ENVISION

Version 2.0

A RATING SYSTEM FOR SUSTAINABLE INFRASTRUCTURE

INSTITUTE FOR SUSTAINABLE INFRASTRUCTURE

ISI

ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE

Graduate School of Design
Harvard University

ENVISION™

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I S I

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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.

APWA
Your Comprehensive Public Works Resource

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

ACEC
American Council of Engineering Companies
100 Years of Excellence

The Institute for Sustainable Infrastructure 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.

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INTRODUCTION

What is Envision?

In today's environment, the conditions and constraints under which infrastructure must perform are increasingly challenging. Demands for water and energy resources continue to climb, making conservation and the use of alternatives a design requirement. Additionally, as the effects of a warming climate are likely to continue, communities are being forced to adapt to new conditions through corresponding changes in infrastructure design and construction. To meet these 21st century demands for infrastructure, a new sustainability rating system, Envision™, has been recently created by a strategic alliance between two organizations: the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure.

In order to meet the serious challenges that we face for infrastructure, the Envision™ rating system is designed to be used not only as a project assessment tool but as a guidance for sustainable infrastructure design and integrated education and resource library. This assessment recognizes the need to stretch the traditional design boundaries in which infrastructure projects are judged, not only by how they are delivered, but by how long they last, accounting for durability, flexibility and utility of the constructed works. This new sustainable infrastructure rating system is a cutting-edge development for the world's infrastructure design and built environment.

This new sustainable infrastructure rating system has been created to evaluate, grade and give recognition to infrastructure projects that provide progress and contributions for a sustainable future. Its purpose is to foster a necessary and dramatic improvement in the performance and resiliency of physical infrastructure across the full economic, social, and environmental dimensions of sustainability. Designers, decision-makers, and the public currently face a proliferation of sustainability rating tools, most of which focus on the performance of a particular infrastructure element rather than its contribution to the system in which it resides.

To do this, Envision™ takes a new tack by establishing a holistic framework for evaluating and rating infrastructure projects against the needs and values of the community. The rating system ensures that the true sustainability of tomorrow's infrastructure is addressed by considering the entire life cycle of projects at a systems level. Envision™ not only asks "Will we do the project right?" but also, "Will we do the right project?"

In addition, Envision™ raises the bar on sustainability performance by recognizing efforts that replenish and restore natural resources and ecosystems as well as evaluating infrastructure throughout its full life with ratings for design and planning, construction, operations, and decommissioning. This initial release of Envision™ addresses the design and planning phase with subsequent phase ratings to follow.

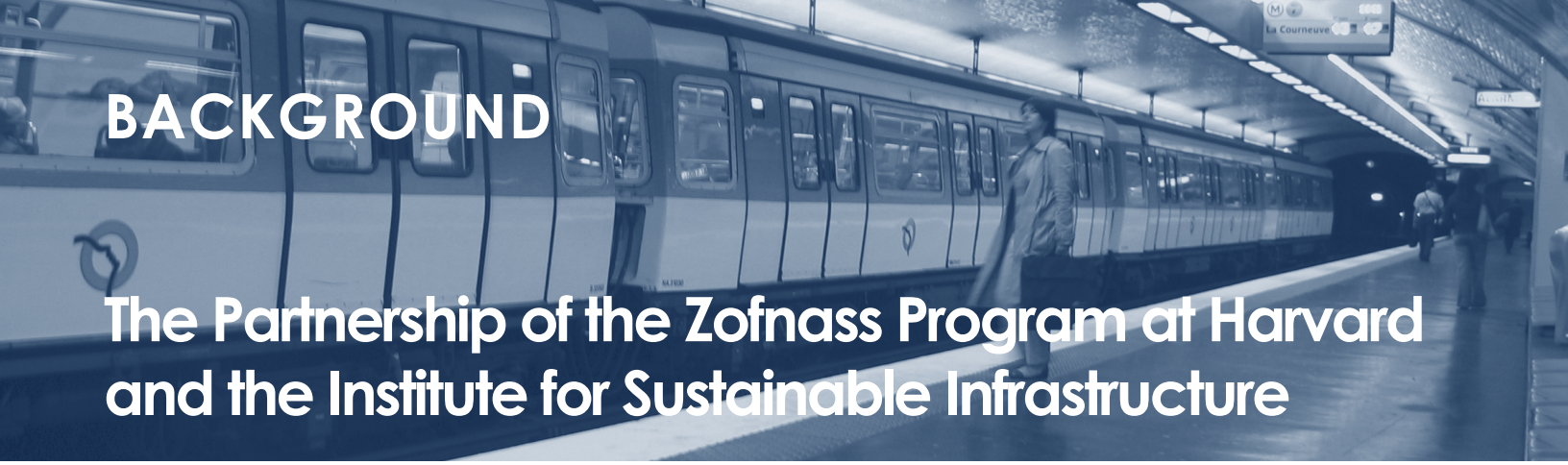
Within each phase, sustainability objectives are organized in three tiers; categories, subcategories, and credits. By meeting objectives within a credit, projects earn points toward their rating score. The achievement of points within the credit is scaled in five levels to ensure all efforts to achieve sustainability are rewarded proportionally.

Recognition of the challenges, issues, and complexity of achieving sustainability is a necessary step in improving infrastructure development. The purpose of Envision™ is to initiate a systemic change. An efficiently-operating infrastructure is an essential component of national competitiveness. Achieving high levels of efficiency requires infrastructure that is not only well maintained, but well connected and integrated across the cities and communities it is designed to serve.

Educational programs will be offered in conjunction with the system release to not only train individuals to use Envision™ but to incorporate systems level thinking into their approach to sustainability, considering the broader, often overlooked, impacts of a project.

In addition to the release of Envision™, the Harvard Zofnass Program and the Institute for Sustainable Infrastructure will jointly release in 2012 two companion tools: a pre-planning checklist for assessing project sustainability in increasing awareness of issues, and an economic assessment tool to help project owners determine the sustainable return on their investment. Both tools are under development and important steps in realizing the goal for a holistic system.

> **"The purpose of Envision is to initiate a systemic change... to transform the way infrastructure is designed, built, and operated"**
>
> **William Bertera**
> **Executive Director, ISI**



BACKGROUND

The Partnership of the Zofnass Program at Harvard and the Institute for Sustainable Infrastructure

The Zofnass Program for Sustainable Infrastructure at the Harvard Graduate School of Design, and the Institute for Sustainable Infrastructure (ISI), have established a strategic partnership in support of sustainable infrastructure.

Both programs had previously developed independent comprehensive rating systems to measure and encourage the development of sustainable civil infrastructure that is compatible with and compliments societal goals for environmental protection, public health, economic growth and personal security. Through the strategic partnership between these two programs Envision 2.0 was developed to create a unique and holistic approach, bringing together the best of both.

According to Timothy Psomas, Chairman of the ISI Board, "This is how successful societies are supposed to work. We pool our talent, focus our resources and commit ourselves to a common outcome. Establishing a formal working relationship between the ISI and the Zofnass Program for Sustainable Infrastructure makes good sense...for our respective programs and for the public interest."

On announcing the agreement to collaborate, Paul Zofnass, Founder and President of the Environmental Financial and Consulting Group (EFCG), noted a strong public interest in complementary organizations that work collaboratively to address significant issues of societal priority, "Deciding what is sustainable in a world of finite resources, where the demand for essential goods and services is growing along with our population, is the most pressing public administration issue of our time. And, it is an issue so large and so important that neither government nor the private sector can successfully address it on their own. The collaboration between these two prestigious organizations will unite the resources, knowledge, and skills of the engineering profession, the private companies that engineers work for, the public sector "owners" of infrastructure and one of the worlds' greatest research universities."

The Zofnass Program for Sustainable Infrastructure is a multi-disciplinary effort funded by siblings Paul and Joan Zofnass and supported by prominent firms focused on infrastructure, engineering, and construction: Autodesk, EXP (formerly Trow), Halcrow – a CH2M Hill company, HDR, HNTB, Granite, MWH and Stantec. Housed in the Harvard Graduate School of Design, the Zofnass Program is a collaborative effort that leverages the contributions of faculty from across Harvard University's many schools and research centers including among others, faculty from the Harvard University Center for the Environment, the Harvard Business School, the Harvard Kennedy School of Government, and the Harvard School of Public Health.

The Harvard University Graduate School of Design (GSD) is dedicated to the education and development of design professionals in architecture, landscape architecture, urban planning, and urban design. The GSD provides leadership for shaping the built environment of the 21st Century.

The Institute for Sustainable Infrastructure is a not-for-profit association of the American Society of Civil Engineers, the American Council of Engineering Companies and the American Public Works Association. Recognizing a gap in civil infrastructure, their organizational support and dedication to sustainable solutions were the driving forces in the development of ISI as Founding Partners. Its purpose is to improve the performance and viability of infrastructure through the application of more sustainable technologies and methodologies.

THE ENVISION RATING SYSTEM

The Role of Envision

The Envision™ Rating System is an objective framework of criteria and performance achievements. It is designed to help users identify ways in which sustainable approaches can be used to plan, design, construct and operate infrastructure projects. The goal is to improve the sustainable performance of infrastructure projects in terms of not only the technical performance but also from a social, environmental and economic perspective. Envision™ provides an opportunity for infrastructure owners and designers to provide higher performing solutions by using a lifecycle approach, by working with communities, and by using a restorative approach to infrastructure projects.

SCOPE AND PURPOSE

Envision covers the roads, bridges, pipelines, railways, airports, dams, levees, landfills, water treatment systems, and other civil infrastructure that make up the built environment. Envision does not include buildings or facilities, as these are well covered by existing rating systems. The initial version of Envision was designed to address North American infrastructure, including the US and Canada, and occasionally references codes and regulations used in these countries. Nevertheless, it is the hope that Envision will expand internationally when, and wherever, appropriate. The purpose of Envision is to foster a dramatic and necessary improvement in the performance and resiliency of our physical infrastructure across the full dimensions of sustainability. Envision provides the framework and incentives needed to initiate this systemic change.

RELATIONSHIP TO OTHER RATING SYSTEMS

Envision is not intended to replace existing sustainability rating systems. Rather it fills a gap, within North America, for a holistic rating system for sustainable infrastructure. While sector specific systems exist, (e.g., roads, ports) Envision is intended as an overarching tool that covers all aspects of infrastructure.

Why is a holistic approach to infrastructure important? Unlike buildings, convergence and optimization of the various elements of infrastructure are accomplished at the community level. At this 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. Thus, rating systems that evaluate and recognize sustainable performance in a single infrastructure element will miss the more important aspects of sustainable performance, i.e., how that element contributes to the overall sustainability of the community that it serves. Using the example of a highway, the first and most important sustainability question is not how much recycled material was used in constructing the highway. The question is whether a highway or some other mode of transportation best fulfills the mobility and access needs of the community, considering the triple bottom line.

Envision encourages the use of additional sustainability rating systems that may address in-depth specific or specialized aspects of a project. However, Envision is key to realizing the overall, and full, impacts of a project.

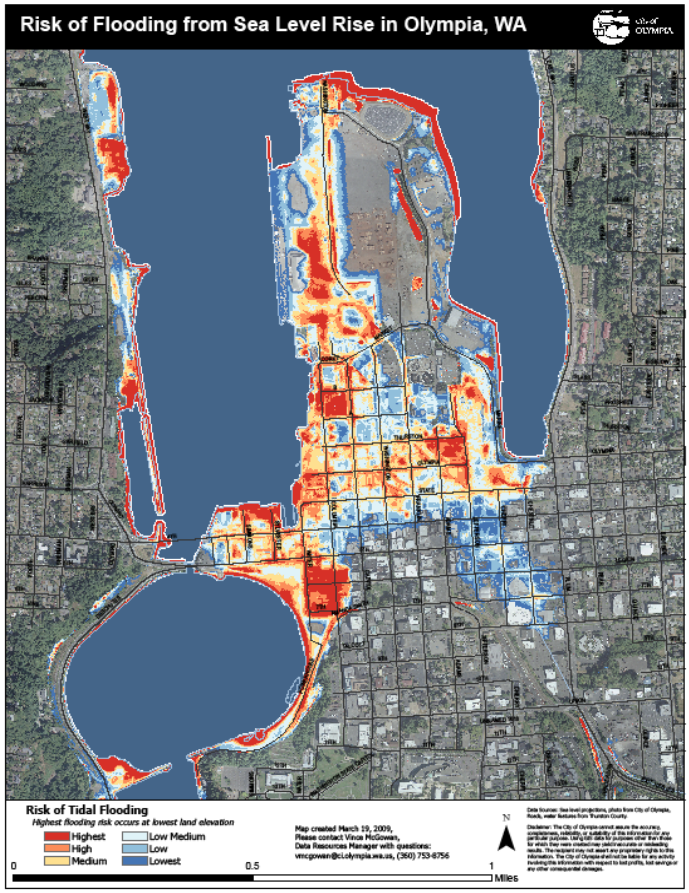


Figure 1: The impact of projected sea level rise on downtown Olympia, WA.

Key Features of Envision

EXPANDING THE BREADTH OF THE CONTRIBUTION TO SUSTAINABILITY

Envision categorizes a project's contribution to sustainability into two key areas; performance contribution and pathway contribution. Here performance contribution is the efficiency or effectiveness of the project whereby project teams seek out all reasonable opportunities to improve sustainable performance by raising the bar in one or more dimensions of performance. These important criteria include energy efficiency, water consumption, and materials consumption, to name a few. Collectively these criteria can be used to answer the question, "Are we doing the project right?"

Envision expands these considerations by assessing what is referred to as pathway contribution. Pathway contribution considers how the project aligns with overall community needs and enhances quality of life. Here key criteria include whether the project aligns with community goals, supports responsible and sustainable development, and integrates with existing systems and infrastructure in a meaningful way. Collectively these criteria can be used to assess an equally important question, "Are we doing the right project?"

As an example, a road project may use recycled materials and low energy construction methods to improve the project performance contribution to sustainability. However, if the road project increases congestion, urban sprawl, and divides communities, its pathway contribution is arguably low.

AVOIDING TRAPS AND VULNERABILITIES

An important pathway credit in the Envision rating system asks whether or not the infrastructure project avoids or eliminates traps and vulnerabilities that create long-term costs and risks for the community in which it resides. These traps can be categorized into three types:

- Resource Traps
- Configuration Traps
- Standards Traps

Resource traps refer to 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 in the future. For example, the dependence on fossil fuels may commit communities to increasing operating costs as fuel prices rise. Configuration traps are projects that create or exacerbate infrastructure configurations that increase vulnerability to extreme weather events, natural disasters, economic conditions and/or actions. These not only score low, but are seen as conceptually deficient. Projects located in floodplains, which damage natural floodplain functions, will increase the destructive force of floods. Likewise, coastal projects which fail to take into account the estimated rise in sea level open communities to unnecessary vulnerability and risk. Finally, many design standards were developed decades ago and do not take into account the pressing need for sustainable growth. Nor do they take into account the changing conditions current infrastructure will face. Following standards without taking into account these factors will fail to achieve the necessary systemic change toward sustainability.

EXPANDING OPPORTUNITIES AND TARGETS FOR HIGH PERFORMANCE

Opportunities for improving project performance begin at the project planning stage and are depicted in Figure 2. This rating system encourages opening up traditional project boundaries in order to maximize those opportunities.

Project life-cycle. Credit is given to project teams that extend design considerations to the full extent of the project life-cycle. Designs that offer increased durability and flexibility to extend the useful life of the constructed works are afforded additional recognition. Extending the useful life of constructed works means that replacement structures are needed less. More recognition is

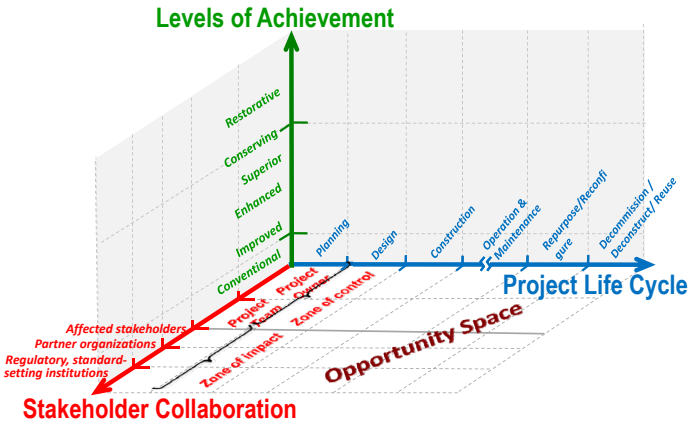


Figure 2: Expanding opportunities and performance targets in three dimensions.

> "If we can come up with a set of metrics that people can agree to and that has the credibility . . . to measure and evaluate these projects I think we're going to have a very meaningful impact, a critically important impact, on preserving our environment."
>
> **Paul Zofnass, President, EFCG**

given for designs that incorporate deconstruction principles and enable reuse and up-cycling of materials and equipment.

Stakeholder collaboration. Credit is also given to project teams that look for opportunities to work with stakeholders, both internal and external. Internally, establishing a collaborative working relationship between the project owner and the project team will help create an environment for innovation and an inclination for raising the bar on project performance. Based on this positive working relationship, the project team can then engage effectively with project stakeholders to identify issues and concerns. In this rating system, the project team is encourages to contact nearby facilities in search of unused materials that could be used on the project. Moreover, project teams can work with regulators to identify regulations or policies that run counter to sustainability objectives and seek relief. Envision gives credit for these pursuits.

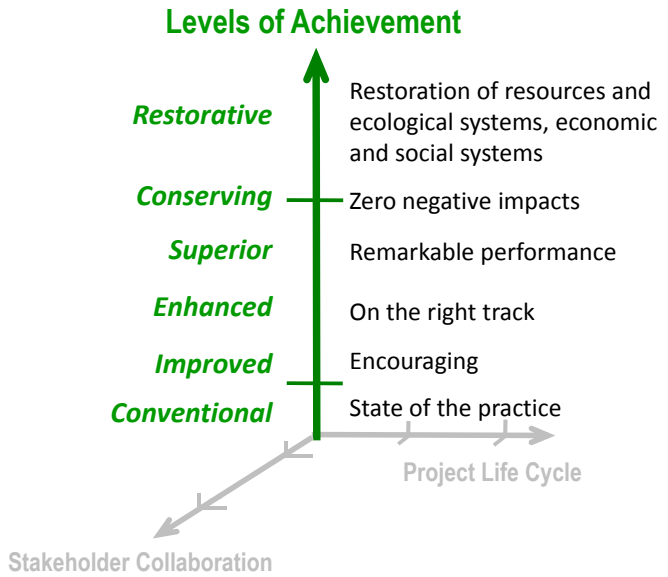


Figure 3: Establishing restorative as a level of achievement.

RECOGNIZING RESTORATIVE PERFORMANCE

While improving sustainable performance is an essential and immediate goal, long-term goals must be geared towards restoration. This rating system makes restoration an explicit goal, as well as the highest category in its five levels of achievement. This is intended to underscore the point that to really contribute to sustainability, projects must do more then make incremental improvements that have diminished, but still negative, impacts on environmental, social and economic conditions.

RECOGNIZING AND REWARDING SIGNIFICANT AND RELEVANT INNOVATION

Envision™ recognizes that making progress toward conditions of sustainability requires a total 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 bar on performance in one or more dimensions of sustainability. Envision™ identifies and credits three categories of innovation, none of which are mutually exclusive:

- Achieving exceptional levels of performance. Exceptional performance is defined as 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 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. 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.

ADDRESSING CHANGING OPERATING ENVIRONMENTS

For engineers and designers, the primary consequence of working in a non-sustainable operating environment is that many, if not most, of the normal project design assumptions and variables could change significantly over the design life of the project. In addition, different materials, brought in for their

more sustainable characteristics, may have significantly different properties that need to be accounted for in the design. Some assumptions about expected operating conditions will have changed, requiring determinations of new averages, variances and possible extremes. New variables and new relationships among existing variables will appear and need to be taken into account. Resource demands will drive up the cost and scarcity of important materials and fuels. Extreme weather events and atypical weather patterns may change the operating environment. In addition to the physical structure, the project may need to incorporate "soft" engineering solutions, such as new forms of monitoring and data collection, contingency plans, public education and training. Deteriorating infrastructure paired with a growing population yet struggling economy present serious challenges to conventional thinking. The rating system recognizes these changes and incorporates a number of process-based objectives to ensure that these matters are considered by the project team.

