **Metrics:** How the credit will be measured.

● **Total Possible Points:** Value of the highest level of achievement.

25 POINTS

QUALITY OF LIFE PURPOSE



METRIC:

Measures taken to assess community needs and improve quality of life while minimizing negative impacts.

B. Has the project team sought to align the project vision and goals to the needs and goals of the host and affected communities?

1. Evidence showing a comparison of the project vision and goals to the needs, goals, plans, and issues of the community.

C. Has the project team sought to identify and address potential adverse impacts to the host and affected communities?

1. Comprehensive impact assessments conducted, identifying and evaluating the positive and negative impacts of the project on affected communities. Planned actions for mitigating adverse impacts.
2. Minutes of meetings, letters, and memoranda with key stakeholders, community leaders, and decision makers for obtaining input and agreement regarding the impact assessment and planned actions.

D. Have the affected communities been meaningfully engaged in the project design process?

1. Reports and documented results of meetings, design charrettes, and other activities conducted with representatives of affected communities.
2. Evidence of project processes for collecting, evaluating, and incorporating community input into the project design. Demonstration of the thoroughness of the evaluation and incorporation to the designs.
3. Evidence showing the extent to which options were identified, and any needed, reasonable changes to the project made in accordance with community needs or plans.

E. Are the affected communities satisfied that the project is addressing their immediate and long-term issues, needs, and goals?

1. Acknowledgments and endorsements by the community that the design participation process was helpful and that their input was appropriately assessed and incorporated into project design.
2. Evidence of community satisfaction and endorsement of plans.

F. Have the project owner and the project team designed the project in a way that improves existing community conditions and rehabilitates infrastructure assets?

1. Plans, designs, and meeting minutes with community stakeholders and decision makers demonstrating an understanding of community conditions and assets and substantive efforts to rehabilitate.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.

RELATED ENVISION CREDITS

- QL1.2 Stimulate Sustainable Growth and Development
- QL1.3 Develop Local Skills and Capabilities
- QL2.2 Minimize Noise and Vibration
- QL2.3 Minimize Light Pollution
- QL2.4 Improve Community Mobility and Access
- QL3.1 Preserve Historic and Cultural Resources
- QL3.2 Preserve Views and Local Character
- QL3.3 Enhance Public Space
- LD1.4 Provide for Stakeholder Involvement
- LD2.2 Improve Infrastructure Integration
- RA1.4 Use Regional Materials
- NW1.3 Preserve Prime Farmland

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● **Advancing to Higher Levels of Achievement:** Sets the benchmark for performance. It also provides general strategy for performance improvements.

● **Documentation Reference:** References the lettered evaluation criteria needed to assess achievement for each level listed in *Evaluation Criteria* section.

● **Description:** Explanation of the sustainability issue addressed by the credit and its significance in infrastructure projects.

● **Related Envision Credits:** Envision credits which may share documentation requirements, or may relate in a symbiotic way in order to meet level of achievement requirements.

● **Sources:** Citation of sources used in the development of the credit.

● **Evaluation Criteria:** Specifies the questions that the project must address in order to meet the requirements of a level of achievement. It also provides examples of the types of documents that may be submitted for verification in order to demonstrate that requirements were met.

THE ENVISION RATING SYSTEM

ENVISION ORGANIZATION AND STRUCTURE

The Envision rating system is comprised of 60 performance objectives, called credits, that cover the full dimensions of infrastructure sustainability. Each credit in the Envision system includes an intent statement and metric, levels of achievement, a description, ways to advance to higher achievement levels, evaluation criteria and documentation, sources, and related Envision credits. The credits are organized into five categories and 14 subcategories by subject matter.

Each Envision credit contains one or more levels of achievement: Improved, Enhanced, Superior, Conserving, and Restorative. Improved, Enhanced, and Superior signify increasing sustainability performance. The Conserving level is defined as having no negative impacts. The Restorative level signifies significant restoration of social systems and/or natural resources and ecosystems.

Each of the 60 credits contains a set of evaluation criteria that are necessary for developing sustainable infrastructure and, in some cases, for restoring already depleted resources or damaged environment.

Scoring performance for an infrastructure project is done using a point system. Each of the credits and their associated levels of achievement are assigned points weighted in accordance with their estimated contribution to sustainability. In each credit description, guidance is provided on how to determine the level of achievement for a given project. Envision recognizes that some credits may not be applicable to every project. Credits can be omitted if it can be shown that they are not applicable to the project.

Envision recognizes innovation and exceptional performance is necessary in order to attain a sustainable society. Additional bonus points are therefore available for projects that exceed credit requirements or that pilot innovative methods, applications, or technologies.

CATEGORIES AND SUBCATEGORIES

- **Quality of Life:** Purpose, Community, Wellbeing
- **Leadership:** Collaboration, Management, Planning
- **Resource Allocation:** Materials, Energy, Water
- **Natural World:** Siting, Land and Water, Biodiversity
- **Climate and Risk:** Emissions, Resilience

Every infrastructure project has an important impact on all five Envision categories. For example, in an effort to avoid critical habitats, projects may have to consume more resources. Conversely, projects that reduce resource

consumption may find they are also achieving the benefit of reducing harmful emissions. By grouping the credits into broader categories of impact, Envision helps users to navigate the complex trade-offs or synergies across the credits.

LEVELS OF ACHIEVEMENT

The Envision levels of achievement define the level and quality of project performance in each credit as follows:

- **Improved**—Performance that is above conventional. Slightly exceeds regulatory requirements;
- **Enhanced**—Sustainable performance that is on the right track. There are indications that superior performance is within reach;
- **Superior**—Sustainable performance that is noteworthy, but not conserving. Point scores are designed to provide incentives for achieving sustainable or restorative performance;
- **Conserving**—Performance that has achieved essentially zero negative impact;
- **Restorative**—Performance that restores natural or social systems. Such performance receives the highest award possible, and is celebrated as such. The Restorative level is not applicable to all objectives.

In most credits the lower levels of achievement must first be satisfied in order for the higher levels to be achieved. For instance, to meet the requirements for Conserving, a project must also meet the requirements for Improved, Enhanced, and Superior. Levels of achievement have an associated point value that varies between credits. Not all credits have five levels of achievement. The levels are determined by the nature of the credit and the ability to make meaningful distinctions between levels.



EVALUATION CRITERIA

The evaluation criteria contain explanations of what documentation is necessary to demonstrate that a level of achievement has been met. Evaluation criteria include both qualitative and quantitative requirements. Examples of evaluation criteria are:

- Yes/No—An action taken or an outcome achieved
 - Is the project located on a site with no adverse geologic features such as earthquake faults or karst topography?
 - Does the project have a net positive impact on ground and surface water quality and quantity?
- Target—A specified outcome with discrete or variable levels
 - Has the project team diverted at least 75% of significant waste streams away from landfills?
 - Was the project designed to obtain 41 to 80% of its energy from renewable energy sources?
- Execution—A process conducted or a commitment made to accomplish a stated objective
 - Has the project team conducted an overall assessment of lighting needs?
 - Has the project team made a specific commitment to hire local workers?
- Accomplishment—A process conducted with a general or nonspecified result
 - Has the team assessed street lighting needs and specified the removal of unneeded street lighting?
 - Has the project team reduced the amount of lighting required through the use of nonlighting alternatives?

RELATED ENVISION CREDITS

Many of the Envision credits are interrelated. These are listed at the end of each credit section under “Related Envision Credits” so the project team can more easily improve the sustainability aspects of their project. Many of the related credits contain a life-cycle assessment (LCA) as part of the credit criteria. Project teams pursuing these credits may find conducting a single, thorough, and comprehensive LCA to be more efficient. This will provide a single, holistic evaluation of the project over its entire life cycle, from the extraction of raw materials to the project’s end of life. Credits that encourage an LCA are RA1.1, RA1.5, RA2.1, RA3.2, CR1.1, and CR1.2.

INNOVATION

The Envision rating system strongly encourages innovative methods that advance sustainable infrastructure practices or show exceptional performance beyond the expectations of the credit requirements. Each category includes an “Innovate or Exceed Credit Requirements” credit, indicated by a “0.0”. Projects may achieve all or part of the points in these credits. The 0.0 credits are not required and these points act as bonus points that are added to the category or total score.

Envision identifies and awards bonus points on three types of innovation. The project team may offer one type or bundle two or more types in a single category. The types of innovation are as follows:

- Achieving exceptional levels of performance. Exceptional performance is performance in one or more key credits that achieves new and remarkable levels of efficiency or effectiveness.
- Overcoming significant problems, barriers, or limitations. Demonstration of having reduced or eliminated significant issues that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project.
- Creating scalable and/or transferable solutions. Demonstration that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.

EVALUATION AND SCORING

ENVISION PROJECT SCORING

Each of the credits and their associated levels of achievement are assigned points weighted in accordance with their estimated contribution to sustainability. Guidance is provided in each credit description on how to determine the level of achievement for a given project. Scores for each applicable credit are added together to give the total Envision score. For projects seeking Verification, users should provide the documentation described in the evaluation criteria to support the level of achievement they selected.

Credits can be omitted if it can be shown that they are not applicable to the project. For projects that will be submitted for Verification, this requires an explanation of why the credit is not applicable to the project.

ONLINE SCORING MODULE

The scoring module is an online interactive tool that guides users by assigning levels of achievement for each credit. Scores are tallied by credit category and for the whole project. The scoring module is available on ISI's website (www.sustainableinfrastructure.org).

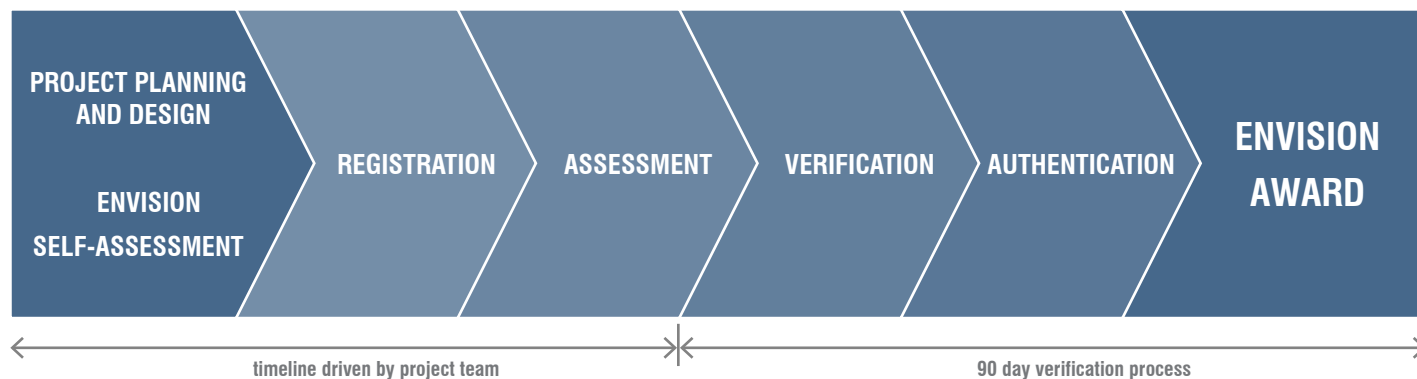
ENVISION SUSTAINABILITY PROFESSIONAL

Envision Sustainability Professionals (ENV SPs) are trained and credentialed in the use of Envision. They work in the project team on behalf of a design firm, contractor, or infrastructure owner to guide the team to achieve higher levels of sustainability and to document project sustainability accomplishments. While anyone can use Envision for their project, an ENV SP must be involved for projects to be verified and eligible for an Envision project award. Both online and in-person ENV SP training are available through ISI.

THIRD-PARTY EVALUATION

While the Envision rating system can be used as a template to guide project planning, ISI's independent third-party project verification program is a transparent process to confirm that a project meets Envision evaluation criteria. The ENV SP, Verifier, and Authenticator play a central role in the Verification process. The Verifier is a qualified expert contracted by ISI to verify or confirm the levels of achievement, required documentation, and final score submitted by the project team. The Authenticator is an ISI staff person who provides oversight and quality control during Verification.

Project Design and Verification



ENVISION POINTS TABLE

		IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE	
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
		QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
		QL1.3 Develop local skills and capabilities	1	2	5	12	15
	WELLBEING	QL2.1 Enhance public health and safety	2	—	—	16	
		QL2.2 Minimize noise and vibration	1	—	—	8	11
		QL2.3 Minimize light pollution	1	2	4	8	11
		QL2.4 Improve community mobility and access	1	4	7	14	
		QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
		QL2.6 Improve site accessibility, safety and wayfinding	—	3	6	12	15
	COMMUNITY	QL3.1 Preserve historic and cultural resources	1	—	7	13	16
QL3.2 Preserve views and local character		1	3	6	11	14	
QL3.3 Enhance public space		1	3	6	11	13	
Maximum QL Points:					181*		
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
		LD1.2 Establish a sustainability management system	1	4	7	14	
		LD1.3 Foster collaboration and teamwork	1	4	8	15	
		LD1.4 Provide for stakeholder involvement	1	5	9	14	
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
		LD2.2 Improve infrastructure integration	1	3	7	13	16
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3	—	10	
		LD3.2 Address conflicting regulations and policies	1	2	4	8	
		LD3.3 Extend useful life	1	3	6	12	
Maximum LD Points:					121*		
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
		RA1.2 Support sustainable procurement practices	2	3	6	9	
		RA1.3 Use recycled materials	2	5	11	14	
		RA1.4 Use regional materials	3	6	9	10	
		RA1.5 Divert waste from landfills	3	6	8	11	
		RA1.6 Reduce excavated materials taken off site	2	4	5	6	
		RA1.7 Provide for deconstruction and recycling	1	4	8	12	
	ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
		RA2.2 Use renewable energy	4	6	13	16	20
		RA2.3 Commission and monitor energy systems	—	3	—	11	
	WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
		RA3.2 Reduce potable water consumption	4	9	13	17	21
		RA3.3 Monitor water systems	1	3	6	11	
Maximum RA Points:					182*		
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	—	—	9	14	18
		NW1.2 Protect wetlands and surface water	1	4	9	14	18
		NW1.3 Preserve prime farmland	—	—	6	12	15
		NW1.4 Avoid adverse geology	1	2	3	5	
		NW1.5 Preserve floodplain functions	2	5	8	14	
		NW1.6 Avoid unsuitable development on steep slopes	1	—	4	6	
		NW1.7 Preserve greenfields	3	6	10	15	23
	LAND & WATER	NW2.1 Manage stormwater	—	4	9	17	21
		NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
		NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
	BIODIVERSITY	NW3.1 Preserve species biodiversity	2	—	—	13	16
		NW3.2 Control invasive species	—	—	5	9	11
		NW3.3 Restore disturbed soils	—	—	—	8	10
		NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
Maximum NW Points:					203*		
CLIMATE & RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
		CR1.2 Reduce air pollutant emissions	2	6	—	12	15
	RESILIENCE	CR2.1 Assess climate threat	—	—	—	15	
		CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
		CR2.3 Prepare for long-term adaptability	—	—	—	16	20
		CR2.4 Prepare for short-term hazards	3	—	10	17	21
		CR2.5 Manage heat islands effects	1	2	4	6	
Maximum CR Points:					122*		
Maximum TOTAL Points:					809*		

* Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

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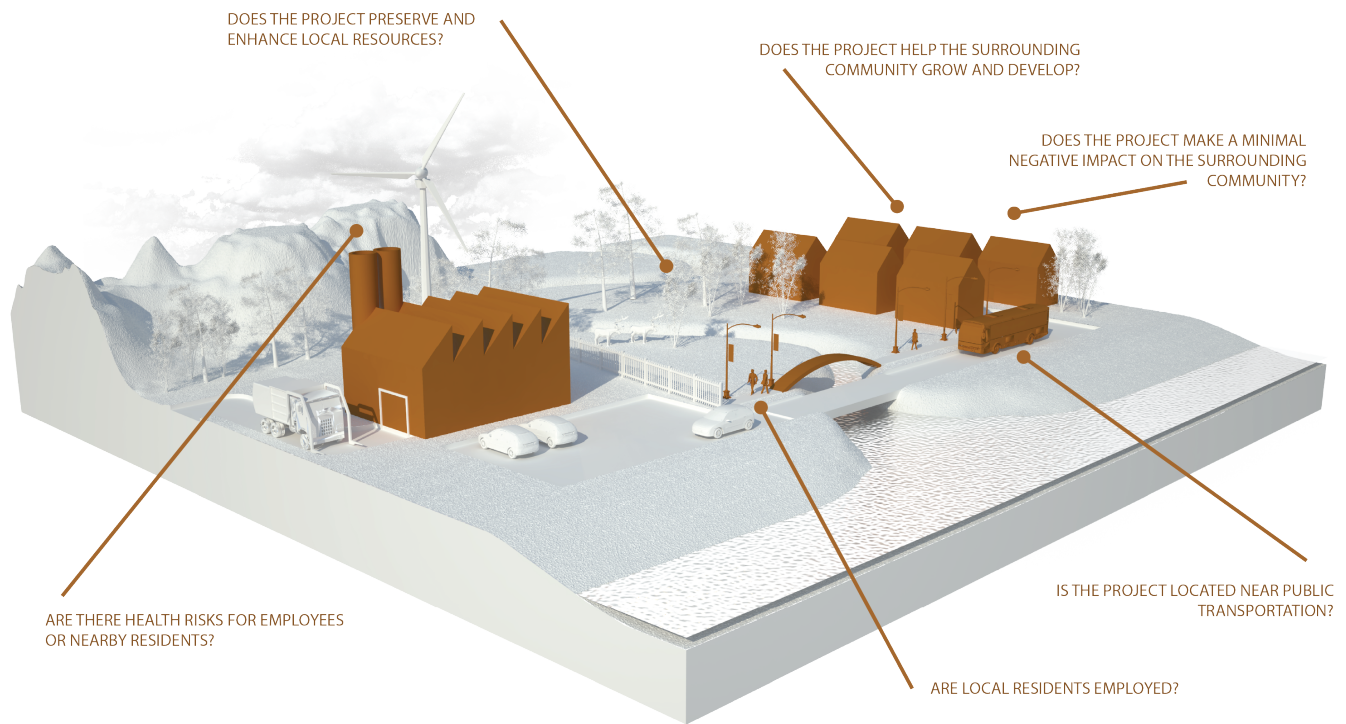




**QUALITY
OF LIFE**



QUALITY OF LIFE



QUALITY OF LIFE

Quality of Life addresses a project's impact on host and affected communities, from the health and wellbeing of individuals to the wellbeing of the larger social fabric as a whole. These impacts may be physical, economic, or social. Quality of Life focuses on assessing whether infrastructure projects align with community goals, are incorporated into existing community networks, and will benefit the community in the long term. Community members affected by the project are considered important stakeholders in the decision-making process. The category is further divided into three subcategories: Purpose, Wellbeing, and Community.

PURPOSE

The Purpose subcategory addresses the project's impact on functional aspects of the community, such as growth, development, job creation, and the general improvement of quality of life. Positive results from infrastructure projects can include community education, outreach, knowledge creation, and worker training.

WELLBEING

As integral parts of the community, sustainable infrastructure projects address individual comfort, health, and mobility. During construction and operation, physical safety of workers and residents are ensured and nuisances minimized (including light pollution, odors, noise, and vibration). Attention is also given to encouraging alternative modes of transportation and incorporating the project to the larger community mobility network. Infrastructure owners are encouraged to enable access and mobility to enhance community livability.

COMMUNITY

It is important that the project respects and maintains or improves its surroundings through context-sensitive design. While infrastructure primarily is driven by engineering parameters, its visual and functional impacts should be considered during design. Depending on whether the project is located in a rural or urban setting, this may include preserving views and natural features or incorporating the local character of the built environment into the design.



1 PURPOSE

- QL1.1 Improve Community Quality of Life
- QL1.2 Stimulate Sustainable Growth and Development
- QL1.3 Develop Local Skills and Capabilities

2 WELLBEING

- QL2.1 Enhance Public Health and Safety
- QL2.2 Minimize Noise and Vibration
- QL2.3 Minimize Light Pollution
- QL2.4 Improve Community Mobility and Access
- QL2.5 Encourage Alternative Modes of Transportation
- QL2.6 Improve Site Accessibility, Safety, and Wayfinding

3 COMMUNITY

- QL3.1 Preserve Historic and Cultural Resources
- QL3.2 Preserve Views and Local Character
- QL3.3 Enhance Public Space

- QL0.0 Innovate or Exceed Credit Requirements

QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE

INTENT:

Improve the net quality of life of all communities affected by the project and mitigate negative impacts to communities.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Internal focus. The project team has located and reviewed the most recent community planning information. Some, but not systematic, outreach to stakeholders and decision makers has taken place. Some relatively easy, but not particularly important or meaningful, changes made to the project. No serious adverse community effects are caused by the project. (A, B, C, D)	(5) Community linkages. More efforts to locate, review, assess, and incorporate the needs, goals, and plans of the host community to the project. Most potential negative adverse impacts of the project on the host community are reduced or eliminated. Key stakeholders are involved in the project decision-making process. (A, B, C, D)	(10) Broad community alignment. All community plans are reviewed and verified through stakeholder input. The project team works to achieve good project alignment with community plans, recognizing that the scope of the project is a limiting factor. Potential negative impacts on nearby affected communities are reduced or eliminated. (A, B, C, D)	(20) Holistic assessment and collaboration. The project makes a positive contribution to the quality of life of the host and nearby affected communities. The project team makes a holistic assessment of community needs, goals, and plans, incorporating meaningful stakeholder input. Project meets or exceeds important identified community needs and long-term requirements for sustainability. Remaining adverse impacts are minimal, mostly accepted as reasonable trade-offs for benefits achieved. The project has broad community endorsement. (A, B, C, D, E)	(25) Community renaissance. Through rehabilitation of important community assets (e.g., upgraded and extended access, increased safety, improved environmental quality, and additional infrastructure capacity) the project substantially reinvigorates the host and nearby communities. Working in genuine collaboration with stakeholders and community decision makers, the project owner and the project team scope the project in a way that elevates community awareness and pride. Overall quality of life in these communities is markedly elevated. (A, B, C, D, E, F)

DESCRIPTION

This credit addresses the extent to which the project contributes to the quality of life of the host and affected communities. This determination is based on how well the project team has identified, assessed, and incorporated community needs, goals, and objectives into the project. Relevant community plans are assumed to be a viable expression of those needs, goals, objectives, and aspirations. In a real sense, they are the community's expression of their desired quality of life.

Communication and interactions with community stakeholders are essential to reaffirm and improve the assessment. The project team works closely with community stakeholders to identify and address issues and concerns. When operational, the completed project is expected to contribute to the efficiency and effectiveness of community infrastructure while having minimal impact on the environment. Its benefits should be seen as equitably distributed throughout the community.

A project designed to benefit one community may have adverse effects on others. The purpose of this credit is to recognize projects that provide significant benefits to affected communities and reduce or eliminate negative impacts. Because positive effects on all dimensions of performance may not be practical, the credit seeks a net positive impact.

If the project team can show that the affected community (or communities) has an existing project assessment and approval process that verifies that the project is in concert with community goals and objectives and that the project has gone through that process successfully, then that success will constitute achievement of this credit. The level of achievement will be

determined by the project team and is a function of the comprehensiveness of the process, the extent to which community stakeholders are engaged in collaborative dialogue (rather than merely outside input to the process), and the degree to which improvements were made and/or adverse impacts mitigated.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team locates and reviews community plans, looking for possible project fatal flaws. The team complies with local regulations and policies for stakeholder involvement.

Performance Improvement: Give increased attention to community needs, goals, and plans as they relate to the project. Increase the thoroughness and participatory engagement by which community goals and plans are incorporated into the project. Give additional consideration to existing conditions and look for opportunities to rehabilitate community assets. Achieve strong endorsement by stakeholders and community leaders.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team identified and taken into account community needs, goals, and issues?

1. Lists and examples of documents obtained and reviewed; minutes of meetings with key stakeholders, community leaders, and decision makers; letters; and memoranda.

**METRIC:**

Measures taken to assess community needs and improve quality of life while minimizing negative impacts.

B. Has the project team sought to align the project vision and goals to the needs and goals of the host and affected communities?

1. Evidence showing a comparison of the project vision and goals to the needs, goals, plans, and issues of the community.

C. Has the project team sought to identify and address potential adverse impacts to the host and affected communities?

1. Comprehensive impact assessments conducted, identifying and evaluating the positive and negative impacts of the project on affected communities. Planned actions for mitigating adverse impacts.

2. Minutes of meetings, letters, and memoranda with key stakeholders, community leaders, and decision makers for obtaining input and agreement regarding the impact assessment and planned actions.

D. Have the affected communities been meaningfully engaged in the project design process?

1. Reports and documented results of meetings, design charrettes, and other activities conducted with representatives of affected communities.

2. Evidence of project processes for collecting, evaluating, and incorporating community input into the project designs. Demonstration of the thoroughness of the evaluation and incorporation to the designs.

3. Evidence showing the extent to which options were identified, and any needed, reasonable changes to the project made in accordance with community needs or plans.

E. Are the affected communities satisfied that the project is addressing their immediate and long-term issues, needs, and goals?

1. Acknowledgments and endorsements by the community that the design participation process was helpful and that their input was appropriately assessed and incorporated into project design.

2. Evidence of community satisfaction and endorsement of plans.

F. Have the project owner and the project team designed the project in a way that improves existing community conditions and rehabilitates infrastructure assets?

1. Plans, designs, and meeting minutes with community stakeholders and decision makers demonstrating an understanding of community conditions and assets and substantive efforts to rehabilitate.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.

RELATED ENVISION CREDITS

QL1.2 Stimulate Sustainable Growth and Development

QL1.3 Develop Local Skills and Capabilities

QL2.2 Minimize Noise and Vibration

QL2.3 Minimize Light Pollution

QL2.4 Improve Community Mobility and Access

QL3.1 Preserve Historic and Cultural Resources

QL3.2 Preserve Views and Local Character

QL3.3 Enhance Public Space

LD1.4 Provide for Stakeholder Involvement

LD2.2 Improve Infrastructure Integration

RA1.4 Use Regional Materials

NW1.3 Preserve Prime Farmland

QL1.2 STIMULATE SUSTAINABLE GROWTH AND DEVELOPMENT

INTENT:

Support and stimulate sustainable growth and development, including improvements in job growth, capacity building, productivity, business attractiveness, and livability.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Project only focus. Community growth and development is measurable but confined to the economic contribution of the delivery of a single project. The economics of the project are the only contribution to economic growth and development. That contribution primarily consists of jobs created during design and construction. (A)	(2) Significant and desirable development. The completed project contributes to community growth and development by adding a new operating capacity or increasing the quality of existing capacity. Capacity additions can apply to business and industry. They also can apply to the public in terms of cultural and recreational facilities and infrastructure. Additional jobs are created because of this development. (A, B)	(5) Improving local productivity. Additional access and increases in the number and quality of choices are sufficient to substantially increase local productivity. Need for repair or refurbishment of existing infrastructure is considered. Cost-effective access to business and industry-related infrastructure increases productivity. The completed project fosters an expansion of the local skill base. (A, B, C)	(13) Business and people attractiveness. The completed project is designed to contribute substantially to community attractiveness for compatible businesses and industries by improving the overall business environment. This may include increased productivity, cost-effective access to facilities and infrastructure, and enhanced cultural and recreational opportunities. People want to live and work in the community. (A, B, C, D)	(16) Developmental rebirth. During early development stages, the project owner and project team work with the community to identify existing community assets in the natural or built environment that, if restored, would improve the economic growth and development capacity of the community. The completed project improves attractiveness through restoration of existing infrastructure, including physical, knowledge, and social assets. It is adaptive to changing conditions. (A, B, C, D, E)

DESCRIPTION

This credit is designed to foster sustainable, long-term economic growth and development for the community that is in concert with established community goals. The overall objective is to create socioeconomic vitality and prosperity.

The goal of infrastructure projects is to contribute to the socioeconomic vitality and attractiveness of the community for both work and life. Such a community attracts business and industry for its productivity and livability. People want to reside in the community because of opportunity, culture, recreation, and security. Sustainable long-term growth and development requires an ability to adapt to changing economic conditions and a changing operating environment. Businesses want to relocate to the area because of the overall benefits and attractiveness.

Sustainable economic growth and development is not synonymous with expansion. Because of economic downturns, changes in demographics, and other factors, many communities face shrinking populations and an eroding tax base. In these situations, it may be more desirable to reduce the quantity of unused and abandoned housing, commercial buildings, and industrial facilities to reduce the associated burden of infrastructure operations and maintenance.

For this credit, projects are recognized for their contribution to what is termed “sustainable community growth and development”. This is growth and development that takes into account what is realistic and affordable and sets the community on an efficient path toward development and/or renewal. Communities are consolidated and reconfigured in ways that form

the nucleus for redevelopment. Infrastructure projects contribute to overall community attractiveness for businesses and people. Existing infrastructure is repaired, replaced, and/or refurbished on a schedule that is cost effective and aligned with community development goals. The alternatives considered are broad in scope, covering commercial, industrial, cultural, and recreational aspects of community development.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project is designed to simply meet the planning and regulatory requirements. No overall assessment of its contribution to sustainable community growth and development is made.

Performance Improvement: Expand focus from a project-only outlook to community-wide considerations. Make growth and development for businesses and people attractive through increased infrastructure efficiency and cultural/recreational resources. Seek to restore, redevelop, and repurpose community assets.

EVALUATION CRITERIA AND DOCUMENTATION

A. Does the project create a significant number of new jobs during its design, construction, and operation?

1. *Analyses showing new jobs that will be created from design, construction, and operation of the project.*

**METRIC:**

Assessment of the project's impact on the community's sustainable economic growth and development.

B. Does the completed project create new capacity or increase the quality of existing, operating, recreational or cultural capacity for business, industry, or the public?

1. *Report showing how the completed project expands the capacity or increases the quality of operating, recreational or cultural capacity.*
2. *Confirmation of the report results by references to official community plans, goals, needs assessments, minutes of meetings, or letters from community leaders, or decision makers.*

C. Does the completed project measurably improve community productivity?

1. *Analyses showing the effects of the completed project on local productivity, e.g., reduced congestion, lower operating costs, increased operating capacity, increased efficiency, and new operating alternatives.*

D. Does the project improve community attractiveness for compatible businesses and industries, improve recreational opportunities, and generally improve the socioeconomic conditions of the community?

1. *Demonstration of how the project improves community attractiveness for compatible businesses and industries, improves recreational opportunities, and generally improves socioeconomic conditions in the community.*
2. *Evidence showing how the project will improve the overall business environment (e.g., increased productivity; improved access to facilities and infrastructure; and increased alternative resources, facilities, and infrastructure).*

E. As part of the delivery of the completed project, does the project rehabilitate, restore, create, or repurpose existing community infrastructure assets in the natural and/or built environment, and, in doing so, improve community prospects for sustainable economic growth and development?

1. *Reports, minutes of meetings, and memoranda documenting efforts by the project team to work with the community in identifying community infrastructure assets, needs for improvement, prospects, and plans for growth and development.*
2. *Analyses showing how the project will improve community prospects for sustainable economic growth and development.*

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL1.3 Develop Local Skills and Capabilities

RA1.2 Support Sustainable Procurement Practices

RA1.4 Use Regional Materials

NW1.3 Preserve Prime Farmland

QL1.3 DEVELOP LOCAL SKILLS AND CAPABILITIES

INTENT:

Expand the knowledge, skills, and capacity of the community workforce to improve their ability to grow and develop.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Cost efficient. The project team commits to significant efforts to hire and train local workers as needed, mostly providing hiring specifications directed toward the construction contractor. Programs have articulated goals to meet or exceed industry sector averages. Training is to be done on an as-needed basis. Emphasis placed on hiring and training disadvantaged groups. (A)	(2) Hire locally. The project team makes commitments to broader programs within the project to bring on local firms and workers at higher skill levels. Local hiring is to extend beyond specifications to the construction contractor and into the project design team. Training and education is still proposed to be on an as-needed basis. It is not designed to build significant local skills or capabilities. (A)	(5) Specific skills outreach. The project team has developed and committed to affirmative outreach plans and programs to identify and hire local firms and workers at a broad range of skill levels. Education in some specialty areas will be provided when required. The project team makes an assessment of those educational needs and establishes the requisite education programs. (A)	(12) Local capacity development. The project team commits to working with the community to assess local employment and educational needs. Specific commitments are made to establish programs to hire and train local workers with an emphasis on minorities and/or other disadvantaged groups. Plans and commitments for hiring, training, and education as compared to community needs are proposed. (A)	(15) Long-term competitiveness. The project team commits to working with the local community to assess local employment and educational needs and to address future community competitiveness. Working with community leaders, programs are established to identify educational and employment needs and shortfalls. The team then works with the community to improve and retrofit the local skills base, thereby improving long-term competitiveness. (A, B)

DESCRIPTION

This credit addresses the degree to which the project improves both local employment and the skills mix during the project design, construction, and operation phases. At one end of the achievement spectrum, the owner, designer, and contractor commit to hire local workers mostly for the construction phase. At the other end, commitments to local hiring are established in all three phases, resulting in a more skilled and competitive workforce. Training and education programs are established in the project delivery phases to strengthen the skills base, with an emphasis on minority and/or disadvantaged groups.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Hiring and training of local workers or firms is strictly a cost decision and predominantly unskilled labor is used. Training is done as needed or as required by regulations and standards.

Performance Improvement: Shift from hiring local workers as needed to capacity building. More consideration of local employment, educational needs, and long-term workforce competitiveness.

EVALUATION CRITERIA AND DOCUMENTATION

- A. What is the expected degree to which the project will contribute to local employment, training, and education, with an emphasis on the most needy and/or disadvantaged groups through project planning, design, and construction?
 1. *Explanation of how the project team identified community employment, training, and worker education needs.*
 2. *Documentation of plans and commitments for hiring local workers for the project, including people from disadvantaged groups.*
 3. *Documentation of the extent and skill level of work planned for local firms.*
 4. *Documentation of the proposed skills mix of local project hires in relation to overall project employment.*
 5. *Statement of the ratio of proposed local hires to overall hires and the skills mix of local hires in relation to overall project hiring and employment.*
- B. How will the project contribute to long-term community competitiveness?
 1. *Documentation of proposed education and training programs to be developed and implemented, and an explanation of the extent to which these programs will address identified current and future community needs and improved community competitiveness.*

15 POINTS

QUALITY OF LIFE

PURPOSE



METRIC:

The extent to which the project will improve local employment levels, skills mix, and capabilities.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL1.2 Stimulate Sustainable Growth And Development

QL2.1 ENHANCE PUBLIC HEALTH AND SAFETY

INTENT:

Take into account the health and safety implications of using new materials, technologies, or methodologies above and beyond meeting regulatory requirements.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
<p>(2) Assessment of new requirements.</p> <p>In addition to the health and safety plans and programs put in place as required by law and regulation, the owner and the project team identify, assess, and institute new standards, methods, and procedures to address any additional risks and exposures created by the application of new technologies, materials, equipment, and methodologies. Requirements are passed down to the construction contractor in the form of construction specifications.</p> <p>(A, B, C)</p>			<p>(16) Excellence in all categories.</p> <p>The project team puts in place health and safety plans and programs that substantially exceed all applicable regulations. Explicit and comprehensive consideration given to the application of new technologies, materials, equipment, and methodologies and the corresponding new health and safety requirements and considerations.</p> <p>(A, B, C)</p>	

DESCRIPTION

This credit ensures that the owner and the project team take into account new health and safety issues that may arise because of the use of new materials and/or the application of new technologies and methodologies. After assessing the risks associated with using new materials, technologies, and/or methodologies, additional health and safety protocols should be added to address the additional risks. These new protocols need to be compatible with existing and accepted protocols.

Given the relative newness of many of the technologies and methodologies used to improve sustainable performance, the project team is expected to carry out additional assessments covering potential risks to public health and the environment and to project workers. Any significant risks that are discovered should be addressed in the project health and safety plans.

The project team must consult with government officials responsible for public and environmental health and safety. Together, they will review project plans and assess the risks and exposures associated with any new materials, equipment, processes, technologies, or methodologies to be used in the project. Health and safety plans and protocols should be adjusted to address the additional risks and exposures. A final compatibility check should be run to check overall protocol compatibility.

The addition of new and appropriate health and safety requirements, specifications, and protocols may require consultation and sign-off by environmental, health, and safety officials.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Project health and safety plans meet the minimum requirements. There is no additional consideration of new technologies and methodologies unless specified in applicable laws and regulations.

Performance Improvement: Increase the detail and comprehensiveness of the evaluation and risk assessment of all new and/or nonstandard technologies, materials, equipment, and methodologies to be used in the project. Institute appropriate changes in project design and construction to reduce the risk to public and worker health and safety to acceptable levels. Institute appropriate health and safety methodologies and protocols during construction.

EVALUATION CRITERIA AND DOCUMENTATION

A. Have the project owner and the project team assessed the exposures and risks created by the application of new and/or nonstandard technologies, materials, equipment, and methodologies to be used in the project?

1. *Reports documenting the assessment of the exposures and risks to public health and safety.*

**METRIC:**

Efforts to exceed normal health and safety requirements, taking into account additional risks in the application of new technologies, materials, and methodologies.

B. Have the project owner and the project team assessed and made appropriate changes to the project design to reduce the risk to public and worker health and safety to acceptable levels and received approval and sign-off by the appropriate environmental and public health and safety officials?

1. Documentation of where and the degree to which the project owner and the project team changed the design of the project to better protect public health and safety.

2. Evidence of approval and sign-off by appropriate environmental and public health and safety officials.

C. Have the project owner and the project team instituted the appropriate health and safety methodologies and protocols during construction?

1. Evidence that health and safety methodologies and protocols have been passed onto the constructor.

RELATED ENVISION CREDITS

QL2.6 Improve Site Accessibility, Safety, and Wayfinding

LD1.1 Provide Effective Leadership and Commitment

QL2.2 MINIMIZE NOISE AND VIBRATION

INTENT:

Minimize noise and vibration generated during construction and operation of the completed project to maintain and improve community livability.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Studies and predictions. Conduct baseline studies of existing levels of noise and vibration specified in the project for construction and operations. Predictions of levels of noise and vibration based on proposed project siting and design are produced. (A)			(8) Achieving acceptable levels. Proposals for mitigation of airborne and ground-borne noise and vibration to acceptable levels in the affected community are created based on studies and determination of the noise goals of the affected communities. Proposals are presented, approved, and incorporated into project designs. Project team sets construction specifications for noise and vibration limits. Programs to monitor noise and vibration during operation are established. (A, B, C)	(11) Creating quieter communities. The project is designed to reduce ambient noise in the area. As a result of the project, noise levels in the community have been substantially reduced below previous levels, and at least to affected community noise objectives. Specifications set for noise and vibration during construction take into account community needs. (A, B, C)

DESCRIPTION

“Noise” is defined as an unwanted or disturbing sound. It becomes unwanted when it interferes with normal activities or diminishes quality of life. Noise can have significant negative health effects, including hearing impairment, hypertension, and sleep disturbance. It can also reduce performance in cognitive tasks. Residential property values may be improved as a result of reduced ambient noise levels. Noise pollution can also interfere with animal communication, predator–prey relations, and mating habits, particularly among birds.

Permissible Sound Levels, dBA (7 AM – 10 PM, otherwise minus 5 dBA)					
Zone Categories of Source	Zone Categories of Receiver (measured at property line)				
		Residential	Open Space	Commercial	Industrial
	Residential	55	55	60	65
	Open Space	55	55	60	65
	Commercial	60	60	70	70
	Industrial	65	65	70	75
During all hours, the sound levels shall be decreased 5 dBA for narrow band or steady sound.					

Sample Target Noise Levels (Source: City of Portland, Oregon, Noise Control Ordinance, City Code and Charter, Title 18, Chapter 18, Section 18.10.010, Land Use Zones.)

Target noise levels are based on a cumulative period of 30 minutes or more. Noise measurements are taken at the nearest property boundary of the affected land use.

Proposals to mitigate noise and vibration from stationary and mobile sources are approved by local authorities and decision makers and incorporated into the design. Mitigation measures include the use of soundproofing, noise barriers, designs to locate mechanical equipment and other sources away from exterior spaces designed for use, and the use of innovative pavements designed to reduce traffic noise. For outdoor areas of occupancy, these measures provide for quieter outdoor spaces. The project team should measure ambient noise levels before initial design work. The team designs the project, giving extra attention to mitigating and eliminating sources of noise and vibration.