ADVANCING SUSTAINABILITY KNOWLEDGE AND EDUCATION

Envision™ is designed to do more than simply rate and rank projects in the built environment. It is designed as a template for planning, designing and constructing projects that contribute to the reduction of our environmental footprint while not diminishing our overall quality of life. At the same time, it helps engineers and other practitioners take into account the changes in operating conditions in ways that ensure the project will perform as specified over the entire design life. As such, Envision™ helps to create a new breed of sustainability engineer/practitioner, a person that has good knowledge of what it takes to design a project that truly contributes to sustainability.

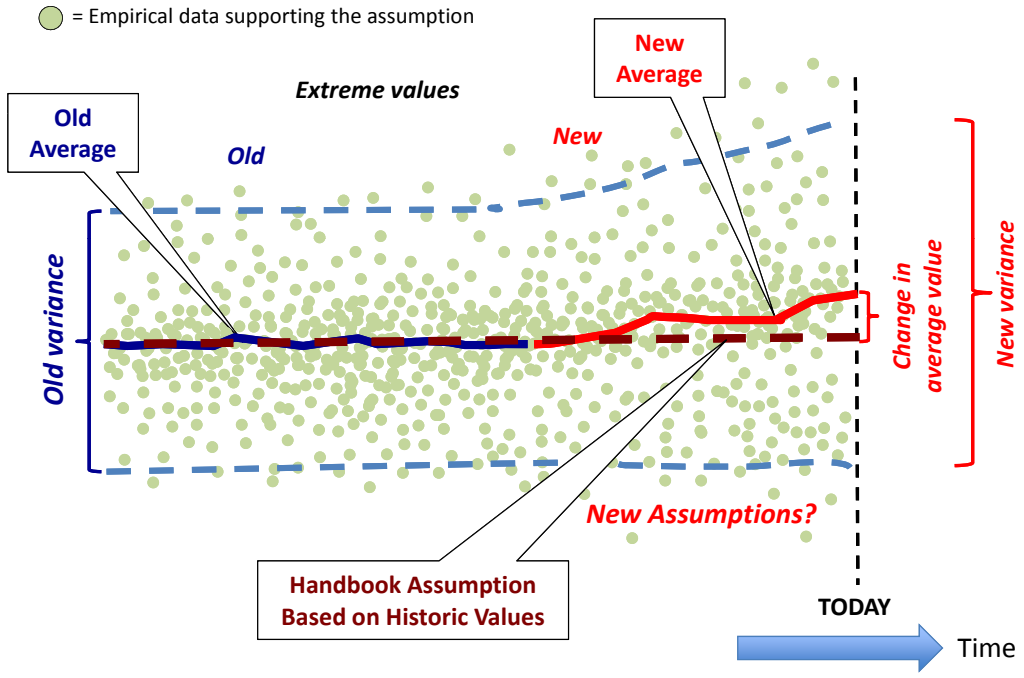


Figure 4: New averages challenge historic handbook assumptions.

Organization and Structure

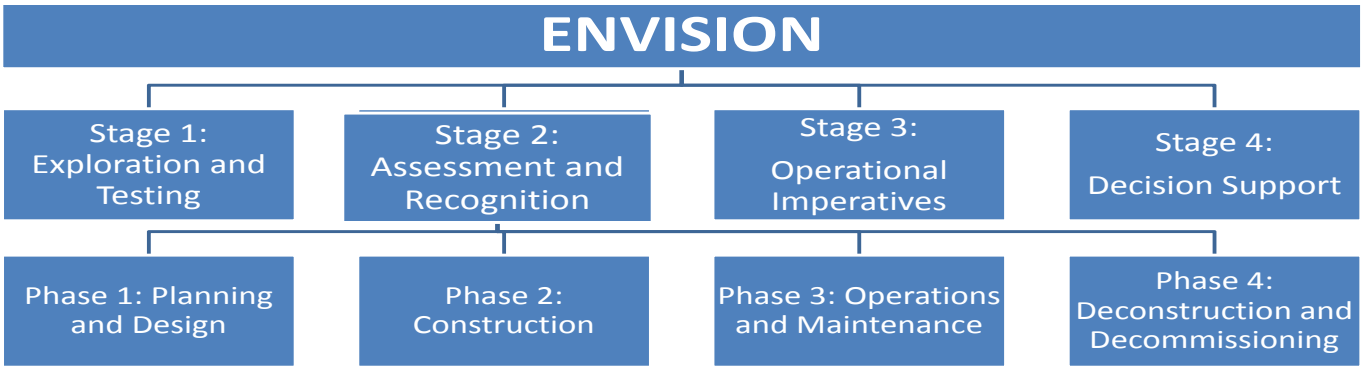


Figure 5: The Envision system structure.

The Envision system is a family of tools divided primarily by the scope of the sustainability assessment (stages), and the phase of the project life (phases). This document focuses primarily on the Stage 2 (Assessment and Recognition) for the Phase 1 (Planning and Design) period of a project. The system includes a matrix calculator of objectives and performance levels along with associated guidance documents, references, glossaries and case studies that illustrate practical applications where sustainability performance has been enhanced. The following sections will walk through how the system is organized and how it functions.

STAGES

The Envision™ system is a family of assessment methods divided into 'stages'. Each stage has customized criteria intended to address the scope of the work being assessed.

Stage 1 begins with projects that are still in the conceptual or preplanning phase. In this stage project owners may not have determined a specific site or even project strategy. Often numerous alternatives need to be compared quickly and at a very broad level. To facilitate this, Stage 1 is structured as a series of yes/no questions by which project owners can determine whether projects will address the various aspects of sustainability. Here the purpose is to educate and familiarize users with the criteria by which the sustainability of the project will be assessed. Stage 1 questions are the conceptual foundation of the more detailed criteria in Stage 2, and therefore prepare the owner and project team for the more rigorous Stage 2 assessment. By recognizing the relative strengths and weaknesses of alternative projects in Stage 1, project teams can make informed decisions on which project to pursue and better establish an effective strategy for achieving Stage 2 goals. The Envision system recognizes that true sustainability can only be achieved when project teams not only "do the project right", but "do the right project".

Stage 2 is the core level of the system and one which users may find the most familiar. The rating assessment and verification are performed in this stage. Project teams submit documentation to demonstrate they have met the requirements of the sustainability criteria and are awarded points. The submission is verified and projects are recognized for their achievement. This manual is primarily a resource for the Stage 2 assessment, and its organization and implementation are described in greater detail below.

Stages 3 and 4 are currently under development by the ISI and Zofnass Program. Stage 3 will incorporate the capability to do an in depth audit of existing projects sustainability. In addition, projects may be awarded for exceptional performance in a particular field in this stage For example, projects which do not meet the point totals necessary for the standard award recognition may be recognized for their specific contribution in priority areas of concern (e.g., energy or water conservation). These projects are still expected to meet basic performance criteria within the credit rating system.

Within Stage 4 the ISI and Zofnass Program will link the Envision™ Rating System with existing industry assessment tools. This will give greater functionality to users and help to inform decision making through the utilization of existing tools. Beginning in 2012, the ISI and Zofnass Program have begun research to develop

a supplemental Economic Assessment Tool which will help users quantify and compare, in a holistic way, the true costs and savings of sustainable development.

PHASES

In a Stage 2 assessment, Envision™ is committed to a holistic approach that assesses the sustainability of a project over its entire lifecycle. However, given the often extraordinarily long life spans of most infrastructure systems, from planning to decommissioning and deconstruction, it is impractical to wait until the end of a project's life to make an assessment. This is especially true given the pressing need for improving sustainability. Furthermore, the role of decision maker changes frequently over a projects life and it is Envision™'s purpose to recognize and reward efforts to improve sustainability by all stakeholders, including owners, designers, contractors, operators, and decision makers. Therefore, Stage 2 is further subdivided by project phase to permit a more nuanced assessment. These phases include: planning and design, construction, operations and maintenance, and decommissioning and deconstruction.

Envision™ strongly believes that a truly sustainable project must meet high expectations over its entire lifecycle. While it is necessary to divide the assessment by phase, Envision™ retains important links across phases; for example, project teams are expected to design projects during the design and planning phase to reduce energy consumption during operations. Likewise, designers should incorporate end-of-life thinking into the design and material choices of the project. Envision™ strongly encourages projects to pursue assessments in all phases and gives special recognition for this achievement.

LIFE CYCLE ASSESSMENT (LCA) CONSIDERATIONS

Growing awareness of the environmental impacts of processes which occur throughout the entire life span of products and projects is bringing about an increased interest in the quantification of these impacts. A prominent methodology developed in this field is conducting a life cycle assessment (LCA).

LCA addresses the environmental loadings and impacts throughout a product's or process' life cycle. This includes any and all steps from raw material extraction to final disposal or recycling. Quite often the goals of a LCA study are to assess only a limited range of impacts or life cycle stages (such as production) associated with a product or process. This type of LCA is known as a streamlined LCA. Specifically, LCA models a chain of processes with the following inputs: material consumption, energy consumption, and water consumption; and the following outputs: emissions to air, emissions to water, emissions to land and solid waste.

The value of the results of LCA is being increasingly recognized. The International Standards Organization (ISO) standardized LCA methodology in 1990. LCA is now being used by companies, manufacturers, and governmental centers for strategic decision making, eco-labeling and marketing or designing environmental public policies. In particular, LCA has been used to inform the development of public policy related to environmental performance of the built environment (Commission 2008).

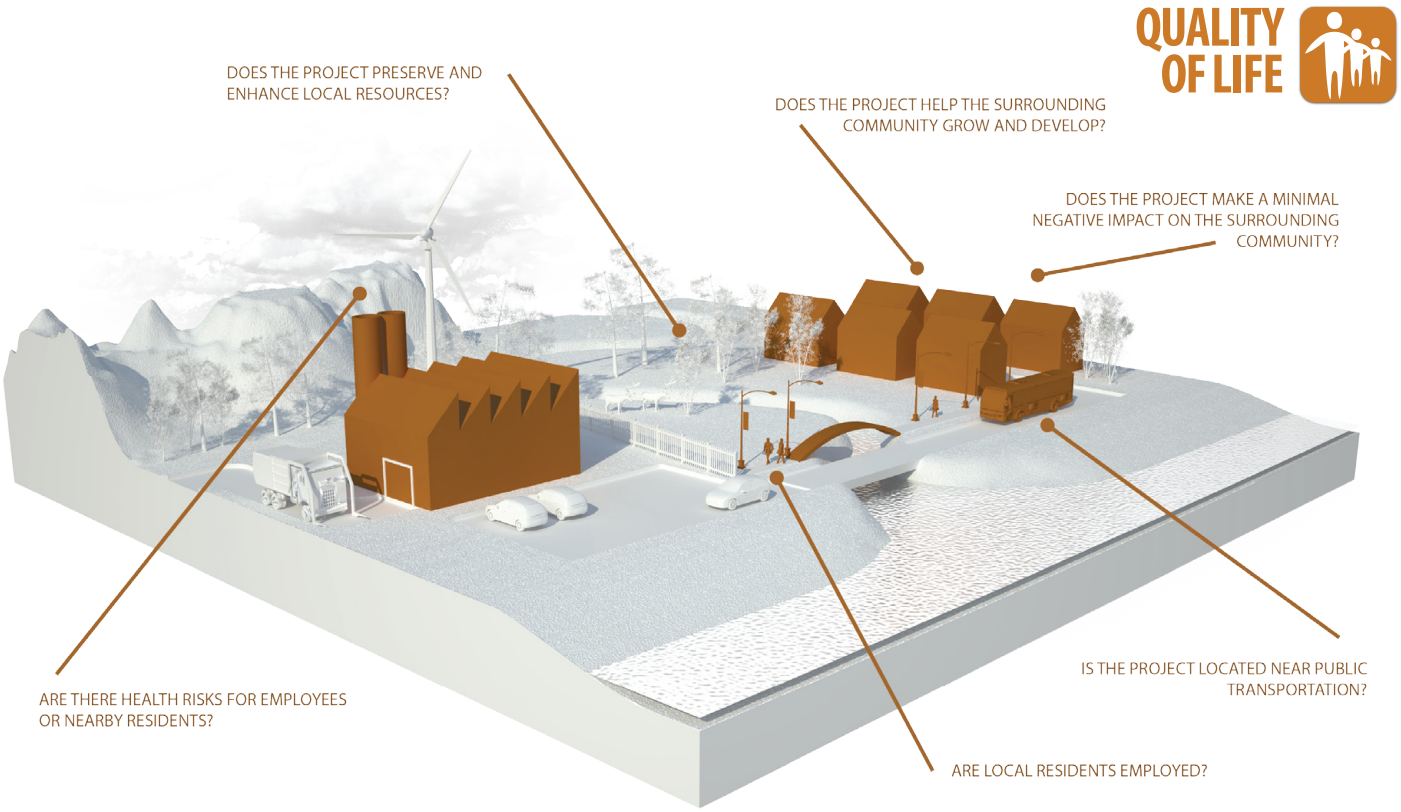
Currently, LCA represents a useful tool to assess and improve the environmental impact of infrastructure projects throughout their life cycle. For this reason, Envision™ presents an integrated approach so that LCA can be used in a synergic manner.

Also, recognized LCA results databases (such as for material extraction and processing) exist for diverse materials and processes today. It is expected that recognized LCA results databases of an increasing number of materials and systems in the construction and infrastructure sectors will became available. They present a valuable resource to be considered and used at Envision™ Rating Systems.

In particular, Envision™ is articulated such that if LCA results are published, or LCA have been carried out for part or the whole life cycle of the project, then the LCA results can be easily incorporated into the Envision documentation for meeting credit requirements. On the other hand, Envision recognizes the difficulties in carrying out a LCA - time and cost, among others. With this in mind, Envision™ offers alternative calculating means, whenever possible. It should be mentioned that Envision™ recommends but does not require the use of published LCA results or carrying out a LCA of the project under consideration.

As mentioned previously, Envision™ establishes a rating system for the four mentioned phases of the project life cycle. Each of the four rating systems, and the LCA if project teams pursue it, for each phase will consider the products and processes throughout the project life cycle that can be defined or modified within the phase under assessment. As mentioned previously, essential links are retained across phases.

It is also important to note that Envision™ considers LCA but presents a larger scope. While an LCA may help project teams provide the documentation for certain credits, LCAs do not encompass the broad range of social, environmental, and economic criteria addressed in Envision™. Examples include the control of invasive species, preservation of natural habitat, community engagement, and many more.



CATEGORIES

In order to structure the credits and illustrate their interrelatedness Envision organizes them into five categories and fourteen subcategories based on their main area of impact. The five categories include:

- *Quality of Life*
- *Leadership*
- *Resource Allocation*
- *Natural World*
- *Climate and Risk*

Every infrastructure project has an important impact on all five EnvisionTM categories. Grouping the credit indicators into categories is important as sustainability is nuanced and complex often with overlapping or conflicting goals. For example, in avoiding critical habitats projects may have to consume more resources. Conversely, projects which reduce resource consumption may find they are also achieving the benefit of reducing harmful emissions. By grouping the credits into broader categories of impact, EnvisionTM helps users to see "the forest AND the trees", and navigate the complex trade-offs or synergies across the credit indicators.

Each of the sixty credits contains a set of evaluation criteria which are necessary not only for developing sustainable infrastructure but, in some cases, for restoring our already depleted resources or damaged environment. The degree to which projects meet these evaluation criteria is graded for each credit on a five step scale called the levels of achievement: improved, enhanced, superior, conserving, and restorative (for more detailed explanations of each of these levels, see 8.3.9, Levels of Achievement). Envision™'s purpose is to initiate a systemic change toward sustainability and therefore seeks to recognize the full spectrum of effort, from projects that take steps to improve upon the status quo, to projects that restore communities, environments and the economy.

SUBCATEGORIES

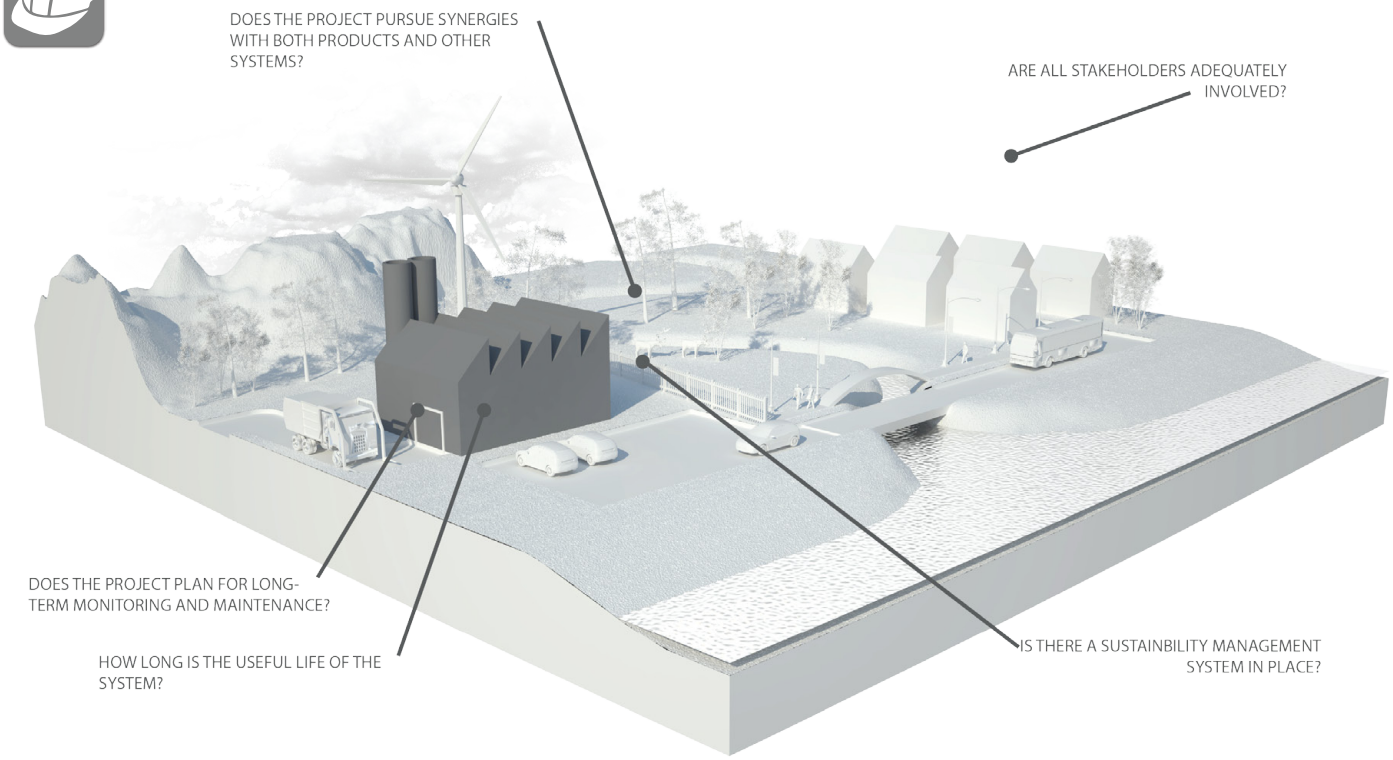
Each of the five categories contains two to three subcategories and each subcategory contains several credits. The subcategories provide a means of further grouping the credits within a category but should not be viewed as encompassing the entirety of the subcategory topic. The subcategories are as below:

- *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*

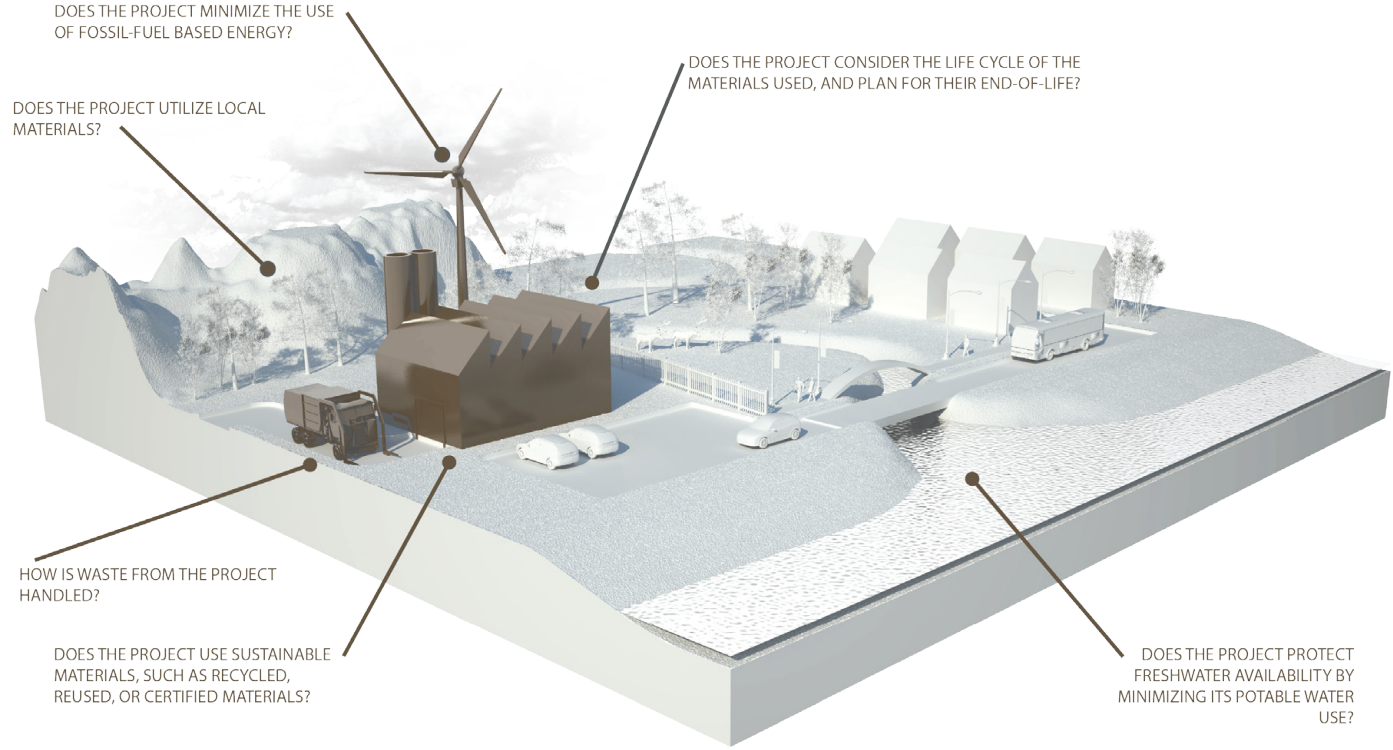
As mentioned previously, many credits impact multiple areas. For example, credit QL 2.5 which involves siting a project near public transportation is located in the Wellbeing subcategory under Quality of Life, and not under Siting in Natural World. This is because the Siting subcategory addresses those credits within Natural World that involve the direct impact on the natural world from the project's site location. Credit QL 2.5 addresses primarily community issues and individuals' access to public transportation, and is therefore located under Quality of Life.