Specifications for minimizing construction noise and vibration should meet or exceed accepted local practices. Programs should include details on the expected sources of significant noise and vibration, how the effects of those sources will be minimized, how noise and vibration will be monitored, and what corrective actions will be taken if specified levels are exceeded. The construction contractor is expected to work with affected neighbors to develop construction plans as well as monitoring and corrective action programs.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No baseline studies and predictions of noise and vibration have been conducted unless required by regulations. Compliance with local

**METRIC:**

The extent to which noise and vibration will be reduced during construction and operation.

laws and regulations regarding construction noise; there are no proposed inspection and enforcement programs beyond stipulated requirements.

Performance Improvement: Shift from meeting standards and regulatory requirements to further reductions in ambient noise and vibrations, ultimately creating quieter communities.

EVALUATION CRITERIA AND DOCUMENTATION

A. Have appropriate studies been carried out to predict the levels of airborne, ground-borne, and structure-borne noise and vibration that will be present during construction and when the completed project is in operation?

1. *Noise and vibration studies and field monitoring, providing adequate baseline information and predictions of ambient noise and vibration levels during construction and operation.*
2. *Credentials and qualifications of the person(s) responsible for conducting baseline studies and predictions and developing the mitigation proposals.*

B. Have proposals for ambient noise and vibration mitigation and monitoring been made and incorporated into the project design to reduce noise and vibration to accepted standard target levels?

1. *Proposals for ambient noise and vibration mitigation and monitoring; proposals should be comprehensive in terms of coverage, detail, and the flow-down of requirements to the construction contractor.*

C. Has the project been designed to markedly reduce ambient noise and vibration to levels that substantially improve community livability?

1. *Analyses and documentation of estimates of ambient noise and vibration levels and comparisons to community needs and goals for livability.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.7: Provide views of vegetation and quiet outdoor spaces for mental restoration.

City of Portland, Oregon, Noise Control Ordinance, City Code and Charter, Title 18, Chapter 18, Section 18.10.010, Land Use Zones.

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 11.3.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

NW1.1 Preserve Prime Habitat

QL2.3 MINIMIZE LIGHT POLLUTION

INTENT:

Prevent excessive glare, light at night, and light directed skyward to conserve energy and reduce obtrusive lighting.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Cost savings focus. The project team conducts an overall assessment of lighting needs for the project. The team looks for opportunities to reduce or eliminate outdoor lighting based on potential cost savings. Appropriate measures are taken to prevent light spillage and glare in the design. Design specifications require the use of energy-efficient lighting and use of automatic turnoff of outdoor lighting during off hours. The design meets requirements for digital signage. Specify lighting requirements and limitations for the construction contractor. (A, B)	(2) Non-lighting alternatives. The project team makes additional reductions in the amount of lighting required by using nonlighting alternatives (e.g., clear signage and clearly painted roadway lines). The design reduces light-spillage effects and glare through strategies such as high barriers and planted trees and shrubs. (A, B, C)	(4) Cohesive zoning. The project team aligns the project with appropriate lighting zones and existing zoned districts. The team establishes lighting zones based on lighting needs balanced against the needs and limitations posed by sensitive environments and receptors. The team assesses street lighting needs and specifies the removal of unneeded street lighting. (A, B, C)	(8) Preserving the night sky. The project team performs an audit of lighting needs for all the areas affected by the project. The team assesses lighting needs and makes recommendations for overall lighting needs and reducing light spillage. The design specifies outdoor lighting with full cutoff lenses and reductions in lighting intensity for preserving the night sky. The team optimizes energy efficiency, considering time-of-day lighting needs and the use of energy-efficient lamps. (A, B, C)	(11) Restoring the night sky. The project team works with lighting experts to assess true lighting needs as well as areas where exterior lighting is directed upward. The team identifies more fully where, when, and to what levels lighting is needed to meet wayfinding, safety and other illumination requirements. The team identifies and appropriately reduces or eliminates lighting where existing lighting is negatively impacting dark sky conditions. Extensive use of appropriate time-of-day lighting schedule. Broad application of full cutoff lenses. Optimize energy efficiency and assess and optimize energy expenditures. Focus on reducing unnecessary upward illumination. (A, B, C)

DESCRIPTION

The red and purple glow that covers the sky and blocks out the stars in many densely populated areas is of concern for several reasons. The cumulative exterior light directed upward into the sky because of inappropriate lighting design represents a massive waste of energy. Light spillage also disturbs nocturnal animals and interferes with sensitive environments, including open space, wilderness parks and preserves, areas near astronomical observatories, and other light-sensitive habitats. Finally, the ambient light that blocks the stars from view is undesirable for human beings from both an aesthetic and health perspective. Light pollution has the potential to disrupt circadian rhythms and human sleep patterns, which may have numerous health implications.

Well-designed lighting can maintain adequate light levels on the ground while reducing light pollution by using lighting more efficiently. Many cities and communities may be using more light than is necessary and could benefit from a lighting-needs audit and assessment.

Design for reducing light spillage effects and glare can be accomplished through the application of full cutoff lenses that direct lighting to where it is needed. High barriers and planted trees and shrubs can also block light spillage effectively.

The Royal Astronomical Society of Canada has designated numerous Dark-Sky Preserves where artificial lighting is strictly controlled. Additional resources include the International Dark-Sky Association and UNESCO Starlight Reserves.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Compliance with local laws and regulations regarding light pollution, but not beyond what is required. Compliance with local laws and regulations regarding construction light pollution.

Performance Improvement: Incorporate nonlighting alternatives and rethink real lighting needs. Eliminate unnecessary lighting. Reduce glare and light spillage and increase the use of dark-sky-friendly lighting devices.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Has the project team conducted an overall assessment of lighting needs for the project?
 1. *Documentation of lighting assessments conducted for the project.*
 2. *Considerations of appropriate overall lighting zone levels.*
- B. Has the project team designed the lighting components of the project in a way that reduces lighting energy requirements?
 1. *Plans, drawings, and specifications showing the use of energy-efficient lighting, removal of existing but unneeded lighting, use of automatic turnoff systems, and application of nonlighting alternatives.*

**METRIC:**

Lighting meets minimum standards for safety, but does not spill over into areas beyond site boundaries or create obtrusive and disruptive glare.

C. Has the project team designed the lighting components of the project in a way that reduces or eliminates light spillage into sensitive environments and preserves the night sky?

1. *Plans, drawings, and specifications showing reductions in lighting intensity, the use of high barriers and planted trees and shrubs, and the use of full cutoff lenses.*
2. *Demonstration that signage for the constructed works will meet the following standards for digital signs, digital billboards, electronic message boards or displays, electronic message centers, and marquee signs and electronic display systems: during daylight hours between sunrise and sunset, luminance shall be no greater than 2000 candelas per square meter. At all other times, luminance shall be no greater than 250 candelas per square meter. There shall be no display movement such as twirls, swirls, blinking, video clips, or other forms of animation. Sign copy cannot change more than once per hour.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 11.5.

Municipal Research and Services Center of Washington, Light Nuisances—Ambient Light, Light Pollution Glare, www.mrsc.org/subjects/legal/nuisances/nu-light.aspx.

Royal Astronomical Society of Canada, www.rasc.ca/dark-sky-site-designations

International Dark Sky Association, www.darksky.org.

The New England Light Pollution Advisory Group, www.cfa.harvard.edu/nelpag/nelpag.html.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL2.6 Improve Site Accessibility, Safety, and Wayfinding

RA2.1 Reduce Energy Consumption

NW1.1 Preserve Prime Habitat

QL2.4 IMPROVE COMMUNITY MOBILITY AND ACCESS

INTENT:

Locate, design, and construct the project to ease traffic congestion, improve mobility and access, prevent urban sprawl, and otherwise improve community livability.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Limited coordination. <p>The project team recognizes the need and utility in providing access to adjacent facilities, amenities, and transportation hubs. Coordination with owners and operators of adjacent facilities, amenities, and/or transportation operators is limited. Design decisions are made internally within the project team. Despite attempts at coordination, design gaps in mobility and access are still significant. Concepts, approaches, and specifications for reducing negative impacts on mobility and access in the construction phase are limited.</p> <p>(A, B)</p>	(4) Satisfactory access. <p>The project team recognizes the need and utility for providing good access and mobility. The team obtains input from the operators of adjacent facilities, amenities, and transportation hubs. Design decisions are based, in part, on improved access and mobility. Design decisions also are based on coordination with operators of adjacent facilities, amenities, and transportation hubs. Principles and specifications for reducing negative impacts in the construction phase extend to adjacent facilities.</p> <p>(A, B)</p>	(7) Exceptional access and flow. <p>The project team expands considerations to anticipated traffic flows and volumes, preferred modes of access, and effects on mobility. Discussions are held with decision makers to optimize design choices. The project team works with decision makers in adjacent facilities and amenities and transportation hubs to determine the best modes of access. Designs based on anticipated traffic flows and transportation choices. Principles and specifications for reducing negative construction impacts emphasize substantially reduced impacts that are well beyond construction norms. Construction specifications direct the contractor to consider alternative modes of access (e.g., rail, water) to reduce road traffic. Also takes into consideration materials to be brought in and taken off site.</p> <p>(A, B, C, D, E)</p>	(14) More livable communities. <p>The project team expands the range of discussion. The team works with decision makers in adjacent facilities and also with local community officials. Design considerations have moved beyond access and flow issues and now address the reduction of traffic congestion, improvements in walkability in the community, and other key measures of mobility and access. The location of the project has been chosen to utilize and improve the existing transportation infrastructure. It incorporates a community transportation strategy. Principles and specifications for reducing negative construction impacts include strong programs for working with the affected community.</p> <p>(A, B, C, D, E, F)</p>	

DESCRIPTION

This credit reduces the impacts of the completed project on transportation, mobility, and access, thereby reducing congestion, improving traffic flow, and contributing to community livability.

If public access is required and the site and completed project is not located near existing public transportation, consider creating new links to public transport rather than relying on motorized vehicles providing access.

Use of alternate materials and sources that reduce the need for materials transport should be specified during construction. Alternative means of transportation (e.g., rail, water) and waste materials needing to be transported off site are considered in the delivery of construction materials.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Compliance with local laws and regulations. Conduct only conventional impact studies as required by regulation, with no particular efforts in the design to improve access or reduce congestion; use only conventional design standards for access.

Performance Improvement: Broader consideration given to coordination with adjacent facilities, amenities, and transportation hubs. Focus on reducing

traffic congestion and improving walkability; net improvement on community livability.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Have the expected impacts of the project on community access and mobility during construction and operation been properly and comprehensively addressed in the planning and design phase?
 1. *Assessment studies and reports addressing the effects of the constructed work on access and mobility.*
- B. Has the project team coordinated with owners and operators of adjacent facilities, amenities, and/or transportation hubs to address issues of mobility and access during operation of the constructed work?
 1. *Reports, memoranda, and minutes of meetings with managers and operators covering access to adjacent facilities, amenities, and transportation hubs.*
 2. *Records of decisions made and actions taken.*

**METRIC:**

The project improves access and walkability and reduces commute and traverse times to existing facilities and transportation. Improves user safety considering all modes of transportation (e.g., personal vehicle, commercial vehicle, transit, and bike/pedestrian).

C. Has the project team considered and incorporated the use of alternate modes of transport when feasible?

1. *Assessments of the availability, feasibility, and use of rail, water, nonmotorized transit, and pipeline access to ease congestion.*
2. *Changes made or not made to transportation modes and rationale.*

D. Has the project team developed plans and specifications to reduce traffic disruption during construction, including monitoring and corrective action?

1. *Specifications of requirements and procedures directed to the constructor.*
2. *Comprehensiveness of those specifications.*

E. Has the project team incorporated design strategies to address access and mobility concerns during operation (e.g., congestion, usage rates of existing transit infrastructure, and access to public transit and nonmotorized transportation)?

1. *Access and mobility principles, concepts, requirements, and specifications incorporated in the design, and expected outcomes.*

F. Has the project team expanded mobility and access considerations to include improvements to long-term transportation infrastructure efficiency, walkability, and livability?

1. *Reports, memoranda, and minutes of meetings with community officials covering the long-term mobility and access needs of the community.*
2. *Design components showing the extent to which long-term mobility and access needs and issues were incorporated into the constructed work.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 1.6: Select sites within existing communities.

Greenroads Manual v1.5, AE-5: Pedestrian Access, AE-6: Bicycle Access, AE-7: Transit and HOV Access, www.greenroads.us.

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 10.1.2, 10.1.3, 10.1.4, 10.2.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL2.5 Encourage Alternative Modes of Transportation

QL2.6 Improve Site Accessibility, Safety, and Wayfinding

QL2.5 ENCOURAGE ALTERNATIVE MODES OF TRANSPORTATION

INTENT:

Improve accessibility to nonmotorized transportation and public transit. Promote alternative transportation and reduce congestion.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Transit access. The location of the completed project encourages the use of transit or nonmotorized transportation (e.g., walking or cycling). The completed project is located within walking distance of pedestrian-accessible, multimodal transportation. Restrictions on parking of motorized vehicles is incorporated into the design. (A, B)	(3) Non-motorized or transit friendly. The completed project creates or offers convenient access to transit. The completed project is designed for convenience in movement to transit facilities. Extended contiguous trails and bicycle networks connect to the site and/or the completed project. (A, B, C)	(6) Non-motorized and transit friendly. The completed project is located in a place and configured in such a way that encourages the use of nonmotorized transportation and transit for access. The location selected is convenient to extended and contiguous walking and bike paths. Secure bicycle lockers are available. Facilities for users of the completed project incorporate appropriate support policies. (A, B, C, D)	12) Public transportation enhancements. The project enhances public transportation facilities or implements programs to encourage the use of public and nonmotorized transportation. Enhancements include provisions for sheltered and well-lit bus stops, tram stops, or transit access points. Enhancements also include effective display of information such as time and route of public transportation. (A, B, C, D, E)	(15) Reviving transportation options. The project is designed and constructed in a way that rehabilitates pathways, bike paths, rail and/or water modes of transportation that were unused and/or in disrepair and/or removes barriers to the use of alternative modes of transportation. The project integrates these underutilized assets to the existing transportation infrastructure and the larger transportation infrastructure strategy. (A, B, C, D, E, F)

DESCRIPTION

It is important to integrate the completed project to the existing public transportation network and incorporate improvements whenever possible and practical. An overdependence on cars and other motorized vehicles has had long-lasting and detrimental effects on cities. Widening streets and large areas of surface parking have caused cities to spread out, making movement more difficult for pedestrians, bicyclists, and those dependent on public transportation.

The completed project is located within walking distance to pedestrian-accessible, multimodal transportation facilities and parking of motorized vehicles is restricted.

Moreover, the completed project is located in a place that encourages the use of nonmotorized transportation for access. The location selected is convenient to extended and contiguous walking and bike paths. Secure bicycle lockers are made available. Facilities for workers in the completed project are designed to incorporate the appropriate support facilities. User policies are designed to encourage nonmotorized transportation.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Simple access to transit, walking, or bike paths.

Performance Improvement: Improved access and convenience for nonmotorized transportation. Design encourages the use of alternative modes of transportation.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Is the completed project located within walking distance and is it pedestrian accessible to multimodal transportation facilities?
 1. *Location and design drawings showing proximity and accessibility to transportation facilities. The generally accepted standard for walking distance is 0.5 miles or a 10-minute walk.*
 2. *Degree of convenience and accessibility.*
- B. Does the completed project and associated infrastructure restrict the parking of motorized vehicles?
 1. *Location and design drawings showing parking availability in and around the completed project.*
 2. *Parking spaces available relative to expected use of the completed project and availability of alternative transportation. Comparisons to other parking-restricted facilities and infrastructure.*
- C. Is the completed project and associated infrastructure designed for convenience in access to multimodal transportation facilities?
 1. *Location and design drawings showing bicycle and pedestrian walkways, trails, and networks that connect to the site and completed project.*
 2. *Convenience, quality, and safety of those walkways, trails, and networks.*

**METRIC:**

The degree to which the project has increased walkability, use of public transit, and nonmotorized transit.

D. Is the completed project configured and located so that users are encouraged to use nonmotorized transportation?

1. Location and design drawings showing that the topography is relatively flat with a network of walkways and bikeways converging on or near the completed project.

2. Availability of facilities and policies for the users.

E. Have the project owner and the project team, working with the community, developed programs to encourage the use of alternative modes of transportation?

1. Provision for sheltered and well-lit bus stops, tram stops, or transit access points.

2. Plans or documents showing effective display of information such as time and route of public transportation (kiosks, protected displays at bus stops, etc.)

F. Have the project owner and the project team upgraded and put to use underused pathways, bikeways, rail, and/or water modes of transportation that are unused, in disrepair, and/or have barriers to safe use?

1. Site plans showing pathways, bikeways, rail and/or water modes of transportation that are unused and in disrepair.

2. Design drawings and specifications for upgrading and incorporating these elements into the existing transportation infrastructure.

3. Design drawings showing the extent to which these elements will be upgraded and integrated to the existing transportation infrastructure.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 10.1.2, 10.1.3, 10.1.4.

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.5: Provide for optimum site accessibility, safety, and wayfinding.

RELATED ENVISION CREDITS

QL2.4 Improve Community Mobility and Access

QL2.6 Improve Site Accessibility, Safety, and Wayfinding

QL2.6 IMPROVE SITE ACCESSIBILITY, SAFETY, AND WAYFINDING

INTENT:

Improve user accessibility, safety, and wayfinding of the site and surrounding areas.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
	(3) Onsite wayfinding. Increase the ability of users and safety personnel to understand and safely access the completed project and the site. Provide signage and other guidance that makes it intuitive for users to orient themselves and navigate from place to place. (A, B)	(6) Additional safety and security. In addition to the site, the project makes additional efforts to improve the safety and security of its surroundings. This may include protecting sensitive sites (wetland, cultural sites, etc.) or, in populated areas, neighborhood safety and security. (A, B, C)	(12) Integration with surroundings. In addition to the site, the project takes notable steps to understand and reduce the project's negative impact on its surroundings. This may include protecting sensitive sites (wetland, cultural sites, etc.) or, in populated areas, neighborhood safety and security. Project enhances public safety. The completed project integrates well with the local community and its environmental and cultural resources. (A, B, C, D, E)	(15) Restoring safe neighborhoods. Beyond the accessibility, safety, and wayfinding aspects of the project, the changes made to the site and general vicinity of the completed project improve overall access and safety of the adjacent neighborhoods, providing an increase from previous levels. (A, B, C, D, E, F)

DESCRIPTION

The project is designed so users can find their way in and around the facility as well as nearby and related infrastructure. Wayfinding also has health and safety implications because it relates to the ability and ease of users and occupants to exit the facility and get out of harm's way in the event of an emergency. It also improves the ability of emergency personnel to access the facility and find their way in the event of an emergency.

During design, the project team considers impacts on surroundings and taking the following measures:

- Physical Safety
 - Improve the safety and accessibility of street crossings by providing universal access curb cuts, pedestrian crossing signs, and high-visibility crosswalks. Or, for major roads, provide pedestrian over/under passes.
 - Include traffic-calming measures in areas with heavy pedestrian or bicycle traffic.
 - Install physical barriers between sidewalks and street traffic exceeding 40 mph.
 - Design bike lanes to encourage bicycling by being as safe as possible. This may include separating bike lanes from street traffic. When designing street parking, consider the vehicle door swing if adjacent bike lanes are to be included.

- The design makes a clear distinction between publicly accessible space, where pedestrian traffic is encouraged, and restricted space, where it is not.
- Crime and Vandalism
 - Locate publicly accessible space to be as visible as possible from surrounding neighborhoods at night.
 - Design public space to have clear lines of sight internally and from major pedestrian traffic zones.
 - Install surveillance equipment to discourage crime and vandalism.
 - Design public space to integrate to the urban context and encourage pedestrian traffic.
 - Design site for easy public access to, from, and around the project with clear signage and wayfinding signals.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Only use conventional design standards for signage and wayfinding. Meet health and safety regulations applicable to site safety in wayfinding. Signage meets Manual on Uniform Traffic Control Devices and Americans with Disabilities Act requirements and other applicable standards.

Performance Improvement: Increasingly clear, identifiable, and intuitive design and signage for safe access and egress.

**METRIC:**

Clarity, simplicity, readability, and broad-population reliability in wayfinding, user benefit, and safety.

EVALUATION CRITERIA AND DOCUMENTATION

A. Have the project owner and the project team developed the appropriate signage for safety and wayfinding in and around the completed project?

1. *Design documents showing plans for access and egress and plans for signage showing how the design and signage is clear and intuitive for users.*

B. Have the project owner and the project team appropriately addressed safety and accessibility in and around the completed project for emergency personnel?

1. *Design documents showing plans for access and egress routes for emergency personnel, users, and occupants.*
2. *Effectiveness of the design for emergency situations.*

C. Have the project owner and the project team extended accessibility and signage to protect nearby sensitive sites (wetland, cultural sites, etc.) or, in populated areas, neighborhood safety and security?

1. *Design documents showing plans for accessibility to and protection of nearby sensitive and/or cultural sites.*
2. *Effectiveness of accessibility and protection.*

D. Have the project owner and the project team designed the project to have a net positive impact on public safety and security?

1. *Design documents and plans showing how the project will impact public safety and security.*

E. Does the completed project integrate well with the local community and its surroundings?

1. *Design documents and plans showing how the project will integrate with the local community and its environmental and cultural resources.*

F. Have the owner and the project team incorporated features into the project design that restore and improve overall access and safety in adjacent neighborhoods?

1. *Design documents and plans showing how the project has restored safety and access in adjacent neighborhoods.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 10.1.2, 10.1.3, 10.1.4.

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.5: Provide for optimum site accessibility, safety, and wayfinding.

U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices.

RELATED ENVISION CREDITS

QL2.4 Improve Community Mobility and Access

QL2.5 Encourage Alternative Modes of Transportation

QL3.1 PRESERVE HISTORIC AND CULTURAL RESOURCES

INTENT:

Preserve or restore significant historical and cultural sites and related resources to enhance community cultural resources.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Initial efforts. The project team works with the community and required regulatory and resource agencies to identify historic and cultural resources in and around the project site and develop approaches to avoid, minimize, and mitigate impacts to those resources. A feasibility analysis is conducted to understand the feasibility and practicality of incorporating preservation and enhancement to the project. (A, B)		(7) Stakeholder consultation. Potential stakeholders are consulted early in the project's development. Opportunities to preserve and protect cultural and heritage sites are taken based on feasibility. The project team works with historic/cultural stakeholders to develop a sensitive design approach. (A, B, C)	(13) Preservation and conservation. The project is designed to fully preserve the character-defining features of that resource. The project is developed in close coordination with all stakeholders and likely will involve a variety of interests ranging from local, state/provincial, national, public, regulatory, nonprofit, and private interests. (A, B, C)	(16) Conservation and restoration. The project is designed to fully preserve the character-defining features of that resource and enhances the resource in a significant manner. Examples may include rehabilitation in accordance with the Secretary of Interior Standards, restoration of lost features such as a historic landscape or green spaces, upgrade and expansion of recreational facilities, or a publicly accessible educational or museum site in accordance with historic/cultural stakeholder wishes. (A, B, C, D)

DESCRIPTION

This credit addresses the need to preserve and enhance historic and cultural resources. Historic and cultural resources include both architectural and archeological resources as well as tribal cultural properties. In the United States, these resources are protected by the following broad federal statutes: the Antiquities Act and the National Historic Preservation Act. However, those authorities are limited to federal agency actions. Other jurisdictions may have promulgated their own preservation laws. Communities also may have additional local ordinances. Similarly in Canada, historic resources are regulated at the federal, provincial, and municipal levels including the Alberta Historical Resources Act and the Ontario Heritage Act as well as others.

It is important to note that preservation of historic sites and cultural resources might conflict with a community's efforts to consolidate and reduce the costs of maintaining the community's excess infrastructure.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Action does not result in either preservation of or a net benefit to historic and/or cultural resources.

Performance Improvement: Project teams increase efforts to understand community needs and opportunities for preservation, protection, and enhancement. Owners increase flexibility in terms of incorporating protection and preservation elements to the project. Preservation and conservation shifts to restoration and enhancement of cultural and heritage sites.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Has the project team worked with the community and required regulatory and resource agencies to identify historic and cultural resources?
 1. *Reports, memoranda, and minutes of meetings with the community and required regulatory and resource agencies to identify historic and cultural resources.*
- B. Has the project team conducted a feasibility analysis to determine the feasibility of incorporating preservation or enhancement of these resources to the project?
 1. *Documentation of a feasibility analysis or documentation that conflicts with a community's efforts to consolidate and reduce the cost of maintaining excess infrastructure have been addressed and resolved.*
- C. Has the project team worked with historic/cultural stakeholders to develop a sensitive design and approach with the goal of avoiding all historic/cultural resources or fully preserving the character-defining features of that resource?
 1. *Location and design drawings of efforts to mitigate impacts or demonstrating that the site avoids impacting any cultural resource.*
 2. *Design documents of all mitigation efforts in the design.*

**METRIC:****Summary of steps taken to identify, preserve, or restore cultural resources.**

D. Has the project team given special consideration to enhancing or restoring historic/cultural resources?

1. *Documentation of efforts to enhance or restore existing historic and cultural resources.*
2. *Documentation that work was done in collaboration with historic or cultural preservationists to ensure that restoration does not damage the quality of the existing historic and/or cultural resource.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 3.2.1, 5.1.1.

Section 106 of the National Historic Preservation Act.

Alberta Historical Resources Act, www.qp.alberta.ca

Ontario Heritage Act, www.mtc.gov.on.ca

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL3.2 Preserve Views and Local Character

QL3.3 Enhance Public Space

QL3.2 PRESERVE VIEWS AND LOCAL CHARACTER

INTENT:

Design the project to maintain the local character of the community and to not negatively impact community views.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Understanding and balance. A public view plan is developed and the project adheres to existing policies and regulations regarding its fit with local character. The plan takes into consideration the preservation of natural landscape features. Balances the need for safety measures and barriers against the desire for protection or enhancement of views. (A, B, C)	(3) Alignment with community values. As part of the stakeholder consultation process, the project team identifies community values and concerns regarding protection and enhancement. Based on evaluations, the project team submits a plan for how views will be protected and enhanced, important natural landscape or community features are preserved, and the overall placement in landscape or urban context is considered. Aesthetic quality of the project beyond regulations is considered. (A, B, C, D)	(6) Community preservation and enhancement. A public view plan implemented with little to no deviation. Contract includes clauses on the preservation of high-value landscapes and landscape features. This includes the handling of onsite trees, vegetation, and other features. Project implements significant measures to fit with local character. (A, B, C, D, E)	(11) Community connections and collaboration. The project team assists the local community to establish or enhance the regulations, policies, and standards on view corridors, views from public/open spaces, views of features associated with community identity, or natural features. Fit with local character is considered a key aspect of the project and alternatives are developed and implemented in collaboration with community stakeholders. Significant efforts are made in siting the project and during design and construction to preserve landscape features. (A, B, C, D, E, F)	(14) Restoration of community and character. Where appropriate, the owner seeks to improve the local character of the natural landscape or urban fabric through restorative action as part of the project. This may include removing barriers, structures, or vegetation to restore views; restoring lost or damaged natural landscape features; and designing the project to restore lost character features within the community. (A, B, C, D, E, F)

DESCRIPTION

It is important that a project's design reflect its context. This includes both preserving views and fitting in with local character. The criteria may change depending on the context, but the goals remain the same. For example, in a rural setting, the project may need to be sensitive to views, or vistas, of natural landscapes and prominent features. Design features can fit with local character by reflecting the importance of natural surroundings. In urban settings, projects likewise seek to maintain important view corridors and to avoid blocking views from previous development. The project also seeks to fit in with the local urban character, reflecting traditional streetscapes, materials choices, height limitations, etc.

In fulfilling this credit, project teams minimize the impact on natural or community features, including rock formations and cutting of trees and other vegetation. Designs take into account either the natural or urban local character in terms of landform or levels, materials, plantings, style/detailing, scale, and landscape/townscape. Special consideration should be given to identify and prevent negative impacts to views. Designs should be in accordance with community goals and plans to protect view corridors, views from public or open spaces, and views of features strongly associated with the identity of the city or community.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team has some limited consideration of local landscape or urban character, but only to ensure that the project will not be a disharmonious imposition on the local landscape. No consideration is

given to views or view corridors unless required. The project team achieves minimum compliance with laws and regulations for adverse impact to landscape features and for any protected features, trees, and so on.

Performance Improvement: Shift from minimizing impacts to preservation and restoration. Expand planning to be more comprehensive, taking stakeholder input into account.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Has the project team made a reasonable determination of the local character of the project setting?
 1. *Plans, drawings, and reports identifying important elements of the site character including landform or levels, views, natural landscape features, materials, planting, style/detailing, scale, and landscape/townscape pattern.*
 2. *Existing policies and regulations regarding public views and design guidelines relevant to the project.*

**METRIC:**

Thorough efforts to identify important community views and aspects of local landscape, including communities, and incorporate them into the project design.

B. Has the project team developed or adopted existing public view plans and design guidelines to preserve important view sheds and local character?

1. *An inventory of all natural landscape features to be protected.*
2. *An inventory of all view resources to be protected.*
3. *A plan for addressing public views in the project design. Plans include identification and location of the areas to be protected, identifying compatible land use, setting development standards, and establishing policies for inappropriate development and land use.*
4. *Design guidelines written for the project to preserve public views and important natural landscape features and to generally fit with the local character and context of its surroundings, whether urban or rural.*

C. Does the final design preserve views and local character, taking into account community plans and guidelines for views and local character?

1. *Reports, drawings, plans, or images demonstrating how the final project design addresses each of the identified views, natural landscape features, and elements of local character.*

D. Has the project team worked with local officials, communities, and decision makers to obtain input and alignment with views and local character?

1. *Reports, memoranda, and minutes of meetings with local officials and decision makers regarding local policies and regulations.*
2. *Reports, memoranda, and minutes of meetings with local officials and decision makers to identify views, natural landscape features, and important local character traits.*
3. *Reports, memoranda, minutes of meetings with local officials and decision makers demonstrating their involvement in developing design guidelines or their approval of the final design guidelines for views and fit with local character.*

E. Does the construction contract include clauses on the preservation of high-value landscapes and landscape features, including stated penalties for noncompliance and programs to inspect outcomes and to enforce?

1. *Contract clauses regarding the preservation of high-value landscapes and landscape features.*
2. *Documentation describing penalties for noncompliance.*
3. *Programs for monitoring and enforcement*

F. Has the project team aided local communities in developing or improving local policies and regulations regarding views and fit with local character?

1. *Report documenting any efforts to aid local communities in developing more comprehensive policies and regulations regarding views and fit with local character.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 3.1.4, 3.2.

Greenroads Manual, v1.5, 2011, Access & Equity, AE-8 Scenic Views

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL3.1 Preserve Historic and Cultural Resources

QL3.3 Enhance Public Space

NW1.2 Protect Wetlands and Surface Water

NW1.3 Preserve Prime Farmland

NW1.6 Avoid Unsuitable Development on Steep Slopes

NW1.7 Preserve Greenfields

QL3.3 ENHANCE PUBLIC SPACE

INTENT:

Improve public spaces including parks, plazas, recreational facilities, or wildlife refuges to enhance community livability.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) No adverse effects. Project team works with the community, property owner and required regulatory and resource agencies to identify public space resources and develop possible solutions. Feasibility analysis done for incorporating preservation, enhancement, or the creation of new spaces into the project. Project is designed such that it results in no long-term adverse effects and may include mitigation. Project may result in minor temporary impacts. (A, B)	(3) No Impact to resources. Project team works with the community, property owner and required regulatory and resource agencies to develop avoidance solutions. Focus is on no impact to resource. The project has no significant permanent impact to the resource. Temporary impacts are minimized. Consideration is given to the creation of new public space. (A, B)	(6) Improvement and enhancement. The project team identifies and implements meaningful enhancement or the creation of new public space. The project team works with stakeholders (users, regulatory agencies, and the resource owner) to develop a sensitive design. Official with jurisdiction over the resource must concur in writing with impact assessment, both for temporary and permanent impacts. (A, B)	(11) Overall net benefit. Examples include creating new space or facilities, addition of recreational facilities to an existing resource, and/or significantly improving access for current and future users. Stakeholder satisfaction with planned efforts and outcomes. Official with jurisdiction over the resource must concur in writing with impact assessment, both for temporary and permanent impacts. (A, B)	(13) Substantial restoration. Restoration of existing plazas, parks, recreational areas, or wildlife refuges is delivered. Examples may include restoring hiking trails, pavilions, or athletic fields. Urban contexts may include opening previously private space to public access or restoring existing public space. Stakeholder satisfaction with efforts and results. Official(s) with jurisdiction over that resource must concur in writing with impact assessment, both for temporary and permanent impacts. (A, B, C)

DESCRIPTION

Opening space whenever possible to community activity is helpful in gaining acceptance by local communities, educating the public about sustainable infrastructure, reducing crime, and encouraging healthy and vibrant neighborhoods. Public space can be in either urban or natural settings and may include, but is not limited to, parks, plazas, recreational facilities, and wildlife refuges. For natural settings such as parks and wildlife refuges, “public” refers to space accessible for human recreation and enjoyment. The preservation of habitats and species biodiversity is addressed by credits in the Natural World category. Infrastructure designs that open public space must take into account and mitigate any significant increases in risk to the public.

This credit applies to all publicly owned parks, recreational areas, and wildlife refuges, or such privately owned resources where there is significant and formalized public access that is specifically outlined in the written management plans and/or legal agreements of those privately owned resources.

An action is a net benefit if it results in the overall enhancement of the significant activities, features, and attributes of a park, recreational area, or wildlife refuge. The official(s) with jurisdiction over that resource must concur in writing that the proposed project will indeed result in a net benefit to that resource. Specific attention is given to enhancements that improve security and crime safety during various times of the day. Allowing clear sight lines, increasing human activity, and improving site quality and safety may help reduce crime and improve the greater community as a whole.

The official(s) with jurisdiction represent the entity that has control over the operation or governance of that resource. The official is often the owner, but also may include additional entities, as is the case with leases, trusts, and other legal agreements.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The action has no particular effect, positive or negative, regarding the preservation or improvement of public space. No efforts to identify, preserve, or enhance other than what is required by local laws or regulations.

Performance Improvement: Maintenance and preservation shifts to enhancement and restoration.

**METRIC:**

Plans and commitments to preserve, conserve, enhance, and/or restore the defining elements of the public space.

EVALUATION CRITERIA AND DOCUMENTATION

A. Will the project add to public space (e.g., parks, plazas, recreational facilities, or accessible space in wildlife refuges) in a way that significantly enhances community livability?

1. *Studies and assessments of the impact of the project on existing public space.*
2. *Design documents describing any new public space developed as part of the project.*
3. *Reports documenting determination of benefits, improvements, negative impacts.*
4. *Reports documenting determination of risks to public health and safety.*

B. Are the public agencies and other stakeholders satisfied with the project plans involving public space?

1. *Acceptance by the appropriate public agencies.*
2. *Letters, memoranda, and minutes of meetings with stakeholders showing stakeholder satisfaction.*

C. Will meaningful and beneficial restoration efforts be undertaken?

1. *Plans and drawings showing the scope and extent of any restoration efforts to be made on public space.*

SOURCES

CEEQUAL Assessment Manual for Projects, Version 4, December 2008, Roger K. Venables, Sections 3.2.1, 5.1.1.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL3.1 Preserve Historic and Cultural Resources

QL3.2 Preserve Views and Local Character

NW1.2 Protect Wetlands and Surface Water

QL0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

To reward exceptional performance beyond the expectations of the system and application of innovative methods that advance state-of-the-art sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
<p>(+8) Innovate or exceed credit requirements.</p> <p>Projects clearly document a performance that far exceeds both industry norms and the existing requirements within the system. Projects may also demonstrate the innovative application of methods, technologies, or processes that are novel either in their use, application, or within the local regulatory or cultural climate.</p>

DESCRIPTION

This credit addresses special instances in which projects far exceed the performance requirements of a credit or innovate in a way that advances the industry and the field of knowledge. These points are not calculated in the overall applicable points and, therefore, act as bonus points. Given the nature of the credit, the broad format of which is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Projects may pursue points for innovation or exceptional performance.

Exceptional Performance

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For instance, projects seeking additional points in credit QL3.1 Preserve Historic and Cultural Resources must already be achieving a restorative impact on existing cultural resources. In this instance, exceptional performance may be pursued by projects whose magnitude of preservation and investment in restoration represent a significant percentage of the project budget and a primary objective of the project.

Exceptional performance constitutes achieving a remarkable increase in performance. This would be a multiple-factor increase in efficiency or effectiveness in one or more credits. Possible areas of achievement in exceptional performance for Quality of Life may include, but are not limited to, the following:

- Projects for which job development and training far exceed the Restorative achievement expectations, demonstrating that the project will fundamentally revitalize the communities' economy through job creation and skilled training;
- Projects for which net positive impact on public space exceeds small-scale parks and plazas to include large parks or reserves, recreational facilities, or urban spaces that represent a significant contribution to the quality of the community;

- Project whose impact will fundamentally change the ability of community residents to access and use sustainable means of transportation on a large scale.

Innovation

To qualify for innovation points, projects must demonstrate achievement in at least one of the following goals:

- Overcoming significant problems, barriers, or limitations—Project teams demonstrate that they have reduced or eliminated significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project;
- Creating scalable and/or transferable solutions—Project teams demonstrate that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.

Project teams may use innovative technology, methods, or application (e.g., the use of a pre-existing technology in a new way or the successful application of a technology or methods in regions or locales where existing policies, regulations, or general opinion have prevented their use). In these circumstances, it is imperative to prove that the application of the technology does, and will continue to, meet performance expectations and that it does not have a corresponding negative impact on the local or global environment, economy, or community.

Projects may demonstrate they implement innovative technologies or methods in several ways:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs;
- The project uses technologies or methods that may be general practice in other regions or parts of the world, but within the unique context of the project (whether climate, regulations, policies, political support,

**METRIC:**

Whether project achievement qualifies as exceptional performance or innovation.

public opinion, etc.) have not yet gained acceptance. Significant efforts are taken to demonstrate the effectiveness of the technology or method within the context and provide a precedent for future adoption.

- The project team takes significant steps to include research goals within the project's development, or work with a university or research organization to advance the general knowledge of the profession. Proprietary research that is not made publicly available cannot count toward achieving this credit.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Any action that is already documented as an evaluation criteria for credits within the Quality of Life category.

Performance Improvement: Exceed evaluation criteria for the highest levels of achievement or implement innovative methods in meeting infrastructure needs that are not addressed within the system.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project exceeded the highest levels of achievement for a given credit?

1. *Detailed documentation of how the project exceeds the existing requirements currently within a given Quality of Life credit.*

B. To what extent does the project implement innovative technologies or methods?

1. *Documentation of the application of innovative technologies or methods. Detailed description of how this application will improve existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered innovative either as a technology, a method, or within the project context (climate, political, cultural, etc.).*

C. To what extent does the project overcome significant problems, barriers, or limitations or create scalable and/or transferable solutions?