CATEGORY
↳ SUBCATEGORY
↳ CREDIT
- description + instructions for how to earn credit
- point value

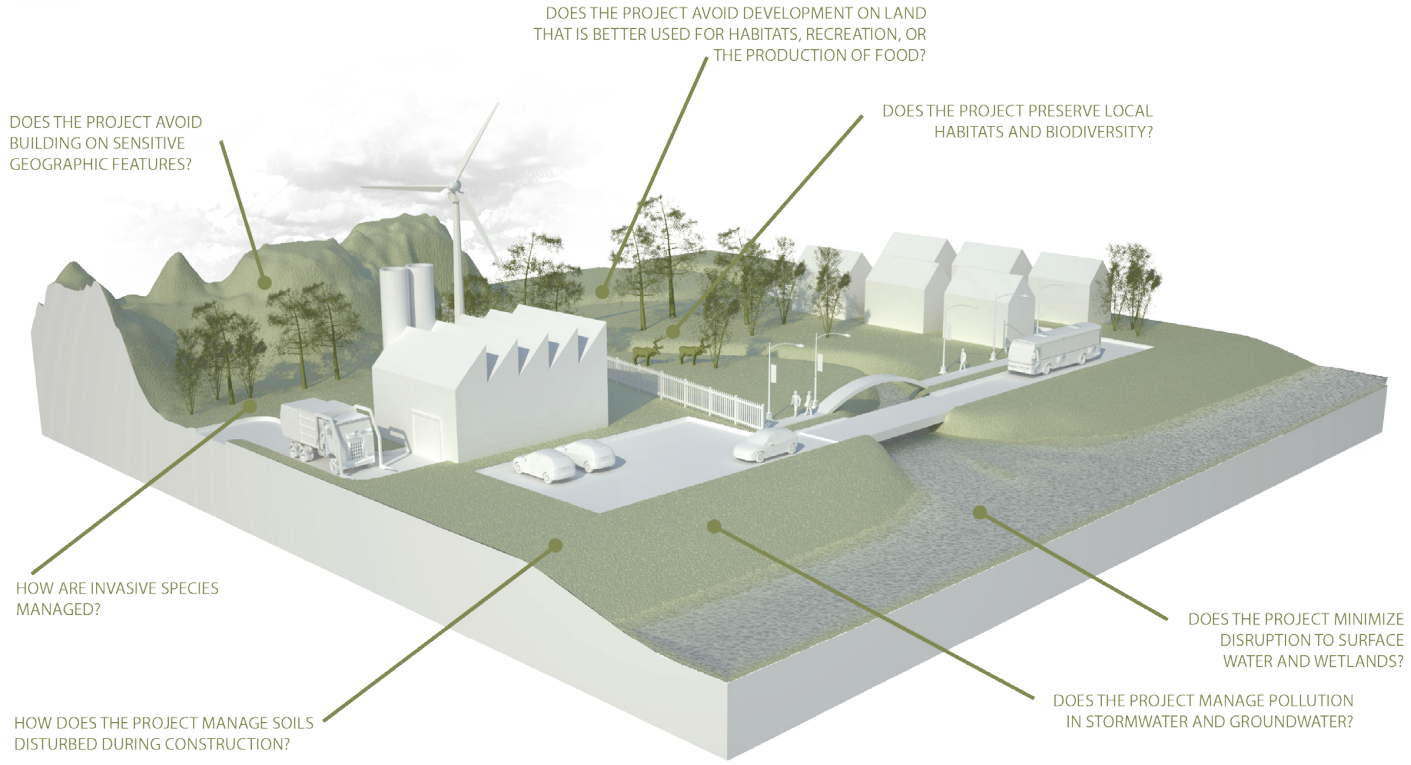
LEADERSHIP



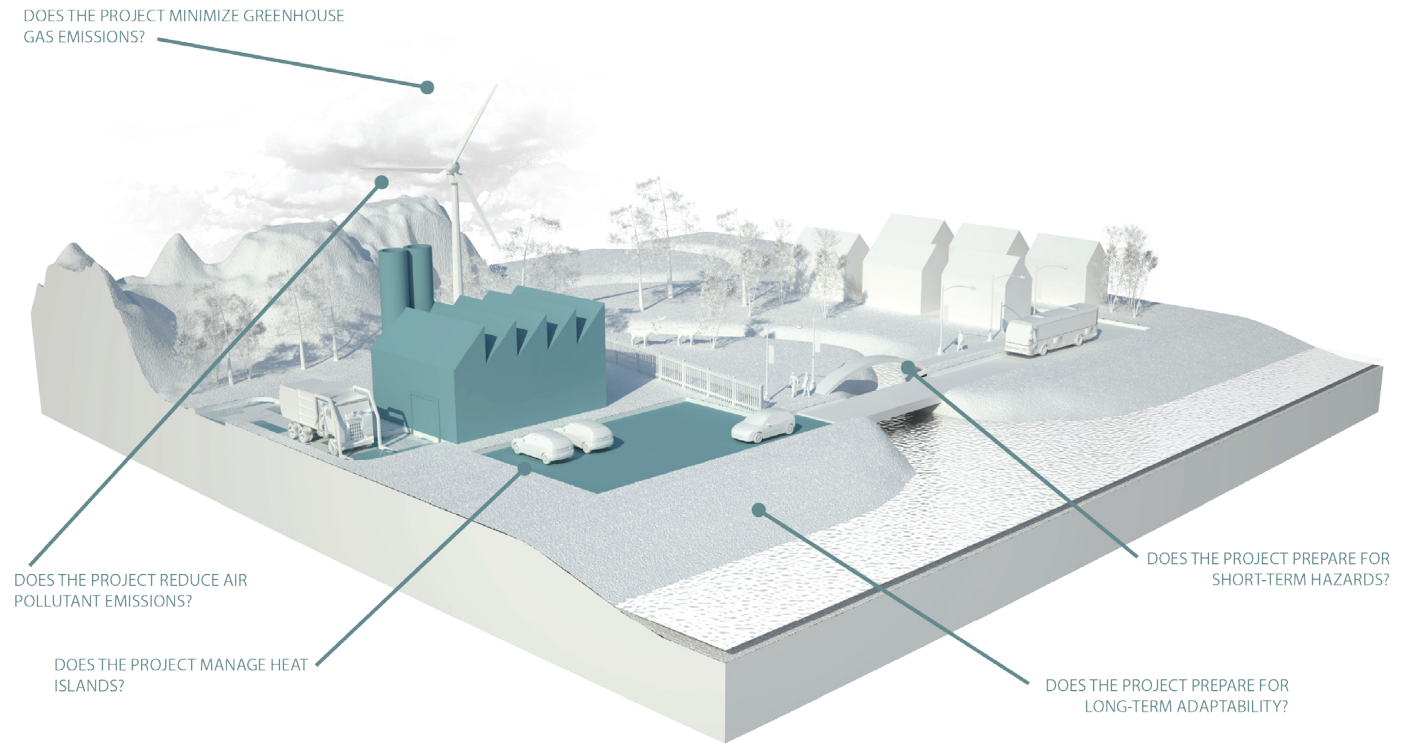
RESOURCE ALLOCATION



NATURAL WORLD



CLIMATE AND RISK



CREDITS

There are sixty credits in all. A credit comprises a sustainability indicator on an aspect of environmental, social, or economic concern. In the Envision Guidance Manual, each credit section presents a description and evaluation criteria for how to earn points associated with the credit. A point value is assigned for each level of achievement within the credit. The point value has been determined according to the importance of the credit subject for infrastructure sustainability. Teams earn points when they meet the requirements established by the evaluation criteria.

LEVELS OF ACHIEVEMENT

As mentioned, Envision™'s purpose is to initiate a systemic change toward sustainability and therefore seeks to recognize the full spectrum of effort, from projects that take steps to improve upon the status quo, to projects that restore communities, environments and the economy. A five-point scale allows project teams the flexibility to establish achievement levels that are within the project budget and scope:

- Improved
- Enhanced
- Superior
- Conserving
- Restorative

These achievement levels may be structured in several ways, for example, from credit requirements that have multiple steps, or meeting credit requirements at increasing levels (30%, 60%, or 90%). Levels of achievement always build upon one another - it is not possible to meet the requirements for the conserving level without also meeting the requirements for improved, enhanced, and superior. The improved levels indicates performance that is above conventional, slightly exceeding regulatory requirements. Projects reaching the conserving level in a credit achieve a zero negative impact, or "neutral impact", in the credit subject. The restorative level is the highest level and indicates a regenerative effect in the credit subject.

A point value is assigned to each level of achievement for every credit. Credits do not always have all five levels of achievement. The total possible point value for each credit is set at the conserving level of achievement. For some credits the additional level of restorative is possible as are additional points. Projects are not penalized for failing to achieve the restorative level.

EVALUATION CRITERIA

As mentioned, each of the sixty credits contains a set of evaluation criteria that assessors will look for when determining if the qualifications for each level of achievement have been met for a particular credit. This is essentially a step-by-step outline of how to meet the credit requirements. Evaluation criteria requirements may include, but are not limited to:

- Performing calculations (for example, calculating energy use or the percent of recycled materials in the structure);
- Creating an action plan (for example, a plan to promote public transportation use or a plan to prepare for possible disasters);
- Meetings with stakeholders;
- Consulting with experts (for example, working with a local ecologist to minimize adverse impacts on local wildlife).

The Envision™ rating system has both quantitative and qualitative means of evaluating credits. For qualitative credits, achieving the credit involves submitting documentation or a narrative of the steps the project took to meet the credit requirements. For example, the Leadership Credit 1.4 Provide for Stakeholder Involvement requires projects to put in action practices that enhance stakeholder involvement and submit evidence that these were carried out. Quantitative credits require more calculations and supporting evidence. For example, Resource Allocation Credit 1.4 Use Regional Materials requires calculation and documentation of the percentage of materials sourced within a designated distance of the site.

INNOVATION

The Envision™ Program recognizes that new technology and methods are evolving every day. The rating system strongly encourages innovative new methods that advance the state of the art for sustainable infrastructure and exceptional performance beyond the expectations of the credit requirements. For that purpose, each category ends with an *Innovate or Exceed Credit Requirements* credit, with 0.0 as the identification number. This credit intends to reward exceptional performance beyond the expectations of the system as well as the application of methods which push innovation in sustainable infrastructure. These credits do not behave the same as other credits and their achievement is considered 'bonus' points for project teams.

SUSTAINABILITY AND THE BUILT ENVIRONMENT

Our Quality of Life: The Big Picture

Over the last decade, the notion that society's approach to economic development is not sustainable has moved from extremist thinking to mainstream opinion. Spiking energy prices, extended droughts and water shortages, overtaxed electrical power grids, traffic congestion, collapsing bridges, urban sprawl, frequent forest fires and unprecedented flood damage: incidents once seen as disturbing but manageable are now viewed as challenges to maintaining and improving our quality of life.

Viewed individually, these trends and events might be dismissed as the inevitable consequences of an increasingly complex world, problems to be addressed or perhaps tolerated in order to maintain a high standard of living. Viewed collectively, however, they can be interpreted as the consequences of society's current approach to economic development. This is an approach that uses resources without much restraint, burdens our ecosystems with more waste and pollution, neglects the care and upgrading of our supporting infrastructures, and disrupts the social fabric of societies. These incidents are evidence of an unsustainable model for development, one which treats materials, energy and fresh water supplies as if they were inexhaustible and the environment as if it were infinitely regenerative.

SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT

The traditional definition of sustainable development is taken from the 1987 UN World Commission on Environment and Development report, also known as the Brundtland Commission Report, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This raises the critical point that our current quality of life cannot be bought at the expense of future generations. Sustainability is not only about preserving and protecting the environment but about preserving the ability of society to sustain itself. These two goals are inextricably linked.

The American Society of Civil Engineers (ASCE) has a comparable definition of sustainability as a set of economic, environmental 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 the availability of natural resources and ecosystems.

THE IMPORTANCE OF INFRASTRUCTURE

Competitiveness, as defined by the World Economic Forum, is "…the set of institutions, policies, and factors that determine the level of productivity of a country." The Forum has grouped these determinants into what it calls the "12 pillars of competitiveness." Infrastructure is the second pillar, one of the four basic requirements for sustaining and improving the productivity of a nation.[1]

The Forum explains further that an efficiently-operating infrastructure is an essential component for a prosperous and growing economy. Effective transportation systems bring goods to market, workers to jobs, children to schools, and families to stores and recreation areas in a safe and timely manner. Dependable water and wastewater systems bring fresh water to industry, agriculture and people. Reliable electricity supplies allow businesses and factories to work unimpeded, and bring a high level of convenience and productivity to home life across the nation. Extensive telecommunication networks connect people and businesses across the globe and enable the fast flow of information essential to commerce.

An efficiently-operating infrastructure is one that delivers the required services at affordable costs while conserving the country's natural resources and energy. Moreover, these services must be continually maintained and improved in order to remain competitive in the global marketplace. Unfortunately over the last several decades, the state of U.S. infrastructure has declined substantially, eroding our competitive base. In 2005 the Forum rated U.S. infrastructure as number one in the world. In five years this ranking dropped to number 15, largely due to a lack of meaningful infrastructure investments.[2]

For a long time, the engineering community has studied this decline and publicly appealed for fixes. Since 1988, the American Society of Civil Engineers (ASCE) has reported regularly on the condition of U.S. infrastructure in the form of a report card. In its most recent 2009 report, ASCE gave U.S. infrastructure an overall grade of "D" and priced the needed repair and refurbishment work at $2.2 trillion. ASCE further noted that this degraded condition is having a negative impact on the U.S. economy. For example, ASCE calculated that by 2020, the a continued degradation of the surface transportation infrastructure will cost the U.S. economy over 876,000 jobs and depress the U.S. gross national product by $897 billion. For the water delivery and wastewater treatment infrastructure, the estimated negative impacts in 2020 amount to the loss of 700,000 jobs and $206 billion in increased costs to businesses and households.[3]

Degradation of U.S. infrastructure in the built environment is not the only problem. Today, the design, construction and operation of our transportation, water and

1. The Global Competitiveness Report 2010–2011, World Economic Forum, Geneva, Switzerland, 2010, pp. 4-5.
2. Building America's Future: Falling Apart and Falling Behind, http://www.bafuture.com/BAFEF_Infrastructure_Facts_2011.pdf
3. ASCE, Failure to Act: the economic impact of current investment trends in water and wastewater treatment infrastructure, Washington, DC (2011).

> "[Sustainable development is] ...development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
>
> **Brundtland Commission Report**

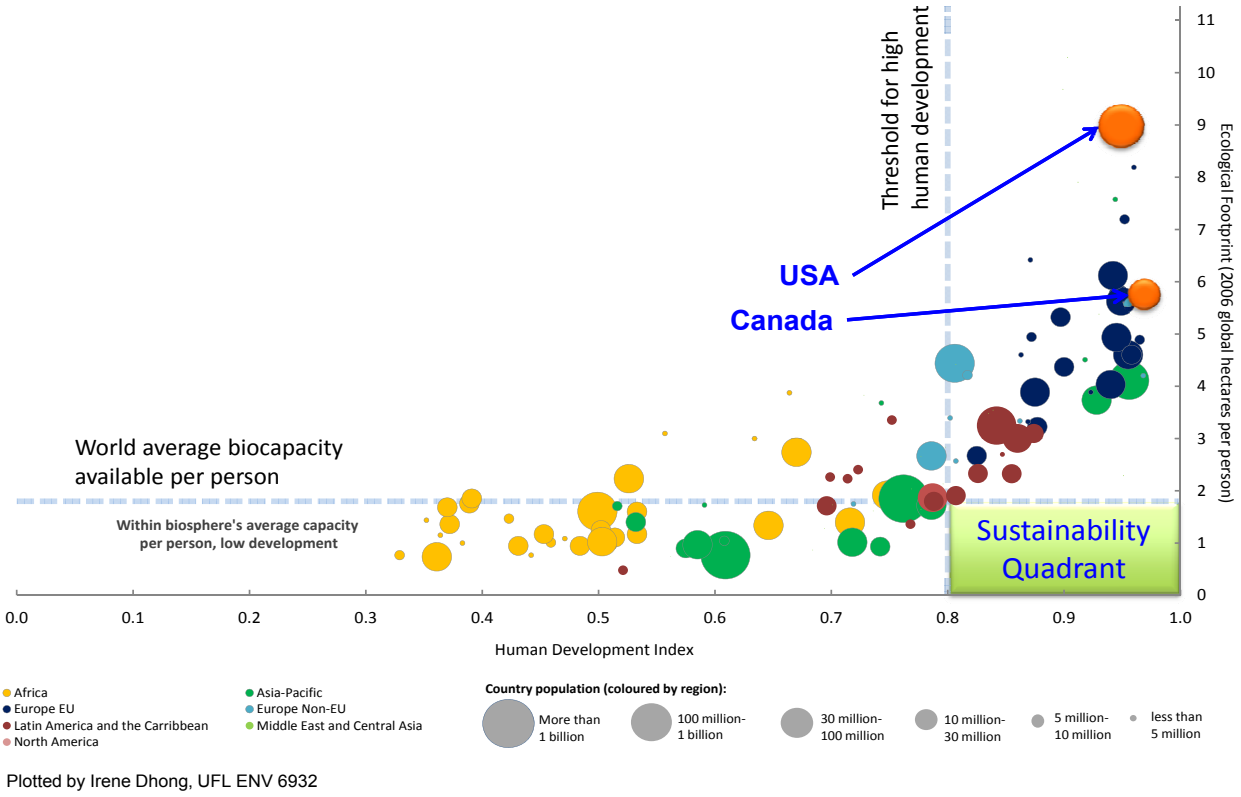


Figure 6: Human development index vs. ecological footprint by country (Source: Living Planet Report 2006, World Wildlife Fund).

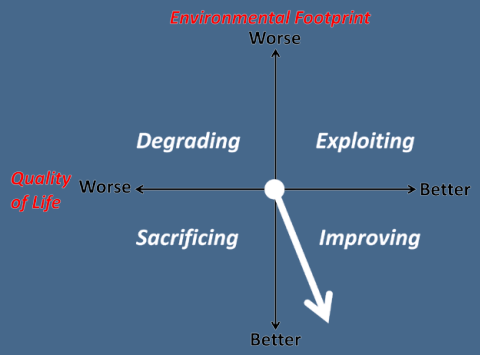
wastewater, and energy systems are having a substantial negative impact on our natural resources and ecological systems. To sustain current lifestyles, the U.S. consumes vast amounts of resources and damages ecosystem functions. In terms of its ecological footprint, the U.S. is operating as if it had 5 planets to work with instead of 1. The current world average usage is 1.5 planets. If allowed to continue, this overuse of natural resources and reduction of ecosystem services will have devastating consequences, not only for this country but also for the rest of society.

Infrastructure is long lived. The highways, bridges, power stations and wastewater treatment plants we build today have design lives ranging from 20 to over 75 years. This means that the infrastructure we are building today will establish the energy, water and materials efficiencies, and ecosystem impacts for decades to come. Therefore, whatever we build today, we better get it right. We must do the best we can with existing technologies, designing and delivering the most resource and energy conserving infrastructure within the limits of budgets and priorities. In addition, the efficiency and effectiveness of infrastructure depends not only on its intrinsic design, but on how that design integrates and functions for the community in which it resides.

QUALITY OF LIFE AND THE HUMAN DEVELOPMENT INDEX

Most developed countries enjoy a high quality of life but do so by consuming material and natural resources at a rate our planet cannot support. This undermines the ability of future generations to sustain that quality of life. The problem is exacerbated by developing countries which rightfully are seeking to improve their own quality of life. In following the model set by developed countries they are consuming resources at an exorbitant rate. The human development index is a rough measure of quality of life developed by the UN. As input it factors life expectancy, education, and gross domestic product.

The problems faced by the U.S. as well as other nations in preserving natural resources and ecological system while maintaining or improving their quality of life is depicted in the graph above. Here, the ecological footprint of each country is plotted as a function of their human development index. The area of the circle represents population size. Conditions of sustainability are seen as the area bounded horizontally by the world average available biocapacity and vertically by the threshold of high human development.



HDI is a measure of quality of life, while ecological footprint is one measure of sustainability. The ultimate goal of any project should be to maintain, or increase, quality of life while minimizing ecological footprint in order to improve sustainability.

SETTING A COURSE TOWARDS SUSTAINABILITY

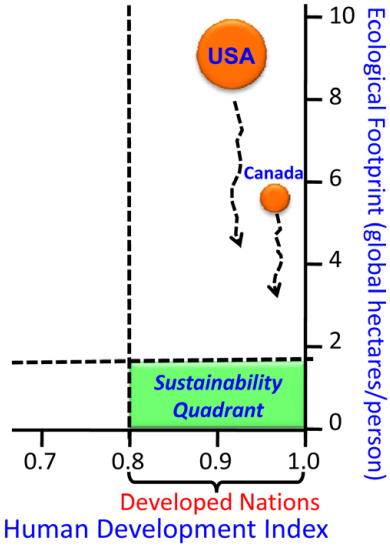
The challenge faced by developed countries worldwide, is how to reduce our net environmental footprint, i.e., make a meaningful shift towards the sustainability quadrant, without sacrificing our quality of life. Clearly, there are a number of obvious actions to take, e.g., improving energy efficiency, reduce our dependence on fossil fuels, reduce greenhouse gas emissions, increase water recycling, reclamation and conservation, to name a few. However, our ability to instigate any comprehensive and well thought out action is severely hampered, not only by limited resources, but by multiple priorities and agendas of those potentially affected by the actions proposed.

In addition, this challenge is not small. Taken to its logical conclusion, reaching the sustainable quadrant involves, more or less, a complete overhaul of our nation's infrastructure, replacing old components with those that are more effective and efficient. Absent huge and unprecedented investments or the emergence of some "silver bullet" technologies, progress will be made incrementally by project owners, designers and constructors delivering infrastructure projects that make significant improvements in performance across multiple dimensions of sustainability. To be efficient and effective, these projects must also integrate well with the infrastructure in the community, both existing and planned. Lastly, the designers must take into account changes in the environment in which the delivered works must operate.

CHANGING ROLES

The consequences of conventional building practices are substantially altering the practice of engineering. Shortages in resources, such as fresh water and energy, are changing the assumptions regarding their future costs and availability. Resource substitutes or recycled materials have different properties and performance characteristics, all of which need to be factored into the design. The effects of a changing climate are forcing designers to change their assumptions about design parameters in terms of the expected averages, variances and possible extremes. Variables such as increases in mean temperature, the possible cost of fuel, the length and severity of droughts or increases in rainfall intensity are now part of the conversation at the preliminary design stage. In addition, new parameters such as carbon emission rates and embodied energy of materials are emerging and need to be accounted for.

Infrastructure rating systems must account for the new engineering design paradigm, one in which the engineering design constants and behavior of design variables of the past can no longer be taken for granted. At this juncture, there is no prescriptive solution for how to properly account for these changes. Instead, the rating systems need to incorporate a process by which the project owner, designer and constructor explicitly consider the possibility of new constants, new variable behaviors and new extreme values, and devise an effective approach for dealing with them. It is we these considerations that the Envision™ rating system was created.



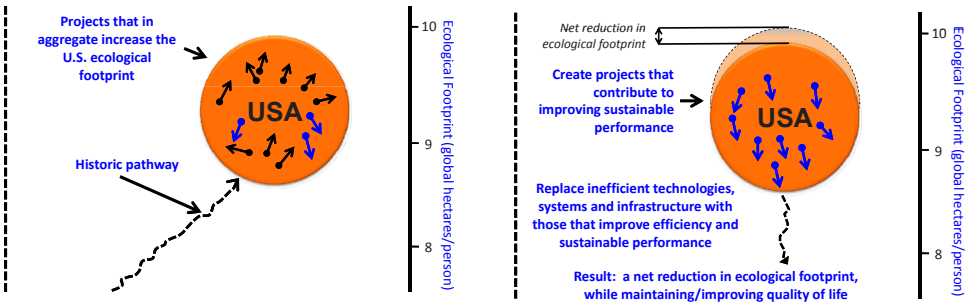


Figure 7 (left): Driving down ecological footprint while maintaining a high HDI
Figure 8 (mid): Historic path where cumulative affect of projects drives up ecological footprint
Figure 9 (lright): Reducing net ecological footprint requires every project to reduce ecological footprint

GUIDANCE MANUAL

Project Scoring and Guidance

The Envision™ Sustainable Infrastructure Rating System, Version 2.0, Stage 2, (Envision™ Stage 2) is designed to help users consider the array of objectives that enhance the sustainability performance of an infrastructure project. Consideration of those objectives is measured against a ranking of increasing sustainable achievements that will develop a numeric indicator of overall performance.

The Envision™ Stage 2 toolkit (released for public use in January, 2012), is designed primarily for use in the assessment of infrastructure projects during the planning and design phases. Objectives and measures that are more appropriate for the construction, operations and maintenance phases of infrastructure projects will be incorporated in Envision™ tools that are currently under development. Users can use the Envision™ Stage 2 planning and design tool to extrapolate or interpret other project phases. However, extrapolated assessments will not be accepted by ISI for project verification until the appropriate Envision™ toolkit is available. The Envision™ Stage 2 toolkit consists of two components: a Guidance Manual and a Scoring Module.

The Envision™ Stage 2 Guidance Manual is a detailed explanation of 60 assessment objectives, called credits. The 60 credits are presented within the five categories previously described: *Quality of Life*, *Leadership*, *Resource Allocation, Natural World*, and *Climate and Risk*. Each of the sixty credits is explained in a two-page narrative that includes the credit name, intent, levels of achievement, description, explanation on how to advance to higher achievement levels, evaluation criteria and documentation, sources, and related credits.

Users are invited to provide their feedback using the 'Comments' link on the ISI website. The ISI and Zofnass Program will use suggestions to develop rating system output and interpretation documents and other rating system tools. It is anticipated that increased field testing of the rating system will provide information that will increase the value of the rating system as well as associated resources that will be of value to owners, practitioners and other users

PROJECT TYPE AND CREDIT APPLICABILITY

A great challenge in developing this rating system is the variety of functions that infrastructure performs. Water treatment, energy generation, and transportation each have unique performance criteria and unique impacts on the community, environment, and economy. The Envision™ System is intended to be used as a universal framework for evaluating sustainability of all types of infrastructure projects. In particular, the categories were selected considering their applicability to all types of infrastructure. As such, the rating system provides a broad framework that can be customized for each project type. In order to customize the rating system to each project type, not all credits apply to every project. As project teams use the Envision™ Rating System indicated credits can be omitted if not applicable to the project. Omitting credits requires teams provide justification which will be confirmed by the verifier.

POINTS AND SCORING

As mentioned previously, each credit has designated point values for the established levels of achievement. Credits vary in points based on a variety of factors, including the level of sustainability achieved within the credit and the weight of the credit in the overall sustainability assessment of the project. The following table of point values, present the designated point values for each credit. In order to achieve the points associated with a given level of achievement project teams are required to submit the requested documentation that verifiers will use to determine whether the objectives were met.

INNOVATION POINTS

Each category closes with an Innovate or Exceed Credit Requirements credit, with 0.0 as the identification number. These credits behave differently than other credits regarding how the points are established and awarded.

The Envision™ rating system allows a maximum of 5% of the total points in each category to be deployed for innovation or exceeding credit requirements. This establishes a range of 5-9 possible points for each Innovation credit. The effort necessary to deploy innovative strategies or exceed credit requirements and the overall net impact on the environment varies greatly from credit to credit and project to project. However, the more points attributed to a credit the higher the expectations of achievement. Verifiers will ultimately make the determination whether projects have met these expectations regarding true innovation.

Guidelines for determining whether true innovation is achieved are as follows:

- Projects which achieve extraordinary performance well beyond the highest level of achievement within an existing credit.
- The project overcomes significant problems, barriers, or limitations to achieving sustainability in a way that paves the way for future projects.
- Projects successfully deploy sustainable solutions that are scalable and therefore applicable to a wider range of projects.
- Projects successfully deploy sustainable solutions that are transferable across sectors or project types opening up new opportunities.

TABLE OF POINT VALUES

				Improved	Enhanced	Superior	Conserving	Restorative
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
2			QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
3			QL1.3 Develop local skills and capabilities	1	2	5	12	15
4		COMMUNITY	QL2.1 Enhance public health and safety	2			16	
5			QL2.2 Minimize noise and vibration	1			8	11
6			QL2.3 Minimize light pollution	1	2	4	8	11
7			QL2.4 Improve community mobility and access	1	4	7	14	
8			QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
9			QL2.6 Improve site accessibility, safety and wayfinding		3	6	12	15
10		WELLBEING	QL3.1 Preserve historic and cultural resources	1		7	13	16
11			QL3.2 Preserve views and local character	1	3	6	11	14
12			QL3.3 Enhance public space	1	3	6	11	13
				13	**27**	**62**	**150**	**151**
13	LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
14			LD1.2 Establish a sustainability management system	1	4	7	14	
15			LD1.3 Foster collaboration and teamwork	1	4	8	15	
16			LD1.4 Provide for stakeholder involvement	1	5	9	14	
17		MNGMT.	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
18			LD2.2 Improve infrastructure integration	1	3	7	13	16
19		PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3		10	
20			LD3.2 Address conflicting regulations and policies	1	2	4	8	
21			LD3.3 Extend useful life	1	3	6	12	
				10	**31**	**56**	**115**	**31**
22	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
23			RA1.2 Support sustainable procurement practices	2	3	6	9	
24			RA1.3 Use recycled materials	2	5	11	14	
25			RA1.4 Use regional materials	3	6	9	10	
26			RA1.5 Divert waste from landfills	3	6	8	11	
27			RA1.6 Reduce excavated materials taken off site	2	4	5	6	
28			RA1.7 Provide for deconstruction and recycling	1	4	8	12	
29		ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
30			RA2.2 Use renewable energy	4	6	13	16	20
31			RA2.3 Commission and monitor energy systems		3		11	
32		WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
33			RA3.2 Reduce potable water consumption	4	9	13	17	21
34			RA3.3 Monitor water systems	1	3	6	11	
				29	**66**	**112**	**170**	**62**
35	NATURAL WORLD	SITING	NW1.1 Preserve prime habitat			9	14	18
36			NW1.2 Protect wetlands and surface water	1	4	9	14	18
37			NW1.3 Preserve prime farmland			6	12	15
38			NW1.4 Avoid adverse geology	1	2	3	5	
39			NW1.5 Preserve floodplain functions	2	5	8	14	
40			NW1.6 Avoid unsuitable development on steep slopes	1		4	6	
41			NW1.7 Preserve greenfields	3	6	10	15	23
42		L&W	NW2.1 Manage stormwater		4	9	17	21
43			NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
44			NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
45		BIODIVERSITY	NW3.1 Preserve species biodiversity	2			13	16
46			NW3.2 Control invasive species			5	9	11
47			NW3.3 Restore disturbed soils				8	10
48			NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
				15	**33**	**86**	**165**	**169**
49	CLIMATE	Emission	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
50			CR1.2 Reduce air pollutant emissions	2	6		12	15
51		Resilience	CR2.1 Assess climate threat				15	
52			CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
53			CR2.3 Prepare for long-term adaptability				16	20
54			CR2.4 Prepare for short-term hazards	3		10	17	21
55			CR2.5 Manage heat islands effects	1	2	4	6	
				12	**21**	**39**	**100**	**101**
				79	**178**	**355**	**700**	**514**

USING THE SCORING MODULE

The Scoring Module works in conjunction with the Guidance Manual and is an online interactive tool that guides users by assigning levels of achievement for each credit. Summaries of those scores will determine a primary section sub-total and the overall sustainability score for the project. Users may access the Scoring Module on the ISI website (http://www.sustainableinfrastructure.org/).

I. When accessing the Scoring Module, a project must be created in the database before the user can start the scoring process. Using the "Create a New Project" link, the user establishes the project name, location and a brief description of the project.
   a. This form can be modified at a later date, as needed. Users can have multiple active projects that can be saved for later review, updates or modifications.
   b. Users may create a hypothetical or example project to access and test the scoring module and there approaches to actual project situations.

II. The Section Menu provides the links to the scoring sheets for the five sections of EnvisionTM: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk.
   a. The Section input pages can be accessed in any order and partially or completely answered.
   b. The user must save changes to Section pages for the data to show correctly in the output pages. Saved entries will be reflected in the Section Totals Summary and the Report output pages.

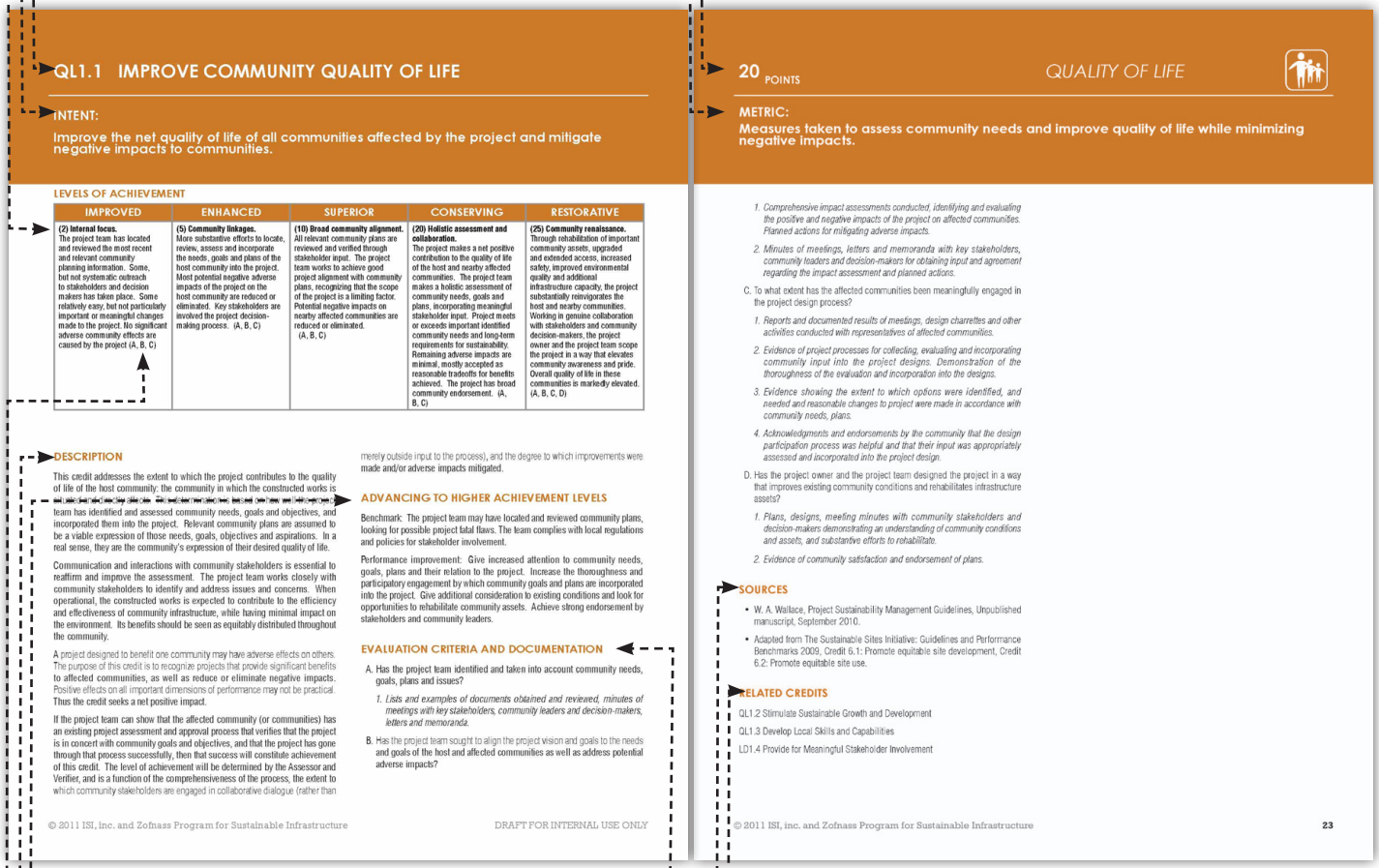
III. The scoring sheet for each section can be accessed by clicking on the corresponding section name. Each scoring sheet follows a standard format.
   a. Credits are listed by section and credit numbers.
   b. The Objectives column briefly describes the intent of each credit. Detailed credit descriptions can be found by following the "details/guidance" link to the Guidance Manual.
   c. The Required for Project column allows the user to indicate if the credit applies to the project Certain credits are mandatory and must be answered by the user. Some customization of the assessment can be made to reflect the context of the project by excluding some of the objectives. These are noted in the Scoring Module scoring sheets.
      i. Users can exclude non-required credits if they do not apply to the project. These credits are indicated with Assessor Decision shown in the Required for Project column.
         1. If the user selects Exclude, then the Level of Achievement for that credit will change to "No Added Value" and the Score and Objective Available Points columns will become inactive.
         2. If Include is selected, user may choose the appropriate Level of Achievement and the Score and Objective Available Points will be included in the score.
      ii. Points for excluded credits will not be added to the total possible points for the project: excluding credits will not negatively impact a project's overall score.
   d. There are five Levels of Achievement: Improved, Enhanced, Superior, Conserving, and Restorative. Not every credit offers all five levels.
      i. Users should consult the Guidance Manual, using the "details/guidance" link under Objectives, to determine what documentation is needed to prove the appropriate Level of Achievement.
      ii. Points for the Innovate or Exceed Credits (QL0.0, LD0.0, RA0.0, NW0.0, and CR0.0) are not calculated in the maximum possible score for a section. They are supplementary points added to the total section points. They recognize creativity, innovation or added value during the sustainability assessment.
   e. The Score is automatically calculated based on the selected Level of Achievement.
   f. The Objective Available Points do not change unless a credit is excluded.

IV. The Section Totals Summary summarizes the overall section scores and the total project score. It also includes a stacked bar chart that provides a visual representation of how each section scores in relation to the maximum possible score for that section.
   a. This summary is automatically generated based on the scoring sheets. The user does not enter anything on this page.
   b. Additional material on the interpretation of the outputs from the Scoring Module will be developed by ISI based on actual field testing of Envision™. At this initial stage, interpretation of the outputs will be the responsibility of the user, assessor and project credentials.