1. *Documentation that the project reduces or eliminates significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project.*
2. *Documentation that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.*

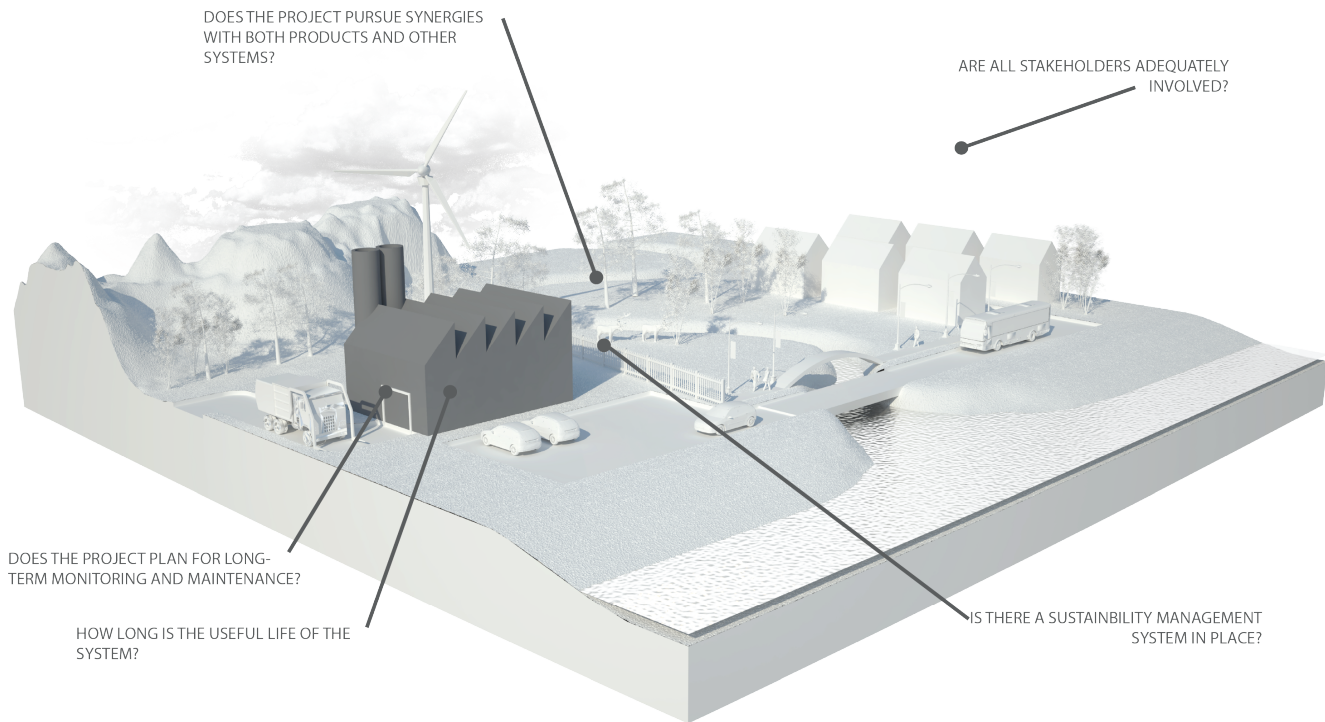




LEADERSHIP



LEADERSHIP



LEADERSHIP

Successful sustainable projects require a new way of thinking about how projects are developed and delivered. Project teams are most successful if they communicate and collaborate early on, involve a wide variety of people in creating ideas for the project, and understand the long-term, holistic view of the project and its life cycle. This section encourages and rewards these actions under the view that, together with traditional sustainability actions such as reducing energy and water use, effective and collaborative leadership produces a truly sustainable project that contributes positively to the world around it. This category is divided into the three subcategories of Collaboration, Management, and Planning.

COLLABORATION

Sustainable projects must include input from a wide variety of stakeholders to fully capture synergies, savings, and opportunities for innovation. This type of collaboration requires a new level of leadership and commitment from the project team and new ways of managing the process. Rather than each part of the team working alone on their own piece of the project, teams should meet and communicate, allowing stakeholders to contribute ideas and perspectives.

MANAGEMENT

A broader comprehensive understanding of the project can allow the team to see and pursue synergies between systems, either within the project or among larger infrastructure systems. This requires a new way of managing and understanding the project as a whole, but can reduce costs, increase sustainability, expand the useful life of the project, and protect against future problems.

PLANNING

Taking a long-term view of the project can also greatly increase the sustainability of the project. Understanding planning issues, such as the regulatory environment in which the project is being pursued and future growth trends in the area, can lead to a project that avoids pitfalls and plans effectively for its own future. This can reduce costs and streamline the entire project process.



1 COLLABORATION

- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Establish a Sustainability Management System
- LD1.3 Foster Collaboration and Teamwork
- LD1.4 Provide for Stakeholder Involvement

2 MANAGEMENT

- LD2.1 Pursue By-Product Synergy Opportunities
- LD2.2 Improve Infrastructure Integration

3 PLANNING

- LD3.1 Plan Long-Term Maintenance and Monitoring
- LD3.2 Address Conflicting Regulations and Policies
- LD3.3 Extend Useful Life

- LD0.0 Innovate or Exceed Credit Requirements

LD1.1 PROVIDE EFFECTIVE LEADERSHIP AND COMMITMENT

INTENT:

Provide effective leadership and commitment to achieve project sustainability goals.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Limited commitment. General sustainability policy statements can be found in organizational literature, but are not extensive. Existence of public statements by the organization's leadership about their commitment to sustainability, but not related to the specific project. A few substantive examples of how that commitment to sustainability principles translates into actual practice. (A)	(4) Better clarity and commitment. Commitment to sustainability has moved beyond general statements to more specific statements. Organizational demonstration of commitment is backed up by several, but not extensive, examples of activities undertaken and performance achieved. (A)	(9) "Walking the talk." Significant commitment across the organization with a few exceptions. Improvement programs are underway. Organizational demonstration of commitment includes various examples of activities undertaken or performance achieved focused on this project. Commitment is backed up by numerous and wide-ranging examples of activities undertaken and performance achieved. Sustainability performance of the organization is reported regularly through annual reports. (A)	(17) Sustainability is a core value. Sustainability is a core value of the organization and the project team as demonstrated by their policies, activities, and performance. Apparent full commitment by all parties to address all aspects of the triple bottom line as they apply to the project. Understanding of the issues and problems associated with sustainability. Explicit recognition of the need for action to address the consequences of operating in a nonsustainable environment. (A)	

DESCRIPTION

The effects and consequences of not being sustainable are changing the design assumptions and variables used in infrastructure design and construction. Strong leadership is required to manage the extraordinary challenge of changing design norms to contribute to long-term conditions of sustainability. Furthermore, strong leadership can inspire future projects (as well as future leaders) in sustainability, especially if leaders demonstrate how easy sustainable projects can be.

This credit provides incentives for establishing sound and credible management and leadership to adequately and competently address issues surrounding sustainability. The community will be better served with project teams led and managed by people and organizations that have a strong commitment to the principles of sustainability and have demonstrated the ability to effectively incorporate them into projects.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No specific policy statements regarding sustainability or commitments to improve triple bottom line aspects of the project. Published statements proclaim that the organization will meet all requirements.

Performance Improvement: Shift from tactical to strategic commitment. Sustainability becomes a core value of the individual organizations and the project team.

EVALUATION CRITERIA AND DOCUMENTATION

- A. To what level and extent have the project owner and the project team made public commitments, both organizational and project specific, to improve sustainable performance?
1. *Public statements by leadership in the project owner's organization and leadership of the project team regarding their commitment to the principles of sustainability.*
 2. *Written commitment by the project owner and the project team to address the economic, environmental, and social aspects of the project at each project stage. For large projects, evidence that a chartering session was conducted that included the project owner, designer, contractor, and operator, with a charter document agreed to and signed by all parties.*
 3. *Examples of published sustainability reports and organizational principles and policies regarding sustainability.*
 4. *Examples of past or ongoing significant actions taken to improve sustainable performance.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 1.1.1, 1.1.2.



METRIC:

The project owner and project team demonstrate meaningful commitment to the principles of sustainability and sustainable performance improvement.

RELATED ENVISION CREDITS

QL2.1 Enhance Public Health and Safety

LD1.2 Establish a Sustainability Management System

LD1.3 Foster Collaboration and Teamwork

LD1.4 Provide for Stakeholder Involvement

LD1.2 ESTABLISH A SUSTAINABILITY MANAGEMENT SYSTEM

INTENT:

Create a project management system that can manage the scope, scale, and complexity of a project seeking to improve sustainable performance.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Sparse mechanisms. The sustainability management system contains a number of business processes and mechanisms for managing the sustainability aspects of the project, including ecological aspects. However, detail is limited and is not sufficient to match the scope and scale of the project, nor is it adequate to manage the complexity or the potential changes expected in the operating environment. Roles and responsibilities for addressing sustainability are not well defined or are limited in scope. Sustainability positions are at a low level in the organization. (A, B, C, D, E)	(4) A basic plan. A good but still incomplete sustainability management system. The system contains some of the important elements of a system to address sustainability issues, but the system is incomplete and/or is insufficient to manage the level of change and complexity associated with the project. Some important but not mission-critical elements are missing. Roles and responsibilities for the sustainable aspects of the project are better defined at appropriate levels in the organization. Concerns are in the lines of authority and responsibility. Some conflicts. Actual ability to affect change adequately is not clear. (A, B, C, D, E)	(7) "Plan-do-check-act." The project management plan contains a sufficient set of business processes and management controls to address most any issue. Systems are mostly complete, but fall short of a full sustainability management system. Mechanisms are present and sufficient for the project, but are not necessarily robust and able to handle change. For the most part, a member(s) of the project team have been assigned the appropriate roles and responsibilities of the position(s). The roles and responsibilities of the person(s) assigned to manage the sustainability aspects of the project are well defined, and their authority on the project to affect change is sufficient. (A, B, C, D, E)	(14) Full implementation. Full sustainability management system in place. Plan-do-check-act business processes are more than sufficient. The system is robust, having a number of different mechanisms sufficient to manage change and handle project complexities. The system can sufficiently address changes in the design variables (e.g., changes in expected averages, variances, and plausible extremes). Authority and responsibility for sustainability are at high levels in the project team organization. Single point responsibility for the sustainability aspects of the project. There is a high degree of clarity for how the sustainability aspects of the project will be addressed. (A, B, C, D, E)	

DESCRIPTION

A sustainability management system is a system that enables an organization to set goals, objectives, and policies; instigate plans and programs; review performance against a plan; and take corrective actions across the full dimensions of sustainability. At this juncture, sustainability management systems tend to be environmental management systems that also incorporate social performance considerations. International Organization for Standardization (ISO) 14004, a guideline on environmental management systems, provides guidance on converting an environmental management system to a sustainability management system. Sustainability management systems differ from environmental management systems because they cover the economic and social aspects as well as the environmental aspects of performance.

Establishing a sustainability management system starts with the creation of a sustainability policy that defines the scope of the project and the project team's commitment to sustainable performance improvement. The policy covers project stakeholders, including affected communities and project suppliers and contractors. The policy commits the project team to meeting or exceeding all health and safety standards and improving social and ethical performance. This policy can be a pre-established policy created by the project owner, agreed to by the project team, and customized for the project to the extent required.

To create the sustainability management system, the project team should develop a list of all the environmental, economic, and social aspects of the project that relate to sustainability. Once established, the list of aspects is prioritized by the project team based on the importance of meeting both project and sustainability goals.

Once prioritized, the project team creates an action plan consisting of objectives and performance targets for achieving those goals. Project and business processes should be established to periodically review and assess performance against the action plan and to take the necessary corrective actions.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No specific mechanisms or business processes have been put in place to manage the project's sustainability issues, impacts, or opportunities.

Performance Improvement: Incorporate specific business processes to manage sustainability issues, impacts, and opportunities. Increase management system comprehensiveness to match the project scale and complexity and the need to manage change. Increasing system completeness and effectiveness in meeting sustainability goals and objectives.

**METRIC:**

Organizational policies, authorities, mechanisms, and business processes that have been put in place and the determination that they are sufficient for the scope, scale, and complexity of the project.

EVALUATION CRITERIA AND DOCUMENTATION

A. Are the project roles, responsibilities, and authorities for addressing the issues of sustainability for the project clearly assigned and sufficiently delegated?

1. *Organizational charts and documentation showing the persons responsible for project sustainability issues, their position in the project organization, and their authority to make project decisions and affect change.*

B. Has the project team created a sustainability management policy commensurate with the scope, scale, and complexity of the project?

1. *Degree of completeness of the project's sustainability management policy document.*
2. *Coverage of project stakeholders, including the affected communities as well as project suppliers and contractors.*
3. *Commitment of the project team to meeting or exceeding all health and safety standards and improving social and ethical performance.*
4. *Definitive commitment to achieving improvements in sustainable performance as documented in project plans and in the project's sustainability objectives and targets.*

C. Have the project owner and the project team assessed and prioritized the environmental, economic, and social aspects of the project and set project sustainability goals, objectives, and targets appropriate for the affected communities?

1. *Assessment of the environmental, economic, and social aspects relevant to the project.*
2. *Assessment of the potential for extraordinary changes in these aspects because of existing unsustainable conditions.*
3. *Prioritized list of project goals, objectives, performance targets that take into account project importance and the consequences of change.*
4. *Alignment of goals, objectives, and targets to community needs and issues.*

D. Is the system sufficient in scope and does it contain an adequate set of mechanisms and business processes to manage the project and achieve the project's objectives and targets?

1. *Documentation of the project's business processes and management controls in the form of procedures, flowcharts, checklists, and other documented control measures.*

E. Is the project sustainability management system sufficient to manage extraordinary change in environmental operating conditions or key design variables?

1. *Documentation showing that broad and robust business processes and management controls are in place.*
2. *Documentation for addressing the potential for extraordinary change in expected averages, variances, and plausible extremes in key design variables.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 1.2.1, 1.2.2, 1.2.3, 1.2.4, 4.1.3

ISO 14004 Environmental Management Systems

RELATED ENVISION CREDITS

LD1.1 Provide Effective Leadership and Commitment

RA1.5 Divert Waste from Landfills

LD1.3 FOSTER COLLABORATION AND TEAMWORK

INTENT:

Eliminate conflicting design elements and optimize the system by using integrated design and delivery methodologies and collaborative processes.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Random acts of sustainability. No particular process or methodologies to incorporate sustainability into the design. Sustainability features are added as opportunities arise. The owner and the project team have expressed a desire to improve sustainable performance, but the approach taken is not systematic. "Green" features are added to the project, but in a relatively haphazard fashion. (A)	(4) Taking a systems view. The project team approaches the project as a system or set of systems interconnected with other systems. The owner and the project team recognize the importance of addressing infrastructure projects in the context of the entire community or city infrastructure. The resulting systems view is seen as important to optimizing the overall performance of the community/city infrastructure. (A)	(8) Sustainable design as a team sport. The project owner and the project team recognize the importance of working together as a team to achieve high levels of sustainable performance. Team chartering sessions are to be conducted with the owner and the multidisciplinary project team. Project management processes are collaborative. Design charrettes are to be held and involve a broad set of stakeholders. The project owner is willing to share risk and rewards with the project team, recognizing that achieving higher levels of performance may involve incorporation of new and relatively untried technologies. (A, B)	(15) Whole systems design and delivery. Whole systems design processes, procedures, and methodologies are incorporated into the overall project delivery process. The multidisciplinary project team works together to find ways to improve sustainable performance commensurate with the owner's goals and objectives, technical feasibility, costs, and appetite for risk. Design considerations include reducing sources of demand, using recycled and/or renewable resource supplies and excess resources generated within the system, and eliminating design conflicts and duplicate functions or unnecessary redundancies. Risk/reward sharing is part of the owner's contract with the design team. (A, B)	

DESCRIPTION

This credit provides incentives for, and recognition of, owner and project team collaboration in the delivery of the completed project. In conventionally delivered projects, project team members tend to work as independent entities, focusing on delivering their portion of the project mostly in isolation from other members. Integrated project delivery brings project team members together early in the planning and design stages to understand how their design assumptions and decisions positively or negatively affect the work of others. This includes members of the project team who are traditionally involved later in the project (e.g., constructor, commissioning agent). Working separately, performance is suboptimal, confined to individual project components. Working together as an integrated team, performance can be optimized across the entire project.

At advanced levels of achievement, the project team explores ways to improve performance and reduce costs by using whole system design methodologies. Design considerations include reducing sources of demand, using recycled and/or renewable resource supplies, using excess resources generated within the system, eliminating design conflicts, and eliminating duplicate functions or unnecessary redundancies.

Design charrettes are used during design development to foster an environment for project innovation. The design team works together to identify opportunities to improve sustainable performance. Commissioning

functions are brought in early in the design process to ensure that project components and systems will function as intended.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Teamwork is not a dominant component in project delivery processes. The team members' primary objective is meeting project requirements, client expectations, and avoiding claims and litigation. The project is delivered by different task groups that mainly work independently.

Performance Improvement: Shift from a task view to a systems view of project design and delivery. Increasing recognition of the importance of working together as a collaborative team, including the project owner. Incorporation of true and effective risk/reward sharing between the project owner and the project team.

**METRIC:**

The extent of collaboration within the project team and the degree to which project delivery processes incorporate whole systems design and delivery approaches.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project team incorporated the principles of collaboration, teamwork, and whole systems design in the execution of the project?

1. *Documentation of the multidisciplinary project team's business processes and management controls in the form of procedures, flowcharts, checklists, and other documented control measures.*
2. *Documentation of the planned use of design charrettes to identify opportunities for improving sustainable performance and reducing design conflicts.*
3. *Documentation of the planned use of whole systems design processes to optimize project performance.*

B. To what extent has meaningful risk and reward sharing been made part of the contract between the project owner and the project team?

1. *Existence of risk and reward sharing terms in project contract documents.*

RELATED ENVISION CREDITS

LD1.1 Provide Effective Leadership and Commitment

LD1.2 Establish a Sustainability Management System

LD1.4 PROVIDE FOR STAKEHOLDER INVOLVEMENT

INTENT:

Establish sound and meaningful programs for stakeholder identification, engagement, and involvement in project decision making.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
<p>(1) Information transfer.</p> <p>A limited program is established for stakeholder communication and information transfer. Programs provide a basic exchange of information about the project. Lines of communication are established. There is some community involvement, but it is limited. There is feedback to the community, but it is essentially a summary of community input. Some planning and commitment to action exists. Actions are taken based on input received.</p> <p>(A, B)</p>	<p>(5) Active engagement and dialog.</p> <p>Communication with and feedback from project stakeholders and the affected public are important elements of the project. A lead person from the project team works with stakeholder groups to understand communication needs and the desire for, and scope of, involvement. Active engagement and dialogue is planned. The feedback received is compared to impacts to the project. Actions taken are based on a combination of stakeholder feedback and practical project considerations.</p> <p>(A, B)</p>	<p>(9) Open to a wider community.</p> <p>Engagements expand to a wider community, including people and relevant groups that are affected by, or have an interest in, the project. There is frequent communication with the public and stakeholders throughout significant project phases. Feedback is obtained through solid, credible programs for obtaining stakeholder and community feedback. Feedback is assessed and applied to project decisions. Actions taken are based on community/stakeholder feedback and are modified by feasibility and practicality. Public and stakeholder groups see sufficient and credible opportunities for involvement in project decision making. The project team demonstrates to stakeholders and the public that the public participation process is transparent and that they have an opportunity to provide meaningful input.</p> <p>(A, B, C)</p>	<p>(14) Community relationship building.</p> <p>Communication programs and exercises are designed to develop relationships with key stakeholders and give them involvement in the project decision-making processes. Solid, credible programs are established for soliciting feedback from the public and key stakeholders regarding communications and public involvement in the project decision-making processes. The project can demonstrate specific and significant case(s) in which changes were made based on feedback. Given the likely broad array of issues and positions, the project team not only focuses on obtaining meaningful input, but also making the process for project decisions fair and equitable. Built properly, these relationships can assist in breaking project logjams. Feedback programs are designed to give complete credible feedback regarding the communications and public involvement processes. Project decisions incorporate fairness and equity.</p> <p>(A, B, C, D)</p>	

DESCRIPTION

This credit rates the sufficiency of the public input process established by the owner and the project team. Relationship building among the public and key stakeholders is an important component of the engagement process. A public participation process is set up to identify and engage key stakeholders in project decision making. Key stakeholders include members of the communities that are affected by the project.

Stakeholder engagement involves a process for informing stakeholders of the scope and content of the project, identification of stakeholder issues and concerns, soliciting and collecting feedback, and incorporating that feedback to the design, construction, and operation of the completed project.

While stakeholders can help an organization identify the relevance of particular issues to its activities, stakeholders do not replace broader society in determining norms and expectations. For example, a particular issue may be relevant to a project even if it is not specifically identified by the stakeholders consulted by the organization. Relevant public concerns

and expectations are not defined as the summary of stakeholder issues and discussions.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Public input is limited to what is required by regulation and statute or local policies. The majority of the communication is primarily one way and promotional. Its focus is to provide information about the project, promote project benefits, and to reveal (perhaps minimizing) negative impacts along with how negative impacts will be reduced or eliminated. Programs for soliciting feedback are handled more as requirements and obligations than as sources of meaningful input.

Performance Improvement: Information exchange shifts to active stakeholder engagement and dialogue, there is more community involvement and transparency in project decisions, and the project shifts to an ongoing community relations program.

**METRIC:**

The extent to which project stakeholders are identified and engaged in project decision making and both stakeholders and decision makers are satisfied with the involvement process.

EVALUATION CRITERIA AND DOCUMENTATION

A. What is the scope and extent to which key stakeholders have been identified and characterized and key concerns and issues identified?

1. Lists of stakeholder groups identified as key compared to total potential.

2. Statement of rationale for selection.

B. To what extent has the project team solicited and assessed stakeholder issues and concerns through meetings and information exchanges?

1. Letters, memoranda, notes, and minutes of meetings with stakeholder groups.

2. Documentation of the concerns and issues of key stakeholders.

3. Policies and business practices that ensure fair and equitable assessment and action.

C. To what extent have the project owner and the project team incorporated stakeholder input into project plans and decision making?

1. Documentation of stakeholder input provided and resulting project decisions made.

D. Have stakeholder participation and communication programs been established on the project to facilitate stakeholder communication and feedback?

1. Documentation of a planned or operating stakeholder involvement program for the project.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 12.1, 12.2, 12.3.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

LD1.1 Provide Effective Leadership and Commitment

LD2.1 Pursue Byproduct Synergy Opportunities

CR2.2 Avoid Traps and Vulnerabilities

LD2.1 PURSUE BY-PRODUCT SYNERGY OPPORTUNITIES

INTENT:

Reduce waste, improve project performance, and reduce project costs by identifying and pursuing opportunities to use unwanted by-products or discarded materials and resources from nearby operations.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Casual search and diversion. Identification and characterization done on a limited set of nearby facilities and waste streams. Candidate facilities and by-product possibilities are identified, but little work is done assessing the potential. Availability of excess resources and/or energy unclear. A general assessment (primarily on paper) is conducted. Studies and assessments are made and managers of nearby facilities may be contacted. However, identification and screening efforts are limited. A few obvious by-product synergy possibilities are identified. (A, B)	(3) Affirmative program. Owner and project team management demonstrate an appetite and inclination to address by-product synergy opportunities. Efforts to identify candidate facilities and by-product possibilities are broad and reasonably comprehensive. More aggressive searching and screening of opportunities. An assessment is done in some depth. Facilities and possibilities are identified, but contact with facility decision makers to assess the potential is inconsistent. (A, B, C)	(6) Opportunity foresight and pursuit. Broad and comprehensive efforts to identify managers of nearby facilities who may have by-products or discarded materials that can be used on the project. Assessment done in sufficient depth to determine possibilities. Decision makers are contacted and good prospects are pursued. Systematic assessment is done. Availability of excess resources, energy, or other possible synergies is clearly identified. Research is put into regional by-product synergy projects. Aggressive searching and screening of opportunities. (A, B, C)	(12) Opportunity pursuit and capture. Aggressive searching for by-product synergy possibilities is a significant project element. The owner and project team understand the principles of industrial ecology. Facility decision makers are identified and contacted to assess the potential and relationships are developed. Active discussions are conducted with managers of nearby facilities to pursue by-product synergy opportunities. Constructive discussions with regulatory agencies, policy, or standard-setting organizations regarding potential conflicts with regulations, policies, and standards. Considerations in forming relationships with nearby facility managers to implement industrial ecology practices (i.e., a long-term supply of facility by-products for use in the operation of the completed project). The team has one successful by-product synergy application. (A, B, C, D)	(15) Additional synergy opportunity captures. Successful negotiation with managers of nearby facilities for securing two or more of their unwanted by-product supplies. Material supplies can be for short-term project construction or for long-term operation of the completed project. (A, B, C, D)

DESCRIPTION

By-product synergy involves identification and cost-effective use of unwanted materials located near the project. Making use of these materials can be accomplished in two ways. By identifying the existence of materials useful in construction, the project team can work with the owners to obtain those materials, thereby reducing the cost of the project. By identifying the existence of materials useful in operation, the project team can also work with owners and reduce the cost of operations. In the latter instance, the project owner may become part of a local by-product synergy project in which wastes from one facility can become feedstock for another. The by-product synergy project will implement a process in which participants exchange information about wastes or by-products that are generated as well as feedstock needs.

Following the principles of industrial ecology, the project team also considers the development of long-term relationships with nearby facilities, such as cogeneration facilities, for the supply of unwanted by-products for use during operation of the completed project.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Identification, assessment, and use of unwanted by-products from nearby facilities are not considered. There are no efforts to look for opportunities to obtain by-products or discarded materials and resources from nearby operations.

Performance Improvement: More systematic efforts to identify unwanted by-product materials that could be used on the project, and more aggressive searching and screening of opportunities. Opportunity identification advances to opportunity screening and development. Focus on searching and screening shifts to relationships developed with nearby facilities. Successful use of unwanted by-product(s) on the project.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent did the project team search for and identify unwanted by-products or discarded materials located in nearby facilities?

1. *Records and documentation of contacts and searches made in nearby facilities as compared to the total number of potential opportunities.*

**METRIC:**

The extent to which the project team identified project materials needs, sought out nearby facilities with by-product resources that could meet those needs, and captured synergy opportunities.

B. How detailed was the assessment of their potential for use on the project either in the design and construction stage or in operations?

1. Scope and details of assessment processes used and assessments made.

C. To what extent did the project team pursue promising by-product synergy opportunities?

1. Records of by-product synergy opportunities identified, assessed, and pursued. Results of pursuits documented.

D. Did the project team achieve success in making use of unwanted by-products or discarded materials on the project either in the design and construction stage or in operations?

1. Documentation of successful by product synergy opportunity capture and application.

RELATED ENVISION CREDITS

LD1.4 Provide for Stakeholder Involvement

RA1.5 Divert Waste from Landfills

LD2.2 IMPROVE INFRASTRUCTURE INTEGRATION

INTENT:

Design the project to take into account operational relationships among other elements of community infrastructure that results in an overall improvement in infrastructure efficiency and effectiveness.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Narrow optimization focus. Project performance improvements in the triple bottom line, including resource conservation and use of renewable resources. Protection of environmental, economic, and social systems are substantive, but are confined to individual components. Individual gains are present, but are suboptimal because of the lack of component integration. Little or no exploration of synergies among components. (A)	(3) Internal systems focus. Project owner and designer look at the project and its delivered works as a system. Triple bottom line project performance improvements are significant because of efforts to optimize performance across the entire project and its delivered works. Efforts are made to integrate the design, to eliminate design conflicts, and to find system synergies that enhance overall performance. (A)	(7) Infrastructure bundling and synergies. Project is planned and designed with other related community infrastructure taken into account (i.e., how its design and operation will work in harmony with other infrastructure elements external to the project). Additional investments are planned to create linkages and improve synergies and, by doing so, improve overall performance. Infrastructure deficit (i.e., need to repair and refurbish existing infrastructure) is factored in. (A, B)	(13) Full infrastructure integration. The project owner and designer place the project in a community context and participate in multisectoral regional strategic planning for integrated community sustainability plans. They assess the existing community's physical infrastructure as well as its nonphysical assets. Project is planned and designed to take into account not only physical infrastructure, but also related community infrastructure. The project incorporates and takes advantage of valuable community assets (e.g., knowledge and social capital). The project integrates with the community's asset management program. (A, B)	(16) High performance through restorative actions. Early in project development, the project owner and project team work with the community to identify existing community assets in the natural or built environment that, when restored, would improve the economic growth and development capacity of the community. The project incorporates restoration of those assets as part of a comprehensive strategic sustainability plan. The project takes into account other related community infrastructure as well as sustaining and/or restoring community assets to enhance overall community efficiencies and effectiveness. There is integration with, and restoration of, natural systems, resources, community knowledge, and social capital assets. (A, B, C)

DESCRIPTION

Optimal infrastructure performance integrates all infrastructure elements at the community level. Therefore, each new or renovated element of infrastructure ideally is designed and constructed to take into account how that element of infrastructure will link with, support, and act in harmony with other existing and planned infrastructure elements. For example, the addition of a new roadway, if not designed properly, will increase stormwater flows and may overwhelm existing stormwater management systems.

Priority is given to the repair and replacement of existing infrastructure that is currently in poor condition because continuing degradation could be harmful, cause additional inefficiencies, and increase repair or replacement costs disproportionately. Project planning efforts assess opportunities for improving linkages and compatibilities with other infrastructure elements to improve overall efficiencies and effectiveness. Strong consideration is given to restoring existing community infrastructure assets. Preservation and use of natural system functions and resources is also factored into project plans and designs.

The intended result is an improvement in access to resources and/or facilities; an increase in the flow of information, goods, and services; and/or overall improvement of local efficiencies.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: All considerations of linkages are conventional. Sustainability issues, linkages, and connectivity are not considered.

Performance Improvement: Shift from optimization of individual components to system optimization and ultimately integration with related systems and infrastructure in the community. Increase focus on restoration of facilities and infrastructure.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent did the project team seek to improve project sustainability performance through project-wide systems integration?

1. *Design documents showing improvements made and the degree to which these improvements were integrated with other community infrastructure elements.*

**METRIC:**

The extent to which design of the completed project integrates with existing and planned community infrastructure and results in a net improvement in efficiency and effectiveness.

B. Has the project team sought to improve sustainable performance of infrastructure through community-wide infrastructure systems integration?

1. Documentation of the extent to which the project design explicitly brought other community infrastructure projects and designs into consideration.

C. Has the project team sought to restore existing community infrastructure assets for the purpose of achieving higher performance through community-wide infrastructure systems integration and restoration?

1. Documentation of project plans to restore existing infrastructure and integrate it to project design.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

LD3.2 Address Conflicting Regulations and Policies

RA1.5 Divert Waste from Landfills

CR2.2 Avoid Traps and Vulnerabilities

LD3.1 PLAN FOR LONG-TERM MONITORING AND MAINTENANCE

INTENT:

Put in place plans and sufficient resources to ensure, to the extent practical, that ecological protection, mitigation, and enhancement measures are incorporated into the project and can be carried out.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Plan outline. A limited outline of the maintenance and monitoring plan exists, extending monitoring and maintenance activities beyond regulatory requirements. If positions are identified, authorities for effective implementation are unclear. No resources or skills in place before the end of construction. (A, B)	(3) Working plan. Owner has developed a working plan for long-term monitoring and maintenance and has identified personnel and resources to make it happen. (A, B)		(10) Comprehensive long-term plan. A comprehensive maintenance and monitoring plan has been prepared well in advance of project completion. The owner recognizes that attention to implementation during early stages is important to ensure that resources are available and that the personnel assigned understand their responsibilities. (A, B)	

DESCRIPTION

An important component of the design step is to establish plans and resources for long-term monitoring and maintenance of the completed project. This activity ensures that the design performance will be maintained throughout the design life of the project. The project owner provides sufficient resources and personnel to implement the plan.

In addition, clear and concise maintenance requirements and specifications are provided to prevent sustainable performance degradation resulting from the failure to follow specified operations or maintenance procedures required to maintain system performance. This type of regression is also known as “backsliding”. Without clear guidance on what is required to maintain sustainable performance, future owners and operators may rely on old approaches, processes, and replacement parts simply out of ignorance or convenience.

Monitoring programs provide accurate and timely information that will be used for performance assessment. Skills and resources are available to ensure that the ecological features of the project are nurtured to full fruition during the early years of operation. A comprehensive long-term plan is prepared and in place before the end of construction.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No clear plan for long-term monitoring and maintenance is in place.

Performance Improvement: Develop a long term monitoring and maintenance plan and allocate sufficient resources to implement the plan.

Improve completeness and comprehensiveness of the plan and resource sufficiency to implement the plan.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Is there a clear and comprehensive plan in place for long-term monitoring and maintenance of the completed project?
 - 1. *Plans for long-term monitoring and maintenance of the completed project, including requisite access to completed and operating works.*
 - 2. *Monitoring and maintenance plans include assessments that the completed project is functioning as designed and that environmental impacts are within design parameters.*
- B. Have sufficient resources been allocated for monitoring and maintenance of the completed project?
 - 1. *Designations of the persons or organizations assigned to monitor and maintain the completed project.*
 - 2. *Explanation of how funding will be allocated, set aside, and maintained at sufficient levels to fund necessary monitoring and maintenance.*
 - 3. *Documentation or plans showing that these resources will be in place following delivery of the project.*



METRIC:

Comprehensiveness and detail of long-term monitoring and maintenance plans, and commitment of resources to fund the activities.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008,
Roger K. Venables, Section 4.5.1.

RELATED ENVISION CREDITS

RA1.7 Provide for Deconstruction and Recycling

RA2.3 Commission and Monitor Energy Systems

RA3.3 Monitor Water Systems

NW1.3 Preserve Prime Farmland

CR2.2 Avoid Traps and Vulnerabilities

LD3.2 ADDRESS CONFLICTING REGULATIONS AND POLICIES

INTENT:

Work with officials to identify and address laws, standards, regulations, or policies that may unintentionally create barriers to the implementation of sustainable infrastructure.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Initial search. Basic searches and assessments are conducted. Applicable regulations are identified and there is some effort to correlate requirements to sustainability objectives. Responsible regulators and organizations are identified but identification is not complete; primarily a general assessment. (A)	(2) More investigation. Systematic assessment of the laws, regulations, policies, and standards applicable to the project. Regulating and standard-setting groups and the decision makers within those groups are identified. The owner and the project team assess potential conflicts, devise alternatives, and set priorities. Resolution of those conflicts is sought at all levels of the regulating or standard-setting organization. (A, B)	(4) Increased resolve. Extensive and more complete assessment of the laws, regulations, policies, and standards applicable to the project that unintentionally run counter to sustainability goals, objectives, and practices. The owner and the project team approach decision makers, identifying conflicts over current laws, regulations, policies, and standards that run counter to efforts to improve sustainable performance. Resolution of those conflicts is sought at all levels of the regulating or standard-setting organization. (A, B)	(8) Collaborative resolution. Extensive assessments conducted, but with an eye toward structural change. Laws, standards, regulations, and policies that unintentionally run counter to sustainability objectives and practices are addressed broadly with the intent of changing overall approaches and philosophies. The owner and the project team offer a view of how overall design and construction standards and practices need to be changed to address new problems arising from sustainability issues. (A, B)	

DESCRIPTION

Many laws, regulations, policies, and standards were formulated in a different era, well before sustainable development was an important issue. For example, the use of greywater for certain purposes is not allowed by many regulation and/or building codes. This may force designers and builders to use potable water for applications in which lower-quality water may be sufficient. Additionally, certain standards regarding construction materials require the use of virgin materials as opposed to recycled materials. This requirement has a sound foundation in that the properties of the recycled counterparts may be unknown or highly variable compared to virgin materials.

Changing laws and regulations that restrict more sustainable practices can be difficult. For instance, until July of 2009, rainwater harvesting was illegal in the state of Colorado based on state laws on surface and groundwater ownership. Today, rainwater harvesting is legal but subject to significant restrictions. The law was changed in part because of a study that found that 97% of the precipitation in Colorado never makes it to streams or groundwater. Rather, it is taken up by plants or evaporates. Rainwater harvesting can only be done by residents who have well permits and for whom no municipal sources of water are available. Examples such as this one show that while some laws may make sustainable development difficult, it is possible to change laws and lower restrictions.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Laws, regulations, policies, or standards of practice affecting the project are taken as a “given” regardless of their intended purpose or compatibility with sustainability goals and objectives.

Performance Improvement: Increasing scope and more systematic assessment. Shift from conflict identification and resolution on individual projects to broader relief and structural change.

EVALUATION CRITERIA AND DOCUMENTATION

A. What is the scope, extent, and assessment of negative impacts from conflicting regulations and policies?

1. *Documentation of activities to find applicable laws, standards, regulations, and/or policies with requirements that appear to be unintentionally running counter to sustainability goals, objectives, and practices.*
2. *Documentation of the efforts to assess their impact on project sustainability performance.*



METRIC:

Efforts to identify and change laws, standards, regulations, or policies that may unintentionally run counter to sustainability goals, objectives, and practices.

B. What is the extent to which the project team worked with regulators to mitigate the negative effects?

1. Letters, memoranda, and minutes of meetings with regulatory agencies set up to identify and resolve issues and the results of those efforts.

2. Documentation of resolutions achieved.

RELATED ENVISION CREDITS

LD1.4 Provide for Stakeholder Involvement

CR2.3 Prepare for Long-Term Adaptability

LD3.3 EXTEND USEFUL LIFE

INTENT:

Extend a project's useful life by designing a completed project that is more durable, flexible, and resilient.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Marginal extensions. Marginal incursion into project life cycle. Nothing beyond construction. Considerations of flexibility, durability, and resilience are minimally considered. (A)	(3) Nudging the boundaries. A few directed extensions in the design addressing flexibility, durability, and resilience. More specific considerations to extending the useful life of the project. The project team expands considerations beyond the point of project delivery. Together, they seek to expand the useful life of the delivered project by adding additional considerations of functionality that are useful to the owner, such as durability, flexibility, resilience, and ease of upgrading and expansion. (A, B)	(6) Pushing the boundaries. Project owner and designer push boundaries to improve overall performance across the useful life of the project. Project owner, working with the designer, expands considerations to encompass future owners. Flexibility features are added to the design for future alternative uses. Expanded consideration of durability, flexibility, and resilience. Use materials that are easily adaptable for changing configurations, retrofits, or repairs. Focus is mostly on areas of short-term payback. (A, B, C)	(12) Extending the boundaries. The project team has broad latitude to explore ways to extend the useful life of the project. The project team uses that latitude to expand opportunities to add to the project's useful life, improve durability, flexibility, and resilience, and ease retrofitting and repair. The project includes investment in areas of both short and long-term payback. (A, B, C)	

DESCRIPTION

This credit offers additional scores for project teams who extend the useful life of a completed project. Credit is given for designing the project in a way that adds flexibility to the completed project, enabling easy reconfiguration and refurbishment. Credit is also given for enhancing durability and resilience to the design. The principle behind this credit is that the longer the useful life of the completed project, the less it will need to be replaced, substantially reducing the energy, water, and materials required for a rebuild.

In fulfilling this credit, the project team should design the project in a way that makes the completed project more durable and resilient to extend its useful life. Designs should add flexibility to the completed project to enable refurbishment and reconfiguration and further extend its useful life. For instance, many cities are looking for ways to alleviate congestion with excessive traffic volumes hurting local economies and diminishing productivity. However, the original designs of these systems may not have accounted for additional capacity.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project stays within traditional project boundaries and little effort is made to specify materials and equipment or to design the project in a way that extends its useful life.

Performance Improvement: Expand the scope to include more life cycle elements beyond construction, moving outside normal owner considerations of functionality. For example, incorporate flexibility into the design to increase the possibilities for alternative future uses.

EVALUATION CRITERIA AND DOCUMENTATION

- A. To what extent have the owner and project team considered ways to extend the durability, flexibility, and resilience of the project early in the planning and design stage to extend the useful life of the completed project?
 1. Documentation showing how the elements intended to add durability, flexibility, and resilience throughout the useful life of the project were incorporated into the design.
 2. Documentation showing the specification of durable materials and how these improve upon industry norms.
 3. Documentation showing how implementation elements were placed into construction contracts, and operations and maintenance procedures.
- B. To what extent have the owner and project team considered the ability for future expansion or reconfiguration?
 1. Documentation of how the overall design will allow for expansion, reconfiguration, or multiple uses.
- C. Have the owner and project team conducted a feasibility study to determine areas for potential long-term cost savings in regard to designing for future expansion, reconfiguration, durability, reduced maintenance, etc.?
 1. Results of the feasibility study identifying key areas where increasing investment in extending useful life will offer a reasonable payback.



METRIC:

The degree to which the project team incorporates full life-cycle thinking in improving the durability, flexibility, and resilience of the project.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 1.4.1.

RELATED ENVISION CREDITS

LD2.2 Improve Infrastructure Integration

RA1.3 Use Recycled Materials

RA1.7 Provide for Deconstruction and Recycling

CR2.1 Assess Climate Threat

CR2.3 Prepare for Long-Term Adaptability

CR2.4 Prepare for Short-Term Hazards

LD0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

To reward exceptional performance beyond expectations of the system as well as the application of innovative methods that advance state-of-the-art sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
<p>(+6) Innovate or exceed credit requirements.</p> <p>Projects clearly document a performance that far exceeds both industry norms and the existing requirements within the system. Projects may also demonstrate the innovative application of methods, technologies, or processes that are novel either in their use, application, or within the local regulatory or cultural climate.</p>

DESCRIPTION

This credit addresses special cases in which projects far exceed the performance requirements of a credit or innovate in a way that advances the industry and the field of knowledge. These points are not calculated in the overall applicable points and, therefore, act as bonus points. Given the nature of the credit, the broad format of which is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Projects may pursue points for innovation or exceptional performance.

Exceptional Performance

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For instance, credits seeking additional points in credit LD2.1 Pursue Byproduct Synergy Opportunities must already have conducted a thorough investigation into the potential recycling sources for the project's byproducts. In this case, projects that not only implement a byproduct recycling program with other facilities but with a magnitude of byproduct diversion representing a significant effort and investment by the owner may pursue exceptional performance. Projects also may pursue this credit if new and innovative uses are found for byproducts formerly considered unusable or nonrecyclable waste. Exceptional performance may not be pursued by projects whose basic primary function meets the requirements. For instance, a recycling facility is excluded from innovation in byproduct or waste diversion unless it implements innovative methods that far exceed the industry norm in efficiency.