V. The Report is a printable document that shows individual credit information input by the user, notes, and scoring.

Navigating The Guidance Manual

- Credit Title and Identification Number , which includes the two-letter code identifying the category, and a number identifying the subcategory.
- Intent: The purpose of the credit.
- Levels of Achievement: Brief description of the requirements necessary to meet each level of achievement. Levels increase in their contribution toward sustainability.
- Total Possible Points: Value of the Conserving level of achievement.
- Metrics: How the credit will be measured.



QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE

20 POINTS

QUALITY OF LIFE

INTENT:

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

METRIC:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Internal focus. The project team has located and reviewed the most recent and relevant 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 significant adverse community effects are caused by the project (A, B, C)	**(5) Community linkages.** More substantive efforts to locate, review, assess and incorporate the needs, goals and plans of the host community into the project. Most potential negative adverse impacts of the project on the host community are reduced or eliminated. Key stakeholders are involved the project decision-making process. (A, B, C)	**(10) Broad community alignment.** All relevant 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)	**(20) Holistic assessment and collaboration.** The project makes a net 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 tradeoffs for benefits achieved. The project has broad community endorsement. (A, B, C)	**(25) Community renaissance.** Through rehabilitation of important community assets, 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)

DESCRIPTION

This credit addresses the extent to which the project contributes to the quality of life of the host community: the community in which the constructed works is [illegible] team has identified and assessed community needs, goals and objectives, and incorporated them 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 is 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 constructed works 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, as well as reduce or eliminate negative impacts. Positive effects on all important dimensions of performance may not be practical. Thus 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 Assessor and Verifier, 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 may have located and reviewed 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, plans and their relation 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, plans 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.*

B. Has the project team sought to align the project vision and goals to the needs and goals of the host and affected communities as well as address potential adverse impacts?

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.*

C. To what extent has 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 into the designs.*
3. *Evidence showing the extent to which options were identified, and needed and reasonable changes to project were made in accordance with community needs, plans.*
4. *Acknowledgments and endorsements by the community that the design participation process was helpful and that their input was appropriately assessed and incorporated into the project design.*

D. Has 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, meeting minutes with community stakeholders and decision-makers demonstrating an understanding of community conditions and assets, and substantive efforts to rehabilitate.*
2. *Evidence of community satisfaction and endorsement of plans.*

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.

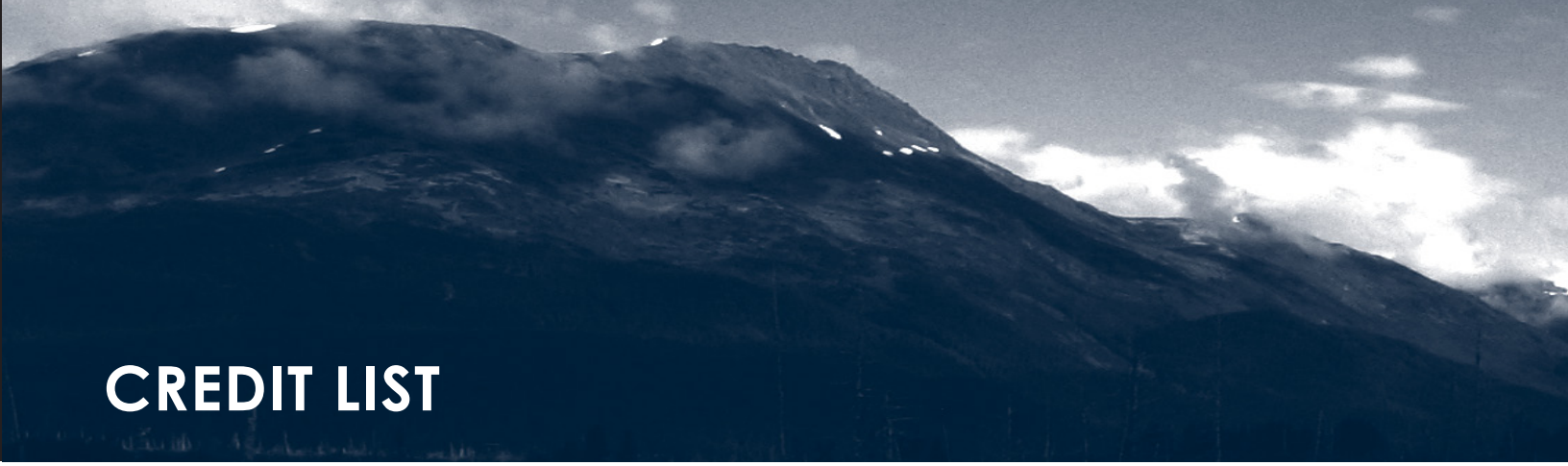
RELATED CREDITS

QL1.2 Stimulate Sustainable Growth and Development

QL1.3 Develop Local Skills and Capabilities

LD1.4 Provide for Meaningful Stakeholder Involvement

- Documentation Code: References the documentation needed to assess achievement for each level listed in the *Evaluation Criteria* section.
- Description: Explanation of the sustainability issue addressed by the credit and its significance in infrastructure projects.
- Advancing to Higher Levels of Achievement: Sets the benchmark for performance. It also provides general strategy for performance improvements.
- Evaluation Criteria: Specifies the questions that the project must address in order to meet the requirements of a level of achievement. It also indicates the documents that must be submitted for verification that requirements were met.
- Sources: Citation of sources used in the development of the credit.
- Related Credits: EnvisionTM credits which may share documentation requirements, objectives, or may relate in a symbiotic way in order to meet level of achievement requirements.



CREDIT LIST

QUALITY OF LIFE

13 Credits

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 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

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 Long-Term Maintenance and Monitoring

LD3.2 Address Conflicting Regulations and Policies

LD3.3 Extend Useful Life

LD0.0 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

NATURAL WORLD

15 Credits

1 SITING

NW1.1 Preserve Prime Habitat
NW1.2 Preserve 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

CLIMATE AND RISK

8 Credits

1 EMISSIONS

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

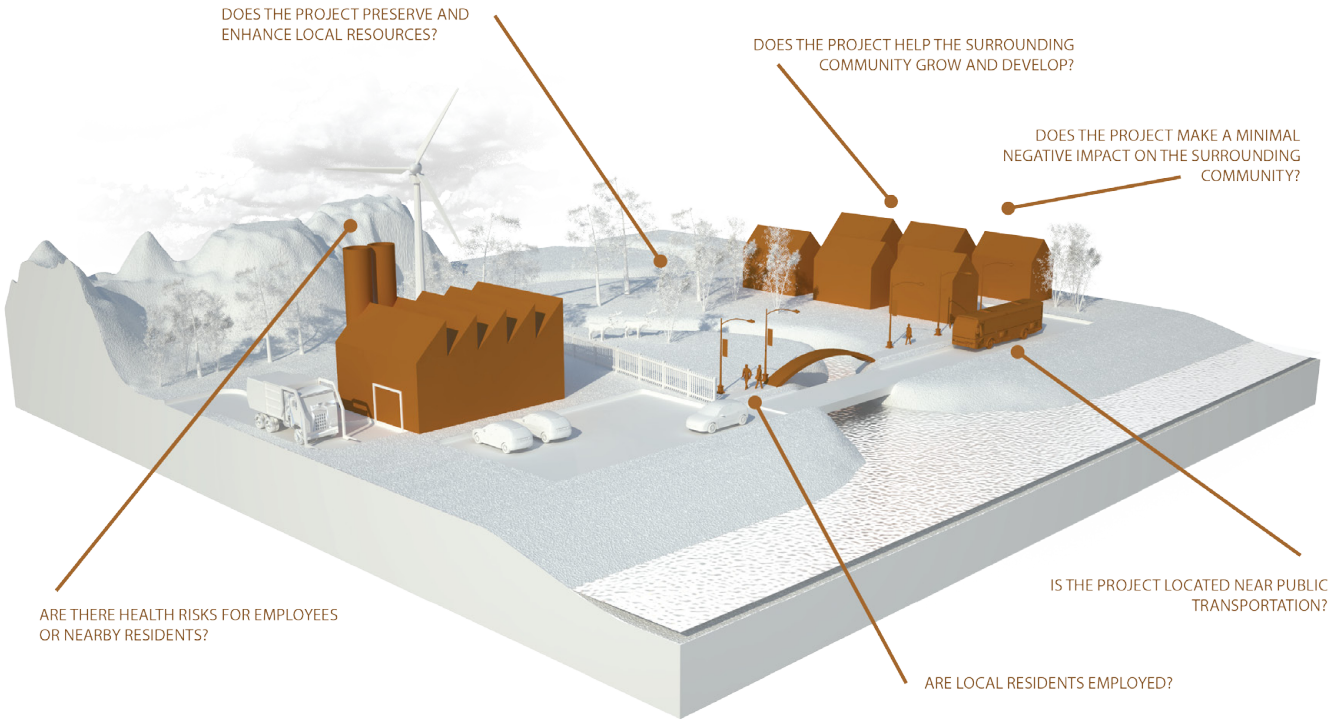
2 RESILIENCE

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

QUALITY OF LIFE

QUALITY OF LIFE



QUALITY OF LIFE

Quality of Life addresses a project's impact on surrounding 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 particularly focuses on assessing whether infrastructure projects are in line with community goals, incorporated into existing community networks, and will benefit the community long-term. For that purpose, community involvement should be sought by infrastructure owners. Community members (both users and non-users) affected by the project should be considered important stakeholders in the decision-making process (during design as well as during operations). The category is further divided into three subcategories: Purpose, Wellbeing, and Community.

PURPOSE

It is critical to ask, "Is this the right project?" 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. Projects can teach about their specific sustainable features and processes, and of broader sustainability impacts. Displaying performance may also help facilitate positive user behavior changes.

WELLBEING

As integral parts of the community sustainable infrastructure projects should address individual comfort, health, and mobility. Physical safety of workers and residents should be ensured and nuisances should be minimized (including light pollution, odors, noise, and vibration) during construction and operations. Attention is also given to encouraging alternative modes of transportation and incorporating the project into the larger community mobility network. Further, infrastructure owners are encouraged to ensure equal access (availability and quality) to all; exclusionary practices should be avoided.

COMMUNITY

It is important to ensure the project respects and maintains or improves its surroundings through context-sensitive design. While infrastructure is driven primarily by engineering parameters, its visual and functional impacts should be considered during design. Depending whether the project is located in a rural or urban setting this may include preserving views and natural features or incorporating into the local character of the built environment; most often a combination of both. Successful sustainable projects require a new way of thinking about how they integrate into their community.

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 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 and relevant 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 significant adverse community effects are caused by the project (A, B, C)	**(5) Community linkages.** More substantive efforts to locate, review, assess and incorporate the needs, goals and plans of the host community into the project. Most potential negative adverse impacts of the project on the host community are reduced or eliminated. Key stakeholders are involved the project decision-making process. (A, B, C)	**(10) Broad community alignment.** All relevant 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)	**(20) Holistic assessment and collaboration.** The project makes a net 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 tradeoffs for benefits achieved. The project has broad community endorsement. (A, B, C)	**(25) Community renaissance.** Through rehabilitation of important community assets, 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)

DESCRIPTION

This credit addresses the extent to which the project contributes to the quality of life of the host community: the community in which the constructed works is situated and directly affects. This determination is based on how well the project team has identified and assessed community needs, goals and objectives, and incorporated them 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 is 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 constructed works 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, as well as reduce or eliminate negative impacts. Positive effects on all important dimensions of performance may not be practical. Thus 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 Assessor and Verifier, 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 may have located and reviewed 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, plans and their relation 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, plans 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 as well as address potential adverse impacts?

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.*

C. To what extent has 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 into the designs.*
3. *Evidence showing the extent to which options were identified, and needed and reasonable changes to project were made in accordance with community needs, plans.*
4. *Acknowledgments and endorsements by the community that the design participation process was helpful and that their input was appropriately assessed and incorporated into the project design.*

D. Has 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, meeting minutes with community stakeholders and decision-makers demonstrating an understanding of community conditions and assets, and substantive efforts to rehabilitate.*
2. *Evidence of community satisfaction and endorsement of plans.*

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.

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 consists primarily of jobs created during the design and construction. (A)	**(2) Significant and desirable development.** The project creates facilities and infrastructure that increase access to other facilities and infrastructure. The completed works contributes to community growth and development by adding a new operating capacity, or increase the quality of existing capacity. Capacity additions can apply to business and industry. They can also apply to the public in terms of cultural and recreational facilities and infrastructure. Jobs are created because of this development. (A, B)	**(5) Improving local productivity.** The additional access and increases in the number and quality of choices is 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 constructed works fosters an expansion of the local skill base. (A, B, C)	**(13) Business and people attractiveness.** The constructed works 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.** At the early development stages, the project owner and the project team work with the community to identify existing community assets in the natural or built environment which, if restored, would improve the economic growth and development capacity of the community. The constructed works improve attractiveness through restoration of existing infrastructure, including physical, knowledge and social assets. 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 preexisting community goals. The overall objective is to create socio-economic vitality and prosperity. The goal of infrastructure projects is to contribute to the socio-economic 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 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 and changes in demographics, many communities are facing shrinking populations and an eroding tax base. As a consequence, growth per se is not a viable option. In fact, 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 infrastructure burden.

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 for development and/or renewal. Communities are consolidated and reconfigured in ways that form the nucleus for redevelopment. Infrastructure projects must contribute to the overall community attractiveness for business and people. Existing infrastructure should be repaired, replaced and/or refurbished on a cost-effective schedule. A broad set of alternatives should be considered, covering business and industry, cultural and recreational elements.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project is designed as an entity unto itself, simply meeting 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 look to community-wide considerations. Make growth and development for business 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 jobs during its design and construction?

1. *Analyses showing what jobs are reasonably created during the design and construction of the project.*

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

1. *Report showing how the delivered works expands the capacity or increases the quality of operating, recreational or cultural capacity.*

METRIC:

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

2. *Verification of the report results by references to official community plans, goals, needs assessments, minutes of meetings, or letters from community leaders, decision-makers.*

C. Does the delivered works significantly improve community productivity?

1. *Analyses showing the effects of the delivered works 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, improves recreational opportunities, and generally improves the economic and social condition of the community?

1. *Demonstration of how the project improves community attractiveness for compatible businesses and industries, improves recreational opportunities, and generally improves the economic and social 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, increased alternative resources, facilities and infrastructure.*
3. *Evidence of new employment opportunities that will be created and the skill base is expanded.*

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

1. *Reports, minutes of meetings, memoranda documenting efforts by the project team to work with the community to identify 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.*

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

RELATED CREDITS

QL1.1 Improve Community Quality of Life

QL1.3 Develop Local Skills and Capabilities

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 proposes significant efforts to hire and train local workers as needed, but mostly hiring specifications directed to 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 lays out 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 where 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 are compared to community needs are proposed. (A)	**(15) Long-term competitiveness.** The project team commits to working with the local community not only to assess local employment and educational needs, but also 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 skill base, thereby improving long term competitiveness. (A, B)

DESCRIPTION

The intent of this credit is to address the degree to which the project improves both local employment and the skills mix during the project design and implementation phases. At one end of the achievement spectrum, the owner, designer and contractor commit to hire local workers mostly in 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 is predominantly unskilled labor. 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 and education needs, 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 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 and disadvantaged groups for the project.*
3. *Documentation of the extent and skill level of work planned for local firms.*
4. *Documentation of the proposed skill 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 skill mix of local hires in relation to overall project hiring and employment.*
6. *New businesses with local employment expected with the project.*

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 community needs and improved community competitiveness, current and future.*

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

RELATED CREDITS

QL1.1 Improve Community Quality of Life

METRIC:

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

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
(2) Assessment of new requirements. 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. (A, B, C)			**(16) Excellence in all categories.** The project team puts in place health and safety plans and programs that substantively exceed all applicable regulations. Explicit and comprehensive consideration given to the application of new technologies, materials, equipment and methodologies, and the corresponding new and health and safety requirements and considerations. (A, B, C)	

DESCRIPTION

The purpose of this credit is to ensure 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 the use of 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 the potential risks to public health and the environment, and to project workers. Any significant risks uncovered should be addressed in the project health and safety plans.

The project team must consult with the 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 signoff by environmental and health and safety officials.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Project health and safety plans meet the minimum requirements. 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 the new and/or non-standard technologies, materials, equipment and methodologies to be employed on the project. Institution of the appropriate changes in project design and construction to reduce the risk to public and worker health and safety to acceptable levels. Institution of the 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 non-standard technologies, materials, equipment and methodologies to be employed on the project?

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

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

METRIC:

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

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 signoff by the 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 of approval and signoff by the appropriate environmental and public health and safety officials.*
2. *Evidence that the health and safety methodologies and protocols have been passed onto the constructor.*

RELATED CREDITS

QL1.1 Improve Community Quality of Life

QL2.6 Improve Accessibility, Safety, & Wayfinding

LD1.1 Provide Effective Leadership & Commitment

QL2.2 MINIMIZE NOISE AND VIBRATION

INTENT:

Minimize noise and vibration generated during construction and in the operation of the constructed works to maintain and improve community livability.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Studies, 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 air-borne 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 the 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 in such a way as to reduce ambient noise in the area. As a result of the project and the completed works, 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.

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.

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.					

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.)

Proposals to mitigate noise and vibration from stationary and mobile sources are approved by local authorities and decision-makers, and incorporated into the design. Monitoring programs are included. Mitigation measures include the use of sound proofing, noise barriers, designs to locate mechanical equipment and other sources away from exterior spaces designed for use, and use of innovative pavements designed to reduce traffic noise. For outdoor areas of occupancy, provide quiet outdoor spaces. The project team should measure ambient noise levels prior to 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 laws and regulations regarding construction noise, but 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.

METRIC:

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

EVALUATION CRITERIA AND DOCUMENTATION

A. Have appropriate studies been carried out to predict the levels of air-borne, ground-borne and structure-borne noise and vibration that will be present during construction and when the completed works 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. *Acceptability of the credentials and qualifications of the person(s) conducting the baselines 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 submitted.*
2. *Comprehensiveness of proposals in terms of coverage, detail and the flowdown of requirements to the construction contractor.*

C. Has the project been designed to markedly reduce ambient noise and vibration down 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

- Adapted from 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.

QL2.3 MINIMIZE LIGHT POLLUTION

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Cost savings focus. The project team conducts and 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 taken to prevent light spillage and glare in the design. Design specifications state 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. See Discussion below regarding requirements for digital signage. (A, B)	**(2) Non-lighting alternatives.** The project team makes additional reductions in the amount of lighting required by employing non-lighting alternatives, e.g., clear signage and clearly painted roadway lines. The design meets requirements for digital signage. The design reduces light spillage effects and glare through strategies such as high barriers and planted trees and shrubs. See Discussion below regarding requirements for digital signage. (A, B, C)	**(4) Cohesive zoning.** The project team aligns the project with appropriate lighting zones and existing zoned districts. The team may establish 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, plus considerations for 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.** Work with lighting experts to assess true lighting needs as well as areas where exterior lighting is directed upward. Identify more fully, where, when and to what levels lighting is needed to meet wayfinding, safety and other illumination requirements. Also identify and appropriately reduce or eliminate 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. 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 upwards into the sky due to 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 with 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 necessary and may 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.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

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

Performance improvement: Incorporate non-lighting alternatives and rethink real lighting needs. Eliminate unnecessary lighting. Reduce glare and light spillage. Increase 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 overall appropriate 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, specifications showing the use of energy-efficient lighting, removal of existing but unneeded lighting, use of automatic turnoff systems, application of non-lighting alternatives.*

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, 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, marquee signs and electronic display systems: During daylight hours between sunrise and*

METRIC:

Lighting meets minimum standards for safety but does not spill over into areas beyond site boundaries, nor does it create obtrusive and disruptive glare.

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 (MRSC), Light Nuisances - Ambient Light, Light Pollution Glare http://www.mrsc.org/subjects/legal/nuisances/nu-light.aspx ,\
- International Dark Sky Association, http://www.darksky.org/mc/page.do;jsessionid=611873BE90FA3AE5DE973FEDBC4D5DA2.mc0?sitePageId=119791 .
- The New England Light Pollution Advisory Group (NELPAG) http://www.cfa.harvard.edu/nelpag/nelpag.html .

RELATED CREDITS

QL1.1 Improve Community Quality of Life

RA2.1 Reduce Energy Consumption

QL2.6 Improve Site Accessibility, Safety and Wayfinding

QL2.4 IMPROVE COMMUNITY MOBILITY AND ACCESS

INTENT:

Locate, design and construct the project in a way that eases traffic congestion, improves mobility and access, does not promote urban sprawl, and otherwise improves community livability.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Limited coordination. The project team recognizes the need and utility in providing access to adjacent facilities, amenities and transportation hubs. However, the team has not coordinated fully with owners and operators of adjacent facilities, amenities and/or transportation operators. Design decisions are made internally, within the project team. Despite attempts at coordination, design gaps in mobility and access are still significant. Principles and specifications for reducing negative impacts on mobility and access in the construction phase are limited. (A, B)	**(4) Satisfactory access.** Project team recognizes the need and utility of providing such access, and seeks input from the operators of adjacent facilities, amenities and transportation hubs. Design decisions are based in part on improved access. Access design decisions 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. (A, B)	**(7) Exceptional access and flow.** Project team expands access considerations to expected traffic flows and volumes, preferred modes of access. Discussions with decision-makers to optimize design choices. Project team works with decision-makers in adjacent facilities and amenities and transportation hubs to determine best modes of access. Designs based on expected traffic flows and transportation choices. Principles and specifications for reducing negative construction impacts emphasize substantially reduced impacts, 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. (A, B, C, D, E)	**(14) More livable communities.** Project team expands the range of discussion. The team works not only with decision-makers in adjacent facilities, et al., but also with local community officials. Design considerations have moved beyond access 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 require strong programs for working with affected community. (A, B, C, D, E, F)	

DESCRIPTION

The purpose of this credit is to reduce the negative impacts of the constructed works 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 constructed works are not located near existing public transportation, consider creating new links to public transport rather than relying on motorized vehicles providing access.

The use of alternate materials and sources that reduce the need for materials transport should be specified in construction. Alternate means of transportation, e.g., rail, water should be considered in the deliver of construction materials, as well as waste materials needing to be transported off site.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Compliance with local laws and regulations regarding construction transport, but no inspection and enforcement programs beyond what's required, if anything. Only conducting conventional impact studies as required by local regulations. No particular efforts in the design to improve access or reduce congestion. Only using 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 impacts of the project on community access and mobility during construction and operation been properly and comprehensively addressed?

   1. *Assessment studies and reports addressing the effects of the constructed works on access and mobility.*

   2. *Completeness of the assessment studies and reports.*

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 works?

   1. *Reports, memoranda, minutes of meetings with managers and operators covering access to adjacent facilities, amenities and transportation hubs.*

   2. *Decisions made and actions taken.*

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

METRIC:

Extent to which the project improves access and walkability, reductions in commute times, traverse times to existing facilities and transportation. Improved user safety considering all modes, e.g., personal vehicle, commercial vehicle, transit and bike/pedestrian.

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

D. Has the project team developed plans 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, access to public transit and non-motorized transportation?

1. *Access and mobility principles, requirements and specifications incorporated into 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 works.*

SOURCES

- Adapted from 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, http://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 CREDITS

QL1.1 Improve Community Quality of Life

QL2.5 Encourage Alternative Modes of Transportation

QL2.6 Improve Site Accessibility, Safety and Wayfinding

RA1.6 Reduce Excavated Materials Taken Off Site

QL2.5 ENCOURAGE ALTERNATIVE MODES OF TRANSPORTATION

INTENT:

Improve accessibility to non-motorized transportation and public transit. Promote alternative transportation and reduce congestion.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Transit access. The constructed works allow for walking distance and pedestrian accessible to multi-modal transportation. Location of facility or constructed works in relationship to multimodal transportation hubs. Pedestrian access. Restrictions on parking of motorized vehicles. (A, B)	**(3) Non motorized or transit friendly.** Location encourages the use of transit or non-motorized transportation, e.g., walking or cycling. The constructed works creates or offers convenient access to transit. Design for convenience in movement to transit facilities. Extended, contiguous trails and bicycle networks that connect to the site and/or constructed works. (A, B, C)	**(6) Non-motorized and transit friendly.** The constructed works is located in a place and configured in such a way that encourages the use of non-motorized transportation and transit for access. Location selected is convenient to extended and contiguous pathways and bikeways. Secure bicycle lockers are available. Facilities for users of the constructed works are designed with appropriate facilities and incorporate appropriate support policies. (A, B, C, D)	**12) Public transportation enhancements.** The project enhances public transportation facilities or implement programs to encourage the use of public and non-motorized transportation. (A, B, C, D, E)	**(15) Reviving transportation options.** The project is designed and constructed in a way that rehabilitates pathways, bikeways, rail and/or water modes of transportation that were unused and/or in disrepair and/or removes barriers to use of alternative modes of transportation. The project integrates these underutilized assets into the existing transportation infrastructure, and the larger transportation infrastructure strategy. (A, B, C, D, E, F)

DESCRIPTION

For projects located in urbanized areas it is important to ensure integration into the existing public transportation network, and if possible improve upon it. The reliance on the car has had long lasting detrimental effects on cities. Widening streets, and large areas of surface parking, have made cities spread out making it more difficult for pedestrians, bicyclists, and those dependent on public transportation.

The constructed works should be located within walking distance and pedestrian accessible to multi-modal transportation facility or constructed works offers convenient access to transit and pedestrian routes. Parking of motorized vehicles should be restricted.

The constructed works should be located in a place that encourages the use of non-motorized transportation for access. The location selected is convenient to extended and contiguous pathways and bikeways. Secure bicycle lockers are available. Facilities for workers in the constructed works are designed with appropriate support facilities. Appropriate user policies are in place to encourage non-motorized transportation.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Simple access to transit, pathways or bikeways.

Performance Improvement: Improved access and convenience for non-motorized transportation. Design encourages the use of alternate modes of transportation.

EVALUATION CRITERIA AND DOCUMENTATION

A. Is the constructed works located within walking distance and is it pedestrian accessible to multi-modal transportation facilities?

1. *Location and design drawings showing proximity and accessibility to transportation facilities.*
2. *Degree of convenience and accessibility.*

B. Does the constructed works and associated infrastructure restrict the parking of motorized vehicles?

1. *Location and design drawings showing parking availability in and around the constructed works.*
2. *Parking spaces available relative to expected use of the constructed works and availability of alternative transportation. Comparisons to other parking restricted facilities and infrastructure.*

C. Is the constructed works and associated infrastructure designed for convenience in access to multi-modal transportation facilities?

1. *Location and design drawings showing bicycle and pedestrian walkways, trails and networks that connect to the site and constructed works.*
2. *Convenience, quality and safety of those walkways, trails and networks.*

D. Is the constructed works configured and located so that users are encouraged to use non-motorized transportation?

1. *Location and design drawings showing the topography is relatively flat, with a network of pathways and bikeways converge on or near the constructed works.*

METRIC:

The degree to which the project has increased walkability, use of public transit, non-motorized transit.

2. Availability of facilities and policies for the users.

E. Has 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. Effective display of information such as time and route of public transportation [kiosks, protected displays at bus stops, etc.]

F. Has the project owner and the project team identified under-unused pathways, bikeways, rail and/or water modes of transportation that are unused, in disrepair and/or have barriers to safe use? Has the team sought to upgrade these elements and integrate them into the existing transportation infrastructure?

1. Location and design drawings showing pathways, bikeways, rail and/or water modes of transportation that are unused and in disrepair.

2. Designs for upgrading and incorporating those elements into the existing transportation infrastructure.

3. Extent and effectiveness of rehabilitation and incorporation.

SOURCES

- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 10.1.2, 10.1.3, 10.1.4.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.5: Provide for optimum site accessibility, safety, and wayfinding.

RELATED 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 users' ability to understand, and safely access and leave the constructed works and the site. Provide signage and other guidance that makes it intuitive for users to orient themselves to 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 and significant effort to understand and improve the projects 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 constructed works integrates well with the local community and its environmental and cultural resources. (A, B, C, D, E)	**(15) Restoring safe neighborhoods.** Over and above the accessibility, safety and wayfinding aspects of the project, the changes made to the site and general vicinity of the constructed works improve overall access and safety of the adjacent neighborhoods, an increase from previous levels. (A, B, C, D, E, F)

DESCRIPTION

The project should be designed in such a way that users can find their way in and around the facility or other infrastructure. Wayfinding also has health and safety implications. It involves the ability 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 project team considers impacts on surroundings and considers 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 including adjacent bike lanes.
- 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 as to be as visible as possible from surrounding neighborhood 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 in 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 cite safety in way-finding. Signage meets MUTCD and ADA requirements and other applicable standards.

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

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 constructed works?

METRIC:

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

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 addressed appropriately, safety and accessibility in and around the constructed works 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 so as to have a net positive impact on public safety?

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

E. Does the constructed works 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 the 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.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.5: Provide for optimum site accessibility, safety, and wayfinding.
- U.S. DOT, Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD).

RELATED CREDITS

QL2.4 Improve Community Mobility and Access

QL2.5 Encourage Alternative Modes of Transportation

QL2.1 Protect Public Health and Safety

QL3.1 PRESERVE HISTORIC AND CULTURAL RESOURCES

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Moderate efforts. Project team works with the community and required regulatory and resource agencies to identify historic and cultural resources and develop approaches to avoid, minimize and mitigate impacts to those resources. Feasibility analysis done to understand possibilities of incorporating preservation, enhancement into project. (A, B)		**(7) Proactive efforts.** Potential stakeholders are consulted early in the project's development. Opportunities to preserve and protect cultural and heritage sites are taken. The project team works with cultural stakeholders to develop a sensitive design approach. (A, B, C)	**(13) Preservation and conservation.** Project is designed so it fully preserves the character-defining features of that resource. Project is developed in close coordination with all stakeholders and will likely involve a variety of interests ranging from local, state, national as well as public, regulatory, non-profits and private interests. (A, B, C)	**(16) Conservation and restoration.** 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 an historic landscape or green spaces, upgrade and expansion of recreational facilities, or a publicly accessible educational or museum site in accord with cultural stakeholder wishes. (A, B, C, D)

DESCRIPTION

This objective 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. To some extent, these resources are protected by federal statutes. However, those authorities are limited to federal agency actions. Other jurisdictions may have promulgated their own preservation laws. Communities may have additional local ordinances. In addition, the siting and construction of large renewable energy infrastructure may impact negatively historical landscapes and viewsheds. Reducing energy demands reduces the need for large, utility-scale renewable energy infrastructure. It should also be noted that preservation of historic sites and cultural resources might be in 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 should increase efforts to understand community needs, opportunities for preservation, protection and enhancement. Owners should increase flexibility in incorporating protection and preservation elements into the project. Shift from preservation and conservation to restoration and enhancement of cultural and heritage sites.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project team worked with the community and required regulatory and resources agencies to identify cultural resources?

   1. *Reports, memoranda, minutes of meetings with the community and required regulatory and resource agencies to identify cultural resources.*

B. Has the project team conducted a feasibility analysis to understand the possibilities of incorporating preservation, or enhancement, into the project?

   1. *Evidence of a feasibility study.*

C. To what extent has the project team worked with cultural stakeholders to develop a sensitive design and approach, with the ultimate goal of avoiding all cultural resources or fully preserving the character defining features of that resource?

   1. *Location and design drawings demonstrating that the site avoids impacting any cultural resource, or of efforts to mitigate impacts.*
   2. *Design documents of all mitigation efforts in the design.*

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

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

METRIC:

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

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.

RELATED 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 in a way that maintains the local character of the community and does not have negative impacts on community views.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Understanding and balance. Public view plan developed and project adheres to existing policies and regulations regarding fit with local character. Take into consideration the preservation of natural landscape features. Balance the need for safety measures and barriers against desire for protection or enhancement of views. (A, B, C)	**(3) Alignment with community values.** As part of the stakeholder consultation process, 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 considered. Aesthetic quality of the project beyond regulations considered. (A, B, C, D)	**(6) Community preservation and enhancement.** 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 on-site trees, vegetation, and other features. Stated penalties for non-compliance and programs to inspect outcomes and enforce. Project implements significant measures to fit with local character either natural or man-made. (A, B, C, D, E)	**(11) Community connections and collaboration.** Project team assists local community establish or enhance 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 key aspect of the project and alternatives are developed and implemented in collaboration with community stakeholders. Significant efforts in siting project and design and construction to preserve landscape features. (A, B, C, D, E, F)	**(14) Restoration of community and character.** Owner seeks where appropriate 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 project to restore lost character features within the community. (A, B, C, D, E, F)

DESCRIPTION

It is important that a project's design should 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 of natural landscapes and prominent features. Design features can fit with local character by reflecting the importance of the natural surroundings. In urban settings projects should likewise seek to maintain important view corridors, avoid blocking views from previous development. It should also seek to fit with the local urban character reflecting traditional streetscapes, materials choices, height limitations, etc.

In fulfilling this credit project teams should minimize the impact on natural or community features, including rock formations, cutting of trees and other vegetation. Designs should take into account either the natural or urban local character in terms of landform or levels, materials, plantings, style/detailing, scale, landscape/townscape, etc. 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 of views or view corridors, unless required. The project team achieves minimum compliance with laws and regulations for adverse impact on landscape features, and for any protected features, trees etc.

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. To what extent has the project team demonstrated an understanding of local character of the project setting, in terms of landform or levels, views, natural landscape features, materials, planting, style/detailing, scale, and landscape/townscape pattern?

   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.*

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 should include: identification and location of the areas to be protected, identifying*

METRIC:

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

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, important natural landscape features, and generally fit with the local character and context of its surroundings whether urban or rural.*

C. To what extent does the final design address 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. To what extent has the project team worked with local official, communities, and decision makers?

1. *Reports, memoranda, minutes of meetings with local officials and decision-makers regarding local policies and regulations.*
2. *Reports, memoranda, 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 contract include clauses on the preservation of high value landscapes and landscape features, including stated penalties for non-compliance and programs to inspect outcomes and enforce?

1. *Contract clauses regarding the preservation of high value landscapes and landscape features.*
2. *Penalties for non-compliance.*
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 for future projects?

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

QL3.3 ENHANCE PUBLIC SPACE

INTENT:

Improve existing public space 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.** Project team identifies and implements meaningful enhancement or the creation of new public space. The project team works with stakeholders (users, regulatory agencies, and resource owner) to develop a sensitive design. Official with jurisdiction over that 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 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. In the case of 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 should be given to enhancements that improve security and crime safety during various times of the day. Allowing clear sightlines, 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 is the entity that has control over the operation or governance of that resource. The official is often the owner, but may include additional entities in the cases of 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: Shift from maintenance and preservation to enhancement and restoration.

EVALUATION CRITERIA AND DOCUMENTATION

A. What effect will the project have on public space (e.g., parks, plazas, recreational facilities, or accessible space in wildlife refuges) that enhances community livability?

1. *Studies, 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. *Determination of benefits, improvements, negative impacts.*
4. *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, minutes of meetings with stakeholders showing stakeholder satisfaction.*

C. Will meaningful and beneficial restoration efforts be undertaken?

METRIC:

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

1. *Plans, 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 CREDITS

QL1.1 Improve Community Quality Of Life

QL3.1 Preserve Historic And Cultural Resources

QL3.2 Preserve Views And Local Character

QL0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

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

LEVELS OF ACHIEVEMENT

INNOVATION
(+8) Innovate or exceed credit requirements. 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, novel either in their use, their application, or within the local regulatory or cultural climate.

DESCRIPTION

This objective 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 in regards to sustainability. These points are not calculated in the overall available points and therefore act as 'bonus' points. Given the nature of the credit, whose broad format is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Verifiers will take a more involved role in assessing achievement and project teams should be confident in the project's ability to meet expectations before applying.

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For example, project 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 case exceptional performance may be pursued by projects whose magnitude of preservation, and investment in restoration, is a significant percentage of the project budget and a primary objective of the project. Verifiers will determine whether the magnitude of the effort exceeds the expectations for the current Restorative achievement level.

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 whose 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 major contribution to the quality of the community.
- A project whose impact will fundamentally change the ability of community residents to access and use sustainable means of transportation on a large scale.

Innovation is not encouraged for the sake of novelty. Projects should demonstrate that through the innovative approach the project has achieved at least one of two 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 utilize innovative technology, methods, or application. For example, 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.

Possible areas of achievement in innovation may include, but are not limited to, the following:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs.
- The project employs 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

METRIC:

Whether project achievement qualifies as exceptional performance or innovation.

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 highest levels of achievement or implement innovative methods in meeting infrastructure needs 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 Resource Allocation credit.*

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

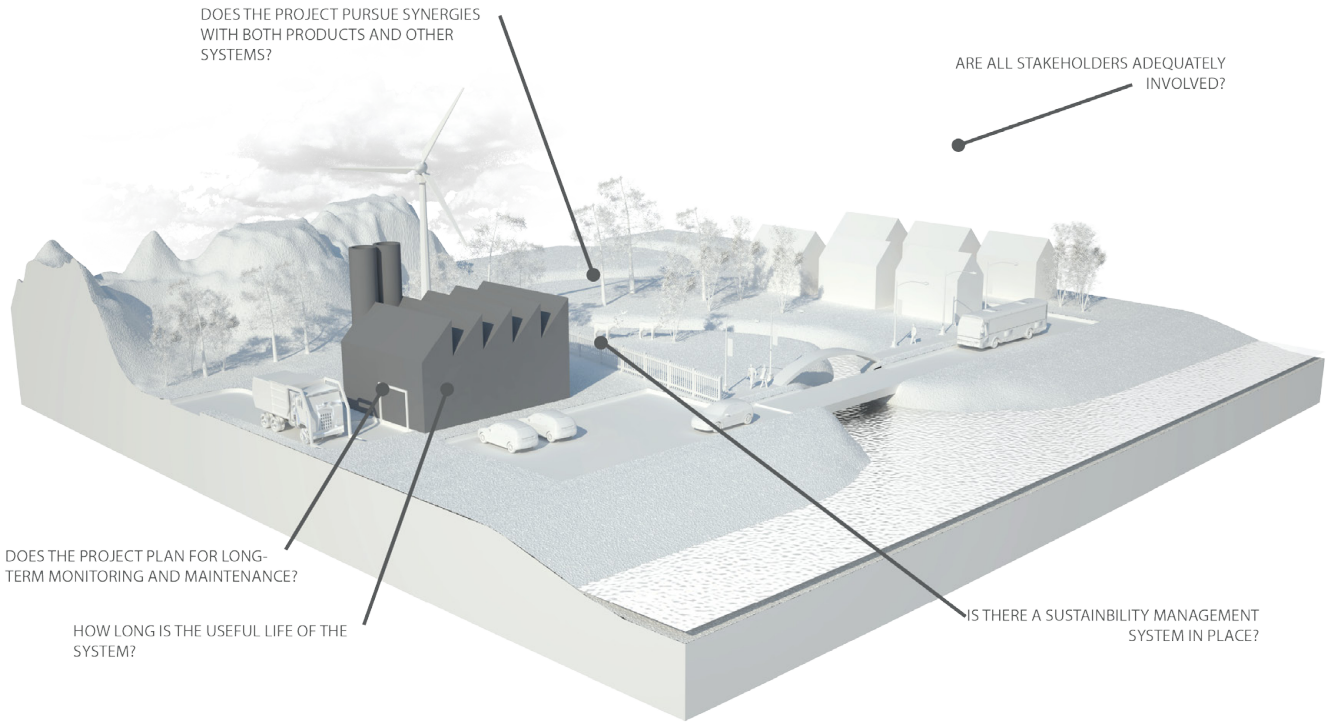
1. *Documentation of the application of innovative technologies or methods. Detailed description as to how this application will improve upon existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered 'innovative' either as a technology, a method, or its application 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 which 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 come to life. 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 section is divided into the three sub-sections of Collaboration, Management, and Planning.

COLLABORATION

Sustainable projects must include input from a wide variety of stakeholders to fully understand synergies, savings, and opportunities for innovation. This type of collaboration requires a new kind 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, and allow nontraditional 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 save money, 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 the future growth trends in the area can lead to a project that avoids pitfalls and plans effectively for its own future. This can save money and streamline the whole 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 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. Programs to improve 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 non-sustainable environment. (A)	

DESCRIPTION

The effects and consequences of non-sustainability are changing the design assumptions and variables used in infrastructure design and construction. Strong leadership is required to manage this extraordinary level of change and make a contribution to long-term conditions of sustainability.

The purpose of this credit is to provide incentives for establishing sound and credible management and leadership to address adequately and competently the 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 a demonstrated ability to effectively incorporate them into projects.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No specific policy statements regarding sustainability work commitments to improve triple bottom line aspects of the project. Published statements say 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 improving sustainable performance?

1. *Public statements by the leadership in the project owner's organization, and the 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.