Exceptional performance constitutes achieving a remarkable increase in performance. This would be a multiple-factor increase in efficiency or effectiveness in one or more credits. Possible areas of achievement in exceptional performance for Leadership may include, but are not limited to, the following:

- Projects in which byproducts are used on a large scale in a novel way either in construction or operation of the project. This application must have the potential to be adopted in other related projects;

- A project whose integration to existing infrastructure systems was key to leveraging multiple-factor increases in efficiency at a scale far beyond the project boundaries.

Innovation

To qualify for innovation points, projects must demonstrate achievement in at least one of the following goals:

- Overcoming significant problems, barriers, or limitations—Project teams demonstrate that they have reduced or eliminated significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project;
- Creating scalable and/or transferable solutions—Project teams demonstrate that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.

Project teams may use innovative technology, methods, or application (e.g., the use of a pre-existing technology in a new way, or the successful application of a technology or methods in regions or locales where existing policies, regulations, or general opinion have prevented their use). In these circumstances, it is imperative to prove that the application of the technology does, and will continue to, meet performance expectations and that it does not have a corresponding negative impact on the local or global environment, economy, or community.

Projects may demonstrate they implement innovative technologies or methods in several ways:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs;
- The project uses technologies or methods that may be general practice in other regions or parts of the world, but within the unique context of the project (whether climate, regulations, policies, political support,

**METRIC:**

Whether project achievement qualifies as exceptional performance or innovation.

public opinion, etc.) have not yet gained acceptance. Significant efforts are taken to demonstrate the effectiveness of the technology or method within the context and provide a precedent for future adoption.

- The project team takes significant steps to include research goals within the project's development, or work with a university or research organization to advance the general knowledge of the profession. Proprietary research that is not made publicly available cannot count toward achieving this credit.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Any action that is already documented as an evaluation criteria for credits within the Leadership credit category.

Performance Improvement: Exceed evaluation criteria for the highest levels of achievement or implement innovative methods in meeting infrastructure needs that are not addressed within the system.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project exceeded the highest levels of achievement for a given credit?

1. *Detailed documentation of how the project exceeds the existing requirements currently within a given Leadership credit.*

B. To what extent does the project implement innovative technologies or methods?

1. *Documentation of the application of innovative technologies or methods. Detailed description of how this application will improve existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered innovative either as a technology, a method, or within the project context (climate, political, cultural, etc.).*

C. To what extent does the project overcome significant problems, barriers, or limitations or create scalable and/or transferable solutions?

1. *Documentation that the project reduces or eliminates significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project.*
2. *Documentation that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.*

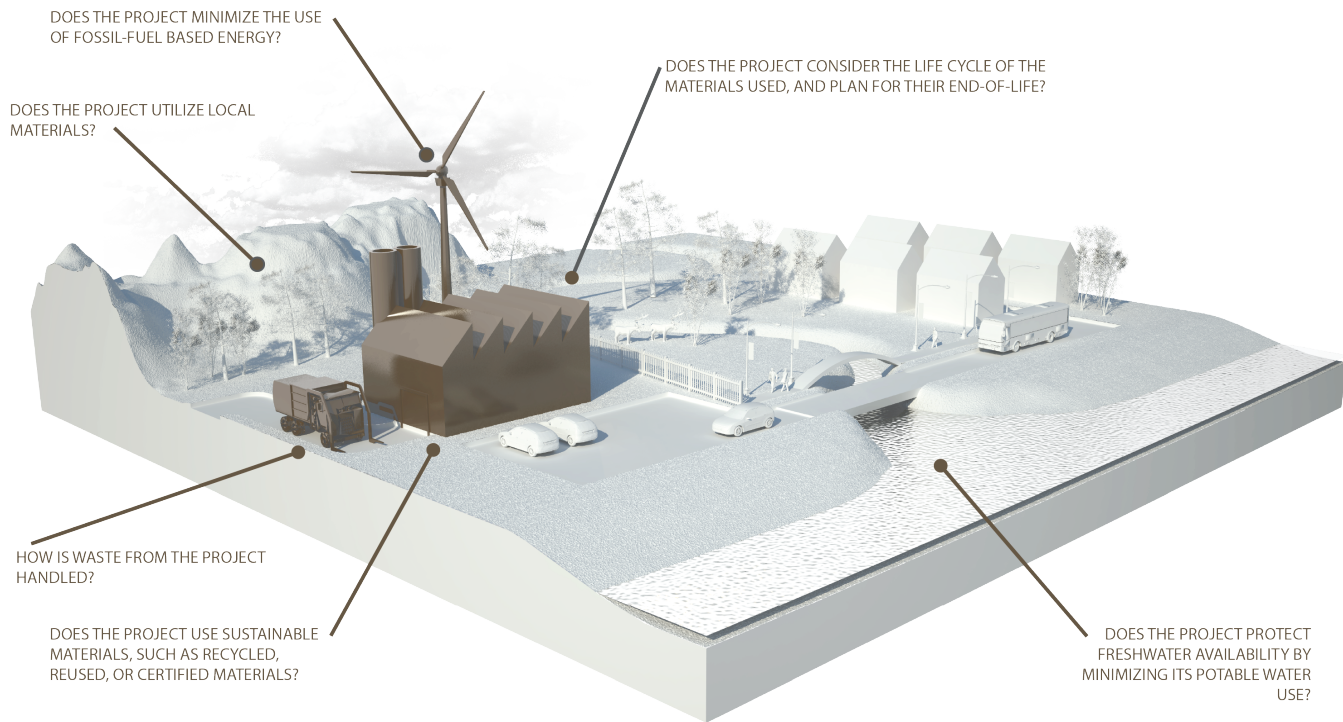




**RESOURCE
ALLOCATION**



RESOURCE ALLOCATION



RESOURCE ALLOCATION

Resources are the assets that are needed to build infrastructure and keep it running. This category is broadly concerned with the quantity, source, and characteristics of these resources and their impacts on the overall sustainability of the project. Resources addressed include physical materials (both those that are consumed and that leave the project), energy, and water use. These resources are finite and should be treated as an asset to use respectfully. Materials, Energy, and Water comprise the three subcategories of Resource Allocation.

MATERIALS

Minimizing the total amount of materials used should be a primary consideration for infrastructure projects. This reduces the amount of natural resources that must be extracted and processed and the energy required to produce and transport those materials. Reducing material use must be balanced with safety, stability, and durability. The source of materials also matters. Materials obtained from distant sources should not be used if the same type and quality of material is available locally. The life cycle of a material should always be considered: where it has come from and where it will go after its useful life in the project. Other favorable material characteristics include the percentage of recycled or reused content, the

ability to be recycled/reused at the end of life, durability, and adaptability. These help to minimize the total amount of natural resources consumed.

ENERGY

Energy from nonrenewable fossil fuel sources is finite. Therefore, use of renewable energy is encouraged as a means to minimize fossil fuel consumption. Reducing overall energy use is crucial and, ideally, projects will both reduce overall energy use and meet the remaining energy needs through renewable sources whenever possible. Commissioning and monitoring energy systems is critical to ensure projects function as planned and maintain the intended level of efficiency throughout the life of the project.

WATER

Between a growing population, increasing consumption, and a changing climate, the future of water availability is uncertain. Therefore, it is critical that infrastructure projects reduce overall water use, particularly potable water. Alternative water sources, such as stormwater runoff, can be captured and reused for many functions without reducing the overall water resource. Monitoring and studying water availability is an important step in validating whether a community's water consumption is in balance.



1 MATERIALS

- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA1.5 Divert Waste from Landfills
- RA1.6 Reduce Excavated Materials Taken Off Site
- RA1.7 Provide for Deconstruction and Recycling

2 ENERGY

- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA2.3 Commission and Monitor Energy Systems

3 WATER

- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems

RA0.0 Innovate or Exceed Credit Requirements

RA1.1 REDUCE NET EMBODIED ENERGY

INTENT:

Conserve energy by reducing the net embodied energy of project materials over the project life.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Life-cycle energy assessment. The embodied energy of the materials used in the project has been acquired by a validated source or determined by a life-cycle energy assessment. The assessment involves calculating the initial embodied energy from material extraction, refinement, and manufacture. Materials considered should be those that are used in significant quantities in any phase of the project life. (A)	(6) At least 10% reduction. Using the embodied energy data determined by a life-cycle energy assessment, the project team works to design the project to reduce embodied energy by at least 10% over the project life. This involves reducing the quantity of material and selecting materials with lower embodied energy over the project life. Energy savings are achieved as compared to industry norms. (A, B)	(12) At least 40% reduction. Using the embodied energy data determined by a life-cycle energy assessment, the project team works to design the project to reduce embodied energy by at least 40% over the project life. This involves reducing the quantity of material and selecting materials with lower embodied energy over the project life. Energy savings are achieved as compared to industry norms. (A, B)	(18) At least 70% reduction. Using the embodied energy data determined by a life-cycle energy assessment, the project team works to design the project to reduce embodied energy by at least 70% over the project life. This involves reducing the quantity of material and selecting materials with lower embodied energy over the project life. Energy savings are achieved as compared to industry norms. (A, B)	

DESCRIPTION

This credit addresses the need to reduce the large amounts of energy that can be consumed long before a project begins operations. This energy is associated with the extraction, processing, manufacturing, and transport of materials and components. Consumption of natural resources is a primary concern and greatly contributes to greenhouse gas emissions, congestion, and environmental pollution and degradation. Reducing initial net embodied energy does not mean building poorly or for the short term. Maintenance and repairs can consume large amounts of material over time. It is common that a well-built project that invests more material and resources initially will result in less material being consumed over the life of the project. Therefore, projects should be designed to consider total consumption of construction and repair material over the project's lifespan.

In fulfilling this credit, estimation of the net embodied energy of project materials is required. The estimation may be carried out by a life-cycle assessment (LCA) and should include the required energy for material extraction, transportation, refinement, manufacturing, and undertaken processes until the material is ready to be transported to the construction site. The estimation must consider the materials to be used in the project's construction as well as the materials to be used for maintenance and operation through all phases of the project life. Project teams consider the durability of materials and systems to reduce the net embodied energy over the entire project life. Because of the relative newness of this assessment and the scarcity of information covering embodied energy, the scope of this credit will be limited to materials that are used in significant quantities and make up the majority portion of the completed project.

Project teams pursuing multiple credits that require a LCA may find conducting a single comprehensive LCA more efficient. This will provide a single holistic evaluation of the environmental loads and impacts of the project over its entire life cycle, from the extraction of raw materials to the project's end of life. Conducting a full LCA will provide, among other results, estimation of carbon and pollutant emissions that can be used on CR1.1, and CR1.2, respectively. The LCA should be conducted in accordance with ISO (International Organization for Standardization) 14040 and ISO 14044 standards.

Submissions should include material embodied energy data provided by the supplier or presented in recognized material databases such as GRANTA-CES Selector (Granta, 2013). When material or product embodied energy data are not included in the cited sources, they may be determined by conducting a streamlined LCA of materials extraction and processing in accordance with the cited ISO standards. It is important to note that the development of a full LCA may be cost prohibitive and, consequently, is not required. Project teams may reference existing databases.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team does not consider estimations of the project material's embodied energy assessed by means of an LCA and no demonstrable energy savings are achieved compared to industry norms.

Performance Improvement: To advance to higher levels of achievement, project teams make efforts to increase reductions in net embodied energy compared to industry norms.

**METRIC:**

Percent reduction in net embodied energy from a life-cycle energy assessment.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team considered estimations of materials' embodied energies assessed by means of an LCA?

1. *Results of the energy LCA.*
2. *Documentation demonstrating the assessment was performed in accordance with recognized and accepted methodologies, data sources, or software. Because of the relative newness of this assessment and the scarcity of information covering embodied energy, the scope of this credit will be limited to materials that are used in significant quantities and that make up a significant portion of the completed project.*
3. *Report on the selection of the life-cycle energy assessment model used and/or databases referenced.*
4. *Narrative describing how strategies to reduce net embodied energy will not increase operational or maintenance energy over the project or shorten the lifespan of the project.*

B. To what extent have the owner and project team reduced the net embodied energy of the project?

1. *Design documents of elements that will reduce the net embodied energy of the project and a rationale for why they were chosen. This may involve reducing the quantity of material and selecting materials with lower embodied energy.*
2. *Calculations showing the overall reduction of embodied energy over industry norms.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 7.1.1, 7.1.2.

Canadian Architect, Measures of Sustainability, Embodied Energy, www.canadianarchitect.com/asf/perspectives_sustainability/measures_of_sustainability/measures_of_sustainability_embodied.htm.

RELATED ENVISION CREDITS

RA1.2 Support Sustainable Procurement Practices

RA1.3 Use Recycled Materials

RA1.4 Use Regional Materials

RA1.5 Divert Waste from Landfills

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

RA3.2 Reduce Potable Water Consumption

NW2.3 Prevent Surface and Groundwater Contamination

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

CR2.1 Assess Climate Threat

CR2.5 Manage Heat Island Effects

RA1.2 SUPPORT SUSTAINABLE PROCUREMENT PRACTICES

INTENT:

Obtain materials and equipment from manufacturers and suppliers that implement sustainable practices.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Basic sustainable sourcing. Written project team procurement policies are in place. Some high-level criteria for use of suppliers that have sustainable procurement policies and practices. No targets set. A modest amount of materials, supplies, and equipment (15% or less) is purchased from manufacturers and suppliers that follow sustainable practices. (A, B)	(3) Modest sustainable suppliers portfolio. The project team has a defined program for sustainable procurement. Selection of manufacturers and suppliers uses basic triple bottom line criteria. At least 16% of the purchased materials and supplies meet these criteria. (A, B)	(6) Strong supplier evaluation practices. The project team has a well-defined program for sustainable procurement. Increased breadth of environmental and social criteria. Increased reliance on third-party certified materials and supplies (e.g., ENERGY STAR, Forest Stewardship Council, Green Seal, EcoLogo). At least 26% of the purchased materials and supplies meet sustainable procurement policies. (A, B, C)	(9) Exceptional sustainable sourcing. The project team has a strong program for sustainable procurement with clear supplier performance specifications stating the characteristics of the products and materials to be supplied, packaging, use, disposal, and product take back. Increased emphasis on suppliers' social and ethical performances. At least 51% of the purchased materials and supplies meet sustainable procurement policies. (A, B, C, D)	

DESCRIPTION

This credit encourages consideration in specifying materials that protect human health and the environment, contain recycled content, do not use hazardous and toxic materials or volatile organic compound-emitting materials, do not contain excess packaging, reduce energy and water use, use renewable energy in production, and reduce greenhouse gas emissions. In fulfilling this credit, project teams seek to purchase materials and supplies that are protective of human health and the environment. For instance, project teams make efforts to use only wood products certified under a recognized third-party sustainable forestry management certification program, or choose suppliers based on the incorporation of sustainability policies and practices to their operations.

Project teams should seek to specify materials from manufacturers that meet the following criteria:

- Have reduced negative environmental impacts by implementing an environmental management system consistent with ISO (International Organization for Standardization) 14001 or equivalent;
- Have publicly disclosed all intentionally added chemical constituents and all unintentional chemical residuals or impurities present at 100 parts per million or more.

Project teams should give preference to suppliers that have taken into account the environmental, economic, and social impacts of their products and have active programs for performance improvement in place. Supplier integrity and ethical behavior are important considerations.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Project team takes a cursory look at the sources of materials and supplies for the project. No specific sustainable procurement policies or practices are put in place. There are also no policies or practices in place regarding procurement of materials and/or services from suppliers that have incorporated sustainability policies and practices. There are no policies or practices in place for selecting materials that inherently contribute to sustainable performance.

Performance Improvement: Increase the amount of low-impact materials specified and the use of suppliers with sustainable policies and practices.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team defined a sound and viable sustainable procurement program?

1. *Evidence of a sustainable procurement program consisting of policies and criteria for supplier identification and selection.*
2. *Documentation of criteria for selection and their breadth of triple bottom line coverage.*

**METRIC:**

Percentage of materials sourced from manufacturers that meet sustainable practices requirements.

B. To what extent has the project team procured materials from sustainable sources?

1. *Documentation of the total weight or volume of materials. Cost of materials is also an acceptable measure.*
2. *An inventory for all materials being tracked for sustainable procurement practices including a description of the material and the manufacturer or supplier of the material.*
3. *Documentation from manufacturers or suppliers (e.g., environmental management system contact, Web link to chemical inventory, life-cycle assessment, environmental product declaration, and utility bills) to demonstrate that sustainable practices are used for percentage of purchased products.*

C. How much of purchased materials and supplies will be certified by third-party accreditation and standard-setting organizations?

1. *Evidence of certification of materials and supplies.*

D. What efforts does the project team intend to make to ascertain supplier integrity?

1. *Evidence of efforts to identify any unresolved worker health and safety or environmental violations of the manufacturers or supplier.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 5.10: Support sustainable practices in materials manufacturing, Credit 5.6: Use certified wood.

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 1.3, 8.3.1, 8.3.2.

U.S. Environmental Protection Agency, Environmentally Preferable Purchasing, www.epa.gov/oppt/epp/pubs/products/construction.htm.

RELATED ENVISION CREDITS

QL1.2 Stimulate Sustainable Growth and Development

RA1.1 Reduce Net Embodied Energy

RA1.3 Use Recycled Materials

RA1.5 Divert Waste from Landfills

RA2.1 Reduce Energy Consumption

RA3.2 Reduce Potable Water Consumption

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

CR2.1 Assess Climate Threat

RA1.3 USE RECYCLED MATERIALS

INTENT:

Reduce the use of virgin materials and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) At least 5% from recycled. At least 5% (by weight or volume) of materials used are from reclaimed or recycled materials. (A, B)	(5) At least 20% from recycled. At least 20% (by weight or volume) of materials used are from reclaimed or recycled materials. (A, B)	(11) At least 50% from recycled. At least 50% (by weight or volume) of materials used are from reclaimed or recycled materials. (A, B)	(14) At least 80% from recycled. At least 80% (by weight or volume) of materials used are from reclaimed or recycled materials. (A, B)	

DESCRIPTION

The purpose of this credit is to reduce the use of virgin materials and avoid sending useful materials to landfills. Using recycled, reused, and renewable materials and products, including existing structures and materials on site, reduces demand for virgin materials and the embodied carbon emissions and environmental degradation attributed to their extraction and processing. Using these materials also reduces waste and supports the market for recycled and reused materials.

Appropriate reuse of structures and parts of structures can significantly reduce demand for new construction materials and other environmental burdens resulting from a development. For sites with existing structures and equipment, the project team conducts an assessment to see whether or not these structures and equipment can be used for the new project. The project team considers the degree to which these structures and pieces of equipment need to be refurbished or modified for use on the new project.

In fulfilling this credit, project teams evaluate their efforts to specify significant use of reclaimed or recycled materials for the project. Special consideration is given as to whether these materials meet necessary quality and performance criteria required for the intended application. Recycled or reused materials are not specified if they pose a risk to human health, safety, or the environment. Efforts are taken to evaluate the potential for making beneficial use of any existing structures and materials.

Calculations of materials can be done by weight or volume, but must remain consistent.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Recycled content of materials is less than 5% (by weight or volume) of the total materials. The project team has limited consideration of obvious reuse opportunities.

Performance Improvement: Improve efforts to specify reclaimed and recycled materials and structures to increase their total percentage within the project.

EVALUATION CRITERIA AND DOCUMENTATION

- To what extent has the project team identified the appropriate reuse of existing structures and materials on site and incorporated them into the project?
 - Inventory of existing materials or structures that may have reuse potential.*
 - Design documents showing the location and weight or volume of reused structures or materials. In determining weight or volume, the project team may refer to standard equivalents.*

**METRIC:****Percentage of project materials that are reused or recycled.**

B. To what extent has the project team specified materials with recycled content? (Examples include reclaimed bricks and elements or components using recycled materials such as recycled plastics or reprocessed timber.)

1. *Total quantity of materials by weight or volume.*
2. *Inventory of specifications for materials seeking inclusion as containing recycled content. Inventory should include the name of the product, the name of the manufacturer, the weight or volume of the material, and the percentage of recycled content (either post-industrial or post-consumer recycled content).*
3. *Documentation that all materials meet the necessary quality and performance criteria required for the intended application. They also must meet all state or local solid waste agency requirements for using recycled materials in construction. Any recycled materials used must not pose significant risks to human health and safety or the environment.*
4. *Calculations of percentage of total project materials by weight or volume that are reused or recycled. To calculate materials with recycled content, multiply the material weight or volume by the percentage of recycled content. Mechanical, electrical, water equipment, and their components may be excluded from the calculations. In these instances, the most efficient equipment should be specified. Calculations do not include plants or soils.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 8.5.1, 8.5.2.

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 5.5: Use recycled content materials.

RELATED ENVISION CREDITS

LD3.3 Extend Useful Life

RA1.1 Reduce Net Embodied Energy

RA1.2 Support Sustainable Procurement Practices

RA1.4 Use Regional Materials

RA1.5 Divert Waste From Landfills

RA1.7 Design for Deconstruction and Recycling

CR1.1 Reduce Greenhouse Gas Emissions

CR2.1 Assess Climate Threat

RA1.4 USE REGIONAL MATERIALS

INTENT:

Minimize transportation costs and impacts and retain regional benefits by specifying local sources.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) At least 30% locally sourced. At least 30% of all materials, plants, and soils are sourced within the distances specified: soils (50 mi, 80 km), aggregate (50 mi, 80 km), concrete (100 mi, 160 km), plants (250 mi, 400 km), and all other materials (500 mi, 800 km). (A)	(6) At least 60% locally sourced. At least 60% of all materials, plants, and soils are sourced within the distances specified: soils (50 mi, 80 km), aggregate (50 mi, 80 km), concrete (100 mi, 160 km), plants (250 mi, 400 km), and all other materials (500 mi, 800 km). (A)	(9) At least 90% locally sourced. At least 90% of all materials, plants, and soils are sourced within the distances specified: soils (50 mi, 80 km), aggregate (50 mi, 80 km), concrete (100 mi, 160 km), plants (250 mi, 400 km), and all other materials (500 mi, 800 km). (A)	(10) At least 95% locally sourced. At least 95% of all materials, plants, and soils are sourced within the distances specified: soils (50 mi, 80 km), aggregate (50 mi, 80 km), concrete (100 mi, 160 km), plants (250 mi, 400 km), and all other materials (500 mi, 800 km). (A)	

DESCRIPTION

Transportation is a significant consumer of fossil fuels and the source of greenhouse gas emissions and other pollutants. Wear and tear reduces the lifespan of transportation infrastructure and sea freight pollutes waters and damages marine environments. This is compounded by the large quantities of materials often needed in infrastructure projects. Regional materials—even materials sourced or processed on site—reduce the impact of long transport and support local economies.

It is important to note that while it is generally desirable to use locally sourced materials for the aforementioned reasons, use of local materials could have negative impacts on performance if those materials result in reduced durability, safety, or service life.

In fulfilling this credit, project teams should make efforts to acquire soils, aggregate, plants, and other materials through local sources. The following table shows distance requirements for each material type:

Material	Distance Requirement
Soils and mulches	50 miles / 80 km
Aggregates, Sands	50 miles / 80 km
Concrete	100 miles / 160 km
Plants	250 miles / 400 km
Other materials (excluding equipment)	500 miles / 800 km

Source: The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Local sourcing is considered. However, decisions are based primarily on cost and developing local relationships. Total materials sourced within the distance requirements do not reach 30%.

Performance Improvement: Increase the percentage of locally sourced materials, plants, and soils.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project team specified locally sourced materials, plants, aggregates, and soils?

1. *Total cost of materials.*
2. *Inventory of materials, plants, aggregates, and soils for construction sourced near the site.*
3. *Soils: Extraction, harvest, or recovery and manufacture must occur within 50 mi / 80 km.*
4. *Aggregate: Extraction, harvest, or recovery and manufacture must occur within 50 mi / 80 km.*
5. *Plants: All growing facilities for the plant must be located within 250 mi / 400 km.*

**METRIC:**

Percentage of project materials by type and weight or volume sourced within the required distance.

6. All other materials: Extraction, harvest, or recovery and manufacture must occur within 500 mi / 800 km.

7. Calculations of percentage of total project materials by cost that are sourced locally. Reused materials, either on site or sourced within a 500-mile (800-km) radius, and materials harvested on site, including retained plants, count toward meeting the credit requirements. Calculations are based on cost or replacement value. Equipment such as electrical, mechanical, or plumbing should not be included in the calculations. In such cases, performance efficiency far outweighs transportation-related emissions. Therefore, the most efficient equipment should be specified regardless of transportation distance.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 5.7: Use regional materials.

RELATED ENVISION CREDITS

- QL1.1 Improve Community Quality of Life
- QL1.2 Stimulate Sustainable Growth and Development
- LD2.1 Pursue Byproduct Synergy Opportunities
- RA1.1 Reduce Net Embodied Energy
- RA1.3 Use Recycled Materials
- CR1.1 Reduce Greenhouse Gas Emissions
- CR1.2 Reduce Air Pollutant Emissions
- CR2.1 Assess Climate Threat

RA1.5 DIVERT WASTE FROM LANDFILLS

INTENT:

Reduce waste and divert waste streams from disposal to recycling and reuse.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) Recycle/reuse at least 25%. Prepare an operations waste plan to divert at least 25% of significant waste streams. Diversion may be a combination of waste-reduction measures and sourcing waste to other facilities for recycling or reuse. (A, B, C)	(6) Recycle/reuse at least 50%. Prepare an operations waste plan to divert at least 50% of significant waste streams. Diversion may be a combination of waste-reduction measures and sourcing waste to other facilities for recycling or reuse. (A, B, C)	(8) Recycle/reuse at least 75%. Prepare an operations waste plan to divert at least 75% of significant waste streams. Diversion may be a combination of waste-reduction measures and sourcing waste to other facilities for recycling or reuse. (A, B, C)	(11) Recycle/reuse 100%. Prepare an operations waste plan to divert 100% of significant waste streams. Diversion may be a combination of waste-reduction measures and sourcing waste to other facilities for recycling or reuse. (A, B, C)	

DESCRIPTION

This credit minimizes the quantity of waste generated by the completed project and maximizes opportunities for the waste that is generated to be recycled or reused. This requires identifying potential sources and destinations for recycling and includes a management plan.

Identification and evaluation of options for recycling and reuse are the first steps in development of effective plans for handling, segregation, and storage of materials. It is important to determine which materials must be separated versus which can be commingled.

Acceptable means of diversion include:

- Waste reduction;
- Reuse or recycle materials on site;
- Materials sent to recycling or reclamation facilities;
- Materials sent to manufacturers to be used as post-consumer recycled content;
- Materials composted on site or sent to a composting facility;
- The use of material, if appropriate, as infill;
- Incineration of biomass for energy generation.

Unacceptable means of diversion include:

- Incineration of materials not classified as biomass;
- Burying waste material unsuited for infill.

Materials to be reused on site do not pose risks to human health and safety or the environment and are in compliance with all state/provincial and local solid waste agency requirements.

Project teams pursuing multiple credits that require a life-cycle assessment (LCA) may find conducting a single comprehensive LCA more efficient. This provides a single holistic evaluation of the environmental loads and impacts of the project over its entire life cycle, from the extraction of raw materials to the project's end of life. The LCA should be conducted in accordance with ISO (International Organization of Standardization) 14040 and ISO 14044 standards.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Waste minimization, waste recycling, and reuse are done if cost reductions can be easily obtained, most likely as end-of-pipe decisions. Although some recycling of waste is done, it is mostly ad hoc. Recycling does not reach 25% over industry norms. Some high-level policies regarding waste reduction and recycling exist. Policies regarding the reduction of hazardous waste generation exist.

Performance Improvement: Increased efforts to reduce waste generation and divert waste from landfills for recycling over industry norms.

**METRIC:**

Percentage of total waste diverted from disposal.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team developed a comprehensive waste management plan to decrease project waste and divert waste from landfills and incinerators during operation?

1. *Waste management plans documenting the volume (or weight) of anticipated waste generation. Plans include waste type and methods to reduce waste generation. Plans present anticipated waste reduction.*

(i) *Strategies are included in the plan to reduce waste generation and to maximize waste reuse or recycling. In the design phase of the project, there may be instances in which waste minimization and recycling/reuse objectives will be in conflict. Decreasing the quantity of waste may increase its toxicity. Methods that produce less waste may result in less likelihood of recycling. Consideration is given to both the quantity of waste being generated and the recyclability of that waste stream and its toxicity.*

(ii) *Plans and designs take into account that efforts to minimize certain waste streams may make those waste streams unusable and/or uneconomical for recycling or reuse. The objective of the designers is to reach a balance such that the net amount of waste that is ultimately released or sent to disposal is minimized.*

2. *Documentation that contractors, subcontractors, and operators are aware of waste sorting requirements and are committed to achieving target levels of reduction.*

B. Has the project team identified potential destinations for waste generated on site?

1. *Inventory of project waste streams and potential sites for acceptable reuse or recycling.*

C. To what extent has the project team diverted waste from landfills?

1. *Calculations of total waste reduction measures and percentage of materials diverted to recycling or reuse. The percentage of diverted waste should be calculated as the ratio of material diverted from landfills against the total waste generated during construction or operations.*

2. *Calculations may be done by weight or volume, but must remain consistent throughout the rating process. Waste deemed hazardous should not be included in the total waste calculations and should be disposed of according to local, state/provincial, and federal law.*

3. *Measures to reduce the generation of hazardous waste may be included under the project team's consideration.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 9.1.1, 9.1.2, 9.3, 9.4.

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 7.4: Divert construction and demolition materials from disposal.

RELATED ENVISION CREDITS

LD1.2 Establish a Sustainability Management System

LD2.1 Pursue Byproduct Synergy Opportunities

LD2.2 Improve Infrastructure Integration

RA1.2 Support Sustainable Procurement Practices

RA1.3 Use Recycled Materials

RA1.7 Provide for Deconstruction and Recycling

RA2.1 Reduce Energy Consumption

RA1.6 REDUCE EXCAVATED MATERIALS TAKEN OFF SITE

INTENT:

Minimize the movement of soils and other excavated materials off site to reduce transportation and environmental impacts.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Reuse at least 30%. Percentage of excavated material suitable for reuse beneficially reused on site. (A)	(4) Reuse at least 50%. Percentage of excavated material suitable for reuse beneficially reused on site. (A)	(5) Reuse at least 80%. Percentage of excavated material suitable for reuse beneficially reused on site. (A)	(6) Reuse at least 95%. Percentage of excavated material suitable for reuse retained and reused on site. (A)	

DESCRIPTION

Transporting soils is expensive and environmentally damaging. Trucks transporting soils emit greenhouse gases and changing site topography can alter runoff patterns, increasing erosion and damaging downstream aquatic environments. Depending on the distance of transportation, moving soils may also result in the introduction of alien species to a region.

During planning and design, project teams identify opportunities to minimize grading, retain all soil on site, and/or eliminate the need to transport additional soil to the site.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Less than 30% of excavated material suitable for reuse is beneficially reused on site.

Performance Improvement: Increase the percentage of excavated materials reused on site.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project team designed the project to balance cut and fill to reduce the excavated material taken off site?

1. Design documents showing estimations of the excavated material to be taken off site.
2. Design documents demonstrating how the project was designed to balance cut and fill.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 8.2.3, 8.2.4.

RELATED ENVISION CREDITS

NW1.3 Preserve Prime Farmland

NW3.3 Restore Disturbed Soils

CR1.1 Reduce Greenhouse Gas Emissions

6 POINTS

RESOURCE ALLOCATION

MATERIALS



METRIC:

Percentage of excavated material retained on site.

RA1.7 PROVIDE FOR DECONSTRUCTION AND RECYCLING

INTENT:

Encourage future recycling, upcycling, and reuse by designing for ease and efficiency in disassembly or deconstruction at the end of a project's useful life.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Basic end-of-life consideration. Disassembly, deconstruction, and recycling or upcycling are minimally considered. Generally, at least 15% of the components or prefabricated units can be easily separated for reuse or recycling and it is reasonable to assume that they will be. (A)	(4) Expanded end-of-life consideration. The project owner, working with the designer, expands considerations beyond the point of project delivery. Generally, at least 30% of the components or prefabricated units can be easily separated for disassembly or deconstruction. (A, B)	(8) Primary concern for end of life. Project owner, working with the designer, expands considerations to those that likely encompass future owners. Generally, at least 50% of the components or prefabricated units can be easily separated for disassembly or deconstruction. (A, B)	(12) True design for end of life. The project team expands opportunities for upcycling of materials, structures, and equipment. At least 75% of the components or prefabricated units can be easily separated for disassembly or deconstruction. (A, B)	

DESCRIPTION

This credit encourages the reuse or recycling of usable components when a constructed project reaches the end of its useful life. Structures and components that can be easily dismantled will yield more materials for high-grade reclamation. Minimizing the use of composite forms will avoid the need to process the components to separate the materials for reuse.

Examples of suitable material types may include bricks, blocks, stone and concrete, untreated timber, glass, different types of plastic, metal, paper, and cardboard.

It is good practice to identify the materials used in the components, particularly plastics, because it will make recycling more effective.

Credit is given for designing the project so that, at the end of its useful life, the completed project can be readily deconstructed and disassembled to enable materials and equipment reuse and upcycling. It is important to note that upcycling may require the use of additional materials so that the end-of-life components and materials remain in a useful state. Therefore, designing for materials reuse and upcycling may run counter to objectives for reducing materials' intensity.

In fulfilling this credit, project teams consider the full range of challenges in designing for future disassembly and deconstruction. Plans and arrangements should be made to identify, track, and communicate components and prefabricated units that have been designed for disassembly and/or deconstruction at the appropriate time. Materials, structures, and equipment should be designed and specified based on their

ability to retain some value in the future through recycling, upcycling, or reuse.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Stay within traditional project boundaries. No special consideration is given to the end-of-life of materials, components, or equipment.

Performance Improvement: Expand the scope to include more life-cycle elements beyond construction, moving outside typical owner considerations of functionality. For example, the design might include enhanced flexibility for increasing the possibility of alternative future uses. Further extend the scope to include end-of-life considerations (i.e., deconstruction, recycling, and upcycling of materials, components, and equipment).

**METRIC:**

Percentage of components that can be easily separated for disassembly or deconstruction.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent have the owner and project team specified materials that can be easily recycled or reused after the useful life of the project has ended?

1. *Inventory of materials incorporated into the design that retain some value for future use. Project teams should consider the likely effects of time and facilities operation on materials before determining if they will retain recyclability or reuse value.*
2. *General percentage of total materials by cost, weight, or volume likely to be recycled at the end of life (note that the ability to recycle a material does not always mean it is likely to be recycled). Verifiers will determine whether the project team's expectations on recyclability are reasonable.*

B. To what extent has the design team facilitated future disassembly and recycling of materials?

1. *Plans and arrangements to identify, keep track of, and communicate at the appropriate time the components and prefabricated units that have been designed for disassembly and/or deconstruction.*
2. *Design documents showing efforts to minimize adhering recyclable materials to nonrecyclable materials or materials that will contaminate the waste stream and limit recyclability.*
3. *Design documents showing efforts to detail connections that will ease disassembly and encourage reuse or recycling.*
4. *Documentation that the owners and project team have anticipated the effect that time and the facilities' operations will have on potentially recyclable materials. Documentation that materials will retain their recyclability through the end of project life. Any opportunities for upcycling are identified.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 5.3: Design for deconstruction and disassembly.

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 1.4.1, 8.8.1, 8.8.2.

RELATED ENVISION CREDITS

LD3.1 Plan for Long-Term Monitoring and Maintenance

LD3.3 Extend Useful Life

RA1.3 Use Recycled Materials

RA1.5 Divert Waste from Landfills

RA2.1 REDUCE ENERGY CONSUMPTION

INTENT:

Conserve energy by reducing overall operation and maintenance energy consumption throughout the project life.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) At least 10% energy reduction. During the planning and design phases of the project, the owner and the project team conduct one or more planning or design reviews to identify and analyze options for reducing energy consumption in the operation and maintenance of the completed project. Operational energy reductions are estimated to be at least 10% compared to industry norms. (A, B, C)	(7) At least 30% energy reduction. Operational energy reductions are estimated to be at least 30% compared to industry norms. (A, B, C)	(12) At least 50% energy reduction. Operational energy reductions are estimated to be at least 50% compared to industry norms. (A, B, C)	(18) At least 70% energy reduction. Operational energy reductions are estimated to be at least 70% compared to industry norms. (A, B, C)	

DESCRIPTION

Energy generation is the primary source of greenhouse gas emissions and numerous other pollutants harmful to the environment and human health. While use of renewable energy can contribute to the reduction of these emissions, the primary goal of all projects should be to reduce the overall energy consumed as much as possible.

The owner and the project team take a whole-systems design approach when considering options. They not only look for obvious single energy and emissions savings, but also consider what multiple benefits might be achieved from a single investment.

In fulfilling this credit, owners and designers should calculate the anticipated operation and maintenance energy consumption on an annual basis for the life of the project. For this credit, special attention should be given to calculating or simulating the project's annual energy consumption to achieve a reduction in operational energy over industry norms. If applicable, the project team may use the ASHRAE (formerly American Society of Heating Refrigerating and Air-Conditioning Engineers) standards in calculating the project's anticipated energy consumption as well as the industry base case. The assessment includes all energy consumption related to functions typically defined for carbon emission as "scope one" and "scope two". Scope one includes energy generated on site or fuel consumed directly by the project, while scope two may include energy purchased from the grid. In transportation infrastructure such as public roads, energy consumed by vehicular traffic, typically considered "scope three", is included in these calculations.

Project teams pursuing multiple credits that require a life-cycle assessment (LCA) may find conducting a single comprehensive LCA more efficient. This will provide a single holistic evaluation of the environmental loads and impacts of the project over its entire life cycle, from the extraction of raw materials to the project's end of life. The LCA should be conducted in accordance with ISO (International Organization for Standardization) 14040 and ISO 14044 standards.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Meets basic code and regulatory requirements regarding energy consumption.

Performance Improvement: Specify energy-efficient equipment and processes and incorporate systems-level thinking early in the design process to reevaluate energy needs and processes and significantly reduce energy consumption throughout the project compared to the set benchmark.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent have the owner and project team conducted planning or design reviews to identify and analyze options for reducing energy consumption in the operation and maintenance of the completed project?

1. *Reports, memoranda, and minutes of meetings with the project team and owner regarding energy reduction strategies.*

**METRIC:****Percentage of reductions achieved.**

B. Have the owner and project team conducted feasibility and cost analyses to determine the most effective methods for energy reduction and incorporated them into the design?

1. *Inventory of energy-saving methods considered.*
2. *Results of feasibility studies.*
3. *Design documents demonstrating the incorporation of energy-saving strategies to the design.*

C. To what extent does the project reduce energy consumption over industry norms?

1. *Calculation of the industry norm to use as a benchmark. All energy sources should be converted into British thermal units (BTU) or Joules (J).*
2. *Submit calculations for the project's estimated annual energy consumption over the life of the project. Document the percentage reduction over the industry norm benchmark. All energy sources should be converted into British thermal units (BTU) or Joules (J).*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 7.2.1.

RELATED ENVISION CREDITS

RA1.2 Support Sustainable Procurement Practices

RA1.5 Divert Waste from Landfills

RA2.2 Use Renewable Energy

RA2.3 Commission and Monitor Energy Systems

RA3.2 Reduce Potable Water Consumption

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

CR2.1 Assess Climate Threat

CR2.5 Manage Heat Island Effects

RA2.2 USE RENEWABLE ENERGY

INTENT:

Meet energy needs through renewable energy sources.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(4) At least 10% from renewable energy. At least 10% of renewable energy resources are used in the completed work. (A)	(6) At least 25% from renewable energy. At least 25% of renewable energy resources are used in the completed work. (A)	(13) At least 40% from renewable energy. At least 40% renewable energy resources are used in the completed work. (A)	(16) At least 80% from renewable energy. At least 80% renewable energy resources are used in the completed work. (A)	(20) Net positive renewable energy generation. The project generates a net positive amount of renewable energy. (A)

DESCRIPTION

While reducing energy use is the primary goal, a net-zero energy society will require significant investment in renewable energy sources. When appropriate, renewable energy can be generated on site to help reduce the need for fossil fuel sources. However, it is important to note that large-scale offsite renewable energy sources such as wind farms, large hydroelectric facilities, or solar arrays are often more efficient. Demonstrating a direct connection to these sources and ensuring their energy generation is not double-counted by other projects is challenging.

Project teams should evaluate the feasibility of renewable energy, including nontraditional energy sources, to effectively increase the portion of operational energy that comes from renewable energy resources.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Renewable energy sources do not exceed 10% of the project's annual anticipated energy consumption.

Performance Improvement: Increase use of renewable energy sources whenever practical and decrease overall energy needs.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent are the project's energy needs met through renewable energy?

1. *Documentation of the project's anticipated annual operational energy consumption broken down by source type. Teams may choose to reference credit RA2.1 Reduce Energy Consumption documentation.*
2. *Documentation of the anticipated annual output of all renewable sources and the overall percentage of renewable energy to total energy consumption. Renewable energy includes solar energy (thermal heating, both active and passive, and photovoltaic), wind (electricity generation), water (hydro or tidal for electricity generation), biomass (electricity generation or as fuels), geothermal (electricity generation or heating and cooling), and hydrogen/fuel cells (used as a fuel).*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 7.1.1, 7.1.2.

20
POINTS

RESOURCE ALLOCATION

ENERGY



METRIC:

Extent to which renewable energy sources are incorporated.

RELATED ENVISION CREDITS

RA1.1 Reduce Net Embodied Energy

RA2.1 Reduce Energy Consumption

RA2.3 Commission and Monitor Energy Systems

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

CR2.1 Assess Climate Threat

RA2.3 COMMISSION AND MONITOR ENERGY SYSTEMS

INTENT:

Ensure efficient functioning and extend useful life by specifying commissioning and monitoring of the performance of energy systems.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
	<p>(3) One-time monitoring.</p> <p>An initial commissioning of the project's energy systems is specified, but little to no effort is made to incorporate and facilitate long-term monitoring.</p> <p>(A)</p>		<p>(11) Long-term monitoring.</p> <p>An extensive initial commissioning is conducted. Information has been provided by the project team for the operator to train operations and maintenance personnel. Equipment and/or software are incorporated in the design to allow detailed monitoring of performance. At a minimum, the equipment installed is capable of monitoring all primary project functions, accounting for at least an accumulated 80% of energy use.</p> <p>(A, B, C)</p>	

DESCRIPTION

This credit recognizes that user behavior is the primary factor in energy performance. Systems designed to be energy efficient often fail because of installation errors or degradation over time during operations. Commissioning ensures systems are functioning as intended from the start of operations. Installing advanced monitoring equipment better allows operators to identify efficiency loss. In addition, monitoring equipment allows operators to identify high-energy processes and target them in their own sustainability efforts. Higher resolution monitoring increases the likelihood that projects will achieve and maintain high levels of energy efficiency throughout their useful life.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No commissioning is conducted. Monitoring capabilities do not exceed industry norms or rely on monthly utility data.

Performance Improvement: Go beyond initial commissioning to ensure long-term monitoring equipment is incorporated into the project to enable better performance during operations.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Has the owner and project team engaged an independent commissioning of the project?
 - 1. *Documentation of commissioning requirements in the contract documents.*
 - 2. *Demonstration that the commissioning authority is independent of both the design and construction team.*
- B. Has the project team assembled the necessary information needed to sufficiently train personnel to enable proper operations and maintenance?
 - 1. *Documentation of materials provided for operations and maintenance.*
- C. Does the design incorporate advanced monitoring systems, such as energy sub-meters, which will enable more efficient operations?
 - 1. *Design documents and specifications showing the location, purpose, and type of monitoring equipment installed that, at a minimum, are capable of monitoring all primary project functions.*
 - 2. *Rationale as to how the monitoring equipment may enable more efficient operations over the industry norm.*



METRIC:

Third-party commissioning of electrical/mechanical systems and documentation of system monitoring equipment in the design.

RELATED ENVISION CREDITS

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

RA3.1 PROTECT FRESH WATER AVAILABILITY

INTENT:

Reduce the negative net impact on the availability, quantity, and quality of fresh water.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) No immediate negatives. Determine how much fresh water will be used by the project both during construction and operations. Take advantage of opportunities for reuse and its effects on local surface water and groundwater, including groundwater flows and quality. Consider peaks in short-term usage. Some estimates regarding long-term impacts, but mostly extrapolations of current estimated usage. (A, B)	(4) Good water management. Design the project to access and control water usage over average maximum conditions with plans to offset peak withdrawals during lower water need periods. Institute water reuse. More comprehensive assessment of long-term needs. (A, B, C)	(9) Wise water management. Design the project to solely access water that can be replenished in quantity and quality. Control water usage over average maximum conditions with plans to offset peak withdrawals during lower water need periods. Determine impacts of fresh water withdrawal on receiving water's current and historic aquatic species. (A, B, C)	(17) Total water management. Design delivery and operations maintained such that there is no net impact on water supply volumes, including managing runoff to recharge local groundwater and surface water supplies in a manner that offsets withdrawals. Fresh water supplies are replenished at the source. Discharges to receiving waters meet quality and quantity requirements of historic high-value aquatic species. Methods may include closed loop recycling of water within the project. (A, B, C)	(21) Positive impact. Replenish the quantity and quality of fresh water surface and groundwater supplies to an agreed upon undeveloped native ecosystem condition. Discharges after use to fresh water surface waters meet historic pre-development seasonal cycles of quality and quantity, including temperature. (A, B, C, D)

DESCRIPTION

This credit addresses the increasing demands for fresh water by agricultural, municipal, and industrial users. These demands, combined with the typical variability in the hydrologic cycle, can affect water availability, quantity, and quality. Fresh water, groundwater, and surface waters are being used at a rate that is faster than the rate they are being naturally replenished. Groundwater mining is allowing saltwater intrusions to groundwater sources in some areas. Land use practices are affecting the quality of surface and groundwater supplies. Increased discharges of fresh water to coastal areas can affect the salinity rate of coastal habitats. Future variability caused by the effects of climate change is expected.

The U.S. Environmental Protection Agency and Environment Canada note that mean temperatures are expected to rise in many parts of North America, likely more in inland areas and at higher latitudes. Higher average temperatures will not only increase water evaporation rates, but will change the quantity, intensity, and timing of precipitation. Increases in mean temperatures can also affect the amount and duration of snow cover and, in turn, affect the average and peak rates of streamflow. All of these issues have important implications to agricultural irrigation, hydropower, flood management, fisheries, recreation, and navigation.

In fulfilling this credit, project teams should determine whether the project's water consumption will have a long-term net negative impact, net neutral impact, or net positive impact. Impacts include both the quantity and quality of fresh water, surface water, and groundwater sources, as well as the salinity of coastal waters.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Project meets minimum regulatory requirements for water use and withdrawals.

Performance Improvement: Increase the comprehensiveness of water availability assessment and improve water management to achieve conditions with no net impact. Restoration is achieved by replenishing water volume at the source for a net positive impact. Replenishing surface and groundwater to historic levels may qualify as exceeding credit requirements.

EVALUATION CRITERIA AND DOCUMENTATION

A. Have the owner and project team conducted a sound and comprehensive water availability assessment?

1. *Design documents indicating the location, type, quantity, rate of recharge, and quality of water resources are available to the project.*

**METRIC:**

The extent to which the project considers availability and replenishment of freshwater resources.

B. Has the project team assessed project water requirements?

1. *Estimations of average peak demands and long-term needs.*
2. *Report on the long-term availability and replenishment or recharge of freshwater supply.*
3. *Inventory of opportunities for water reuse or groundwater recharge on site.*
4. *Calculations of the volume of fresh water discharged after use.*
5. *Location and impact of discharge on receiving water quality and quantity, including temperature and salinity.*

C. Has the project team incorporated design features to minimize the long-term negative net impact on ground and surface water source quality and quantity or to achieve a net positive impact on water sources?

1. *Design documents of all features intended to reduce negative water impacts.*
2. *Rationale as to how the integrated systems of the project will work together to mitigate overall negative impacts or achieve net positive recharge.*
3. *Inventory of any water impacts that the project is not able to mitigate.*

D. Does the project achieve a net positive water impact replenishing the quantity and quality of freshwater surface and groundwater supplies?

1. *Calculation showing the project has a long-term net positive impact and does not significantly alter natural fluctuation in flow in receiving waterway ecosystems.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.1.1a.

U.S. Environmental Protection Agency, "Water Availability", epa.gov/climatechange/effects/water/availability.html.

Environment Canada, "Water Availability", ec.gc.ca/eau-water.

RELATED ENVISION CREDITS

RA2.1 Reduce Energy Consumption

RA3.2 Reduce Potable Water Consumption

RA3.3 Monitor Water Systems

NW1.2 Protect Wetlands and Surface Water

NW1.4 Avoid Adverse Geology

NW1.5 Preserve Floodplain Functions

NW2.1 Manage Stormwater

NW2.2 Reduce Pesticide and Fertilizer Impacts

NW2.3 Prevent Surface and Groundwater Contamination

NW3.4 Maintain Wetland and Surface Water Functions

CR2.3 Prepare for Long-Term Adaptability

RA3.2 REDUCE POTABLE WATER CONSUMPTION

INTENT:

Reduce overall potable water consumption and encourage the use of greywater, recycled water, and stormwater to meet water needs.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(4) At least 25% reduction. The design team focuses on reducing potable water use by at least 25%. Reductions are estimated over industry norms. (A, B, C)	(9) At least 50% reduction. The design team focuses on reducing potable water use by at least 50%. Reductions are estimated over industry norms. (A, B, C)	(13) At least 75% reduction. The design team focuses on reducing potable water use by at least 75%. Reductions are estimated over industry norms. (A, B, C)	(17) 100% reduction. The design team focuses on reducing potable water use to zero. (A, B, C)	(21) Water purification. The project not only reduces potable water consumption to net zero impact, but also recycles water, which can be used by the community. (A, B, C, D)

DESCRIPTION

This credit recognizes that clean water is becoming a scarce resource. Estimates are that more than 40 countries will become embroiled in water-related conflicts in the next 20 years. Overuse of water not only depletes waterbodies and lowers groundwater, but the treatment of water consumes large amounts of energy, contributing to global warming and environmental pollution.

Reductions may be accomplished through design, construction, and operational changes for conservation and/or the ability to use, treat, and/or reuse nonpotable water. Advanced recycling and reuse are encouraged. Project teams verify water supply and replenishment if supply and wastewater are handled by a separate entity.

In many cases, it is not necessary to use potable water for the task at hand. Greywater, recycled water, and stormwater are alternatives to potable water use. If projects choose to filter water to upcycle, they should take into consideration potential energy trade-offs.

It is recommended, but not required, that project teams conduct a streamlined life-cycle assessment (LCA). Project teams pursuing multiple credits that require a LCA may find conducting a single comprehensive LCA more efficient. This will provide a single holistic evaluation of the environmental loads and impacts of the project over its entire life cycle, from the extraction of raw materials to the project's end of life. It is important to note that the use of surface and groundwater reduces the energy necessary to treat and transport potable water and should not be considered if use of

these waters will have a negative impact on water availability or quality (see credit RA3.1 Protect Fresh Water Availability).

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project meets regulatory requirements for water consumption. Water reduction does not exceed 25% over industry norms.

Performance Improvement: Design strategies include water efficient equipment, fixtures, and stormwater or greywater reuse. Reductions may be accomplished through design, construction, and operational changes through conservation and/or the ability to use, treat, and/or reuse nonpotable water. Reductions are estimated over industry norms.

EVALUATION CRITERIA AND DOCUMENTATION

- Have the owner and project team conducted planning or design reviews to identify potable water reduction strategies during operation and maintenance of the project and considered alternatives such as nonpotable water, recycled greywater, and stormwater?
 - Reports, memoranda, and minutes of meetings with project teams and owners regarding water reduction strategies.
 - Design documents of the project's water needs. Submissions may reference documentation for credit RA3.1 Protect Fresh Water Availability.

**METRIC:****Percentage of reduction in water use.**

B. Have the owner and project team conducted a feasibility and cost analysis to determine the most effective methods for potable water reduction and incorporated them in the design?

1. *Inventory of measures taken to reduce potable water consumption during operations.*
2. *Results of feasibility studies.*
3. *Design documents demonstrating the incorporation of water-saving strategies to the design.*

C. To what extent does the project reduce potable water consumption over industry norms?

1. *Calculation of the industry norm to be used as a benchmark.*
2. *Calculations of estimated annual water consumption over the life of the project. Document the percentage reduction over the industry norm benchmark. Calculations may omit nonpotable water use such as recycled greywater or natural surface water and groundwater withdrawals and rainwater, with minimal or no impact on site or at adjacent sites. Designs for use of greywater and rainwater (if appropriate) should be encouraged.*

D. Does the project result in a net positive generation of water and water upcycling as a result of onsite purification or treatment?

1. *Design documents demonstrating that the project achieves a 100% reduction in potable water use, using no water or meeting water needs through nonpotable sources, and provides an available source of usable water (potable or nonpotable) for neighboring projects or communities to offset their own water needs.*

RELATED ENVISION CREDITS

RA1.1 Reduce Net Embodied Energy

RA1.2 Support Sustainable Procurement Practices

RA2.1 Reduce Energy Consumption

RA3.1 Protect Fresh Water Availability

RA3.3 Monitor Water Systems

NW2.1 Manage Stormwater

CR1.2 Reduce Air Pollutant Emissions

CR2.1 Assess Climate Threat

RA3.3 MONITOR WATER SYSTEMS

INTENT:

Implement programs to monitor the performance of water systems and their impact on receiving waters.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) One-time monitoring. An initial commissioning of the project's water systems is specified to validate design objectives, but little to no effort is made to incorporate and facilitate long-term monitoring. (A, B)	(3) Operations monitoring. An extensive initial commissioning is conducted and equipment and/or software are incorporated into the design to allow detailed monitoring of performance. (A, B)	(6) Long-term monitoring. In addition to commissioning and metering, measures have been incorporated to the design and operation of the project to enable long-term water quality monitoring and reporting of surface and groundwater quantity and quality. Monitored data includes water quality data and temperature data. (A, B, C)	(11) Responsive monitoring. The project integrates impact monitoring and operational monitoring to allow responsive management, thereby improving efficiency, reducing negative impacts, and conserving both quantity and quality of water resources. (A, B, C)	

DESCRIPTION

Monitoring water systems and ensuring their proper and efficient operation helps both businesses and the environment. Systems capable of monitoring flows and usage and detecting leaks early save money in operations and prevent the needless waste of potable water and the embodied energy and emissions associated with its treatment and distribution.

Providing quality data and independent validation is the first step toward achieving sustainability goals. Monitoring programs are designed to verify that pollution control measures are working for pollutants of interest when applicable.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No ability to monitor water usage and leak detection beyond utility data. Project meets regulatory requirements for long-term monitoring of water usage.

Performance Improvement: Expand the scope and extent of monitoring activities. Plan to incorporate monitoring data to improve the operational efficiency of the project.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Have the owner and project team engaged an independent entity to monitor or oversee monitoring of the entire system or to periodically check the monitoring of the project?
 1. *Documentation of commissioning of monitoring authority requirements in the contract documents.*
 2. *Demonstration that the monitoring authority is independent of both the design and construction team or collected data are periodically checked by an independent authority.*
- B. Has the project design incorporated means to monitor water performance during operations?
 1. *Design documents and specifications identifying the installation of easily accessible and clearly labeled water sub-meters capable, at a minimum, of monitoring the water flow of all significant project functions.*
 2. *Design documents and specifications identifying the installation of leak detection systems, when appropriate, and water quality collection points.*

**METRIC:****Documentation of system monitoring in the design.**

C. Will the project integrate operations and impact monitoring to mitigate negative impacts and improve efficiency?

1. Rationale as to how the integrated monitoring systems may be used to mitigate negative impacts by shifting water demand to off-peak hours and/or by discharging water to groundwater recharge or constructed wetlands or other best management practices instead of through direct surface water connections or other means.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.4.2.

RELATED ENVISION CREDITS

LD3.1 Plan for Long-Term Monitoring and Maintenance

RA3.1 Protect Fresh Water Availability

RA3.2 Reduce Potable Water Consumption

NW2.1 Manage Stormwater

RA0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

To reward exceptional performance beyond the expectations of the system as well as the application of innovative methods that advance state-of-the-art sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
<p>(+8) Innovate or exceed credit requirements.</p> <p>Projects clearly document a performance that far exceeds both industry norms and the existing requirements within the system. Projects may also demonstrate the innovative application of methods, technologies, or processes that are novel either in their use, application, or within the local regulatory or cultural climate.</p>

DESCRIPTION

This credit addresses special instances in which projects far exceed the performance requirements of a credit or innovate in a way that advances the industry and field of knowledge. These points are not calculated in overall applicable points and, therefore, act as bonus points. Given the nature of the credit, the broad format of which is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Projects may pursue points for innovation or exceptional performance.

Exceptional Performance

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For instance, projects seeking additional points in credit RA3.1 Protect Fresh Water Availability must already be achieving a net positive restorative impact on water availability by obtaining water from renewable sources. In this case, exceptional performance may be pursued by projects whose magnitude of positive impact and investment in water restoration warrants the awarding of additional points. Exceptional performance may not be pursued by projects that have a basic primary function that meets the requirements. For instance, a reservoir may not pursue exceptional performance in credit RA3.1 Protect Fresh Water Availability unless aspects of that project far exceed the industry norm in protecting water sources and it is possible to clearly document that water restoration will occur above and beyond a comparable conventional project.

Exceptional performance constitutes achieving a remarkable increase in performance. This would be a multiple-factor increase in efficiency or effectiveness in one or more credits. Possible areas of achievement in exceptional performance for Resource Allocation may include, but are not limited to, the following:

- Projects for which procuring sustainable materials far exceeds the Conserving requirements in credit RA1.2 Support Sustainable Procurement Practices;

- Projects in which the net positive amount of renewable energy generation has significant impact in terms of scope or scale;
- Projects that achieve significant water efficiency by creatively re-examining water delivery or treatment.

Innovation

To qualify for innovation points, projects must demonstrate achievement in at least one of the following goals:

- Overcoming significant problems, barriers, or limitations—Project teams demonstrate that they have reduced or eliminated significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project;
- Creating scalable and/or transferable solutions—Project teams demonstrate that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.

Project teams may use innovative technology, methods, or application (e.g., the use of a pre-existing technology in a new way or the successful application of a technology or methods in regions or locales where existing policies, regulations, or general opinion have prevented their use). In these circumstances, it is imperative to prove that the application of the technology does, and will continue to, meet performance expectations and that it does not have a corresponding negative impact on the local or global environment, economy, or community.

Projects may demonstrate they implement innovative technologies or methods in several ways:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs;
- The project uses technologies or methods that may be general practice in other regions or parts of the world, but within the unique context

**METRIC:**

Whether project achievement qualifies as exceptional performance or innovation.

of the project (whether climate, regulations, policies, political support, public opinion, etc.) have not yet gained acceptance. Significant efforts are taken to demonstrate the effectiveness of the technology or method within the context and provide a precedent for future adoption.

- The project team takes significant steps to include research goals within the project's development, or work with a university or research organization to advance the general knowledge of the profession. Proprietary research that is not made publicly available cannot count toward achieving this credit.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Any action that is already documented as an evaluation criteria for credits within the Resource Allocation category.

Performance Improvement: Exceed evaluation criteria for the highest levels of achievement or implement innovative methods in meeting infrastructure needs that are not addressed within the system.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project exceeded the highest levels of achievement for a given credit?

1. *Detailed documentation of how the project exceeds existing requirements within a given Resource Allocation credit.*

B. To what extent does the project implement innovative technologies or methods?

1. *Documentation of the application of innovative technologies or methods. Detailed description of how this application will improve existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered innovative either as a technology, a method, or within the project context (climate, political, cultural, etc.).*

C. To what extent does the project overcome significant problems, barriers, or limitations or create scalable and/or transferable solutions?

1. *Documentation that the project reduces or eliminates significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project.*
2. *Documentation that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.*

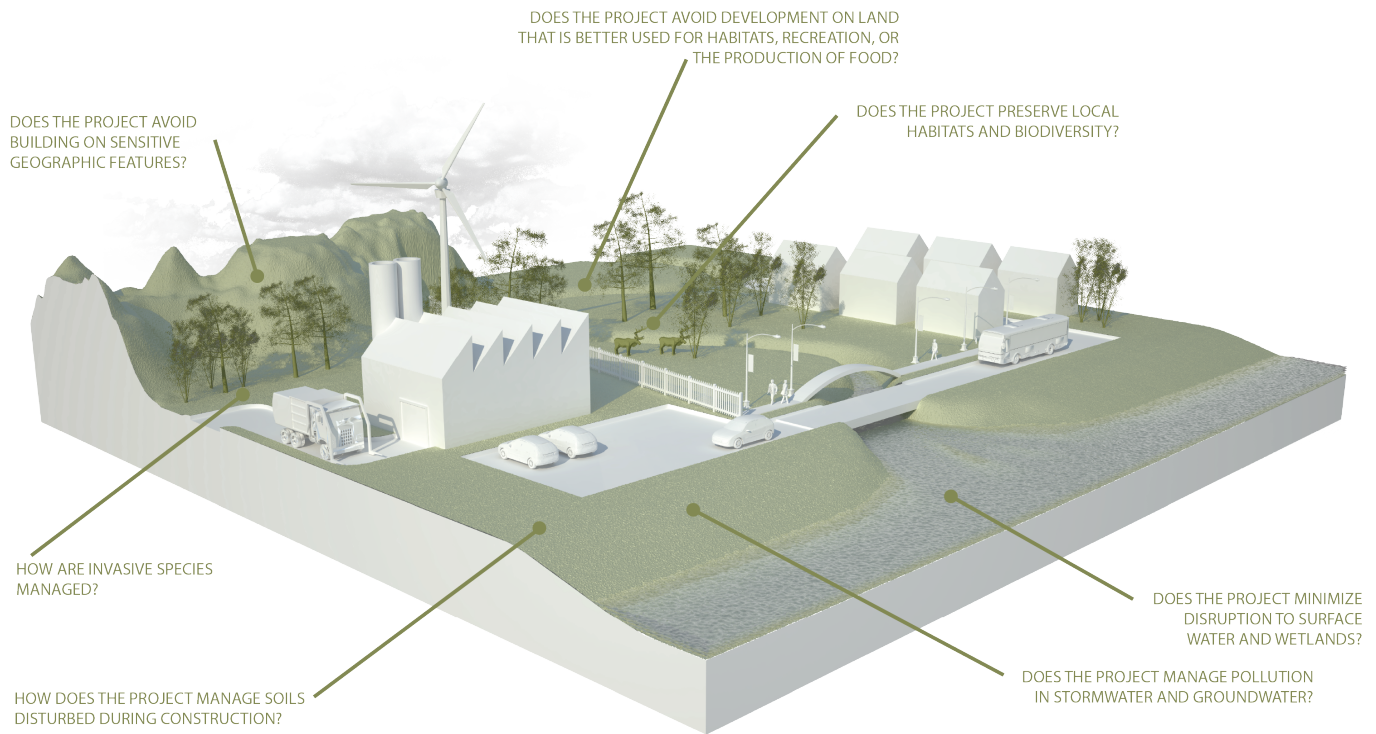




**NATURAL
WORLD**



NATURAL WORLD



NATURAL WORLD

Infrastructure projects have an impact on the natural world around them, including habitats, species, and nonliving natural systems. The way a project is located within these systems and the new elements they may introduce to a system can create unwanted impacts. This section addresses how to understand and minimize negative impacts while considering ways in which the infrastructure can interact with natural systems in a synergistic, positive way. These types of interactions and impacts have been divided into three subcategories: Siting, Land and Water, and Biodiversity.

SITING

Infrastructure should be sited to avoid direct and indirect impacts on important ecological areas such as areas of high ecosystem value or that serve as a diverse habitat, such as waterbodies, wetlands, or temporary waters. Projects should also seek to preserve areas of geologic or hydrologic value and avoid interrupting natural cycles, such as the hydrologic cycle. When the nature or significance of the infrastructure project makes it impossible to avoid sensitive sites, mitigation measures should be taken to minimize disruption of systems. Previously developed or disturbed land is ideal for preventing further damage to that environment, improving land value, and remediating contaminated brownfields.

LAND AND WATER

Infrastructure projects should minimize impacts on existing hydrologic and nutrient cycles. Special care should also be taken to avoid the introduction of contaminants, whether through stormwater runoff or pesticides and fertilizers. With proper foresight, infrastructure can avoid these harmful disruptions. It is important to remember that the impact of contamination is often cumulative, especially in waterbodies such as rivers and streams, and that each project and site shares responsibility for protecting the quality of the larger system.

BIODIVERSITY

Infrastructure projects can minimize negative impacts on natural species and their habitats on and near the site. Projects should avoid introducing invasive species or inadvertently facilitating their spread. Through careful design infrastructure projects can minimize habitat fragmentation and promote habitat connectivity and animal movement. Species of new vegetation should be carefully selected and be appropriate for the location. Infrastructure should not adversely impact wetlands, which tend to provide ecosystems that support a high degree of natural biodiversity.



1 SITING

- NW1.1 Preserve Prime Habitat
- NW1.2 Protect Wetlands and Surface Water
- NW1.3 Preserve Prime Farmland
- NW1.4 Avoid Adverse Geology
- NW1.5 Preserve Floodplain Functions
- NW1.6 Avoid Unsuitable Development on Steep Slopes
- NW1.7 Preserve Greenfields

2 LAND + WATER

- NW2.1 Manage Stormwater
- NW2.2 Reduce Pesticides and Fertilizer Impacts
- NW2.3 Prevent Surface and Groundwater Contamination

3 BIODIVERSITY

- NW3.1 Preserve Species Biodiversity
 - NW3.2 Control Invasive Species
 - NW3.3 Restore Disturbed Soils
 - NW3.4 Maintain Wetland and Surface Water Functions
- NW0.0 Innovate or Exceed Credit Requirements

NW1.1 PRESERVE PRIME HABITAT

INTENT:

Avoid placing the project and the site compound/temporary works on land that has been identified as being of high ecological value or as having species of high value.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
		(9) Avoid development. The project has avoided development of land that is judged to be prime habitat, including, but not limited to, patches of old-growth forest; land of high ecological value or home to species of high value; national parks, monuments, seashores, and forests; wildlife refuges; wildlife preserves; wild and scenic rivers; and other protected areas. (A)	(14) Protection of existing habitat. The project establishes a minimum 300-foot natural buffer zone around all areas deemed "prime habitat". Exceptions are possible if developed sites not within the project scope exist within the minimum distance. (A, B)	(18) Restore habitat. Project significantly increases the area of prime habitat and connectivity. This involves the restoration of habitat as determined by a qualified ecosystem professional. The habitat produced can be part of a protective buffer zone and can be at the site of the project or adjacent to the site. (A, B, C)

DESCRIPTION

Some areas are especially important in protecting wildlife biodiversity because of their size, location, diversity of habitat types, or presence of a particular type of habitat for plant or animal species. Some of these areas are large and already protected; for example, national parks and national forests provide large areas of undeveloped land and support a range of wildlife. Other habitat areas, such as areas of old-growth forest amidst a patch of younger trees, may be smaller and undocumented. However, all play important roles in maintaining biodiversity by providing crucial habitats for wildlife.

Through construction, noise, light pollution, removal of vegetation, and other practices, infrastructure projects can have negative effects on these areas as well as the local biodiversity. Infrastructure impacts can affect offsite areas as well. Therefore, siting infrastructure projects to prevent and minimize direct and indirect impacts is crucial. Problems associated with a poorly sited project are difficult to correct after construction. Preventing impacts by selecting appropriate sites during planning is significantly more effective.

Multiple third parties have already established definitions, standards, and programs for forest protection, including the Sustainable Forestry Initiative (SFI), Canadian Standards Association Sustainable Forest Management (CSA Z809), and Forest Stewardship Council (FSC) standards. These organizations' standards may be used in this credit to define priority conservation areas or as standards for preservation.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Awareness of the issue of preserving high ecological value lands, high conservation value forests, and land supporting high-value species. Checks made with state/provincial or local agencies regarding classifications or regulations regarding high ecological value land or lands supporting high-value species. Compliance with applicable regulations.

Performance Improvement: Shift from avoidance to maintenance to restoration.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Does the project avoid development on land that is judged to be prime habitat by a third party (including SFI, FSC, or CSA Z809)?
 1. Narrative describing efforts by an interdisciplinary team to research and document all areas of "prime habitat" near or on the site using local, state/provincial, or national prime habitat information.
 2. Documentation demonstrating that no areas of prime habitat are located on site or within the specified distance of developed areas.

**METRIC:****Avoidance of high ecological value sites and establishment of protective buffer zones.**

B. Does the project preserve, at a minimum, an appropriately sized buffer zone of undeveloped land or other habitat protection and connectivity according to the specified width around all prime habitat areas?

1. A site map illustrating a buffer of undeveloped land, fulfilling the aforementioned requirements, is preserved (or created if the site is currently developed) around all areas of prime habitat. Provide documentation to demonstrate appropriate size of buffer or other protection.

C. Does the project significantly increase the area of prime habitat through the restoration of vegetation and habitat connectivity to a degree suitable as habitat (as determined by a qualified habitat restoration professional), either as part of the protective buffer zone or adjacent to the site?

1. A restoration plan outlining any efforts to restore prime habitat either on the project site or adjacent to the site, including, at a minimum, a site map outlining locations of restoration and a species list of plants used. This documentation must be signed by a qualified natural resource professional whom assisted with the restoration and monitoring plan.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 4.1.1.

RELATED ENVISION CREDITS

QL2.2 Minimize Noise and Vibration

QL2.3 Minimize Light Pollution

NW1.2 Protect Wetlands and Surface Water

NW1.3 Preserve Prime Farmland

NW1.7 Preserve Greenfields

NW3.1 Preserve Species Biodiversity

NW3.2 Control Invasive Species

NW3.3 Restore Disturbed Soils

NW3.4 Maintain Wetland and Surface Water Functions

NW1.2 PROTECT WETLANDS AND SURFACE WATER

INTENT:

Protect, buffer, enhance, and restore areas designated as wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Avoid development and establish at least a 50-foot buffer. Avoid development on sites that contain or are located within 50 feet of wetlands, shorelines, or waterbodies. Additionally, if applicable, establish a vegetation and soil protection zone (VSPZ) for an area within 50 feet of any wetland areas, shoreline, or waterbody or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent. Activities prohibited in this buffer zone include construction of any structure or road, native vegetation removal, and grading, filling, dredging, or excavation. (A, B)	(4) At least a 100-foot buffer. Establish a VSPZ for an area within 100 feet of any wetland areas, shoreline, or waterbody or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent. (A, B)	(9) At least a 200-foot buffer. Establish a VSPZ for an area within 200 feet of any wetland areas, shoreline, or waterbody or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent. (A, B)	(14) At least a 300-foot buffer. Establish a VSPZ for an area within 300 feet of any wetland areas, shoreline, or waterbody or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent. (A, B)	(18) Aquatic and wetland restoration. In addition to establishing a VSPZ with a 300-foot buffer, the project restores previously degraded buffer zones to a natural state, making them elements of the VSPZ. (A, B, C)

DESCRIPTION

Wetlands, shorelines, and waterbodies provide a number of important ecological services, including mitigating flooding, improving water quality, and providing wildlife habitat. Maintaining the integrity of these important elements requires more than simply protecting the elements themselves from adverse impacts of infrastructure and related development. Buffer zones around wetlands, shorelines, and waterbodies play particularly important roles in the following:

- Protecting wildlife habitats, providing connected habitat corridors, and maintaining biodiversity—Many wetland and aquatic-dependent species also require access to riparian or upland habitats for feeding, nesting, breeding, and hibernation;
- Regulating water temperature—Receiving water infiltrated from surface sources to the ground in buffer areas and shade from vegetation in buffer areas maintains water temperatures. Increased water temperatures can harm aquatic life;
- Maintaining water quality—Buffer areas provide erosion control and filter excess nutrients, such as nitrogen and phosphorus, and pollutants from runoff through groundwater infiltration;
- Protecting hydrology—Buffer areas regulate the flow of stormwater runoff and help preserve surface water and groundwater levels and flows;

- Protecting against human disturbance—Providing a buffer helps protect wetlands and surface waters from impacts in nearby areas, including destroying vegetation, compacting soils, debris, noise, and light.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Determine the full extent, if any, of wetlands on the site. No special protection of buffers to wetlands, rivers, or shores other than what is required by regulations.

Performance Improvement: Improve and extend vegetation and VSPZ while shifting from protection to restoration. Delineate and protect wetlands and other aquatic habitats regardless of size or connectivity.

EVALUATION CRITERIA AND DOCUMENTATION

- Is the project located on a site that neither contains nor is located within the specified distance of vernal pools, wetlands, shorelines, or waterbodies, unless located on a previously developed site?
 - Documentation that the proposed site neither contains nor is within the specified distance of a wetland, vernal pool, shoreline, waterbody, or other aquatic resource.*

**METRIC:**

Size of natural buffer zone established around all wetlands, shorelines, and waterbodies.

B. If the site contains wetlands or waterbodies, has the project team established a VSPZ to provide a natural zone unaffected by development that maintains a buffer equal to the specified distance?

1. A site plan showing the final site design, the boundaries of the VSPZ, and the minimal VSPZ depth calculated as the shortest point between the VSPZ boundary and the identified wetland, waterbody, or shoreline.

C. Has the project team restored previously degraded buffer zones to a natural state on a previously developed site?

1. A restoration plan outlining any efforts to restore wetlands or waterbodies that includes, at a minimum, a site map outlining locations of restoration and proof that both required action types were taken. Restoration must include

(i) Stabilization of the stream channel or shoreline (bulkheads are not an acceptable stabilization measure for this objective) and

(ii) Revegetation with native plant communities. Stream channel restoration must include a geomorphic analysis of the reach and planning for dynamically stable stream banks based on channel dynamics and sediment transport.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 1.3: Preserve wetlands, Credit 3.3: Protect and restore riparian, wetland, and shoreline buffers.

U.S. Army Corps of Engineers Guidance on delineating wetlands.

RELATED ENVISION CREDITS

QL3.2 Preserve Views and Local Character

QL3.3 Enhance Public Space

NW1.1 Preserve Prime Habitat

NW1.5 Preserve Floodplain Functions

NW2.1 Manage Stormwater

NW3.4 Maintain Wetland and Surface Water Functions

NW1.3 PRESERVE PRIME FARMLAND

INTENT:

Identify and protect soils designated as prime farmland, unique farmland, or farmland of statewide importance.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
		(6) 95% Protection. The project team designates at least 95% of prime farmland as a vegetation and soil protection zone (VSPZ). Construction impacts from overall site development shall not decrease the capacity of the VSPZ to support the desired vegetation. No more than 10% of the total area of the VSPZ can contain development. (A, B)	(12) No development. Any soils designated as prime farmland soils, unique farmland, or farmlands of statewide importance found on the site are not developed. Credit is also earned if the owner and the project team can show that meaningful efforts were made to avoid the development of prime farmland during the site selection process. (A, B)	(15) Restore prime farmland. Previously developed areas deemed prime farmland are restored to a productive state. (A, B, C)

DESCRIPTION

Farmland supports the economic base of many rural and suburban communities. Agricultural land is vital to achieving local and national food, health, and economic security. For instance, in the United States, farming employs nearly 23 million people and contributes nearly \$1 trillion to the national economy. In Canada the agriculture and agri-food systems employ 2.1 million people generating \$103.5 billion and accounting for 6.7% of Canada's GDP.

Agricultural land also supplies products with little market value, but enormous cultural and ecological importance. Some are more immediate, such as social heritage, scenic views, open space, and community character. Long-range environmental benefits include wildlife habitat, clean air and water, flood control, groundwater recharge, and carbon sequestration.

Prime farmland possesses a combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops economically if it is treated and managed according to acceptable farming methods. Soil properties are only one of several criteria that are necessary for land to be designated as prime farmland. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding. In the United States, prime farmland is designated by the

U.S. Department of Agriculture (USDA); in Canada, it is classified by the Canadian Land Inventory (CLI).

However, despite its importance to individual communities and the world, farmland is at risk. It is imperiled by poorly planned development, especially in urban-influenced areas, and by the complex forces driving conversion. For instance, the U.S. Department of Agriculture's (USDA's) Economic Research Service developed urban influence codes to classify each of the nation's 3,141 counties and county equivalents into groups that describe the degree of urban influence. The American Farmland Trust found that, in 1997, farms in the 1,210 most urban-influenced counties produced 63% of dairy products and 86% of fruits and vegetables.

Agricultural land is desirable for building because it tends to be flat, well drained, and generally is more affordable to developers than to farmers and ranchers. Far more farmland is being converted than is necessary to provide housing for a growing population.

Over the past 20 years, the acreage per person for new housing has almost doubled. Most of this land is outside of existing urban areas. Since 1994, lots of 10 to 22 acres accounted for 55% of the growth in the housing area. The USDA shows that the best agricultural soils are being developed fastest.

Farmland designations for most of the United States can now be accessed at the county level from the USDA Soil Survey Geographic (SSURGO) soil surveys database. Use the Web Soil Survey for areas of 10,000 acres or less. Similar information for Canada can be accessed through the Canadian Soil Information Service (CanSIS).

**METRIC:**

Percentage of prime farmland avoided during development.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team checks if any soils on site are designated by the Natural Resources Conservation Service as prime farmland, unique farmland, or farmland of statewide importance.

Performance Improvement: Protection shifts to preservation (e.g., no development on prime farmland). It is important to note that the restoration of land to prime farmland is difficult.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Have the project owner and the project team assessed the project site and determined whether or not onsite soils have been identified as prime farmland, unique farmland, or farmland of statewide importance to conserve for future generations?

1. *Results of government studies and soil surveys.*

- B. To what extent is prime farmland, unique farmland, or farmland of statewide importance to conserve for future generations protected or preserved by this project?

1. *Documentation showing how prime farmland is protected or development is prevented.*

2. *Documentation showing that no soils have been stripped from areas on the site defined as prime farmland.*

- C. To what extent has farmland, unique farmland, or farmland of statewide importance to conserve for future generations been restored by this project?

1. *Demonstration that restoration of prime farmland was accomplished.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 1.1: Limit development of soils designated as prime farmland, unique farmland, and farmland of statewide importance.

U.S. Farmland Protection Policy Act, Section 2 (a) (c) (1), www.nrcs.usda.gov.

Fact Sheet: Why Save Farmland? American Farmland Trust, 2/2004, www.farmlandinfo.org.

Food Secure Canada, Protecting Canada's Farmland—Principles and Beneficial Practices, Research Bulletin, June 2014, foodsecurecanada.org

Agriculture and Agri-Food Canada, Overview of Classification Methodology for Determining Land Capability for Agriculture, 2013 sis.agr.gc.ca

CLI HYDRO and CLI coverage maps, 4/2014, sis.agr.gc.ca/cansis/nsdb/cli/index.html.

USDA National Resources Conservation Service: Web Soil Survey, 2/2014, websoilsurvey.nrcs.usda.gov.

RELATED ENVISION CREDITS

QL1.1 Improve Community Quality of Life

QL1.2 Stimulate Sustainable Growth and Development

QL3.2 Preserve Views and Local Character

LD3.1 Plan for Long-Term Monitoring and Maintenance

RA1.6 Reduce Excavated Materials Taken Off Site

NW1.1 Preserve Prime Habitat

NW1.7 Preserve Greenfields

NW1.4 AVOID ADVERSE GEOLOGY

INTENT:

Avoid development on adverse geologic formations and safeguard aquifers to reduce risks of natural hazards and preserve high-quality groundwater resources.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Comprehensive delineation. Before project siting, the owner and the project team have identified and delineated any faults, low-lying coastline, and karst areas in and around the project site. Identification and delineation includes location, distribution, characteristics, and groundwater hydrogeology, including flow and quality. (A)	(2) Sound risk management. Plans and designs are developed to reduce the risk of damage caused by ground motion, tsunami flooding, and collapse of karst areas and associated aquifer damage or from the hazards of these areas (e.g., subsidence, sinkholes, and flooding). Operating procedures for the completed project are designed to prevent damage and contamination. Programs for monitoring are established. (A, B)	(3) Protection and risk management. Based on extensive geotechnical and hydrogeologic assessments, the adverse geologic areas and associated aquifers are well defined. Hazard areas are defined, designated, and avoided. Buffers around faults, coastlines, and karst features are established. Runoff controls, spill prevention, and cleanup plans are created and implemented. (A, B, C)	(5) Total avoidance. The owner and the project team site the project in a safe area that has no adverse geologic features and no negative affects on aquifers. (A, B, C, D)	

DESCRIPTION

There are many types of geologic formations that are difficult to deal with and can either create risk to development or destroy a precious natural resource. Earthquake faults can give rise to devastating ground movements, soil liquefaction, and tsunamis. Coastlines also are at risk of damage from tsunamis, storms, and flooding. In contrast, karst topography can be considered a green infrastructure resource because it may be a source of high-quality water and provide mechanisms for groundwater recharge, stormwater storage, open space, habitat, and recreation. It also can be a natural hazard subject to subsidence, sinkholes, flooding, and groundwater contamination. Natural processes, such as earthquakes and sinkhole formation, can cause increased building and infrastructure maintenance costs (e.g., structural damage to buildings, collapse of roads, and broken underground utilities).