RELATED CREDITS

LD1.2 Establish a sustainability management system

LD1.3 Foster collaboration and teamwork

LD1.4 Provide for stakeholder involvement

17 POINTS

LEADERSHIP

METRIC:

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

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 the ecological aspects. However, the detail is limited and none of those appear to be sufficient to match the scope and scale of the project, nor do they seem adequate to manage change. 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.** Good but still incomplete sustainability management system. The system contains some significant 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 are better defined, and at appropriate levels in the organization. Concerns are in the lines of authority and responsibility. Some conflicts. Actual ability to affect change 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 or members of the project team have been assigned the appropriate roles and responsibilities of the position(s). The roles and responsibilities of the person or persons 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 possible 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. 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 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. ISO 14004 (environmental management system guidance) provides guidance on converting an environmental management system to a sustainability management system. Sustainability management systems differ from environmental management systems as 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 sustainability performance improvement. The policy should cover the project stakeholders, including the affected communities as well as project suppliers and contractors. The policy should commit 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 societal aspects of the project that relate to sustainability. Once established, the list of aspects is prioritized by the project team based on importance in meeting both project and sustainability goals.

Once prioritized, the project team should create 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 plan and 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 and 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.

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?

METRIC:

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

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. *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 societal 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 due to conditions of non-sustainability.*
3. *Prioritized list of project goals, objectives and performance targets that take into account project importance and the consequences of change.*
4. *Alignment of goals, objectives and targets to community needs, 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. *Evidence that broad and robust business processes and management controls are in place.*
2. *Sufficiency 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.

LD1.3 FOSTER COLLABORATION AND TEAMWORK

INTENT:

Eliminate conflicting design elements, and optimize 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 on an opportunistic basis. The owner and the project team have expressed a desire to improve sustainable performance, but the approach taken is not systematic. So-called green features are added to the project in a haphazard fashion. (A, B)	**(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. That systems view is seen as important for optimizing the overall performance of the community/city infrastructure. (A, B)	**(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 multi-disciplinary 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 involves the 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 multi-disciplinary 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. The project team uses whole systems design processes, procedures and 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, eliminating duplicate functions or unnecessary redundancies. Risk/reward sharing is part of the owner's contract with the design team. (A, B)	

DESCRIPTION

The purpose of this credit is to provide incentives for and recognition of owner and project team collaboration in the delivery of the constructed works. 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 affect the work of others, positively or negatively. This includes members of the project team who are traditionally involved later in the project, e.g., constructor, commissioning agent. Working separately, performance is sub-optimal, confined to individual project components. Working together as an integrated team, performance can be optimized across the entire project.

At the advanced levels of achievement, the project team explores ways to improve performance and reduce costs employing 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, eliminating duplicate functions or unnecessary redundancies.

Design charrettes are employed in the development of the design, 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 make sure 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 member's primary objective is meeting project requirements and client expectations, and avoiding claims and litigation. Project is delivered by different task groups mostly working 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 multi-disciplinary project teams business processes and management controls, in the form of procedures, flowcharts, checklists and other documented control measures.*
2. *Evidence of the planned use of design charrettes to identify opportunities for improving sustainable performance and reducing design conflicts.*
3. *Evidence 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.*

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

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
(1) Information transfer. A limited program established for stakeholder communication and information transfer. Programs provide a basic exchange of information about the project. Lines of communication established. Some but limited community involvement. Feedback to the community, but essentially a summary of community input. Some planning and commitment to action, actions taken based on input received. (A, B)	**(5) Active engagement and dialog.** Communication with and feedback from project stakeholders and the affected public are important elements of the project. Lead person works with stakeholder groups to understand communication needs, potential for involvement. Active engagement and dialog is planned. Feedback received is compared against impacts to the project. Actions taken are based on practical project considerations tilted toward less project disruption than community/ stakeholder feedback. (A, B)	**(9) Open to a wider community.** Engagements expand to a wider community, people and relevant groups that are affected by or have an interest in the project. Frequent communication with the public and stakeholders, through significant project phases. Feedback 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, modified by feasibility. Public and stakeholder groups see sufficient and credible opportunities for involvement in project decision-making. Demonstration to stakeholders and the public that the public participation process is transparent and that they have an opportunity to provide meaningful input. (A, B, C)	**(14) Community relationship building.** Communication programs and exercises are designed to develop relationships with the key stakeholders, involvement in the project decision-making processes. Solid, credible programs for soliciting feedback from the public and key stakeholders regarding communications and public involvement in the project decision-making processes. Project can demonstrate specific and significant case(s) where changes were made based on feedback. Given the likely broad array of issues and positions, the project team focuses on not only obtaining meaningful input, but also buy-in that the process for making project decisions is 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. (A, B, C, D)	

DESCRIPTION

This credit is intended to rate 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 should be set up to identify and engage key stakeholders in project decision-making. Key stakeholders must include members of the communities that are affected by the project.

Stakeholder engagement should involve 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 into the design, construction and operation of the completed works.

It is important to note that 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. A particular issue may be relevant to a project even if not specifically identified by the stakeholders consulted by the organization. Relevant public concerns and expectations are not defined as the aggregate summation 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 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: Shift from information exchange to active stakeholder engagement and dialog. More community involvement and transparency in project decisions. Expand to an ongoing community relations program.

METRIC:

The extent to which project stakeholders are identified and engaged in project decision making. Satisfaction of stakeholders and decision makers in 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 as 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. *Evidence in the form of policies and business practices that ensure fair and equitable assessment and action.*

C. To what extent has the project owner and the project team provided opportunities for stakeholder input into project plans and decision-making?

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

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, waste streams. Candidate facilities and by-product possibilities identified but little work done in assessing the potential. Availability of excess resources and/or energy unclear. Assessment done but limited in depth, and only if by-product synergy possibilities seem obvious. Mostly a paper assessment. Studies and assessments are made, and managers of nearby facilities may be contacted. However, identification and screening efforts are limited. (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. Assessment done in some depth. Facilities and possibilities identified. Contact with facility decision-makers to assess the potential is spotty. (A, B, C)	**(6) Opportunity foresight and pursuit.** Broad and comprehensive efforts to identify managers of facilities nearby 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 contacted and pursued. Systematic assessment. Knowledge of the availability of excess resources and/or energy, other possible synergies is clearly identified. Research 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. Owner and project team understand the principles of industrial ecology. Facility decision-makers identified and contacted to assess the potential. Relationships developed. Active discussions 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., long term supply of facility by-products for use in the operation of the constructed works. 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 constructed works. (A, B, C, D)

DESCRIPTION

By-product synergy involves the 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 these 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 these materials useful in operation, the project team can also work with the owners and reduce the cost of operations. In the latter instance, the project owner may become part of a local by-project synergy project in which wastes from one facility can become the feedstock for another. Such projects may have 20-40 participants from industry and government. The by-product synergy project will implement a process in which the participants exchange information about wastes or by-products generated and feedstock needs.

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

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Identification, assessment and use of unwanted by-products from nearby facilities are not considered. 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. More aggressive searching and screening of opportunities. Advance from opportunity identification to opportunity screening and development. Shift from focus on searching and screening to relationships developed with nearby facilities. Successful use of an unwanted by-product 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.

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

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 capture synergy opportunities.

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 identifies, assessed and pursued. Results of pursuits.

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.

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

LD2.2 IMPROVE INFRASTRUCTURE INTEGRATION

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Narrow optimization focus. Project improvements in resource conservation, use of renewable resources 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. Project gains in resource conservation, and the use of renewable resources are significant due to efforts to optimize performance across the project and its delivered works. Efforts are made to integrate the design to eliminate design conflicts and find system synergies that enhance overall performance. (A)	**(7) Infrastructure bundling and synergies.** Project is planned and designed taking into account the other related community infrastructure elements, i.e., how its design and operation will work in harmony and synergy with other infrastructure elements external to the project. Additional investments are planned to create linkages, improve synergies, and by doing so improve overall performance. Factor in infrastructure deficit, i.e., need to repair and refurbish existing infrastructure. (A, B)	**(13) Full infrastructure integration.** The project owner and designer place the project in a community context and participate in multi-sectorial regional strategic planning for sustainability - integrated community sustainability plans. They assess the existing community physical infrastructure as well as its non-physical assets. Project is planned and designed in a way that takes into account not only the physical infrastructure elements but also related community infrastructure elements. The project incorporates and takes advantage of valuable community assets, e.g., knowledge and social capital. Project integrates with the community's asset management program. (A, B)	**(16) High performance through restorative actions.** At the early stages of project development, the project owner and the project team work with the community to identify existing community assets in the natural or built environment which, when restored, would improve the economic growth and development capacity of the community. The project is planned and designed to incorporate restoration of those assets as part of a comprehensive strategic sustainability plan. Project is planned and designed, not only taking into account the other related community infrastructure elements, but sustaining and/or restoring community assets in a way that enhances overall community efficiencies and effectiveness. Integration with and restoration of natural systems and resources. Integration with and restoration of the community's knowledge and social capital assets. (A, B, C)

DESCRIPTION

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

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

The intended result is an improvement in access to resources and/or facilities, a speed up in the flow of information, goods and services, and/or overall improvement of local efficiencies. Infrastructure elements include both natural and man-made.

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 to integration with related system and infrastructure in the community, both natural and man-made. 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?

METRIC:

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

1. Evidence of design improvements made and the degree to which these improvements were integrated with other community infrastructure elements.

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 designs and completed works 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?

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

SOURCES

• W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

LD3.1 PLAN FOR LONG-TERM MONITORING AND MAINTENANCE

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) On paper only. A limited outline of the maintenance and monitoring plan exists, extending monitoring and maintenance activities beyond what is required by regulation. 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 the long-term maintenance and monitoring, and 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 at the early stages is important to make sure that the 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 works. The purpose of this activity is to ensure that the design performance will be maintained throughout the design life of the project. The project owner needs to provide sufficient resources and personnel to implement the plan.

In addition, clear and concise maintenance requirements and specifications should be provided to prevent sustainable performance "backsliding." Without clear guidance on what is required to maintain sustainable performance, future owners and operators may fall back on old approaches, processes and replacement parts simply out of ignorance or convenience.

Monitoring programs must 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 the project's operations. 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 in place.

Performance improvement: Improve completeness and comprehensiveness of plan and resource sufficiency to implement.

EVALUATION CRITERIA AND DOCUMENTATION

A. Is there a clear and comprehensive plan in place for long-term monitoring and maintenance of the constructed works?

1. *Plans for long-term monitoring and maintenance of the constructed works, including the requisite access to the completed and operating works.*
2. *Monitoring and maintenance plans include assessments that the completed works is functioning as designed and that environmental impacts are within the design parameters.*

B. Have sufficient resources been allocated for the monitoring and maintenance of the constructed works?

1. *Designations of the persons or organizations assigned to monitor and maintain the constructed works.*
2. *Explanation of how funding will be allocated, set aside and maintained as sufficient levels to fund the necessary monitoring and maintenance.*
3. *Assurance that these resources will be in place following the delivery of the project.*

SOURCES

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

RELATED CREDITS

RA2.3 Commission and Monitor Energy Systems

RA3.3 Monitor Water Systems and Receiving Waters

METRIC:

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

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 implementing sustainable infrastructure.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Limited search. Searches and assessments done but limited in depth. Applicable regulations identified plus some effort to correlate requirements to sustainability objectives. Responsible regulators and organizations identified but identification is not complete. Primarily a paper 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 arguably 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 towards 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 not an important issue. For example, the use of greywater for certain purposes is not allowed by regulation and/or building codes. This may force designers and builders to use potable water for applications where lesser quality water may be sufficient. For example, in the U.S. at the Federal level, Subtitle C of the Resource Conservation and Recovery Act (RCRA) regulates "cradle to grave" control over hazardous wastes. Wastes classified as hazardous can be recycled and reused, but they must comply fully with the very restrictive requirements of 40 CFR § 261.6, unless exempted by rule. 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 as compared to virgin materials.

Changing laws and regulations that restrict more sustainable practices can be difficult. For example, until July of 2009, rainwater harvesting was illegal in the State of Colorado. Today, rainwater harvesting is legal but subject to significant restrictions. The law was changed in part due to a study, which found that 97% of the precipitation in Colorado never makes it to streams. 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.

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 and extent of search and assess negative impacts from conflicting regulations and policies?

   1. *Evidence 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.*

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.*

METRIC:

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

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

RELATED CREDITS

LD1.4 Provide for Stakeholder Involvement

LD3.3 EXTEND USEFUL LIFE

INTENT:

Extend a project's useful life by designing the project in a way that results in a completed works 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 owner, working with the designer, expands considerations beyond the point of project delivery. They seek to expand the useful life of the delivered project by adding additional considerations of functionality that are useful to the owner: durability and resilience, 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 and resilience. Use materials that are easily adaptable for changing configurations, retrofits or repairs. Focus is 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 and resilience, and ease retrofitting and repair. Project includes investment in areas of long-term payback. (A, B, C)	

DESCRIPTION

This objective offers additional scores for project teams who extend the useful life of a constructed works. Credit is given for designing the project in a way that adds flexibility to the constructed works, 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 constructed works, the less it will need to be replaced, reducing substantially 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 constructed works more durable and resilient to extend its useful life. Designs should add flexibility to the constructed works to enable refurbishment and reconfiguration, and further extend its useful life. For example, the State of Colorado is now looking for ways to alleviate congestion on Interstate 70 (I-70) Mountain Corridor, a 60-mile stretch of the highway connecting Denver and Front Range residents to mountain communities and recreational areas. Traffic volumes have now reached the point of excess congestion, hurting local economies and diminishing productivity. The design of this 4-lane portion of the highway left no room for adding additional lanes or rail lines.

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 in 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 and resilience of the project early in the planning and design stage to reduce future maintenance and waste?

1. *Documentation of how 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 regards 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 project team incorporates full life cycle thinking in improving the durability, flexibility and resilience of the project.

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 1.4.1.

RELATED CREDITS

LD2.2 Improve Infrastructure Integration

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 the expectations of the system as well as the application of innovative methods which advance the state of the art for sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
(+8) Innovate or exceed credit requirements. 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, novel either in their use, their application, or within the local regulatory or cultural climate.

DESCRIPTION

This objective 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 in regards to sustainability. These points are not calculated in the overall available points and therefore act as 'bonus' points. Given the nature of the credit, whose broad format is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Verifiers will take a more involved role in assessing achievement and project teams should be confident in the project's ability to meet expectations before applying.

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For example, project 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 case exceptional performance may be pursued by projects whose magnitude of preservation, and investment in restoration, is a significant percentage of the project budget and a primary objective of the project. Verifiers will determine whether the magnitude of the effort exceeds the expectations for the current Restorative achievement level.

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 whose 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 major contribution to the quality of the community.
- A project whose impact will fundamentally change the ability of community residents to access and use sustainable means of transportation on a large scale.

Innovation is not encouraged for the sake of novelty. Projects should demonstrate that through the innovative approach the project has achieved at least one of two 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 utilize innovative technology, methods, or application. For example, 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.

Possible areas of achievement in innovation may include, but are not limited to, the following:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs.
- The project employs 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

METRIC:

Whether project achievement qualifies as exceptional performance or innovation.

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 highest levels of achievement or implement innovative methods in meeting infrastructure needs 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 Resource Allocation credit.*

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

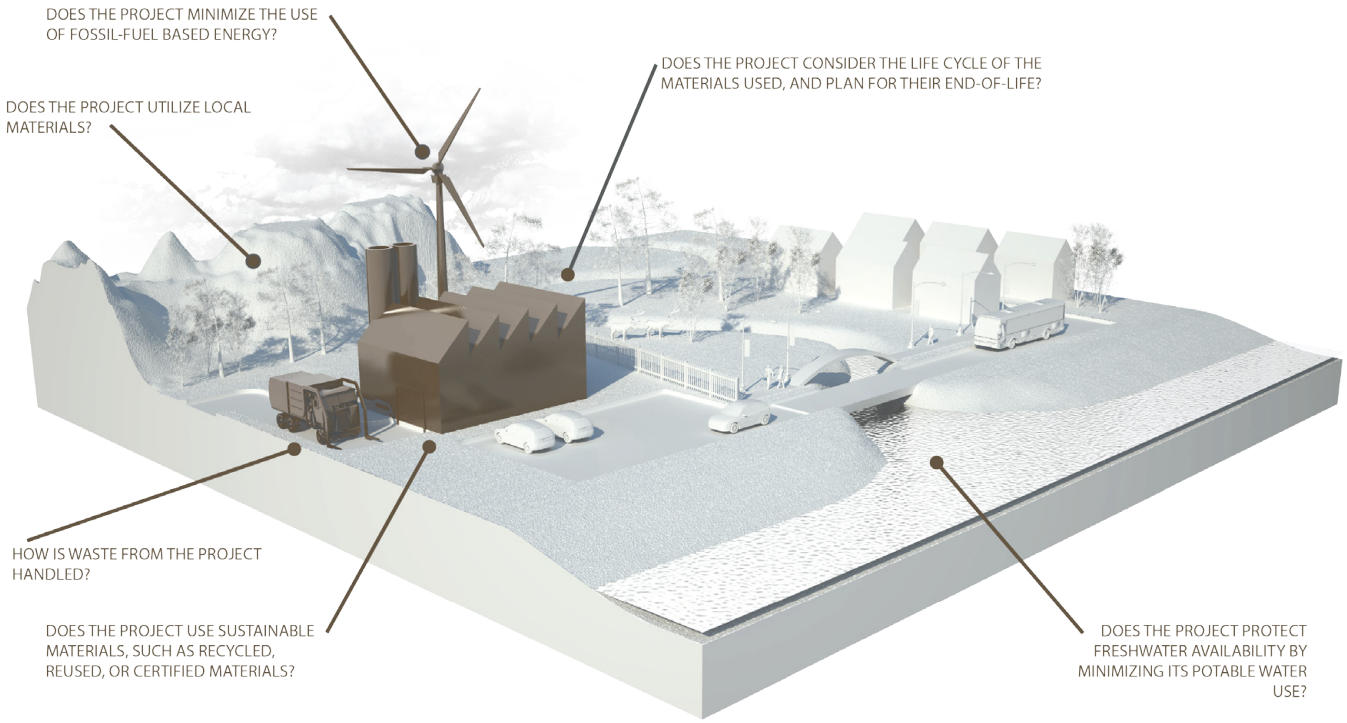
1. *Documentation of the application of innovative technologies or methods. Detailed description as to how this application will improve upon existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered 'innovative' either as a technology, a method, or its application 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 which 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 (construction) and keep it running (operations). 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 in this rating system include physical materials, both those that are consumed and that leave the project, energy for construction, operation, and maintenance, and water use. Each of these materials is finite in its source 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 material used should be a primary consideration for infrastructure projects. Minimizing material use reduces the amount of natural resources that must be extracted and processed, as well as the energy that goes into producing and transporting these materials. Reducing material use must be balanced with safety, stability, and durability. The source of materials matters too. Materials obtained from far away should not be used if the same type and quality of material is available locally. Consideration for the life cycle of the materials should always be given; where it has come from as well as where it will go after its useful life in the project. Other characteristics of materials that make them more favorable for use include: percent of recycled or reused content, ability to be recycled/reused at end of life, durability, and adaptability. These characteristics all help to minimize the total amount of natural resources consumed through materials use.

ENERGY

Reducing overall energy use is crucial, particularly from non-renewable fossil-fuel sources. This energy source is already becoming scarce, and sustainable infrastructure projects should not over-consume a finite energy source. The use of renewable sources of energy is encouraged as a means to minimize fossil fuel consumption, but the ideal project will both reduce overall energy usage and also meet remaining needs with renewable sources if possible.

WATER

With a changing climate and increasing population, future water security is uncertain. Therefore it is critical infrastructure projects reduce overall water use, particularly potable water use. 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 key 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 their extraction, refinement and manufacture. (A)	**(6) 10-40% reductions.** Using the embodied energy data determined by a life-cycle energy assessment, the project team works to design the project so that it produces 10-40% reductions in embodied energy over the project life. This involves reducing the quantity of material, selection of materials with lower embodied energy over the project life. Energy savings are achieved as compared to industry norms. (A, B)	**(12) 41-70% reductions.** Using the embodied energy data determined by a life-cycle energy assessment, the project team works to design the project so that it produces 41-70% reductions in embodied energy over the project life. This involves reducing the quantity of material, selection of materials with lower embodied energy over the project life. Energy savings are achieved as compared to industry norms (A, B)	**(18) >70% reductions.** Using the embodied energy data determined by a life-cycle energy assessment, the project team works to design the project so that it produces greater than 70% reductions in embodied energy. This involves reducing the quantity of material, selection of materials with lower embodied energy over the project life. Energy savings are achieved as compared to industry norms (A, B)	

DESCRIPTION

This objective addresses the need to reduce the large amounts of energy that can be consumed long before a project begins operations. This is energy associated with the extraction, processing, manufacturing, and transport of materials and components. The 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, investing 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' lifespan.