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Follow local regulations regarding building in identified earthquake-prone areas and over karst formations.

Performance Improvement: Shift from delineation to management of risk. Then, shift from management controls to multiple levels of protection and public education. Ultimately, avoid earthquake and tsunami-susceptible areas and karst geology altogether.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Has the project team identified and delineated earthquake faults, low-lying coastal areas, and karst formations and aquifers?
 1. *Documentation of site investigations to identify and delineate earthquake faults, tsunami-susceptible coastlines, and karst areas and aquifers, including the location of the project site relative to these features.*
- B. Has the project team developed plans and designs to reduce the risk of damage and established operating procedures and a monitoring program for adverse geologic settings?
 1. *Documentation of design of the project that illustrates strategies used to avoid damage to sensitive geology or damage from adverse geology, as shown in operating plans and monitoring plans.*
- C. Has the project team established hazard areas, developed buffers around adverse geologic areas, and created runoff controls and spill prevention and cleanup plans?
 1. *Documentation showing hazardous areas and plans that illustrate buffers and runoff controls and spill prevention and cleanup plans.*
- D. Has the project team chosen a site that avoids earthquake- and karst-related damage and does not affect underlying aquifers?
 1. *Documentation that no faults or karst features exist on site nor do any site activities affect underlying aquifers.*



METRIC:

Degree to which natural hazards and sensitive aquifers are avoided and geologic functions are maintained.

RELATED ENVISION CREDITS

RA3.1 Protect Fresh Water Availability

NW1.6 Avoid Unsuitable Development on Steep Slopes

NW2.3 Prevent Surface and Groundwater Contamination

CR2.4 Prepare for Short-Term Hazards

NW1.5 PRESERVE FLOODPLAIN FUNCTIONS

INTENT:

Preserve floodplain functions by limiting development and the impacts of development to maintain water management capacities and capabilities.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Avoid or mitigate impacts. Avoid or limit new development within the design frequency floodplain for waterways of all sizes, unless the project is water-dependent infrastructure that must cross or be adjacent to a waterway. Design water-dependent infrastructure to minimize floodplain impacts or waterway crossings. The project maintains pre-development floodplain storage and does not increase flood elevations. (A)	(5) Maintain infiltration and water quality. Limit or eliminate the use of impervious surfaces to allow for groundwater infiltration. Maintain or enhance vegetation and soil protection zones. Impacts from overall site development shall not decrease the capacity of the floodplain riparian vegetation and soil protection zone to support the desired vegetation. Take into consideration possible beneficial use of stormwater runoff. (A, B)	(8) Enhance riparian and aquatic habitat. Prepare flood emergency plan for floodplain infrastructure. Maintain or enhance the riparian and in-channel physical and vegetative habitat to support threatened and endangered or otherwise desirable species. Emergency operation and/or evacuation plans are prepared for all infrastructure in floodplains. (A, B, C, D)	(14) Enhance connectivity and sediment transport. Modify or remove structures frequently damaged by floods. The project is designed to not inadvertently trap sediment and to allow fish passage through project reach. If repeatedly damaged structures are in project reach, they are removed or modified to reduce the potential for flood damages. (A, B, C, D, E, F)	

DESCRIPTION

Impervious surfaces increase stormwater runoff volume, stream temperatures, and pollutant loading on waterways. Some infrastructure projects may not be able to avoid the floodplain (e.g., roadway and utility crossings, wastewater treatment facilities, ports, and other water-dependent structures). However, these structures should be designed to minimize waterway crossings and floodplain impacts. The project is designed to maintain floodplain storage and to not increase flood elevations.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Floodplain functions are not considered beyond local laws and requirements.

Performance Improvement: Shift from avoiding floodplain development to maintaining floodplain functions. Extend to enhancement of riparian and aquatic habitat. Move to considering aquatic habitat connectivity and sediment transport. Shift to consideration of extreme flood events caused by climate change and to restore connectivity to fragmented aquatic and riparian habitat and sediment transport.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Does the project avoid or limit new development within the design frequency floodplain for waterways of all sizes (unless the project is water-dependent infrastructure that must cross a waterway) or is the water dependent infrastructure designed to minimize floodplain impacts or waterway crossings?
 1. Documentation showing the location of the project relative to the 100-year or design floodplain.
 2. Documentation showing siting choices relative to floodplains and how impacts to the floodplain have been reduced.
 3. Document pre- and post-floodplain storage and floodplain elevations and show that the project does not increase flood elevations outside of project easements and maintains floodplain storage.
- B. Does the project maintain pre-development floodplain infiltration and water quality?
 1. Documentation of approaches used to maintain pre-development floodplain infiltration, such as amount of impervious surfaces, established vegetation and soil protection zones, and other approaches that allow for natural floodwater infiltration and filtration of pollutants.
 2. Estimates of pre-development floodplain infiltration capacity and estimates of post-development floodplain infiltration capacity using the aforementioned strategies.

**METRIC:**

Efforts to avoid floodplains or maintain predevelopment floodplain functions.

C. Does the project maintain or enhance riparian and aquatic habitat and the riparian and in-channel physical and vegetative habitat to support threatened and endangered or otherwise desirable species?

1. Documentation of strategies to maintain or enhance habitat within and along the waterway in the floodplain.

D. Has a flood emergency plan been prepared for all infrastructure in the floodplain, accounting for emergency operations and/or evacuation?

1. Provide documentation of a flood emergency management plan to address the operation and/or evacuation plan for all infrastructure in the floodplain.

E. Does the project maintain or enhance aquatic habitat connectivity and sediment transport?

1. Documentation of strategies used to maintain or enhance aquatic habitat connectivity, fish, and sediment transport, including removal of barriers and traps.

F. Is infrastructure subject to frequent damage by floods being modified or removed?

1. Inventory of flood-damaged infrastructure and plan/design to modify or remove flood-damaged infrastructure.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 1.2: Protect floodplain functions.

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 2.3.

RELATED ENVISION CREDITS

RA3.1 Protect Fresh Water Availability

NW1.2 Protect Wetlands and Surface Water

NW1.7 Preserve Greenfields

NW2.1 Manage Stormwater

NW2.3 Prevent Surface and Groundwater Contamination

NW3.3 Restore Disturbed Soils

NW3.4 Maintain Wetland and Surface Water Functions

NW1.6 AVOID UNSUITABLE DEVELOPMENT ON STEEP SLOPES

INTENT:

Protect steep slopes and hillsides from inappropriate and unsuitable development to avoid exposures and risks from erosion, landslides, and other natural hazards.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
<p>(1) Best practices.</p> <p>Assess the selected site. Design the project to minimize alteration to avoid excessive erosion and the potential for landslides. Institute management practices for the completed project to control erosion and prevent landslides. Add protection to down-slope buildings, facilities, and infrastructure from erosion and landslides.</p> <p>(A)</p>		<p>(4) Optimal project siting.</p> <p>Work with local officials, property owners, and other stakeholders to select and acquire a project site that is sufficiently suited for the project purpose. Seek to minimize siting on hillsides or steep slopes. Work to locate and acquire the best location that minimizes the possibility of excessive erosion and landslides.</p> <p>(A, B)</p>	<p>(6) Steep slopes avoided.</p> <p>Work with local officials, property owners, and other stakeholders to select and acquire a project site that is on land that has no hillsides or steep slopes. In the planning phase, project locations involving hillsides and steep slopes are determined to be candidates for the project site. Even though hillside/steep slope sites are candidates, none are selected.</p> <p>(C)</p>	

DESCRIPTION

Hillsides and steep slopes are part of the natural beauty of a landscape. These features increase the values of property and viewsheds and offer opportunities for recreation. At the same time, development on or near these features creates risks. For example, if improperly developed, hillsides and steep slopes can increase the potential for erosion and landslides. These features also present a greater danger from fires because they are more difficult to control or fight.

Designing, building, and maintaining infrastructure on hillsides and steep slopes, especially roads, sewers, water systems, and power lines, is also more expensive because of the challenges of the terrain.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Follow local regulations, standards, and ordinances regarding development on hillsides and steep slopes, if any.

Performance Improvement: Shift from optimal siting and erosion control to avoiding development on high risk or steep slopes altogether, if possible.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Does the project follow best management practices to manage erosion and prevent landslides?
 - 1. *Documentation of best management and design practices used, including protection of downslope buildings, facilities, and infrastructure.*
- B. Is the project sited optimally and managed to avoid excessive erosion?
 - 1. *Documentation of process used to identify and choose site, including meetings with officials and other stakeholders, site options with benefits and shortfalls of each, and reasoning used for final site selection.*
- C. Does the project avoid high-risk hillsides or steep slopes?
 - 1. *Documentation of process used to identify high-risk hillsides or steep slopes and their location relative to the final site selected.*

RELATED ENVISION CREDITS

- QL3.2 Preserve Views and Local Character
- NW1.4 Avoid Adverse Geology
- NW3.3 Restore Disturbed Soils
- CR2.4 Prepare for Short-Term Hazards



METRIC:

Degree to which development on steep slopes is avoided or to which erosion control and other measures are used to protect the completed project as well as other down-slope structures.

NW1.7 PRESERVE GREENFIELDS

INTENT:

Conserve undeveloped land by locating projects on previously developed greyfields and/or sites classified as brownfields.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) At least 25% greyfield. At least 25% of the developed area of the project is to be located on a greyfield. (A)	(6) At least 50% greyfield. At least 50% of the developed area of the project is to be located on a greyfield. (A)	(10) At least 75% greyfield. At least 75% of the developed area of the project is to be located on a greyfield. (A)	(15) 100% greyfield. One hundred percent of the developed area of the project is to be located on a greyfield. (A)	(23) Remediate a brownfield. The project is located on a brownfield site; a site documented as contaminated by means of an American Society for Testing and Materials (ASTM) E1903-11 Phase II Environmental Site Assessment, Canadian Council of Ministers of the Environment (CCME) National Classification System for Contaminated Sites PN 1403, or a local voluntary cleanup program; or defined as a brownfield by a local, state, or federal government agency. Remediation measures should be sufficient for the planned future use of the site. (A, B, C)

DESCRIPTION

Selecting previously developed greyfields rather than undeveloped greenfields often has fewer impacts on wildlife (by minimizing the likelihood of new habitat fragmentation and reducing the disturbance associated with construction or operations of new infrastructure); lessens the need for additional infrastructure (previously developed sites tend to be already well connected to transportation, water, and other infrastructure systems, whereas greenfield sites may not be); and reduces pressures on development for greenfield sites.

While the term “greyfield” in some contexts may refer to underutilized or abandoned sites, this credit defines all previously developed sites as greyfields. Developed sites consist of pre-existing paving, construction, or altered landscapes. However, land dedicated to current agricultural use, forestry use, or use as a preserved natural area does not qualify as a greyfield even if it contains pre-existing paving, construction, or altered landscapes.

Brownfield sites are properties with documented or assumed contamination caused by former uses. Choosing to redevelop brownfield sites avoids environmental impacts of greenfield development (habitat fragmentation, etc.). In addition, remediating brownfields has the added environmental benefit of cleaning up contamination. These often underutilized sites can pose environmental and health risks to their communities (including water contamination and illness). Cleaning up contamination benefits the local environment and community.

Project teams consider the advantages of locating projects in areas designated or recognized as urban core/desired development zones. Such projects often:

- Promote urban development and channel development to urban areas, resulting in reduced pressure on undeveloped land and conservation of resources;
- Promote socioeconomic urban and neighborhood revitalization. This includes safety improvement, creation of short- and long-term local jobs, and the creation or preservation of parks and other recreational property.

In choosing greyfield sites, projects may realize the following additional benefits:

- Under the Natural World category, projects may provide for the restoration of impaired drainage-ways and other damaged or stressed natural resources;
- Under the Quality of Life category, these projects may positively impact historically and economically disadvantaged urban populations;
- Under the Resource Allocation category, projects located on greyfield sites may provide for the reuse of existing underground and above-ground structures, including buildings, utilities, and roadways.

**METRIC:**

Percentage of area that is a greyfield or the use and cleanup of a site classified as a brownfield.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project site selected is a greenfield site (i.e., a site where no previous development has taken place). Little or no effort was made to locate the project on a greyfield or brownfield site.

Performance Improvement: Site the project to include increasing amounts of previously developed land or select a brownfield site and conduct the necessary cleanup or mitigation measures.

EVALUATION CRITERIA AND DOCUMENTATION

A. Is the project located on a site that was previously developed, and what percentage of the project site was previously developed?

1. *Documentation showing the percentage of the developed area of the site that was formerly developed and may be classified as a greyfield.*

B. Is the project located on a site where all or part of it is documented as contaminated or on a site deemed a brownfield by local, state/provincial, or federal government agencies?

1. *Documentation of brownfield status of the site. Documentation of the local, state/provincial, or federal agency designation or results from an ASTM E1903-11 Phase II Environmental Assessment, or CCME National Classification System for Contaminated Sites PN 1403, confirming contamination will suffice.*

C. Has a brownfield remediation plan been prepared using approved methods?

1. *Documentation that the controlling public authority has approved proposed remediation measures for the site.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 1.5: Select brownfields or greyfields for redevelopment.

ASTM E1903-11 Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process.

Canadian Council of Ministers for the Environment (CCME) National Classification System for Contaminated Sites, PN 1403.

RELATED ENVISION CREDITS

QL3.2 Preserve Views and Local Character

NW1.1 Preserve Prime Habitat

NW1.3 Preserve Prime Farmland

NW1.5 Preserve Floodplain Functions

NW2.1 MANAGE STORMWATER

INTENT:

Minimize the impact of infrastructure on stormwater runoff quantity and quality.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
	(4) Increased storage capacity. The target water storage capacity for greyfields is a 30% improvement in water storage capacity. For brownfields, it is 20% improvement. Greenfield site maintains 100%. (A)	(9) Extended storage capacity. The target water storage capacity for greyfields is a 60% improvement in water storage capacity. For brownfields, 40% improvement. Greenfield site maintains 100%. (A)	(17) Sustainable stormwater management. The target water storage capacity for greyfields, is 90% improvement in water storage capacity. For brownfields, 60% improvement. Greenfields maintain the pre-development water storage capacity. (A)	(21) Enhanced stormwater management. Runoff is maintained on site and/or restores the hydrologic conditions of the undeveloped regional ecosystem. Stormwater management programs and stormwater handling structures are designed to capture and repurpose more than 100% of stormwater on site as part of overall water management regime. (B)

DESCRIPTION

Development causes a change to the natural flow of runoff on a site. Increasing the quantity of impervious surfaces reduces the amount of stormwater that infiltrates to the ground, decreases the amount absorbed and expired by plants (evapotranspiration), and increases the amount of surface runoff.

Impervious Surfaces (Percentages of total site)	% of Stormwater that becomes runoff
0 (Undeveloped Site)	10%
10-20	20%
35-50	30%
75-100 (Urban Area)	55%

Source: The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 3.5: Manage stormwater onsite.

Increased surface runoff typically leads to increases in the erosion of land surfaces, increased water temperatures, and an increase in pollutants reaching surface waters. It can deposit sediment and pollutants into waterways and warm historically cold-water streams. It also increases the quantity of water that drains into water bodies, which can cause channel erosion in streams and downstream flooding. Changes in flow, increased sedimentation, pollutants, water temperatures, and loss of groundwater input can negatively impact aquatic life as native species are replaced with more pollutant-tolerant warm-water species.

Low-impact development measures can be incorporated into the design to reduce the negative impacts associated with increased runoff. Designs attempt to maintain or restore the water storage/infiltration ability of a site through infiltration, evapotranspiration, water harvesting, and cistern storage. These may include rain gardens and bioretention, rooftop gardens, sidewalk storage, vegetated swales, buffers and strips, tree preservation, roof leader disconnection, rain barrels and cisterns, permeable pavers, soil amendments, impervious surface reduction and disconnection, and pollution prevention. Many of these features also provide some level of treatment of the runoff, filtering pollutants and cooling runoff water before reaching the receiving waterway and maintaining or restoring groundwater input to the waterway. Low-impact development measures do not include stormwater ponds that store, but do not infiltrate, stormwater, increasing the temperature of stormwater discharged to receiving waterways.

The National Resource Conservation Service's Technical Release 55 (TR-55) Small Watershed Hydrology methodology can be used in conjunction with previously published work to determine the target percentage of improvement in a site's infiltration, evapotranspiration, and water harvest capacity. This also can be calculated using continuous simulation modeling.

Determine and document the initial, final post-development, and target water storage, infiltration, evaporation, water harvesting, and/or cistern storage capacities using TR-55 or other continuous simulation modeling methods to describe site conditions. Adequate documentation of methods used and results obtained are submitted. For this credit, "target water storage capacity" is defined as follows:

**METRIC:**

Infiltration and evapotranspiration capacity of the site and return to pre-development capacities.

- For greenfields, the target water storage capacity is the pre-development water storage capacity;
- For greyfields and brownfields, the target water storage capacity using TR-55 runoff curve numbers (CNs) has been established for the various climates across the United States to represent pre-development conditions, as follows:
 - Humid East Coast (e.g., Raleigh, North Carolina)—70;
 - Humid Midwest (e.g., Chicago, Illinois)—70;
 - Humid West Coast (e.g., Portland, Oregon)—70;
 - Semiarid West (e.g., Denver, Colorado)—60;
 - Arid Southwest (e.g., Los Angeles, California)—85.

Determine and document that any increased infiltration occurring on site will not exacerbate regional ecological or safety problems. For example, increased infiltration in arid climates may alter historic stream types, converting ephemeral streams to perennial streams.

Determine and document that design will not negatively affect receiving waters by changing the site water balance so that detrimental impacts to base flow, nutrient cycling, sediment transport, and groundwater recharge occur. For example, water harvesting techniques that starve receiving systems of adequate flows necessary to maintain the ecological function of downstream waters are not used.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Development meets minimum regulatory requirements for stormwater management. Create and implement an erosion, sedimentation, and pollutant control plan—commonly referred to as Stormwater Pollution Prevention Plan (SWPPP) or Erosion and Sedimentation Control Plan (ESCP)—for all construction activities associated with the project. The plan (SWPPP or ESCP) conforms to erosion and sedimentation requirements of the 2003 (or most current version) U.S. Environmental Protection Agency Construction General Permit or local erosion and sedimentation control standards and codes, whichever is more stringent.

Performance Improvement: Improvements in water storage/infiltration capacity, extending to capacities larger than those established for pre-development conditions.

EVALUATION CRITERIA AND DOCUMENTATION

- A. What percentage of improvement for a greyfield or brownfield site does the site's proposed water storage, infiltration, evapotranspiration, and/or water harvesting capacity achieve or does the site maintain a greenfield site water storage capacity?
 1. *Documentation of the initial, final post-development, and target water storage, infiltration, evaporation, water harvesting, and/or cistern storage capacities using TR-55 Curve Numbers (CNs) or other continuous simulation-modeling methods to describe site conditions.*
- B. Is 100% of the target water storage capacity achieved for greyfield and brownfield sites or does the greenfield site exceed 100% target water capacity to mitigate the impact of adjacent developed sites?
 1. *Documentation of the initial, final post-development, and target water storage, infiltration, evaporation, water harvesting, and/or cistern-storage capacities using TR-55 Curve Numbers (CNs) or other continuous simulation modeling methods to describe site conditions.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 3.5: Manage stormwater onsite.

RELATED ENVISION CREDITS

- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems
- NW1.2 Protect Wetlands and Surface Water
- NW1.5 Preserve Floodplain Functions
- NW2.3 Prevent Surface and Groundwater Contamination
- NW3.4 Maintain Wetland and Surface Water Functions

NW2.2 REDUCE PESTICIDE AND FERTILIZER IMPACTS

INTENT:

Reduce non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Application management. Operational policies and programs are designed to control the application of pesticides and fertilizers so they are not over applied. Runoff controls are put in place to minimize contamination of groundwater and surface water. (A, B)	(2) Pesticide, herbicide, and fertilizer selection. The project team designs the landscaping to incorporate plant species that require less use of fertilizers and pesticides. Management programs are established to select pesticides and fertilizers with low toxicity, persistence, and bioavailability. Programs are designed to control and reduce fertilizer use by increasing use of compost. (A, B, C)	(5) Better selection, lower use. The project team reduces the potential negative impacts of pesticide and fertilizer use by a combination of plant species that need little or no fertilizers and pesticides and by increasing the use of pesticides and fertilizers with low toxicity, persistence, and bioavailability. (A, B, C)	(9) No pesticide, herbicide, or fertilizer use. The project team designs landscaping to incorporate plant species that require no pesticides, herbicides, and fertilizers. Increased use of composting; integrated pest management is practiced. (D)	

DESCRIPTION

Pesticides and fertilizers are a significant non-point-source pollutant and, whenever possible, their use should be reduced or eliminated. Over application of pesticides and fertilizers is a persistent problem. These chemicals can contaminate runoff and pollute streams, rivers, lakes, and groundwater. If chemicals are necessary, it is often possible to source less-toxic pesticides and fertilizers. In addition, better-suited plants often can be chosen to grow in a particular climate without fertilizers and to resist pests.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Some efforts are made to control the types and use of pesticides and fertilizers, primarily based on cost savings. Some procurement criteria are used covering toxicity, persistence, and bioavailability.

Performance Improvement: Shift from managed use to better selection and selecting products with decreased toxicity, persistence, and bioavailability. Shift from minimal use of pesticides and fertilizers to no use.

EVALUATION CRITERIA AND DOCUMENTATION

- A. What operational policies will be put in place to control the application fertilizers and pesticides?
1. Operational policies for applying fertilizers and pesticides.

- B. What runoff controls will be installed to minimize groundwater and surface water contamination?

1. Plans and drawings showing how runoff controls will be designed and installed.

- C. Has the project team selected pesticides and fertilizers that have low toxicity, persistence, and bioavailability?

1. Documentation showing the mix of pesticides and fertilizers to be used on the finished project, along with measurements of their toxicity, persistence, and bioavailability.

- D. Has the project team designed landscaping to incorporate plant species that require no pesticides, herbicides, and fertilizers or to use integrated pest management approaches?

1. Documentation of plans for landscaping showing the mix of plant species.
2. Design specifications showing that no herbicides or pesticides will be used on the project site.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 1.1: Limit development of soils designated as prime farmland, unique farmland, and farmland of statewide importance.



METRIC:

Efforts made to reduce the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers used on site, including the selection of plant species and the use of integrated pest management techniques.

RELATED ENVISION CREDITS

RA3.1 Protect Fresh Water Availability

NW2.3 Prevent Surface and Groundwater Contamination

NW3.1 Preserve Species Biodiversity

NW3.2 Control Invasive Species

NW2.3 PREVENT SURFACE AND GROUNDWATER CONTAMINATION

INTENT:

Preserve freshwater resources by incorporating measures to prevent pollutants from contaminating surface and groundwater and monitor impacts over operations.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Design for response. Protection is accomplished by spill and leak diversion systems, spill prevention plans, and cleanup. (A, B)	(4) On-site monitoring. Measures have been incorporated into the design and operation of the project to enable onsite water quality monitoring and reporting. Monitoring will include surface and groundwater quantity and quality. Monitored data include water quality data and temperature data. (A, B)	(9) Design for prevention. During the design stage, the location of equipment and facilities containing potentially polluting substances are located away from sensitive environments. Runoff interceptors and drainage channels are designed to accommodate pollutants in stormwater runoff or ice melt, potential spills, and leakage. Spill prevention and response plans are in place. During operation, methods to monitor and minimize pollutants in stormwater runoff or ice melt are used. (A, B, C)	(14) Design for source elimination. Designers focus on eliminating potentially polluting substances from operations. If unable to do so, designers seek to recycle the substances, keeping them within the operation or sending them off site for use in other applications. Designers continue to address prevention measures by identifying equipment and facilities containing potentially polluting substances and locating them away from sensitive environments. (A, B, C)	(18) Remediate existing contamination. The project prevents future contamination by cleaning up previously contaminated land, restoring wellhead protection, and installing land-use controls to prevent future contamination. Restoration also may include removal of materials storage piles, rerouting of surface runoff, or restoring groundwater infiltration patterns. (A, B, C, D)

DESCRIPTION

Aquatic ecosystems depend on a particular set of water conditions. Changes to any of these factors can adversely affect aquatic life and groundwater quality. Aquatic ecosystems are threatened by changes in pH, decreases in water clarity, and increases in temperature, dissolved solids, coliform bacteria, toxic substances, and nutrients (especially phosphorus and nitrogen).

Groundwater is a widely used source of drinking water. Protection of groundwater from contamination around water supply wellheads reduces the chances of groundwater contamination and protects natural water purification processes. Design and operation of the completed project should take into account wellhead protection plans and other requirements.

Concerns regarding equipment and facilities containing potentially polluting substances include fuel and chemical storage, pipelines, piles of raw materials, and process areas.

At the construction stage, potential sources of groundwater and surface water contamination include spills and leaks from tanks, pipes, and construction vehicles; leaching of pollutants from raw or waste materials; and releases of pollutants from the demolition of previously completed projects.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Meet basic regulatory requirements for water quality and spill prevention planning (e.g., spill, prevention, control, and counter-measure plans). Compliance with existing zoning and groundwater protection regulations.

Performance Improvement: Shift from response to prevention to source reduction and elimination. Special considerations are given to the protection and restoration of water-supply wellhead areas.

**METRIC:**

Designs, plans, and programs instituted to prevent and monitor surface and groundwater contamination.

EVALUATION CRITERIA AND DOCUMENTATION

A. Have adequate and responsive surface and groundwater quantity and quality monitoring systems been incorporated into the project design?

1. *Documentation of hydrogeologic delineation studies, taking into consideration the complexity of the aquifers. (Note that delineation already may have been done by local authorities.)*
2. *For projects situated in areas where the groundwater is used as a source or drinking water, documentation of wellhead protection plans and other requirements including establishing wellhead protection areas.*
3. *Documentation of surface and groundwater quality monitoring programs.*
4. *Documentation that the completed project cannot reasonably have any impact on receiving waters. Show that there is no direct connection to receiving waters from the site of the construct work or that pollutant best management practices are implemented and both the discharges to receiving waters and the receiving waters themselves are monitored to verify pollutant loading, biological impact, and the impact on receiving water flow.*

B. Have spill and leak prevention and response plans and designs been incorporated into the design?

1. *Spill and leak prevention and response plans.*
2. *Plans and drawings showing the placement of materials storage piles and handling of potentially polluting runoff.*

C. Has the project team reduced or eliminated potentially polluting substances from construction and operation of the completed project?

1. *Efforts to reduce the use of or replace hazardous and/or potentially polluting materials with nonhazardous or nonpolluting materials.*

D. Has the project team sought to reduce future contamination by cleaning up areas of contamination and instituting land use controls to limit the introduction of future contamination sources?

1. *Plans to clean up contaminated areas.*
2. *Proposed land use controls.*
3. *Plans to prevent contamination from entering receiving waters or altering receiving water flow.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.3.1, 6.3.2.

RELATED ENVISION CREDITS

RA1.1 Reduce Net Embodied Energy

RA3.1 Protect Fresh Water Availability

NW1.4 Avoid Adverse Geology

NW1.5 Preserve Floodplain Functions

NW2.1 Manage Stormwater

NW2.2 Reduce Pesticide and Fertilizer Impacts

NW3.4 Maintain Wetland and Surface Water Functions

NW3.1 PRESERVE SPECIES BIODIVERSITY

INTENT:

Protect biodiversity by preserving and restoring species and habitats.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Identify and protect habitat. Project team works with state and local agencies to identify existing habitats in or near the project site, ensuring that existing habitats are not harmed and compensating for losses. Mitigation measures maintain net habitat quality and area and provide a means for animals to access pre-development habitat after development is complete. (A)			(13) Improve habitat. The project team works with state and local agencies to identify existing habitats in or near the project site. During the course of the project, efforts are made to not only protect existing habitats, but also to upgrade them. Efforts are made to plant appropriate vegetation, improve and expand wildlife corridors, and link existing habitats. Projects can preserve portions of the site, which are contiguous to natural areas outside of the site, in an undisturbed condition; create new connections between areas of important habitat; or remove existing barriers to movement. (A, B)	(16) Restore and create habitats. The project team works with state and local agencies to identify existing habitats in or near the project site. During the course of the project, efforts are made to not only protect and upgrade existing habitats, but also to connect, restore, and create new habitats. Efforts are made to reinstate appropriate vegetation, improve and expand wildlife corridors, and link existing habitats. (A, B, C)

DESCRIPTION

Urbanization threatens wildlife because it fragments and shrinks areas of suitable habitat. Development tends to decrease the total quantity of available habitat and separate it into smaller disconnected patches. When patches are not individually large enough to support the population of a species, connectivity between patches becomes critical for survival. Preserving and linking habitats is critical to biodiversity because it:

- Allows species to move between patches of different types; species may require more than one type of habitat;
- Provides sufficient habitat for large-range species; some animals require a large home range;
- Promotes genetic diversity; connectivity between patches allows separate populations of the same species to interact and breed.

Enlarging habitats, connecting patches, and promoting safe movement between patches is a priority for infrastructure projects.

Supporting and protecting biodiversity typically begins with an analysis of species in the area. For this type of analysis, select at least four focal species that live in the area or that are a target for repopulation. When selecting the species, give priority should be given to species that:

- Have habitat preferences similar to other species;
- Represent a range of animal classes (mammals, birds, amphibians, and reptiles);

- Are susceptible to one or more threats associated with development (including land clearing, buildings and infrastructure, roads and traffic, and the presence of people or domestic animals);
- Are classified as threatened or endangered or whose populations have recently declined;
- Have sufficient information available to assess habitat preference and susceptibility to disturbances.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No willful destruction of valuable habitat, but no active program to protect it either.

Performance Improvement: Shift from protection and enhancement to restoration and creation of new habitats.



METRIC:

Degree of habitat protection.

EVALUATION CRITERIA AND DOCUMENTATION

A. Does the project demonstrate that it does not impact natural habitat and movement corridors or that it will mitigate adverse impacts of development?

1. *Documentation of analysis process that identifies existing habitats and outlines strategies to ensure that these habitats are not disturbed, or, if this is not possible, outlines strategies for mitigation of disturbed habitats.*
2. *For each species, a map or equivalent documentation showing areas of important habitat in the surrounding region (geographic information system analysis and surveys can inform this step). Identify potential and/or likely movement corridors between habitat areas and potential barriers to these corridors on site. These should include existing barriers as well as those that will result from development.*
3. *A site plan and narrative illustrating the measures taken to provide new habitat, improve connectivity, or mitigate adverse impacts of the project.*
4. *A monitoring plan to ensure mitigation measures are effective for preserving animal access. Document collaboration with local and state/provincial agencies.*

B. Does the project facilitate movement between habitats, provide new connections, remove barriers, or otherwise improve existing habitat?

1. *Documentation of strategies to facilitate wildlife movement between habitats and their appropriateness for the local wildlife.*
2. *Documentation of new connections provided between habitats and their appropriateness of the local wildlife.*
3. *Documentation of habitat improvement efforts and the intended impact they will have on species biodiversity.*
4. *Documentation of the removal of existing barriers to movement and habitat connectivity.*

C. Does the project increase available habitat and habitat connectivity?

1. *Documentation of habitat expansion strategies.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 4.3, 4.4.

RELATED ENVISION CREDITS

- NW1.1 Preserve Prime Habitat
- NW2.2 Reduce Pesticide and Fertilizer Impacts
- NW3.2 Control Invasive Species
- NW3.3 Restore Disturbed Soils

NW3.2 CONTROL INVASIVE SPECIES

INTENT:

Use appropriate noninvasive species and control or eliminate existing invasive species.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
		(5) Locally appropriate and noninvasive. The project team works with state and local agencies and other groups to identify and use only locally appropriate plants on the site following completion of construction and commencement of operations. Identify and avoid any noxious plants by referring to lists provided in state noxious weeds laws or federal noxious weeds laws. (A)	(9) Invasive species control. The project team works with state and local agencies to identify current invasive species on the project site. The team establishes a comprehensive multiyear management plan to control invasive species. (A, B)	(11) Invasive species elimination. Effective programs and actions established to eliminate existing invasive species from the project site. (A, B, C)

DESCRIPTION

Invasive species include nonindigenous or non-native flora and fauna that adversely affect the habitats or bioregions they invade. Invasive species may dominate the new region, forcing out existing species by outcompeting native species with a similar niche for nutrients, light, physical space, water, or food.

Invasive species may invade and overcome native species through several mechanisms, including rapid reproduction, a high ability to disperse, and the ability to quickly adapt to a wide range of environmental conditions and food types.

Non-native invasive species can lead to the decline or extinction of native species or change the function of an ecosystem, altering fire regimens, nutrient cycling, and hydrology. Invasive plant species may also affect fauna by altering available food systems or changing living habitats.

Humans can be a significant factor in the distribution and establishment of invasive species colonies. Many non-native species may not become established and invasive until they have been introduced several times (e.g., by cars constantly driving to a site from another location).

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No willful spreading of invasive species, but no active management plans either. Invasive species are avoided, but no active consideration of choice of noninvasive plants to use.

Performance Improvement: Active management plans designed to control or eliminate invasive species.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Does the project use only locally appropriate and noninvasive plants on the site?
 1. A list of invasive species in the region and a map of all invasive species found on or within two-thirds of a mile (1000 meters) of the site.
 2. Documentation that all species introduced to the site are noninvasive; include a site plan of the landscaping strategy that includes all vegetation species.
 3. Documentation of collaboration with state or local agencies or the qualifications of the biologist, ecologist, or environmental professional.
- B. Does the project control invasive species already on the site?
 1. A management/maintenance plan that addresses
 - (i) Prediction and prevention—Strategies for minimizing potential for invasive species, both plant and animal, to reappear after initial removal and/or enter the site from nearby areas and
 - (ii) Detection and management—Strategies that monitor for and remove invasive species emerging on site in the future.

**METRIC:**

Degree to which invasive species have been reduced or eliminated.

C. Does the project actively eliminate existing invasive species and ensure that invasive species stay off the site?

1. *In addition to the aforementioned documentation, a management plan that includes*

(i) *Removal—Elimination of any invasive species on site and*

(ii) *Rehabilitation and restoration—Methods to restore habitats to pre-invasive state.*

RELATED ENVISION CREDITS

NW1.1 Preserve Prime Habitat

NW2.2 Reduce Pesticide and Fertilizer Impacts

NW3.1 Preserve Species Biodiversity

NW3.4 Maintain Wetland and Surface Water Functions

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 4.1: Control and manage known invasive plants found on site, Prerequisite 4.2: Use appropriate, noninvasive plants.

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.3.1, 6.3.2.

NW3.3 RESTORE DISTURBED SOILS

INTENT:

Restore soils that were disturbed during construction and previous development to bring back ecological and hydrological functions.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
			(8) Construction restoration. Restore 100% of soils disturbed during construction in the site's vegetated area. Soils must be reused for functions comparable to their original function (i.e., topsoil is used as topsoil, subsoil as subsoil, or subsoil is amended to become functional topsoil). (A)	(10) Previous development restoration. Restore 100% of soils disturbed as a result of previous development. Soils must be reused for functions comparable to their original function (i.e., topsoil is used as topsoil, subsoil as subsoil, or subsoil is amended to become functional topsoil). (A, B)

DESCRIPTION

Restoring soils disturbed during construction in areas that will be revegetated (all areas surrounding the completed project) improves the soil's ability to support healthy plants, biological communities, water storage, and water infiltration. Previously developed sites also may benefit from soil restoration. Soil structure is also important.

Disturbed soils cannot hold water, nutrients, or carbon dioxide as well as natural, undisturbed soils. For example, disturbed soil is less capable of absorbing floodwaters and is also less able to sustain vegetation, which also helps prevent floods.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Soil restoration only to the extent required by regulations and construction permits.

Performance Improvement: Restoration of soils disturbed during construction of the project and extended to the restoration of soils disturbed during previous development.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Have 100% of soils disturbed during construction been restored and reused properly?
 1. Documentation of soil restoration activities, areas of disturbance, and areas restored.
 2. Calculations showing that 100% of disturbed soils have been restored.
 3. Documentation of soil reuse.
- B. Have 100% of soils disturbed by previous development been restored and reused properly?
 1. Documentation of soil restoration activities, areas of disturbance, and areas restored.
 2. Calculations showing that 100% of disturbed soils have been restored.
 3. Documentation of soil reuse.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Prerequisite 7.2: Restore soils disturbed during construction, Credit 7.3: Restore soils disturbed by previous development.

10 POINTS

NATURAL WORLD

BIODIVERSITY



METRIC:

Percentage of disturbed soils restored.

RELATED ENVISION CREDITS

RA1.6 Reduce Excavated Materials Taken Off Site

NW1.1 Preserve Prime Habitat

NW1.5 Preserve Floodplain Functions

NW1.6 Avoid Unsuitable Development on Steep Slopes

NW3.1 Preserve Species Biodiversity

NW3.4 MAINTAIN WETLAND AND SURFACE WATER FUNCTIONS

INTENT:

Maintain and restore the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) Enhance one ecosystem function. Maintain or enhance one ecosystem function. (A, B, C, or D)	(6) Enhance two ecosystem functions. Maintain or enhance two ecosystem functions. (A, B, C, or D)	(9) Enhance three ecosystem functions. Maintain or enhance three ecosystem functions. (A, B, C or D)	(15) Enhance four ecosystem functions. Maintain or enhance four ecosystem functions. (A, B, C, or D)	(19) Restore ecosystem function. All four functions are maintained or enhanced and restored to have a fully functioning aquatic and riparian ecosystem. (A, B, C, D, E)

DESCRIPTION

Waterways, wetlands, and their riparian areas provide a number of ecosystem functions. Infrastructure and related development has often impacted the ecosystem functions of these aquatic systems. There are four main ways to improve ecosystem functions: maintain or enhance hydrologic connection, maintain or enhance water quality, maintain or enhance habitats, and maintain or enhance sediment transport.

Many healthy waterways and wetlands receive much of their normal flow from underground sources. Maintaining or restoring the water quality of surface water and groundwater sources may be documented by showing the current source of the waterways' normal flow, the water quality of its source water, and how the water quality will be maintained or enhanced. In many areas, this may mean disconnecting direct surface water discharges and constructing infiltration best management practices that will help remove pollutants and cool stormwater, discharging to the waterbody through groundwater.

To maintain or enhance habitats consider past infrastructure projects may have removed the natural riffle, pool, and meander sequence of rivers and streams that is important in providing a healthy ecosystem. Lakes and watercourses may have had structures built on their shoreline, destroying the shoreline habitat for plants and animals.

Waterways not only move water, but also sediment. Natural in-waterway sediment transport is important for a healthily functioning ecosystem.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No action is taken to maintain and restore ecosystem functions of waterways and wetlands on or adjacent to the project.

Performance Improvement: Choose systems to maintain or enhance based on individual characteristics, challenges, and available resources for each individual project. Restore any disturbed functions.

EVALUATION CRITERIA AND DOCUMENTATION

A. Does the project maintain or enhance hydrologic connection?

1. For streams, rivers, and lakes, documentation showing how the waterway is connected or proposed to be connected to its riparian floodplain at a 6-month to 2-year frequency flow event.
2. For wetlands, documentation showing that structures that drain wetlands will be removed and/or appropriate sources of groundwater or surface waters are reconnected, diverted, or maintained.

B. Does the project maintain or enhance water quality?

1. Documentation showing the current source of the waterways' normal flow, the water quality of its source water, and how the water quality will be maintained or enhanced.

**METRIC:**

Number of functions maintained and restored.

C. Does the project maintain or enhance habitat?

1. *A habitat survey of the waterbody and reference areas conducted by a recognized professional, and a plan to maintain or enhance the habitat for aquatic and riparian species by plantings and appropriate physical modifications. This survey may include the location and proposed mitigation of existing obstructions to habitat connectivity such as dams, roadway structures, and other infrastructure that may block aquatic or shoreline species migration.*

D. Does the project maintain or restore sediment transport?

1. *Documentation demonstrating that sediment transport will not be disrupted by the proposed project, existing sources of sediment obstruction will be removed or mitigated, and, if appropriate, sediment will be removed. Reports from qualified resource professionals are required as part of the documentation.*

E. Does the project maintain all four ecosystem functions and fully restore any disturbed functions?

1. *Documentation provided by a resource professional team outlining strategies for ecosystem functions and a description of, and restoration plan for, any disturbed ecosystem functions.*

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 3.4: Rehabilitate lost streams, wetlands, and shorelines.

RELATED ENVISION CREDITS

RA3.1 Protect Fresh Water Availability

NW1.1 Preserve Prime Habitat

NW1.2 Protect Wetlands and Surface Water

NW1.5 Preserve Floodplain Functions

NW2.1 Manage Stormwater

NW2.3 Prevent Surface and Groundwater Contamination

NW3.1 Preserve Species Biodiversity

NW0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

To reward exceptional performance beyond expectations of the system as well as the application of innovative methods that advance state-of-the-art sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
<p>(+9) Innovate or exceed credit requirements.</p> <p>Projects clearly document a performance that far exceeds both industry norms and the existing requirements within the system. Projects may also demonstrate the innovative application of methods, technologies, or processes that are novel either in their use, application, or within the local regulatory or cultural climate.</p>

DESCRIPTION

This credit addresses special cases in which projects far exceed the performance requirements of a credit or innovate in a way that advances the industry and the associated field of knowledge. These points are not calculated in the overall applicable points and, therefore, act as bonus points. Given the nature of the credit, the broad format of which is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Projects may pursue points for innovation or exceptional performance.

Exceptional Performance

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For instance, credits seeking additional points in credit NW1.1 Preserve Prime Habitat must already be restoring prime habitat. In this case, exceptional performance may be pursued by projects where the large magnitude of restoration or the exceptional effort and investment necessary to achieve restoration warrants the awarding of additional points. Exceptional performance may not be pursued by projects that have a basic primary function that meets the requirements. For example, unless extensive restoration was necessary, a nature reserve providing prime habitat may not qualify. It is important to note that exceptional performance is not possible for avoidance. For instance, projects that preserve prime habitat by selecting a project location in areas without prime habitats may achieve the full credit value for NW1.1, but do not qualify for exceptional performance.

Exceptional performance constitutes achieving a remarkable increase in performance. This would be a multiple-factor increase in efficiency or effectiveness in one or more credits. Possible areas of achievement in exceptional performance for the Natural World credit may include, but are not limited to, the following:

- Projects for which significant efforts were made to preserve important natural resources in perpetuity;

- Projects in which efforts to control invasive species represent a significant aspect of the project;
- Projects for which the avoidance of habitat, surface waters, and/or sensitive geologic features required exceptional effort and/or the implementation of innovative methods.

Innovation

To qualify for innovation points, projects must demonstrate achievement in at least one of the following goals:

- Overcoming significant problems, barriers, or limitations—Project teams demonstrate that they have reduced or eliminated significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project;
- Creating scalable and/or transferable solutions—Project teams demonstrate that the improved performance achieved, or the problems, barriers, or limitations overcome, are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.

Project teams may use innovative technology, methods, or application (e.g., the use of a pre-existing technology in a new way or the successful application of a technology or methods in regions or locales where existing policies, regulations, or general opinion have prevented their use). In such circumstances, it is imperative to prove that the application of the technology does, and will continue to, meet performance expectations and that it does not have a corresponding negative impact on the local or global environment, economy, or community.

Projects may demonstrate they implement innovative technologies or methods in several ways:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs;

**METRIC:**

Whether project achievement qualifies as exceptional performance or innovation.

- The project uses technologies or methods that may be general practice in other regions or parts of the world, but within the unique context of the project (whether climate, regulations, policies, political support, public opinion, etc.) have yet to gain acceptance. Significant efforts are taken to demonstrate the effectiveness of the technology or method within the context and to provide a precedent for future adoption.
- The project team takes significant steps to include research goals within the project's development, or work with a university or research organization to advance the general knowledge of the profession. Proprietary research that is not made publicly available cannot count toward achieving this credit.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Any action that is already documented as an evaluation criteria for credits within the Natural World category.

Performance Improvement: Exceed evaluation criteria for the highest levels of achievement or implement innovative methods in meeting infrastructure needs that are not addressed within the system.

EVALUATION CRITERIA AND DOCUMENTATION

- A. To what extent has the project exceeded highest levels of achievement for a given credit?
1. *Detailed documentation of how the project exceeds the existing requirements currently within a given Natural World credit.*
- B. To what extent does the project implement innovative technologies or methods?
1. *Documentation of the application of innovative technologies or methods. Detailed description of how this application will improve existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered innovative either as a technology, a method, or within the project context (climate, political, cultural, etc.).*
- C. To what extent does the project overcome significant problems, barriers, or limitations or create scalable and/or transferable solutions?
1. *Documentation that the project reduces or eliminates significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes or methodologies that improve the efficiency or sustainability of a project.*
 2. *Documentation that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.*





CLIMATE AND RISK



CLIMATE AND RISK

DOES THE PROJECT MINIMIZE GREENHOUSE GAS EMISSIONS?

DOES THE PROJECT REDUCE AIR POLLUTANT EMISSIONS?

DOES THE PROJECT MANAGE HEAT ISLANDS?

DOES THE PROJECT PREPARE FOR SHORT-TERM HAZARDS?

DOES THE PROJECT PREPARE FOR LONG-TERM ADAPTABILITY?

CLIMATE AND RISK

The general scope of the Climate and Risk category is two-fold: minimizing emissions that may contribute to increased short- and long-term risks and ensuring that infrastructure projects are resilient to short-term hazards or can adapt to altered long-term future conditions. The Climate and Risk category is divided into two subcategories: Emissions and Resilience.

EMISSIONS

The goal of this subcategory is to promote the understanding and reduction of dangerous emissions, including greenhouse gas emissions and other dangerous pollutants, during all stages of a project's life cycle. These emissions can increase both short- and long-term risk to the project. Minimizing this risk helps to protect against future problems and may increase the life cycle of the project. While reducing greenhouse gas emissions may not have a direct impact on the consequences of the particular project, it can help to reduce overall global risk and may contribute far beyond the site borders of the project.

RESILIENCE

Resilience includes the ability to withstand short-term risks, such as flooding or fires, and the ability to adapt to changing long-term conditions, such as changes in weather patterns, sea-level rise, or changes in climate. Understanding the types of risks and probability of risks allows the project team to deliver an informed project design that anticipates and withstands or adapts to these risks, minimizing its overall vulnerability. Increased adaptability and decreased vulnerability ensure a longer useful life and ensure that the project will be able to meet the future needs of the community.



1 EMISSIONS

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

2 RESILIENCE

CR2.1 Assess Climate Threat

CR2.2 Avoid Traps and Vulnerabilities

CR2.3 Prepare For Long-Term Adaptability

CR2.4 Prepare for Short-Term Hazards

CR2.5 Manage Heat Island Effects

CR0.0 Innovate or Exceed Credit Requirements

CR1.1 REDUCE GREENHOUSE GAS EMISSIONS

INTENT:

Conduct a comprehensive life-cycle carbon analysis and use this assessment to reduce the anticipated amount of net greenhouse gas emissions during the life cycle of the project, reducing project contribution to climate change.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(4) Life-cycle carbon assessment. A comprehensive life-cycle carbon assessment is undertaken to estimate carbon emissions caused by materials extraction and processing, transportation of materials to be used during construction and operation, and project maintenance and operation, including vehicle traffic. The assessment related to materials includes carbon emissions generated for the key materials to be used in the project from their extraction, refinement, and manufacture, distance transported, and carbon emissions released in use after their incorporation to the completed project. (A)	(7) At least 10% greenhouse gas reduction. Using a completed life-cycle carbon assessment, the project team works to design the project so that it reduces carbon emissions by at least 10%. (A, B)	(13) At least 40% greenhouse gas reduction. Using a completed life-cycle carbon assessment, the project team works to design the project so that it reduces carbon emissions by at least 40%. (A, B)	(18) Carbon neutral. The completed project is carbon neutral (does not produce any net carbon emissions, i.e., a 100% reduction). Using a completed life-cycle carbon assessment, the project team works to design the project so that it is carbon neutral. Extensive use of renewable energy and carbon sinks. (A, B)	(25) Net carbon negative. The completed project is carbon negative (i.e., sequesters more carbon than it produces). Using a completed life-cycle carbon assessment, the project team works to design the project so that it is carbon negative. Extensive use of renewable energy and carbon sinks. (A, B)

DESCRIPTION

In the past century, an increased release of carbon dioxide (CO₂) and other greenhouse gases (GHGs), primarily attributed to the burning of carbon-based fossil fuels, have caused a significant increase in the concentration of CO₂ in the atmosphere. The increase of these gases in the atmosphere enhances the greenhouse effect, which likely causes the earth's surface and the average temperature of the lower layer of the atmosphere to rise. The increase in the average temperature of the earth's surface and atmosphere is part of a broader climate change, disrupting short-term weather patterns and long-term climate. This can have several unintended consequences, such as flooding from excess rain in certain parts of the world, drought from lack of rain in others, ocean acidification, changing crops and crop production, and rising sea level. Reducing the emission of GHGs now will help mitigate the effects of climate change in the future.

Greenhouse gases are factored according to their global warming potential (GWP), resulting in a CO₂ equivalency (CO₂e). Greenhouse gas emissions are primarily associated with direct nonrenewable energy consumption, transportation fuel consumption, and the embodied energy of products and goods.

Unavoidable CO₂e emissions can be countered by carbon sequestration, in which CO₂ is removed from the atmosphere and deposited in a reservoir, typically deep within the earth where it cannot reach the atmosphere. Sequestration also can come in the form of planting new forests, which absorb and use CO₂ for their growth.

To fulfill this credit, a streamlined life-cycle assessment should be conducted in accordance with ISO (International Organization for Standardization) 14040 and ISO 14044 standards.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Life-cycle carbon assessment is considered, but not conducted. No reductions in carbon emissions relative to industry. Follow regulatory requirements only.

Performance Improvement: Improvements in carbon emissions reductions as compared to regulatory requirements. Achieve carbon-neutral status.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team performed a life-cycle carbon assessment on the project using recognized and accepted methodologies, data sources, and software?

1. *Documentation that a life-cycle carbon assessment or a carbon footprint analysis has been performed in accordance with available methodologies, data sources, and software.*

**METRIC:****Life-cycle net carbon dioxide equivalent emissions.**

B. Has the project team worked to design the project so that it reduces carbon emissions to meet the designated reduction compared to the emissions calculated in the life-cycle carbon assessment?

1. Documentation of efforts to reduce carbon emissions and calculations of percentage reduction, as calculated with available methodologies, data sources, and software.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 7.1.3, 7.1.4, 7.3.

ISO 14040 Environmental Management: Life Cycle Assessment

RELATED ENVISION CREDITS

RA1.1 Reduce Net Embodied Energy

RA1.2 Support Sustainable Procurement Practices

RA1.3 Use Recycled Materials

RA1.4 Use Regional Materials

RA1.6 Reduce Excavated Materials Taken Off Site

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

RA2.3 Commission and Monitor Energy Systems

CR1.2 Reduce Air Pollutant Emissions

CR2.1 Assess Climate Threat

CR2.3 Prepare for Long-Term Adaptability

CR1.2 REDUCE AIR POLLUTANT EMISSIONS

INTENT:

Reduce the emission of six criteria pollutants: particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead, as well as noxious odors.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Improved air quality standards. California's standards are more stringent than the National Ambient Air Quality Standards and address additional pollutants beyond the six common air pollutants. Meet California Ambient Air Quality Standards for all project activities. Create a maintenance program to ensure that these standards remain met throughout the life of the project. (A)	(6) Enhanced air quality standards. Meet South Coast Air Quality Management rules in section XI and XIV, as applicable, for Source Specific Standards and Toxics and Other Non-Criteria Pollutants. (B)		(12) Negligible air quality impact. Project has only negligible air pollution impacts or net zero impacts from criteria pollutants. (C)	(15) Air quality improvement. Project not only achieves zero net production of criteria pollutants, but improves air quality to a level higher than pre-development. (C)

DESCRIPTION

The six criteria pollutants (carbon monoxide, nitrogen oxides, sulfur dioxide, suspended particulate matter smaller than PM-10, ozone, and lead) are part of the National Ambient Air Quality Standards (NAAQS) set by U.S. Environmental Protection Agency (U.S. EPA) under the Clean Air Act (CAA). The pollutants damage human health, property, and the environment. For each of these pollutants, CAA sets two limits: a primary limit to protect human health and a secondary limit to prevent damage to the environment and property. According to U.S. EPA, "Despite the progress made in the last 30 years, millions of people live in counties with monitoring data showing unhealthy air for one or more of the six common air pollutants". Those most at risk are children, the elderly, and people with lung diseases such as asthma, chronic bronchitis, and emphysema. In Canada particulates and ozone are regulated under the Canadian Ambient Air Quality Standards and further pollutants may be regulated at the provincial level.

Dust and odors also can cause a nuisance for nearby residents, reduce property values, and aggravate the aforementioned lung conditions.

Other areas have implemented standards more stringent than NAAQS, including the California and the South Coast Air Quality Management (SCAQM) District in Southern California. The California Ambient Air Quality Standards maximums for the six common air pollutants are less than for national standards; SCAQM maximums are even more stringent and include requirements for the management of air pollutants for specific types of high polluting building uses.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No additional measures taken to minimize adverse impacts on air quality other than those required by regulation. Compliance with local laws and regulations regarding the control of dust and odors during construction, but no inspection and enforcement programs beyond minimum requirements.

Performance Improvement: Addition of active controls, monitoring systems, and mitigation measures at the design stage. Shift in emphasis to location selection and siting and source reduction. Ambient air quality is substantially improved over previous levels.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team designed the project to follow CAAQS?

1. Documentation of expected emissions according to CAAQS and strategies implemented to reduce air pollutions to required levels.
2. Monitoring and control program documents.

B. Has the project team designed the project to follow Sections XI and XIV of SCAQM rules?

1. Documentation of applicable rules and strategies for compliance.

**METRIC:**

Measurements of air pollutants compared to standards used.

C. Does the project reduce air pollution to the required level or below pre-development levels?

1. *Documentation of expected emissions of the six criteria pollutants and strategies implemented to reduce air pollutions to required levels.*

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 11.4.

California Ambient Air Quality Standards, www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm.

South Coast Air Quality Management District Rules and Regulations, www.aqmd.gov/rules/rulesreg.html.

National Ambient Air Quality Standards, www.epa.gov/air/criteria.html.

Canadian Ambient Air Quality Standards, www.ec.gc.ca

Six Common Air Pollutants, EPA, 4/20/2012, www.epa.gov/airquality/urbanair.

ISO 14040 Environmental Management: Life Cycle Assessment

RELATED ENVISION CREDITS

RA1.1 Reduce Net Embodied Energy

RA1.2 Support Sustainable Procurement Practices

RA1.3 Use Recycled Materials

RA1.4 Use Regional Materials

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

RA2.3 Commission and Monitor Energy Systems

RA3.2 Reduce Potable Water Consumption

CR1.1 Reduce Greenhouse Gas Emissions

CR2.1 Assess Climate Threat

CR2.1 ASSESS CLIMATE THREAT

INTENT:

Develop a comprehensive climate impact assessment and adaptation plan.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
			<p>(15) Impact assessment and adaptation plan.</p> <p>A comprehensive climate impact assessment and adaptation plan has been developed. The plan should include the following components:</p> <ul style="list-style-type: none">• Vulnerability assessment,• Risk assessment, and• Adaptation assessment. <p>The process should include collaborations with the local emergency management department and meetings with the local community.</p> <p>(A)</p>	

DESCRIPTION

The first line of defense against climate change is always the reduction and management of greenhouse gas emissions to reduce carbon dioxide equivalent (CO₂e) concentrations in the atmosphere and mitigate future climate change. However, existing CO₂e levels are high enough to influence long-term climate change and variations in climate.

The U.S. Environmental Protection Agency as well as Natural Resources Canada note that mean temperatures are expected to rise in many parts of North America, likely more in inland areas and at higher latitudes. Higher average temperatures will not only increase water evaporation rates, but will likely change the quantity, intensity, and timing of precipitation. Increases in mean temperatures can also affect the amount and duration of snow cover and, in turn, affect average and peak rates of streamflow. All of these issues have important implications to agriculture irrigation, hydropower, flood management, fisheries, recreation, and navigation.

While the exact effects of climate change are still uncertain, most anticipated impacts fall into the following four categories:

- Changes in long-term weather patterns (precipitation, temperature, etc.);
- Changes in extreme weather events and natural hazards;
- Increased sea levels;
- Increased desertification.

These changes are important factors in infrastructure design. Projects may be directly threatened by rising sea levels or extreme weather events.

Gradual increases in temperature or decreases in precipitation may increase pressures on energy or water systems. Communities rely on infrastructure projects; failure of systems can cause devastating consequences. Consequently, understanding potential impacts from climate change is critical to ensuring designs can be resilient to future conditions.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No comprehensive climate threat assessment done. May have done assessments on specific aspects (e.g., sea rise in coastal cities, extended drought).

Performance Improvement: Complete a comprehensive climate impact assessment and develop an adaptation plan.

**METRIC:**

Summary of steps taken to prepare for climate variation and natural hazards.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team created a Climate Impact Assessment and Adaptation Plan that identifies climate change risks and possible responses?

1. *Documentation that a plan has been completed that takes into account the impacts of a changing climate on the range of operating conditions assumed in the design of the project. Changes in operating conditions include sea rise, higher ambient temperatures, increased frequency and intensity of storms, flooding, extended droughts, and more. The plan should span the design life of the project. The plan should assess the risk of changing operating conditions on the efficient operation of the completed project as well as on the operation of other related infrastructure. The plan should also address recovery from extreme events.*
2. *Documentation of community outreach during the adaptation plan development process.*
3. *Documentation of input from and consultation with local and regional emergency management officials*

SOURCES

U.S. EPA, "Climate Change Indicators in the United States", www.epa.gov/climatechange.

Natural Resources Canada, "Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation", www.nrcan.gc.ca

RELATED ENVISION CREDITS

- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA3.2 Reduce Potable Water Consumption
- CR1.1 Reduce Greenhouse Gas Emissions
- CR1.2 Reduce Air Pollutant Emissions
- CR2.2 Avoid Traps and Vulnerabilities

CR2.2 AVOID TRAPS AND VULNERABILITIES

INTENT:

Avoid traps and vulnerabilities that could create high long-term costs and risks for the affected communities.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Basic evaluation. During the conceptual or preplanning phase, the project team conducts a survey of possible resource constraints and vulnerabilities that the community could face in the future, including those expected because of climate change. The team identifies potential approaches and practices to address. The team also reviews appropriate local regulations and standards. Some consideration in the project design stage to address issues. (A)	(6) High-level review. The project team works with the community at the conceptual stages of the project and conducts a high-level review of projected resource demands and supplies, resource and infrastructure traps, and vulnerabilities. Its purpose is to understand how the project might affect community vulnerabilities and resource dependencies. An assessment is made of the associated long-term risks. Project-specific issues are raised. Basic plans are developed to address issues. (A)	(12) Detailed evaluation. The project owner and the team work more directly with community decision makers and stakeholders, taking a fresh look at potential resource issues, vulnerabilities, and risks. The parties conduct a more integrated risk assessment of community vulnerabilities and resource dependencies, and determine ways that design changes in the project can result in significant risk reductions. Alternatives are developed and discussed. Detailed plans are developed to address issues. (A, B)	(16) Comprehensive assessment. Work with community decision makers and stakeholders to make a full and comprehensive assessment of resource demands and supplies, resource and infrastructure traps, and vulnerabilities. Use the assessment as a basis for making changes to the project design. Considerations include how the project contributes to the community's assessment of resource demands and supplies, as well as resource and infrastructure traps, and vulnerabilities. (A, B, C)	(20) Robust and resilient. Work with community decision makers and stakeholders to make a comprehensive and long-term assessment of the community's resiliency (i.e., resource demands and supplies, resource and infrastructure traps, and vulnerabilities). Assess long-term risks and consider alternatives. Convert that assessment into design criteria for this project and make recommendations regarding the design criteria for future infrastructure. (A, B, C)

DESCRIPTION

This credit recognizes projects that take a long-term view of the effects of resource depletion, extreme natural or human-caused events, economic changes, or limitations to the ability to adapt to a changing world. Credit is given for the degree to which the design and delivery of the infrastructure project avoids or does not create high long-term costs or adds additional risk and vulnerabilities to the affected communities.

A consequence of a nonsustainable operating environment is that it disrupts basic design assumptions and variables used in infrastructure design and construction. For example, increasing energy demands from rapidly expanding economies, deeper oil reserves that are expensive to reach, and environmental security issues surrounding extractives are causing high volatility in the price of petroleum-based fuels. Another example is that population growth has placed increasing demands on fresh water. As a result, fresh water is in short supply in many places and the situation is made worse by extended droughts and overuse of aquifers. As such, a project's reliance on current petroleum and water prices may drastically affect its long-term viability if commodity prices change.

Climate change also affects the ability for infrastructure to function efficiently, not only because it is the cause of a rise in ambient temperature, but also because it is the proximate cause of extreme weather events, such as droughts, increased storm frequency and intensity, flooding, extended heat waves, and more.

Taken together, these changes are substantially altering the practice of infrastructure design. Long-held assumptions regarding expected averages,

variances, and possible extremes of infrastructure design variables may no longer be valid. Additionally, new variables are now coming into play that had never before been taken into account.

For civil works (e.g., roads, bridges, and water treatment systems) that have expected useful lives of 30 to 50 years or more, these expected changes will require a significant rework in the way this infrastructure is designed, both at the project level and the infrastructure systems level.

At the infrastructure project level, the designer must examine key design variables to determine the extent to which the mean, variance, and plausible extremes could reasonably change over the design life of the completed project. If it is determined that one or more variable changes will be significant over the design life, then the designer must account for these changes in the design.

At the infrastructure systems level, the designer must assess the effect of the project on the community infrastructure as a whole. Under consideration are the following:

- **Resources traps**—infrastructure projects that increase community dependence on resources that could become scarce and expensive. For example, adding an additional highway to a community that already suffers from urban sprawl and in which the automobile is the dominant form of travel puts the community at great economic risk if fuel prices were to increase substantially;
- **Configuration traps**—infrastructure projects that create configurations highly vulnerable to extreme weather events, natural disasters, economic conditions, and/or actions by others. For example, placing infrastructure

**METRIC:**

Assessment of potential long-term traps, vulnerabilities, and risks caused by long-term changes such as climate change and the degree to which these were addressed in the project design and in community design criteria.

in coastal lowlands or in river floodplains places the community at high risk for sea surges or flooding given changing climate conditions;

- Standards traps—infrastructure projects delivered according to design standards and methodologies that are not in alignment with changing environmental or operating conditions or other concerns. For example, designing stormwater management systems that do not take into account increases in storm frequency and intensity can place the community at high risk for additional flood damage.

The performance improvement for this credit is based on the extent to which the designer has taken these issues into account and created a project that addresses the issues of the community's increased long-term cost, risk, and vulnerability. The ultimate objective is to make a significant contribution to community robustness and resiliency in the face of change.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Only related regulations and design standards are considered.

Performance Improvement: Shift from a cursory look to a more systematic evaluation of risks and vulnerabilities. Seek to establish design criteria for infrastructure that contributes to a more robust and resilient community, thus climate-proofing infrastructure.

EVALUATION CRITERIA AND DOCUMENTATION

- A. Has the project team identified and assessed possible changes in key engineering design variables?
 1. *Documentation of the work done to identify and assess possible changes in key engineering design variables. The assessment may include changes that may result from climate change.*
- B. Has the project team assessed potential traps and vulnerabilities and their associated potential costs and risks?
 1. *Documentation outlining potential traps and vulnerabilities and associated costs and risks.*
- C. Does the project avoid, alleviate, or eliminate significant infrastructure traps (e.g., high and long-term operational costs and/or vulnerabilities)?
 1. *Documentation showing the extent to which project concepts, configuration, and design have taken into account the need to reduce identified significant risks, traps, and vulnerabilities with substantial costs and other negatives.*

RELATED ENVISION CREDITS

- CR2.1 Assess Climate Threat
- CR2.3 Prepare for Long-Term Adaptability
- LD1.4 Provide for Stakeholder Involvement
- LD2.2 Improve Infrastructure Integration
- LD3.1 Plan for Long-Term Monitoring and Maintenance
- LD3.2 Address Conflicting Regulations and Policies

CR2.3 PREPARE FOR LONG-TERM ADAPTABILITY

INTENT:

Prepare infrastructure systems to be resilient to the consequences of long-term climate change, perform adequately under altered climate conditions, or adapt to other long-term change scenarios.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
			(16) Highly resilient and adaptive. Plans and designs have been created and implemented to prepare for long-term climate change, including the effects of increased intensity and frequency of extreme weather events, water scarcity, sea level rise, extended droughts and heat waves, and increased ambient temperature. (A)	(20) Recovery from adverse effects. Restore and rehabilitate the effects of long-term change, including desertification, beach erosion, and loss of wetlands. As a bonus, many shoreline restoration activities minimize the effects of climate change on inland populations, including flooding and extreme weather events. (A, B)

DESCRIPTION

Infrastructure projects that are designed for today's conditions may not be able to function adequately under altered conditions in the future. Climate change will likely lead to changes in weather patterns and sea levels. Projects should be designed to withstand a range of conditions that may result from climate change, such as changes in temperatures, humidity, precipitation, seasonal hydrology, flooding, increased sea levels, and so on.

In addition to the project itself, changing climate conditions can have drastic impacts on the site. Desertification is a significant concern throughout the world as water availability and vegetative cover decrease and overgrazing, overharvesting, and mismanagement of vegetative cover increase. For example, about 40% of the continental United States is considered vulnerable to desertification according to the U.S. Bureau of Land Management. In colder climates melting snow, thawing permafrost, and loss of glaciers is a critical concern.

Other conditions such as fires, earthquakes, hurricanes, melting snowpack or a changing water table also may produce long-term alterations of infrastructure systems and their sites. While it is common to prepare systems to resist immediate events, it is less common to consider the long-term recovery and adaptation after these hazards alter their environment, sometimes for decades.

Important themes in designing for climate change are resiliency and adaptive capacity. "Resilience" refers to the ability of a system to recover quickly and cost-effectively following an extreme event. "Adaptive capacity" means the system has the ability to respond to changing conditions over time to better

withstand them. Flexibility is a key part of adaptive capacity. Redundancy, possibly from backup systems or decentralized distributed networks, helps systems remain functional even if one component fails.

Strategies for managing long-term changes may include the following:

- Structural changes—expand the range of conditions in which the system can function;
- Decentralized systems—these depend on many small facilities instead of a single large facility; distributed networks spread risk;
- Natural systems—choose environmentally friendly solutions for infrastructure provision (e.g., using wetlands to treat stormwater also helps protect against flooding);
- Alternative supply options—identify alternative methods or locations for resources that are important for the infrastructure project (water sources, energy sources, materials, etc.);
- Adaptive capabilities—include ways for the system to learn or change over time to be more prepared to deal with altered conditions;
- Site selection—choose sites that are less vulnerable to potential impacts of climate change (farther away from coasts to reduce impact of increasing sea levels, at higher elevations where flooding is less likely, etc.).

**METRIC:**

The degree to which the project has been designed for long-term resilience and adaptation.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No comprehensive climate change consequences preparation done. May have done assessments on specific aspects (e.g., sea rise in coastal cities, extended drought). No specific considerations of alternative water, energy, and materials supplies or design resiliency to changing environmental or operational conditions.

Performance Improvement: Move from assessment to action. Implement strategies that prepare for or mitigate the negative consequences of climate change or other significant alterations in environmental and operating conditions.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team selected the site and designed the infrastructure project and its related systems to be resilient and adaptive to these changes and function under altered climate conditions, supply shortfalls, or other significant long-term changes in operational or environmental conditions?

1. *Identification of specific measures taken to address the potential consequences of long-term climate change such as sea level rise, increased intensity and frequency of extreme weather events, extended droughts, heat waves, increased ambient temperature, and so on.*
2. *Identification of specific measures taken to address other potential long-term threats such as desertification, water and energy shortages, shortages of other critical materials, and so on.*
3. *Identification of siting or design features that increase alternative supply options for water, energy, or other materials critical to operation of the completed project.*

B. Has the project team made substantial efforts to restore or rehabilitate any existing effects of long-term change (e.g., desertification, beach erosion, and loss of wetlands)?

1. *Plans, designs, and documents that show restoration and rehabilitation efforts.*

SOURCES

Federal Emergency Management Agency, "FEMA Climate Change Adaptation Policy Statement", www.fema.gov.

Natural Resources Canada, "Adaptation Platform", www.nrcan.gc.ca.

RELATED ENVISION CREDITS

LD3.2 Address Conflicting Regulations and Policies

RA3.1 Protect Fresh Water Availability

CR1.1 Reduce Greenhouse Gas Emissions

CR2.1 Assess Climate Threat

CR2.2 Avoid Traps and Vulnerabilities

CR2.4 PREPARE FOR SHORT-TERM HAZARDS

INTENT:

Increase resilience and long-term recovery prospects of the project and site from natural and human-induced short-term hazards.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) Hazards assessment. Thorough analysis of likely natural and human-induced hazards in the project area, including analysis and projections for at least the next 25 years. (A)		(10) Preparation for 1-in-50-year hazards. Plans and designs have been created and implemented to prepare for short-term hazards that have a 1-in-50-year or better chance of occurring, including direct and indirect impacts. Designs may limit the hazard itself, fortify against the hazard, or allow the project to adapt to the direct or indirect impacts of the hazards. (A, B)	(17) Preparation for 1-in-100-year hazards. Plans and designs have been created and implemented to prepare for short-term hazards that have a 1-in-100-year or better chance of occurring, including direct and indirect impacts. Designs may limit the hazard itself, fortify against the hazard, or allow the project to adapt to the hazard. (A, B)	(21) Restore environments that reduce risk. Many hazards may be worsened by degraded environments. Restore and rehabilitate natural systems to minimize risks of natural hazards, such as restoring wetlands to accommodate flooding or lessen the effects of hurricanes. (A, B, C)

DESCRIPTION

In addition to long-term climate-related hazards, many infrastructure systems are subject to short-term hazards such as earthquakes, flooding, and fires that may or may not be related to climate change or may have other risk factors.

The potential increase in frequency and severity of extreme weather events and other natural hazards from climate change, including wildfires, storm surges, and flooding, are potential threats to infrastructure. These natural disasters may occur more often and with greater force.

Other hazards such as earthquakes and tsunamis may not be affected by climate change or may increase their occurrence or severity because of outside risk factors; however, additional development in risk-prone areas can magnify their impacts on local communities.

Urban areas are also increasingly vulnerable to human-induced hazards such as hazardous material spills, terrorist attacks, epidemics, and biohazards. Managing and preparing for short-term hazards helps to secure the longevity of infrastructure projects and protect investments and secure the wellbeing of the surrounding community.

Infrastructure projects are subject to the direct effects (such as flooding, wildfires, high wind speeds, lightning, etc.) as well as indirect effects (such as loss of power supply caused by the disaster or disruptions in availability of key resources) of these disasters.

For example, in areas prone to wildfires, the project location is selected to reduce the risk of wildfires. The design provides for access for firefighting

personnel and equipment. Highly flammable materials and vegetation is cleared from the area. Fire-resistant or noncombustible materials are incorporated in the design and construction of structures. Sources of ignition are kept away from flammable materials. Flammable materials are stored in approved safety containers.

Key components to resiliency from hazards include the ability to withstand hazards (e.g., through physical fortification against flooding or hurricanes) or the ability to adapt with the hazard. Adapting to the hazard can include redundancy through backup systems or decentralized distributed networks, which help systems to remain functioning even if one component fails.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No unusual increases in preparation beyond existing regulations.

Performance Improvement: Move from assessment to action. Implement strategies that prepare or mitigate long-term change.

**METRIC:**

Steps taken to improve protection measures beyond existing regulations.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team considered which types of natural and human-induced hazards are possible in the region and researched how the frequency and severity of these disasters may change over the life of the project?

1. Provide a list of expected natural hazards in the area and their predicted frequency and severity including but not limited to: wildfires, floods, tornadoes, hurricanes, earthquakes, tsunamis, and human-induced hazards

B. Has the project team incorporated design strategies into the project to safeguard against these natural hazards?

1. Explanation of the strategies included in the project to cope with each event and how they surpass existing codes and regulations.

C. Does the project restore habitats in a way that reduces the impacts of future short-term disasters?

1. Documentation of strategies used and how they minimize the risk of future hazards using environmental restoration.

SOURCES

Federal Emergency Management Agency, “Plan, Prepare, Mitigate”, www.fema.gov/plan-prepare-mitigate.

Federal Emergency Management Agency, “Multi-Hazard Mitigation Planning”, www.fema.gov/multi-hazard-mitigation-planning.

Federal Emergency Management Agency, “Hazard Mitigation Planning Resources”, www.fema.gov/hazard-mitigation-planning-resources.

RELATED ENVISION CREDITS

LD3.2 Address Conflicting Regulations and Policies

NW1.4 Avoid Adverse Geology

NW1.6 Avoid Unsuitable Development on Steep Slopes

CR2.3 Prepare for Long-Term Adaptability

CR2.5 MANAGE HEAT ISLAND EFFECTS

INTENT:

Minimize surfaces with a low solar reflectance index to reduce localized heat accumulation and manage microclimates.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) At least 10% of surfaces meet solar reflectance index requirements. At least 10% of hardscape surfaces meet shading or solar reflectance index (SRI) requirements of 29 or higher. (A)	(2) At least 30% of surfaces meet solar reflectance index requirements. At least 30% of hardscape surfaces meet shading or SRI requirements of 29 or higher. (A)	(4) At least 60% of surfaces meet solar reflectance index requirements. At least 60% of hardscape surfaces meet shading or SRI requirements of 29 or higher. (A)	(6) At least 90% of surfaces meet solar reflectance index requirements. At least 90% of hardscape surfaces meet shading or SRI requirements of 29 or higher. (A)	

DESCRIPTION

Many hard surfaces, such as rooftops and pavement, absorb a large percentage of the incident solar radiation, heating the surfaces and the surrounding air. This alters the microclimate around them, in turn leading to an increase in energy consumption for additional cooling, and can impact local vegetation, wildlife, and community comfort. The cumulative impact of heat island effects across large areas can also contribute to larger climate-related effects.

This urban heat island effect can be minimized and managed for this credit through the use of materials with high solar reflectance index (SRI) or through increased vegetation, which provides cooling via evapotranspiration, and increased shade. Shading can occur either through structures such as shade panels that meet the SRI requirements or trees that provide shade within 5 years of planting (as measured at noon on the summer solstice).

The SRI is a measurement of a surface's ability to reject solar heat as shown by a small temperature rise. It is defined so that a standard black surface is "0" and a standard white surface is "100".

For this credit, SRIs equal to or larger than 29 are considered adequately high. It is important to note that in certain climates, increased surface heat may be desirable at certain times; therefore, the goal is to take into account individual circumstances to manage these heat islands.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No consideration for heat island effects.

Performance Improvement: Improvement in heat island reduction actions and improved microclimate.

EVALUATION CRITERIA AND DOCUMENTATION

A. Does the project meet heat island requirements through shading or SRI requirements of 29 or higher for the designated percentage of hardscapes?

1. Drawings showing all nonroof nonvegetated areas of the site and the surfacing material.
2. Calculations demonstrating that the hardscape project area meets the requirements.
3. Documentation of all shaded areas, assumed at noon on summer solstice, and a list of species used and expected growth rates showing projected shading 5 years from planting.
4. Documentation of roof or surface areas, surface material, and corresponding SRI.



METRIC:

Percentage of site area that meets solar reflective index criteria.

SOURCES

CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 7.1.3, 7.1.4, 7.3.

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 4.12: Reduce urban heat island effects.

ASTM E1980-11 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

RELATED ENVISION CREDITS

RA1.1 Reduce Net Embodied Energy

RA2.1 Reduce Energy Consumption

CRO.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

To reward exceptional performance beyond the expectations of the system as well as the application of innovative methods that advance state-of-the-art sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
<p>(+5) Innovate or exceed credit requirements.</p> <p>Projects clearly document a performance that far exceeds both industry norms and the existing requirements within the system. Projects may also demonstrate the innovative application of methods, technologies, or processes that are novel either in their use, application, or within the local regulatory or cultural climate.</p>

DESCRIPTION

This credit addresses special instances in which projects far exceed the performance requirements of a credit or innovate in a way that advances the industry and the field of knowledge. These points are not calculated in the overall applicable points and, therefore, act as bonus points. Given the nature of the credit, the broad format of which is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Projects may pursue points for innovation or exceptional performance.

Exceptional Performance

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For instance, projects seeking additional points in credit CR1.1 Reduce Greenhouse Gas Emissions must already be achieving net-zero carbon. In this case, exceptional performance may be pursued by projects whose design and operations not only offset 100% of their own carbon, but will also achieve a significant net-positive reduction in carbon over the life of the project.

Exceptional performance constitutes achieving a remarkable increase in performance. This would be a multiple-factor increase in efficiency or effectiveness in one or more credits. Possible areas of achievement in exceptional performance for the Climate and Risk credit may include, but are not limited to, the following:

- Projects that go beyond carbon negative to become large-scale carbon sinks;
- Projects for which significant effort, beyond standard practices, is given to considering and preparing for changing operating environments;
- Projects for which climate change preparedness and resilience is critical for protecting public safety, availability of services, or long-term community finances at a scale beyond project boundaries (e.g. including long-term weather prediction in levees protecting communities).

Innovation

To qualify for innovation points, projects must demonstrate achievement in at least one of the following goals:

- Overcoming significant problems, barriers, or limitations—Project teams demonstrate that they have reduced or eliminated significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project;
- Creating scalable and/or transferable solutions—Project teams demonstrate that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.

Project teams may use innovative technology, methods, or application (e.g., the use of a pre-existing technology in a new way or the successful application of a technology or methods in regions or locales where existing policies, regulations, or general opinion have prevented their use). In such circumstances, it is imperative to prove that the application of the technology does, and will continue to, meet performance expectations and that it does not have a corresponding negative impact on the local or global environment, economy, or community.

Projects may demonstrate they implement innovative technologies or methods in several ways:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs and
- The project uses technologies or methods that may be general practice in other regions or parts of the world, but within the unique context of the project (whether climate, regulations, policies, political support, public opinion, etc.) have not yet gained acceptance. Significant efforts are taken to demonstrate the effectiveness of the technology or method within the context and provide a precedent for future adoption.

**METRIC:**

Whether project achievement qualifies as exceptional performance or innovation.

- The project team takes significant steps to include research goals within the project's development, or work with a university or research organization to advance the general knowledge of the profession. Proprietary research that is not made publicly available cannot count toward achieving this credit.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Any action that is already documented as an evaluation criteria for credits within the Climate and Risk category.

Performance Improvement: Exceed evaluation criteria for the highest levels of achievement or implement innovative methods in meeting infrastructure needs that are not addressed within the system.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project exceeded highest levels of achievement for a given credit?

1. *Detailed documentation of how the project exceeds existing requirements currently within a given Climate and Risk credit.*

B. To what extent does the project implement innovative technologies or methods?

1. *Documentation of the application of innovative technologies or methods. Detailed description of how this application will improve upon existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered innovative either as a technology, method, or within the project context (climate, political, cultural, etc.).*

C. To what extent does the project overcome significant problems, barriers, or limitations or create scalable and/or transferable solutions?

1. *Documentation that the project reduces or eliminates significant problems, barriers, or limitations that previously hampered the use or implementation of certain resources, technologies, processes, or methodologies that improve the efficiency or sustainability of a project.*
2. *Documentation that the improved performance achieved or the problems, barriers, or limitations overcome are scalable across a wide range of project sizes and/or are applicable and transferable across multiple kinds of infrastructure projects in multiple sectors.*

GLOSSARY

adaptation The collective set of actions taken to respond to climate change and variability. These actions include alterations in behavior and changes in the use of resources and the application of technologies.

affected community Any community that may experience positive or negative effects from the project's design, planning, construction, operation, or demolition. This may include communities beyond the host or benefitted communities.

aquifer A permeable geological formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

ASHRAE A global building technology society. ASHRAE was formerly called the American Society of Heating, Refrigerating and Air Conditioning Engineers.

backsliding The process by which sustainability performance of a given system is degraded, resulting from failure to follow the specified operations and maintenance procedures needed to maintain performance, using conventional but more familiar procedures instead.

benchmark A standard by which something can be measured or judged. For Envision®, "benchmark" stands for conventional or state-of-the-practice procedures and methodologies used in infrastructure design and construction.

best management practice (BMP) A technique, process, activity, or structure used to reduce the pollutant content of a stormwater discharge. They include simple, nonstructural methods such as good housekeeping and preventive maintenance and also may include structural modifications such as the installation of bioretention measures. Best management practices are most effective when used in combination with each other and customized to meet the specific needs (drainage, materials, activities, etc.) of a given operation. Best management practices also can function as treatment controls.

bioavailability The fraction of a substance existing in the environment that reaches and can be absorbed by living systems. "Bioavailability" refers to the difference between the amount of a substance such as a drug, herb, or chemical to which a living system is exposed and the actual dose of the substance the living system receives. Bioavailability accounts for the difference between exposure and dose.

biodiversity The degree of variation of life forms in an environment such as an ecosystem or biome. Biodiversity is one measure of the health of ecosystems. Biological diversity can include species diversity, ecosystem diversity, and genetic diversity.

biome A significant regional or global community produced or caused by living organisms, such as a grassland or desert, characterized chiefly by the dominant forms of plant life and the prevailing climate.

bioretention The process in which contaminants and sedimentation are removed from stormwater runoff. Stormwater is collected into the treatment area, which consists of a grass buffer strip, sand bed, ponding area, organic or mulch layer, planting soil, and plants.

BMP See "best management practice".

BPS See "byproduct synergy".

brownfields Former industrial and commercial sites typically containing low levels of environmental pollution such as hazardous waste or industrial byproducts. Brownfield sites have the potential to be reused once they are cleaned up, but cleaning the contamination may pose regulatory and monetary challenges. Brownfield sites are typically located in areas with existing infrastructure and/or transportation, which makes them more sustainable sites for development than greenfield sites.

buffer zones An area that lies between two or more other areas to segregate them to enhance the protection of areas under management, typically for the importance of their biodiversity. Buffer zones may be around the periphery of an area or may connect two or more protected areas. Buffer zones are intended to mitigate negative environmental or human influences in areas of greater ecological value.

byproduct synergy (BPS) The matching of undervalued waste or byproduct streams from one facility with potential uses at another facility to create new revenues or savings with potential social and environmental benefits. The resulting collaborative network creates new revenues, cost savings, energy conservation, reductions in the need for virgin-source materials, and reductions in waste and pollution, including potentially climate-changing emissions. These are quantifiable benefits to the environment, economy, and communities.

carbon dioxide equivalent (CO₂e) A measure used to compare the emissions of different greenhouse gases based on their global warming potential.

carbon sequestration The capture of carbon dioxide, including its removal from the atmosphere and deposit in a reservoir. This long-term storage of carbon dioxide can help mitigate or defer global warming, avoid climate change, and slow the atmospheric and marine accumulation of greenhouse gases.



climate The average weather or the statistical description in terms of the mean and variability of relevant quantities over a period of time. The relevant quantities are most often surface variables such as temperature, precipitation, and wind.

climate change A change in the state of the climate that persists for an extended period, typically decades or longer. Climate change may result from natural factors such as changes in the sun's intensity or slow changes in the earth's orbit around the sun; natural processes within the climate system (e.g., changes in ocean circulation); human activities that may have the potential to change the atmosphere's composition (e.g., through burning fossil fuels); and the land surface (e.g., deforestation, reforestation, urbanization, desertification, etc.).

community See "host community" and "affected community".

configuration trap Characteristics built into an infrastructure project that create configurations that are highly vulnerable to extreme weather events, natural disasters, or economic conditions.

curve number (CN) See "runoff curve number".

dark sky The night sky without artificial light pollution.

deconstruction Selective dismantling of building components, typically for reuse, recycling, and waste management. Differs from "demolition", whereby a site is cleared by the most expedient means, which creates significant waste and does not recapture the value of building components.

disassembly Dismantling or taking something apart. In this context, similar to "deconstruction", implying the maintenance of subsequent parts for value extraction through reuse or recycling. Differs from "deconstruction", in which building or construction are not designed to be taken apart. Disassembly is used when the system, building, or construction are designed to be taken apart.

durability The ability to resist wear and decay. Implies a longer life cycle, reducing the need for replacement with new goods and waste from worn-out goods.

economic development Efforts that seek to improve the economic wellbeing and quality of life for a community by creating and/or retaining jobs and supporting or growing incomes and the tax base.

economic growth Increase in per capita or total income. Production of more goods and services with the same input of labor, capital, energy, and materials.

ecosystem A system that includes all living organisms (biotic factors) in an area as well as its physical environment (abiotic factors) functioning together as a unit. An ecosystem's abiotic (nonbiological) constituents include minerals, climate, soil, water, sunlight, and all other nonliving elements; its biotic constituents consist of all of its living members.

embodied energy The sum of energy of a material or product that was used in the production of the material or product, including raw material extraction, transport, manufacture, and all the undertaken processes until the material or product is completed and ready.

ESCP Erosion and Sedimentation Control Plan

flexibility Ability of a system to adapt itself to new circumstances, enabling easy reconfiguration and refurbishment, increasing the possibilities for alternative future uses, and, as a result, allowing the system to extend its useful life.

floodplain Flat or nearly flat land adjacent to a stream or river that experiences flooding during periods of high discharge. Floodplains are formed by the natural meandering and flooding of streams and rivers and represent areas likely to experience regular flooding.

global warming Global warming is an average increase in the temperature of the atmosphere near the earth's surface and in the troposphere (i.e., lowest layer of the atmosphere). Global warming can occur from a variety of natural causes and may also be human induced. Global warming represents one aspect of climate change.

global warming potential (GWP) An index based on the radiative characteristics of well-mixed greenhouse gases; represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. Approximates the time-integrated warming effect of a unit mass of a given greenhouse gas in today's atmosphere relative to that of carbon dioxide.

greenfields Undeveloped land in a city or rural area being considered for urban development. May contain natural landscape, natural amenities, or agricultural land.

greenhouse gases Greenhouse gases are chemical compounds in the earth's atmosphere that absorb and emit radiation, which causes the greenhouse effect that affects regulation of the earth's temperature. Water vapor (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), and ozone (O₃) are the primary greenhouse gases in the earth's atmosphere. Synthetic greenhouse gases include fluorinated gases, halocarbons, and other chlorine- and bromine-containing substances.

GLOSSARY

greenhouse effect The earth's surface absorbs solar radiation and emits infrared radiation. Some of the infrared radiation passes through the atmosphere and some is absorbed and re-emitted in all directions by greenhouse gases. This effect helps regulate the temperature of the earth's surface and the lower atmosphere. Increases in these gases raise the heat trapped in the earth's surface and atmosphere.

greyfields Previously developed land. Distinct from brownfields in that they typically do not require remediation to redevelop, but offer value through existing infrastructure and by minimizing the environmental impact on greenfields.

habitat An ecological or environmental area that is inhabited by a particular species of animal, plant, or other organism. It is the natural environment in which an organism lives or in which a species population influences and is utilized by.

heat islands (heat island effects) An area that is significantly warmer than its surrounding rural areas because of materials that cause heat accumulation and lack of vegetation, which cools through evapotranspiration. It can increase the need for air conditioning and other forms of cooling that require energy.

host community The community in which the project is located.

hydrologic cycle The continuous movement of water on, above, and below the surface of the earth and throughout various states of liquid, vapor, and solid.

industry norms Current industry regulatory and/or operational standards for a particular industrial activity.

Infrastructure Infrastructure projects deliver the technical and physical structures (roads, bridges, water supplies and treatment works, dams, and more) required to support the community economy and contribute to the wellbeing of a community. Typically, they are expected to last 30–70 years, depending on the type of structure and how it is maintained. Infrastructure performance efficiency and effectiveness depend to a large degree on their fit and harmony with other elements of infrastructure and their collective ability to adapt to change.

infrastructure traps Characteristics built into an infrastructure project that may create difficult conditions within the life of the constructed works, such as excess consumption of money, energy, or increased vulnerability to changing conditions. The three types of infrastructure traps are resource traps, configuration traps, and standards traps.

integrated pest management (IPM) An effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. Integrated pest management programs use comprehensive information on the life cycles of pests and their interaction with the environment. This information, combined with available pest control methods, is used to manage pest damage by the most economical means and with the least possible hazard to people, property, and the environment.

integrated project delivery A project delivery approach that integrates people, systems, business structures, and practices to collaboratively harnesses the talents of all participants early in a project's conceptualization and design to optimize results and maximize efficiency.

karst topography A geologic formation such as limestone or dolomite that is shaped by the dissolution of layers of bedrock. Karst regions often display distinctive surface features such as sinkholes or caves, and may have limited surface water because of subterranean drainage.

key stakeholders Those people who are directly influential to, or will be directly influenced by, the outcome of the project and whose input must be taken into account if the process is to be considered complete and transparent.

life-cycle assessment (LCA) A technique to assess environmental impacts associated with all stages of a product's life, from raw material extraction through disposal or recycling.

low-impact development (LID) A method for managing stormwater runoff emphasizing conservation and the use of onsite natural features to protect water quality. Low-impact development uses small-scale controls to replicate the pre-development hydrologic regime of watersheds through infiltrating, filtering, storing, evaporating, and detaining runoff close to its source.

official(s) with jurisdiction The official or officials with authority over the location or system that is affected by the project.

persistence The measure of resistance to degradation through chemical, biological, and photolytic processes of pesticides and other pollutants.

pest Organisms that cause problems in crops or livestock, compete with humans for food and fiber, or otherwise cause economic or other problems for humans. Pests include insects, nematodes, mites, plant pathogens, vertebrate pests, and weeds. Their distribution and economic effects depend on a wide range of factors that include changes in farming patterns and agroclimatic and ecological conditions.

pest management Aims to manipulate pests and their environment in such a way as to maintain populations below levels that cause economic crop losses, thereby protecting crops from pest damage and/or destruction.

“SUSTAINABILITY: A set of environmental, economic, and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality, or availability of natural resources and ecosystems.”

plan-do-check-act (PDCA) “Management by fact” or scientific method approach to continuous improvement. Plan-do-check-act creates a process-centered environment involving the study of the current process, collection, and analysis of data to identify causes of problems, planning for improvement, and decisions regarding how to measure improvement (“plan”). The plan is then implemented on a small scale if possible (“do”). The next step is to determine what happened (“check”). If the experiment was successful, the plan is fully implemented (“act”). The cycle is then repeated using what was learned from the preceding cycle.

prime farmland Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. In the United States, the U.S. Department of Agriculture Natural Resources Conservation Service determines prime farmland. In Canada, it is classified by the Canadian Land Inventory (CLI).

prime habitat The most ideal habitats for protecting wildlife biodiversity caused by their size, location, diversity of habitat types, or presence of a particular type of habitat for plant or animal species.

project team The team involved in the planning, design, and development of a project, including the project owner, engineers, designers, biologists, and construction contractors.

public space A social space such as a commons, town square, or public park that is open and accessible to the public.

rainwater harvesting Accumulating and storing rainwater for reuse before it reaches the aquifer. This stormwater can be used for irrigation, flushing toilets, and other uses depending on the level of treatment. Rain collected directly from rooftops is referred to as “rainwater harvesting”; water collected from the ground is called “stormwater harvesting”.

renewable energy Energy that comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat; these sources can be naturally replenished over short periods of time and do not diminish.

resiliency The ability to successfully adapt to and/or recover readily from a significant disruption.

resource trap Characteristics built into an infrastructure project that increase community dependence on resources that could become scarce and expensive.

social capital Structures, institutions, networks, and relationships that enable individuals to maintain and develop human capital; includes families, communities, businesses, educational and voluntary organizations, and legal and political systems.

spill prevention, control, and counter-measure (SPCC) Includes requirements for oil-spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines.

solar reflectance index (SRI) A measure of a material’s ability to reject solar heat, as shown by a small temperature rise, which incorporates both solar reflectance and emittance in a single value. Solar reflectance index is defined such that standard black (reflectance 0.05, emittance 0.90) is “0” and standard white (reflectance 0.80, emittance 0.90) is “100”.

stakeholder A person, group, or organization that has a direct or indirect stake in an organization because it can affect or be affected by the organization’s actions, objectives, and/or policies. Key stakeholders in an infrastructure project may include the project owners, public works officials, the project design team, federal and local regulators, elected representatives, community groups, and members of the community directly affected by the project.

standards trap Projects delivered according to design standards and methodologies that are not in alignment with changing environmental or operating conditions or other concerns.

steep slopes In general, land with a slope angle of 2% or greater.

stormwater Water that originates during precipitation events. Stormwater that does not soak into the ground becomes surface runoff.

surface water Water collecting on the ground or in a stream, river, lake, wetland, or ocean that is naturally replenished by precipitation and lost through evaporation and subsurface seepage into the ground.

sustainability A set of environmental, economic, and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality, or availability of natural resources and ecosystems.

sustainability management system A system for managing an organization’s environmental, social, and economic issues, priorities, and programs in a comprehensive and systematic manner. It serves as a tool for managing and improving sustainable performance. It is also the means by which an organization can address the impacts of its products, processes, and services on the environment and on society.

stormwater pollution prevention plan (SWPPP) A plan for storm water discharge that includes erosion prevention measures and sediment controls that will decrease soil erosion and decrease offsite nonpoint pollution.

GLOSSARY

Technical Release 55 (TR-55) This U.S. Department of Agriculture manual presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States.

toxicity The degree to which a substance can damage living organisms.

triple bottom line The concept that business, traditionally concerned with the financial (economic) bottom line, should also be concerned with other performance metrics, such as environmental and social. The economic-environmental-social concept is often referred to as the “three pillars of sustainability”.

unique farmland Land other than prime farmland that is used for production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables.

upcycling The process of converting waste materials or unused products into new materials or products of better quality or a higher environmental value.

U.S. EPA U. S. Environmental Protection Agency

vegetation and soil protection zone (VSPZ) The ground area that must be protected and incorporated into the overall landscaping of a site being subdivided or developed.

waste streams (significant waste streams) The flow of varied types of waste from the point of generation to final disposal (i.e., landfill). Can be used to describe waste materials that are either of a particular type (e.g., paper waste stream) or produced from a particular source (e.g., construction waste stream).

wayfinding Means of orienting oneself in the physical environment and navigating from place to place using signs, maps, and other graphic or audible methods.

wellhead protection area According to the U.S. Environmental Protection Agency, the surface or subsurface area surrounding a water well or wellfield supplying a public water system through which contaminants are reasonably likely to move toward and reach such the well or wellfield; a groundwater recharge area for a well.

wetland An area of land where the soil is saturated with water, either permanently or seasonally. Wetlands are typically categorized by characteristic vegetation and provide a unique ecosystem for flora and fauna that may not be found in other ecosystems.

ADDITIONAL RESOURCES

The additional resources used in creating the rating system and guidance are presented below, organized by credit. They include credits in other systems that may have some association or related purpose or may provide additional insight and understanding. They also include external sources that provide enhanced definitions, understanding, background, context, or tools for meeting requirements for the credit.

QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE

- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables.
- National Charrette Institute: Charrettes for Sustainability Planning, www.charretteinstitute.org/projects/sustainability-planning.html
- Arnstein, Sherry R. "A Ladder of Citizen Participation," JAIP, Vol. 35, No. 4, July 1969, pp. 216-224.

QL1.2 STIMULATE SUSTAINABLE GROWTH AND DEVELOPMENT

- The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables.

QL2.2 MINIMIZE NOISE AND VIBRATION

- ASTM, 2000. ASTM E1014-84: Standard Guide for Measurement of Outdoor A-Weighted Sound Levels.
- USDOT, 1996. Measurement of Highway-Related Noise, FHWA-PD-96-046 DOT-VNTSC-FHWA-96-5, May 1996
- FHWA Highway Traffic Noise, www.fhwa.dot.gov/environment/noise/
- FAA Airport Noise, www.faa.gov/airports/environmental/airport_noise/
- LAWA Sustainable Airport Planning, Design and Construction Guidelines, v4.0, April 2009, PD4-LP-1
- "Noise Effect on Wildlife: Results and Discussion - Physics of Sound" US DOT Federal Highway Administration, www.fhwa.dot.gov/environment/noise/noise_effect_on_wildlife/effects/wild04.cfm

QL2.3 MINIMIZE LIGHT POLLUTION

- PANYNJ Sustainable Infrastructure Guidelines: IS-15 Minimize Light Pollution

- ASLA Sustainable Sites Initiative 2009: Site Design Human Health & Well-Being Credit 6.9: Reduce Light Pollution
- CASBEE Urban Development 2007: LRUD 1.6 Mitigation of Light Pollution Affecting Outside the Designated Area
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) Neighborhood Development 2009: Green Infrastructure and Buildings Credit 17: Light Pollution Reduction
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 11.5 Light Pollution, Section 12.1 Basic Principles
- Joint IDA-IES Model Lighting Ordinance (MLO), Illuminating Engineering Society, June 2010, www.ies.org/
- International Dark-Sky Association and Illuminating Engineering Society of North America's Model Lighting Ordinance, www.darksky.org
- RG Stevens, "Artificial Lighting in the Industrialized World: Circadian Disruption and Breast Cancer," Cancer Causes and Control 17 (2006): pp. 501-507.

QL2.5 ENCOURAGE ALTERNATIVE MODES OF TRANSPORTATION

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED)
 - ND NPD Credit 7: Transit Facilities
 - NPD Prerequisite 1: Walkable Streets, Credit 14: Tree-Lined and Shaded Streets
 - ND SLL Credit 4: Bicycle Network and Storage
- Pearl Estidama LC-1: Transit Supportive Practices, LC-6: Community Walkability
- Green Globes: Site-Analysis Questionnaire: Energy, Evaluation of site potential for transportation alternatives
- The Sustainable Sites Initiatives: Site Selection, Credit 1.7 Select sites that encourage nonmotorized transportation and use of public transit
- PANYNJ Sustainable Infrastructure Guidelines: IS-16 Optimize Public Environments- Bicycles and Pedestrians
- The Sustainable Sites Initiatives: Human Health and Wellbeing, Credit 6.6 Provide opportunities for outdoor physical activity
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND

QL2.6 IMPROVE SITE ACCESSIBILITY, SAFETY, AND WAYFINDING

- CASBEE Urban Development 2007: QUD 2.4.4: Crime Prevention Performance (Surveillance and Territoriality)
- Estidama Pearl Rating System 2010: Livable Communities LC-12: Safe and Secure Community

QL3.1 PRESERVE HISTORIC AND CULTURAL RESOURCES

- The National Register of Historic Places, www.nps.gov/nr/
- Sections 106 and 110 of the National Historic Preservation Act, www.achp.gov/106summary.html
- Section 4(f) of the Department of Transportation Act, environment.fhwa.dot.gov/4f/index.asp
- Historic Preservation/Section 106 Consultation Checklist, portal.hud.gov/hudportal/documents/huddoc?id=DOC_12987.pdf
- Section 106 Historic Preservation Fact Sheet, bphc.hrsa.gov/policiesregulations/section106.pdf
- National Conference of State Historic Preservation Officers, www.ncshpo.org
- National Trust for Historic Preservation, www.preservationnation.org/
- Leslie E. Barras, "Section 106 of the National Historic Preservation Act: Back To Basics: Part 1: Summary Report", National Trust for Historic Preservation, Washington, DC.

QL3.2 PRESERVE VIEWS AND LOCAL CHARACTER

- Exhibit C: Design Standards for Public View Corridors, City of Redmond, WA, www.ci.redmond.wa.us/workspaces/one.aspx?objectid=32015&contextId=9055

QL3.3 ENHANCE PUBLIC SPACE

- Key Federal Requirements regarding these resources: Section 4(f) of the Department of Transportation Act, Section 6(f) of the Land and Water Conservation Act, National Wildlife Refuge System Administration Act

LD3.3 EXTEND USEFUL LIFE

- Denver Metro Chamber of Commerce, "The Impact of I-70 Congestion on Colorado – Denver to Grand Junction," April 2007, www.drcog.org/documents/I70_Impact_042507.pdf

RA1.1 REDUCE NET EMBODIED ENERGY

- LCA and LCI Databases:
 - ATHENA (Athena Institute, 2011)
 - BEES (NIST Engineering Laboratory, 2010)
 - GaBi (PE International 2010)
 - SimPro (Pre Consultants 2010)
 - NREL U.S Life Cycle Inventory (LCI) Database

- European Commission –Joint Research Center ELCD database
- GRANTA-CES Selector (Granta, 2013)
- PANYNJ Sustainable Infrastructure Guidelines: IM-4 Use Durable Materials

RA1.2 SUPPORT SUSTAINABLE PROCUREMENT PRACTICES

- McDonough Braungart Design Chemistry, LLC (MBDC) Cradle to Cradle (C2C).
- Forest Stewardship Council, PRINCIPLES AND CRITERIA for Forest Stewardship, www.fscus.org/images/documents/FSC_Principles_Criteria.pdf

RA1.3 USE RECYCLED MATERIALS

- PANYNJ Sustainable Infrastructure Guidelines: Credit IM-1 Use Recycled Materials
- Green Building Research Guides, www.greenguide.com/exchange/search.html
- Reuse Development Organization, www.redo.org
- Building Materials Reuse Association's, www.buildingreuse.org
- Habitat for Humanity ReStore website, www.habitat.org/env/restores.aspx
- The U.S. Environmental Protection Agency Comprehensive Procurement Guidelines, www.epa.gov/cpg
- The U.S. Environmental Protection Agency Industrial Materials website, www.epa.gov/epawaste/conserve/imr

RA1.4 USE REGIONAL MATERIALS

- Pearl Community Rating System SM-2: Regional Materials
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) NC: MR c5.2: Regional Materials
- PANYNJ Sustainable Infrastructure Guidelines: IM-2 Use Local/Regional Materials
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 8.3.3.
- Global Reporting Initiative, Sustainability Reporting Guidelines, EC6: Policy, practices, and proportion of spending on locally-based suppliers at significant locations of operation.

RA1.6 REDUCE EXCAVATED MATERIALS TAKEN OFF SITE

- PANYNJ Sustainable Infrastructure Guidelines: IS-11 BALANCE EARTHWORK (pg 44)
- The Sustainable Sites Initiative, Credit 4.4 Minimize Soil Disturbance in Design and Construction

RA1.7 PROVIDE FOR DECONSTRUCTION AND RECYCLING

- Green Building Research Guide, www.greenguide.com/exchange/search.html
- Reuse Development Organization, www.redo.org
- Building Materials Reuse Association's, www.buildingreuse.org
- Habitat for Humanity ReStore website, www.habitat.org/env/restores.aspx
- The U.S. Environmental Protection Agency Comprehensive Procurement Guidelines, www.epa.gov/cpg

RA2.2 USE RENEWABLE ENERGY

- PANYNJ Sustainable Infrastructure Guidelines: IE-4 Use On-Site Renewable Energy
- EPA eGRID, www.epa.gov/cleanrgy/egrid/

RA2.3 COMMISSION AND MONITOR ENERGY SYSTEMS

- The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 9.1: Monitor performance of sustainable design practices
- Pearl Rating System Re-R3: Energy Monitoring & Reporting
- CASBEE-NC: 4.1: Efficient Operation- Monitoring
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 7.3.8
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) NC- EA P1- Fundamental commissioning of the building Energy systems

RA3.1 PROTECT FRESH WATER AVAILABILITY

- Guidelines for the Physical Security of Water Utilities (56-10) and Guidelines for the Physical Security of Wastewater/Stormwater Utilities (57-10) Standards ASCE/EWRI 56-10 & 57-10
- Local Multi-hazard Mitigation Planning Guidance. FEMA, www.fema.gov/multi-hazard-mitigation-planning

RA3.2 REDUCE POTABLE WATER CONSUMPTION

- Pearl Rating System Pw-R1: Community Water Strategy
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.3
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED):
 - ND- GIB prerequisite 3: minimum water efficiency
 - NC- WE c3.1- Water use Reduction: 20%-30%
 - NC- WE c2-Innovative Wastewater Technologies

RA3.3 MONITOR WATER SYSTEMS

- PANYNJ Sustainable Infrastructure Guidelines: IW-4 Utilize End Use Metering – Water

NW1.1 PRESERVE PRIME HABITAT

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) BD+C 2009 Site Selection Credit 1
- The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009 Site Selection Credit 1.5
- Pearl Community Rating System NS-1: Reuse of Land
- LAND Code Preserving and Restoring Habitat
- Forest Stewardship Council, "FSC Certification: Protection of Biodiversity and High Conservation Value Forests (HCVF)." www.fsc.org
- Forest Stewardship Council, FSC Principles and Criteria for Forest Stewardship, FSC-STD-01-001 (version 4-0) EN.
- Forman, Richard T.T., Land Mosaics: The Ecology of Landscapes and Regions. Fig 3.11 – Management Examples for edges and border of a natural resource area, p. 102
- Forman, Richard T.T., et. al. Road Ecology: Science and Solutions, Island Press, Washington 2003.
- Cleary, Edward C. and Dolbeer, Richard A. "Wildlife Hazard Management at Airports: A Manual for Airport Personnel." 2nd Edition(2005). FAA
- Charry, Barbara. Conserving Wildlife On and Around Maine's Roads. Maine DOT, Maine Audubon, and Beginning with Habitat, www.beginningwithhabitat.org/pdf/MARoadsWildlife-FINAL.pdf
- Parks Canada, Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas, 2008, www.pc.gc.ca
- Environment Canada, How Much Habitat is Enough 3rd Edition, 2013.

NW1.2 PROTECT WETLANDS AND SURFACE WATER

- National Wetlands Inventory, www.fws.gov/wetlands
- Environment Canada and Partners, Wetland Mitigation in Canada, A Framework for Application, 2000 www.ec.gc.ca
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED):
 - ND 2009 SLL Prerequisite 3: Wetland and Water Body Conservation
 - ND 2009 SLL Credit 7: Site Design for Habitat or Wetland and Water Body Conservation
 - GB+D 2009 SS Credit 1: Site Selection
- LAND Code: Buffering Critical Habitats (p. 73) Resources and Tools
- Low Impact Development: Technical Guidance Manual for Puget Sound, Chapter 4: Vegetation Protection, Reforestation, and Maintenance, Puget Sound Action Team
- Wetland Laws, Regulations, Treaties: Policy and Technical Guidance Documents (EPA), www2.epa.gov/laws-regulations

- Southeast Watershed Forum Wetland Fact Sheet: Wetland Buffer Zones, www.watershed-assistance.net/resources/files/SEWF_WetlandFactsheet_WetlandBuffer.pdf
- “How Ecology Regulates Wetlands: An Introduction to Regulatory, Wetland definitions and delineation, Wetland characterization and function assessment, Wetland mitigation, Buffers, and more” Andy McMillian, Washington State Department of Ecology, Shorelands and Environment Assistance Program (1998). www.ecy.wa.gov/pubs/97112.pdf
- Setting Buffer Sizes for Wetlands. James M McElfish, Jr., Rebecca L Kihlsinger, and Sandra Nichols. National Wetlands Newsletter, vol. 30 no.2 2008 (Environmental Law Institute, Washington DC)
- Environment Canada, How much Habitat is Enough 3rd Edition, 2013

NW1.3 PRESERVE PRIME FARMLAND

- For areas 10,000 acres or less, use the Web Soil Survey, websoilsurvey.nrcs.usda.gov/app/HomePage.htm

NW1.4 AVOID ADVERSE GEOLOGY

- USGS Karst Website, water.usgs.gov/ogw/karst/index

NW1.5 PRESERVE FLOODPLAIN FUNCTIONS

- SSI Guidelines and Performance Benchmarks 2009:
 - Site Selection Prerequisite 1.2: Protect floodplain functions
 - Site Design - Water Credit 3.4: Rehabilitate lost streams, wetlands, and shorelines
 - Site Selection Credit 3.6: Protect and enhance on-site water resources and receiving water quality
- Natural and Beneficial Functions of Floodplains. FEMA. Publication 409, www.fema.gov/media-library/assets/documents/2128?id=1546
- Institute for Catastrophic Loss Reduction, An Assessment of Flood Risk Management in Canada, 2003, www.iclr.org

NW1.6 AVOID UNSUITABLE DEVELOPMENT ON STEEP SLOPES

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SLL Credit 6: Steep Slope Protection

NW1.7 PRESERVE GREENFIELDS

- ASTM E1903-97 Phase II Environmental Site Assessment
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED)
 - BD+C 2009 Site Selection Credit 2: Development Density and Community Connectivity
 - ND 2009 SSL Prerequisite 1: Smart Location
 - ND 2009 SSL Credit 1: Preferred Locations
 - ND 2009 SSL Credit 2: Brownfields Redevelopment

- Pearl Rating System NS-1: Reuse of Land
- Pearl Rating System NS-2: Remediation of Contaminated Land
- SSI Guidelines and Performance Benchmarks 2009:
 - Site Selection Credit 1.5: Select brownfields or greyfields for redevelopment
 - Site Selection Credit 1.6: Select sites within existing communities
- U.S. EPA, Brownfields and Land Revitalization, www.epa.gov/brownfields/index.html
- “Greyfields into Goldfields: from failing shopping centers to great neighborhoods”, A Study By Congress For The New Urbanism And PricewaterhouseCoopers, February 2001. www.usmayors.org/brownfields/library/greyfieldstogoldfields.pdf
- EPA, Types of Contaminated Sites, www.epa.gov/compliance/cleanup/revitalization/site-types.html

NW2.1 MANAGE STORMWATER

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 GIB Credit 8: Stormwater Management
- Pearl Rating System PW-2: Stormwater Management
- SSI Guidelines and Performance Benchmarks 2009 Site Design - Water Credit 3.5: Manage stormwater on site
- Urban Design Tools, Low Impact Development. www.lid-stormwater.net/index.html
- EPA's Stormwater Management reference page: www.epa.gov/oaintrnt/stormwater/index.htm
- Stormwater Journal for surface water quality professionals: www.stormh20.com/SW/SWhome.aspx
- International Stormwater BMP Database: www.bmpdatabase.org/

NW2.2 REDUCE PESTICIDE AND FERTILIZER IMPACTS

- LAWA Sustainable Airport Planning, Design and Construction Guidelines, v4.0, April 2009, PD7-LD-2, Reduce Impact of Fertilizer Use.
- Canadian Fertilizers Act, laws-lois.justice.gc.ca

NW2.3 PREVENT SURFACE AND GROUNDWATER CONTAMINATION

- Wisconsin Department of Natural Resources, Wellhead protection, dnr.wi.gov/topic/drinkingwater/wellheadprotection/
- Canadian Council of Ministers of the Environment (CCME) Canadian Environment Quality Guidelines, Water Quality Guidelines for the Protection of Aquatic Life, www.st-ts.ccme.ca

NW3.1 PRESERVE SPECIES BIODIVERSITY

- Pearl Rating System NS-4: Habitat Creation and Restoration, p. 45

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SLL Credit 7: Site Design for Habitat or Wetland and Water Body Conservation, p. 36
- Forman, Land Mosaics, Ch 11 “Species movement in mosaics” pg 364 – 402; and Ch 12 “Land transformation and fragmentation” pg 404-423
- Highways and Habitat: Managing Habitat Connectivity and Landscape Permeability for Wildlife (www.fs.fed.us/pnw/science/scifi79.pdf)
- Habitat Connectivity Planning & Assessment – Assessing the Impact of Roads on Animal Population Viability, www.icoet.net/downloads/03Planning&Assessment.pdf
- Habitat Connectivity Mapping Tools (Washington Wildlife Habitat Connectivity Group), waconnected.org/habitat-connectivity-mapping-tools/
- UNiversal CORridor Network Simulator (UNICOR) (Computational Ecology Laboratory, University of Montana), cel.dbs.umt.edu/cms/index.php?option=com_content&view=article&id=50:unicor&catid=36&Itemid=56
- Circuitscape: A Tool for Landscape Ecology. Proceedings of the 7th Python in Science Conference (SciPy 2008), gauss.cs.ucsb.edu/publication/Circuitscape_Python_Scipy08.pdf

Connectivity Analyses:

- Arizona’s Wildlife Linkages Assessment, www.azdot.gov/Highways/OES/AZ_WildLife_Linkages/assessment.asp
- South Coast Ecoregion Missing Linkages, www.scwildlands.org/reports/SCMLRegionalReport.pdf
- Wildlife Connectivity Across Utah’s Highways, escholarship.org/uc/item/3w44k0c4
- Linking Colorado’s landscapes, nativeecosystems.org/campaigns/linking-colorados-landscapes202%20-%20Methods%20WHCWG%20Statewide%20Analysis

NW3.2 CONTROL INVASIVE SPECIES

- U.S. Department of Agriculture, National Invasive Species Information Center, www.invasivespeciesinfo.gov/resources/lists.shtml
- Invasive Alien Species Strategy for Canada, 2004, publications.gc.ca
- Invasive Species (EPA) water.epa.gov/type/oceb/habitat/invasive_species_index.cfm
- SSI Guidelines and Performance Benchmarks 2009 Site Design—Soil and Vegetation
 - Credit 4.2: Use appropriate, non-invasive plants
 - Credit 4.8: Preserve plant communities native to the ecoregion
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009
 - SLL Credit 8: Restoration of Habitat or Wetland and Water Bodies
 - SLL Credit 9: Long-Term Conservation Management of Habitat or Wetlands and Water Bodies
 - SS Credit 5.1: Site Development—Protect or Restore Habitat
 - SS Credit 5.2: Site Development—Maximize Open Space
- Pearl Community Rating System NS-3: Ecological Enhancement
- LAND Code Preserving and Restoring Habitat
- Pearl Community Rating System PW-1.1: Community Water Use Reduction: Landscaping
- State Noxious Weeds laws, and Federal Noxious Weeds laws.
- Invasive Species Definition Clarification and Guidance White Paper, Submitted by the Definitions Subcommittee of the Invasive Species Advisory Committee (ISAC) National Invasive Species Council (NISC). 2006. www.invasivespeciesinfo.gov/docs/council/isacdef.pdf
- Identify Invasive Species www.discoverlife.org/mp/20q?guide=North_American_Invasives&btxt=Invasivespeciesinfo.gov&burl=www.invasivespeciesinfo.gov
- Invasive Species Research (USDA), www.rmrs.nau.edu/invasive_species/
- Invasive Species Program (US Forest Service), www.fs.fed.us/invasivespecies/
- Dangerous Travelers: Controlling Invasive Plants Along America’s Roadways (US Forest Service), www.fs.fed.us/invasivespecies/prevention/dangeroustravelers.shtml
- Invasive and Noxious Weeds Lists (USDA), plants.usda.gov/java/noxiousDriver#introduced

NW3.4 MAINTAIN WETLAND AND SURFACE WATER FUNCTIONS

- FISRWG (10/1998). Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the US gov’t). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN 3/PT.653. ISBN-0-934213-59-3.
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SLL Credit 9: Long-Term Conservation Management of Habitat or Wetlands and Water Bodies
- SSI Guidelines and Performance Benchmarks 2009 Site Design - Water Credit 3.4: Rehabilitate lost streams, wetlands, and shorelines, p. 60
- “An Introduction to Wetland Restoration, Creation, and Enhancement” (2003), Federal Interagency Workgroup on Wetland Restoration www.epa.gov/owow/wetlands/restore/finalinfo.html.
- Ground Water and Ecosystem Restoration Research, EPA. www.epa.gov/ada/

CR1.1 REDUCE GREENHOUSE GAS EMISSIONS

- Databases:
 - ATHENA (Athena Institute, 2011)
 - BEES (NIST Engineering Laboratory, 2010) (both
 - GaBi (PE International 2010)
 - SimPro (Pre Consultants 2010).

- NREL U.S Life Cycle Inventory (LCI) Database
- European Commission, Joint Research Center ELCD database
- Developing a Greenhouse Gas Inventory (EPA), www.epa.gov/statelocalclimate/state/activities/ghg-inventory.html
- Assessing Air Quality, Greenhouse Gas, and Public Health Benefits (EPA), www.epa.gov/statelocalclimate/state/activities/assessing-air-quality-and-public-health.html#a02-c
- Co-Benefits Risk Assessment (COBRA) Screening Model, COBRA is a Screening Tool That Estimates Health of changes in emissions of PM, as well as pollutants associated with the secondary formation of PM (sulfur dioxide (SO₂), nitrogen oxides (NO_x), ammonia (NH₃), and volatile organic compounds (VOCs), at the county, state, regional, or national level. www.epa.gov/statelocalclimate/resources/cobra.html
- PowerProfiler (EPA), energy composition by zipcode, oaspub.epa.gov/powpro/ept_pack.charts

CR1.2 REDUCE AIR POLLUTANT EMISSIONS

- SSI Guidelines and Performance Benchmarks 2009 Operations and Maintenance 8.8: Reduce emissions and promote the use of fuel-efficient vehicles, p. 208
- Assessing Air Quality, Greenhouse Gas, and Public Health Benefits (EPA), www.epa.gov/statelocalclimate/state/activities/assessing-air-quality-and-public-health.html#a02-c
- Co-Benefits Risk Assessment (COBRA) Screening Model, www.epa.gov/statelocalclimate/resources/cobra.html

CR2.1 ASSESS CLIMATE THREAT

- CEEQUAL, Land Use 2.3 Flood Risks
- CASBEE UD 2007, 2.4.1: Understanding the risk of natural hazards
- NYC Green Codes Task Force 2010:
 - BR 1: Create & Use 2080 Flood Map Based on Climate Change Predictions
 - BR 3: Study Adaptive Strategies to Flooding
 - BR 4: Study Adaptive Strategies to Non-Flood Climatic Risks
 - BR 5: Forecast Non-Flood Climatic Hazards to 2080
- Coastal Inundation Toolkit (NOAA), www.csc.noaa.gov/digitalcoast/inundation/
- University of Washington, Center for Science in the Earth System:
 - Conduct a climate change vulnerability assessment, cses.washington.edu/db/pdf/snoveretalgb574ch8.pdf
 - Conduct a climate change risk assessment, cses.washington.edu/db/pdf/snoveretalgb574ch9.pdf
- Climate Resilience Evaluation & Awareness Tool (CREAT) EPA; water.epa.gov/infrastructure/watersecurity/climate/creat.cfm

CR2.3 PREPARE FOR LONG-TERM ADAPTABILITY

- Climate Ready Utilities (EPA), water.epa.gov/infrastructure/watersecurity/climate/
- Climate Ready Water Utilities Toolbox – beta version (EPA), www.epa.gov/safewater/watersecurity/climate/toolbox.html
- Climate Resilient Infrastructure: Preparing for a Changing Climate Summary Document, www.defra.gov.uk/publications/files/summary-report-final-version2.pdf
- Richard J.T. Klein, Robert J. Nicholls and Frank Thomalla. “Resilience To Natural Hazards: How Useful Is This Concept?” March 2004. EVA Working Paper No. 9, DINAS-COAST Working Paper No. 14. Potsdam Institute for Climate Impact Research, Potsdam, Germany.
- Adapting the road sector to climate change Presented by: Fang Xu, Economist, Africa Region Office., Karsten Sten Pedersen, Project Director, COWI A/S, (World Bank), siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1297096897336/7715763-1297096955872/Presentation-Xu.pdf
- A User’s Manual for Building Resistance and Resilience to Climate Change in Natural Systems (World Wildlife Federation), <http://www.panda.org/?8678/BUYING-TIME-A-Users-Manual-for-Building-Resistance-and-Resilience-to-Climate-Change-in-Natural-Systems>
- Millennium Ecosystem Assessment, Ecosystems and Human Well-Being: Desertification Synthesis, www.millenniumassessment.org/documents/document.355.aspx.pdf
- U.S. Department of Agriculture, Natural Resources Conservation Service, Global Desertification Vulnerability Map, www.nrcs.usda.gov/wps/portal/nrcs/detail/national/nedc/training/soil/?cid=nrcs142p2_054003

CR2.4 PREPARE FOR SHORT-TERM HAZARDS

- CEEQUAL, Land Use 2.3 Flood Risks
- NYC Green Codes Task Force 2010:
 - BR 3: Study Adaptive Strategies to Flooding
 - BR 5: Study Adaptive Strategies to Non-Flood Climatic Risks

CR2.5 MANAGE HEAT ISLAND EFFECTS

- ASTM E1980-11 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- PANYNJ Sustainable Infrastructure Guidelines: IS-14 Mitigate Heat Island Effect
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) NC 2009:
 - Credit 7.1 Heat Island Effect Non-roof
 - Credit 7.2 Heat Island Effect Roof
- Pearl Community Rating System: RE-2 Urban Heat Reduction
- The Sustainable Sites Initiatives: Site Design, Credit 4.12 Reduce Urban Heat Island Effects



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