In fulfilling this credit it is required to estimate the net embody energy of project materials. The estimation carried out by means of a life cycle assessment (LCA) includes the required energy for material extraction, transportation, refinement, manufacture and the 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 during the project life. Project teams should consider the durability of materials and systems in order 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 objective will be limited to the materials that make up the majority portion of the constructed works. In order to consider the embodied energy of materials estimated using LCA, consider using the means and methods indicated in the credit appendix. These LCA provide, among other results, estimation on waste production, carbon, and pollutant emissions that can be used on RA1.5, CR1.1 and CR1.2, respectively. For projects pursuing the Envision rating during subsequent phases (construction and operations) the complete results of these LCA will be requested. Project teams pursuing a multiple phase rating may find conducting a single, thorough, and 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.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

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

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

EVALUATION CRITERIA AND DOCUMENTATION

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

1. *Results of the life-cycle energy assessment.*
2. *Documentation demonstrating the assessment was performed in accordance with recognized and accepted methodologies, data sources*

METRIC:

Percentage reduction in net embodied energy from a life cycle energy assessment.

and software. Because of the relative newness of this assessment and the scarcity of information covering embodied energy, the scope of this objective will be limited to the materials that make up the majority portion of the constructed works.

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 life span of the project.*

B. To what extent have the owner and project team reduced the net embodied energy of vhe 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, selection of 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, http://www.canadianarchitect.com/asf/perspectives_sustainibility/measures_of_sustainablity/measures_of_sustainablity_embodied.htm

RELATED CREDITS

RA1.2 Support Sustainable Procurement Practices

RA1.3 Use Recycled Materials

RA1.2 SUPPORT SUSTAINABLE PROCUREMENT PRACTICES

INTENT:

Obtain materials and equipment from manufacturers and suppliers who 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 arguably follow sustainable practices. (A, B)	**(3) Modest sustainable suppliers portfolio.** The project team has a defined program for sustainable procurement. The selection of manufacturers and suppliers uses basic triple bottom line criteria. Up to 25% 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. Up to 50% 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 takeback. Increased emphasis on supplier social and ethical performance. Up to 75% of the purchased materials and supplies meet sustainable procurement policies. (A, B, C, D)	

DESCRIPTION

This objective encourages consideration in specifying materials which protect human health and the environment, contain recycled content, do not use hazardous and toxic materials or VOC-emitting materials, do not contain excess packaging, reduce energy and water use, use renewable energy, and reduce GHG emissions. In fulfilling this credit project teams should seek to purchase materials and supplies that are protective of human health and the environment. Suppliers should be chosen based on the incorporation of sustainability policies and practices into their operations. For example, projects should make efforts to use only wood products certified under a recognized third party sustainable forestry management certification program that meets the credit requirements provided below.

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

- Have reduced negative environmental impacts by implementing an Environmental Management System consistent with ISO 14001 or equivalent.
- Have publicly disclosed all intentionally added chemical constituents and all unintentional chemical residuals or impurities present at 100 ppm 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 in place active programs for performance improvement. 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 the 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 materials specified from 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 the criteria for selection and its breadth of triple bottom line coverage.*

B. To what extent has the project team specified materials from sources been considered?

1. *Documentation the total weight or volume of materials. Cost of materials is also an acceptable measure.*

METRIC:

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

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 (LCA), Environmental Product Declaration (EPD), utility bills, etc.) to demonstrate that sustainable practices are employed for percentage of purchased products.

C. How much of purchased materials and supplies will be certified by reputable 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 heath and safety or environmental violations of the manufacturers or supplier.

SOURCES

- Adapted from 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, http://www.epa.gov/oppt/epp/pubs/products/construction.htm
- Forest Stewardship Council, http://www.fscus.org/
- Sustainable Forestry Initiative, Section 2. SFI 2010-2014 Standard, http://www.sfiprogram.org/

RELATED CREDITS

QL1.2 Stimulate Sustainable Growth And Development

RA1.1 Reduce Net Embodied Energy

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) 5% to less than 20%. 5% to less than 20% by weight or volume of the materials used are from reclaimed or recycled materials. (A, B)	**(5) 20% to less than 50%.** 20% to less than 50% by weight or volume of the materials used are from reclaimed or recycled materials. (A, B)	**(11) 50% to less than 80%.** 50% to less than 80% by weight or volume of the materials used are from reclaimed or recycled materials. (A, B)	**(14) 80% or more.** 80% or more by weight or volume of the 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.

The appropriate re-use of structures and parts of structures can significantly reduce the demand for new construction materials and other environmental burdens resulting from a development. For sites with existing structures and equipment, the project team should conduct an assessment to see whether or not these structures and equipment can be used for the new project. Consideration should be given of 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 should evaluate their efforts to specify significant use of reclaimed or recycled materials for the project. Special consideration should be given to whether these materials meet necessary quality and performance criteria required for the intended application. Recycled or reused materials should not be specified if they pose a risk to human health, safety, or the environment. Efforts should be 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 or volume of the total materials. Project team has limited consideration of obvious reuse opportunities.

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

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent has the project team identified the appropriate reuse of existing structures and materials on site and incorporated them into the project?

1. *Inventory of existing materials or structure that may have reuse potential.*
2. *Design documents showing the location and weight or volume of reused structures or materials. In determining weight or volume project teams may refer to standard equivalents.*

B. To what extent has the project team specified materials with recycled content? (Examples include reclaimed bricks, 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).*

METRIC:

Percentage of project materials that are reused or recycled.

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 risks to human health, safety and 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, and water equipment, and their components, may be excluded from the calculations. In these cases 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.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 5.5: Use recycled content materials.

RELATED CREDITS

LD3.3 Extend Useful Life

RA1.1 Reduce Net Embodied Energy

RA1.2 Support Sustainable Procurement Practices

RA1.4 Use Regional Materials

RA1.4 USE REGIONAL MATERIALS

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) Up to 30% locally sourced. Up to 30% of all materials, plants and soils are sourced in accordance within the distances specified: soils (50 miles), aggregate (50 miles), plants (250 miles), all other materials (500 miles). (A)	**(6) Up to 60% locally sourced.** Up to 60% of all materials, plants and soils are sourced in accordance within the distances specified: soils (50 miles), aggregate (50 miles), plants (250 miles), all other materials (500 miles). (A)	**(9) Up to 90% locally sourced.** Up to 90% of all materials, plants and soils are sourced in accordance within the distances specified: soils (50 miles), aggregate (50 miles), plants (250 miles), all other materials (500 miles). (A)	**(10) Up to 95% locally sourced.** Up to 95% of all materials, plants and soils are sourced in accordance within the distances specified: soils (50 miles), aggregate (50 miles), plants (250 miles), all other materials (500 miles). (A)	

DESCRIPTION

Transportation is a major consumer of fossil fuels and the source of greenhouse gas emissions and other pollutants. Wear and tear reduces the lifespan of transportation infrastructure while 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 supports local economies.

Note that while it is generally desirable to use locally sourced materials for the reasons stated above, the 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 sets the distance requirements for each material type.

Material	Distance Requirement
Soils and mulches	50 miles
Aggregates, Sands	50 miles
Concrete	100 miles
Plants	250 miles
Other materials (excluding equipment)	500 miles

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 does 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.*
   - *Soils: Extraction, harvest or recovery, and manufacture must occur within 50 miles.*
   - *Aggregate: Extraction, harvest or recovery, and manufacture must occur within 50 miles.*
   - *Plants: All growing facilities for the plant must be located within 250 miles.*
   - *All other materials: Extraction, harvest or recovery, and manufacture must occur within 500 miles.*
3. *Calculations of percentage of total project materials by cost that are sourced locally. Reused materials, either onsite or sourced within a 500*

METRIC:

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

mile radius, and materials harvested onsite, 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

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

RELATED CREDITS

RA1.1 Reduce Net Embodied Energy

QL1.2 Stimulate Sustainable Growth And Development

QL1.1 Improve Community Quality Of Life

RA1.5 DIVERT WASTE FROM LANDFILLS

INTENT:

Reduce waste, and divert waste streams away 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

The objective of this credit is to minimize the quantity of waste generated by the constructed works and maximize the opportunities for the waste generated to be recycled or reused. This requires identifying potential sources and destinations for recycling and should include a management plan.

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

Acceptable means of diversion include:

- Waste reduction
- Reuse or recycle materials on site
- Material sent to recycling or reclamation facilities
- Material sent to manufacturers to be used as post-consumer recycled content
- The use of material, if appropriate, as infill

Unacceptable means of diversion include:

- Incineration of materials not classified as bio-mass or for the purpose of energy generation
- Burying waste material unsuited for infill

Materials to be reused on site should not pose risks to human health and safety, and the environment. They should be utilized in a manner that is in compliance with all state and local solid waste agency requirements.

Project teams should note that a useful tool to estimate the anticipated waste generation of a project during operations and maintenance is a streamlined life cycle analysis (LCA). The LCA should be conducted in accordance with the ISO14040, and ISO14044 standards. The results of a streamlined LCA to assess the operation and maintenance phase are also used for credits RA2.1, RA3.2, NW2.3 CR1.1, CR1.2. Conducting this LCA will help project teams better understand relations between RA, NW2, and CR1 credits and aid in advancing to higher levels of achievement. For projects pursuing the Envision rating during subsequent phases (construction and operations) the complete results of these LCA will be requested. Project teams pursuing a multiple phase rating may find conducting a single, thorough, and 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.

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. Some recycling of waste is done, but it is done 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.

METRIC:

Percentage of total waste diverted from disposal.

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

EVALUATION CRITERIA AND DOCUMENTATION

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

1. *Management plan. Waste management plans should document the volume (or weight) of anticipated waste generation. Plans should include waste type, and methods to reduce waste generation. Plans should present anticipated waste reduction compared to industry norms.*
2. *Strategies should be implemented to reduce waste generation and to reuse or recycle waste. In the design phase of the project, there may be instances where 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 have less likelihood of recycling. Project teams should consider not only the quantity of waste being generated but the recyclability of that waste stream as well as it is toxicity.*
3. *Efforts to minimize certain waste streams may make those waste streams unusable and/or uneconomical for recycling or reuse. The objective of the designers should be to reach a balance such that the net amount of waste that is ultimately released or sent to disposal is minimized.*
4. *Documentation that contractors, sub-contractors, and operators are onboard, aware of waste sorting requirements, and committed to achieving the 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 the 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, 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.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 7.4: Divert construction and demolition materials from disposal.

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 30 to 50%. Percentage of excavated material suitable for reuse beneficially reused on site. (A)	**(4) Reuse 51 to 80%.** Percentage of excavated material suitable for reuse beneficially reused on site. (A)	**(5) Reuse 81 to 95%.** Percentage of excavated material suitable for reuse beneficially reused on site. (A)	**(6) Reuse 96 to 100%.** 100% of excavated material suitable for reuse retained and reused on site. (A)	

DESCRIPTION

Transporting soils is economically expensive and environmentally damaging. Trucks transporting soils emit greenhouse gases, and changing site topography can alter runoff patterns, increasing erosions and damaging down-stream aquatic environments.

During planning and design, projects should 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 15% 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 of industry norms and estimations of the excavated material taken off site.*
2. *Design documents demonstrating how the project was designed to balance cut and fill.*
3. *Calculations of the percentage of useful material retained on site over the industry norm case.*

SOURCES

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

RELATED CREDITS

NW3.3 Restore Disturbed Soils

CR1.1 Reduce Greenhouse Gas Emissions

METRIC:

Percentage of excavated material retained on site.

RA1.7 PROVIDE FOR DECONSTRUCTION AND RECYCLING

INTENT:

Encourage future recycling, up-cycling, and reuse by designing for ease and efficiency in project disassembly or deconstruction at the end of its useful life.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Basic end of life consideration. Disassembly, deconstruction and recycling or up-cycling are minimally considered. Generally between 15% and 30% of the components or pre-fabricated units can be easily separated for reuse or recycling and it is reasonable to assume 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 between 30% and 50% of the components or pre-fabricated units can be easily separated for disassembly or deconstruction and it is reasonable to assume they will be. (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 between 50% and 75% of the components or pre-fabricated units can be easily separated for disassembly or deconstruction and it is reasonable to assume they will be. (A, B)	**(12) True design for end of life.** The project team expands opportunities for up-cycling of materials, structures and equipment. More than 75% of the components or pre-fabricated units can be easily separated for disassembly or deconstruction. (A, B)	

DESCRIPTION

The purpose of this credit is to ensure that when a civil works or structure reaches the end of its useful life, usable components are re-used or recycled. 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 component to separate the materials for re-use.

Examples for 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, as it will make recycling more effective.

Credit is given for designing the project so that at the end of its useful life, the constructed works can be readily deconstructed and disassembled to enable materials and equipment reuse and up-cycling. Note that up-cycling may require the use of additional materials so that the end-of-life components and materials remain in a useful state. Designing for materials reuse and up-cycling may run counter to objectives for reducing materials intensity.

In fulfilling this credit project teams should consider the full range of challenges in designing for future disassembly and deconstruction. Plans and arrangements should be made to identify, track, and communicate at the appropriate time the components and pre-fabricated units that have been designed for disassembly and/or deconstruction. Materials, structures, and equipment should be designed and specified based on their ability to retain some value in the future through recycling, up-cycling, or reuse.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Stay within traditional project boundaries. No special consideration given to material end-of-life.

Performance improvement: Expand the scope to include more life cycle elements beyond construction, moving outside normal 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 up-cycling of materials and equipment.

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 retains some value for future use, i.e., up-cycling. 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 or weight or volume likely to be recycled at 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 project teams expectations on recyclability are reasonable.*

METRIC:

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

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

1. *Plans and arrangements to identify, keep track of and communicate at the appropriate time the components and pre-fabricated units that have been designed for disassembly and/or deconstruction.*
2. *Design documents showing efforts to minimize adhering recyclable material to non-recyclable 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. Documentations that materials will retain their recyclability through the end o project life.*

SOURCES

- Adapted from 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.
- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

RELATED CREDITS

LD3.3 Extend Useful Life

LD3.1 Plan For Long-Term Maintenance And Monitoring

RA1.3 Use Recycled Materials

RA2.1 REDUCE ENERGY CONSUMPTION

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) 10% to 30%. 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 constructed works. Operational energy reductions are estimated at 10% to 30% as compared to industry norms. (A, C)	**(7) 31% to 50%.** 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 constructed works. Operational energy reductions are estimated at 31% to 50% as compared to industry norms. (A, B, C)	**(12) 51% to 70%.** 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 constructed works. Operational energy reductions are estimated at 51% to 70% as compared to industry norms. (A, B, C)	**(18) Greater than70%.** 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 constructed works. Operational energy reductions are estimated at greater than 70% as compared to industry norms. (A, B, C)	

DESCRIPTION

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

The owner and the project team should take a "whole systems design" approach when considering options. They should 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 credit RA2.1 special attention should be given to calculating or simulating the project's annual energy consumption in order to achieve a reduction in operational energy over industry norms. If applicable the project team may use the ASHRAE standards in calculating their anticipated energy consumption as well as the industry base case. The assessment should include all energy consumption related to functions typically defined for carbon emission as scope one and scope two. Scope one should include energy generated onsite 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 should be included in these calculations.

It is recommended, but not required, that project teams conduct a streamlined life cycle assessment (LCA) to assess the operation and maintenance phase, in accordance with the ISO14040, and ISO14044 standards. This LCA presents among the results the overall energy required during operations. The results of this LCA may also be used for credits RA1.5, RA3.2, NW2.3, CR1.1, and CR1.2. Conducting this LCA will help project teams better understand the relationship between RA, NW2, and CR1 credits and aid in advancing to higher levels of achievement. For projects pursuing the Envision rating during subsequent phases (construction and operations) the complete results of these LCA will be requested. Project teams pursuing a multiple phase rating may find conducting a single, thorough, and 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.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Meets basic code and regulatory requirements in regard to energy consumption.

Performance improvement: Specify energy efficient equipment and processes and incorporate systems level thinking early in the design process to revaluate energy needs and processes and significantly reduce energy consumption throughout the project as 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 constructed works?

METRIC:

Percentage of reductions achieved.

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

B. Have the owner and project team conducted feasibility and cost analysis 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 into 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. The appropriateness of the comparison will be assessed by the project verifier. All energy sources should be converted into BTU.*
2. *Submit calculations for the projects 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 BTU.*

SOURCES

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

RELATED CREDITS

RA2.2 Use Renewable Energy

RA2.3 Commission And Monitor Energy Systems

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

RA2.2 USE RENEWABLE ENERGY

INTENT:

Meet energy needs through renewable energy sources.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(4) 10 to 25% renewables. Utilization of up to 25% renewable energy resources used in the completed works. (A)	**(6) 26 to 40% renewables.** Utilization of 26 to 40% renewable energy resources used in the completed works. (A)	**(13) 41 to 80% renewables.** Utilization of 41 to 80% renewable energy resources used in the completed works. (A)	**(16) 81 to 100% renewables.** Utilization of 81 to 100% renewable energy resources used in the completed works. (A)	**(20) Net positive renewables.** 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 off-site renewable energy sources, such as wind farms, large hydroelectric, 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 non-traditional 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 is 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 RA 2.1 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 (use as a fuel).*

SOURCES

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

RELATED CREDITS

RA1.1 Reduce Net Embodied Energy

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

METRIC:

Extent to which renewable energy resources are incorporated into the design, construction and operation.

RA2.3 COMMISSION AND MONITOR ENERGY SYSTEMS

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
	(3) One time monitoring. 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. (A)		**(11) Long-term 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, C)	

DESCRIPTION

This credit recognizes that user behavior is the primary factor in energy performance. Systems designed to be energy efficient often fail due to 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 commissioning authority is independent of both the design and construction team.

B. To what extent have the project team assembled the necessary information needed to train operations and maintenance workers in a way that facilitates proper training and operations?

1. Documentation of materials provided for operations and maintenance.

C. To what extent 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 capable of monitoring, at minimum, all primary project functions accounting for at least an accumulated 80% of energy use.

2. Rationale as to how the monitoring equipment may enable more efficient operations over the industry norm.

RELATED CREDITS

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

CR1.1 Reduce Greenhouse Gas Emissions

CR1.2 Reduce Air Pollutant Emissions

METRIC:

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

RA3.1 PROTECT FRESH WATER AVAILABILITY

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) No immediate negatives. The design team determines how much fresh water will be used by the project both during construction and operations. Look for 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 withdraw on receiving waters 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. Freshwater supplies are replenished at 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.** Replenishes the quantity and quality of fresh water surface and groundwater supplies to an agreed upon undeveloped, native ecosystem condition. Discharges to surface waters of fresh water after use, meets historic pre-development seasonal cycles of quality and quantity, including temperature. (A, B, C, D)

DESCRIPTION

The objective of this credit is to address the increasing demands for fresh water by agricultural, municipal and industrial users. These demands combined with the normal variability in the hydrologic cycle can affect water availability, quantity and quality. Fresh water, ground water, and surface waters are being used at a rate faster than they are being naturally replenished. Groundwater mining is allowing salt water intrusions into groundwater sources in some areas. Land use practices are affecting the quality of surface and ground water supplies. Increased discharges of fresh water to coastal areas can affect the salinity rate of coastal habitats. Future variability due to the effects of climate change is expected. The U.S. Environmental Protection Agency notes 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 agriculture irrigation, hydropower, flood management, fisheries, recreation and navigation (Source: U.S. EPA, "Water Availability", http://epa.gov/climatechange/effects/water/availability.html).

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 ground water sources and impact the salinity of coastal waters.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

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

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

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent have the owner and project team conducted a water availability assessment?

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

B. Have 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 fresh water supply.*
   3. *Inventory of opportunities for water reuse or groundwater recharge on site.*
   4. *Calculations of the volume of fresh water discharge after use.*
   5. *Location of discharge and impact of discharge on receiving water quality and quantity, including temperature and salinity.*

METRIC:

The extent to which the project uses fresh water resources without replenishing those resources at its source.

C. To what extent 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 which the project is not able to mitigate.*

D. Does the project achieve a net positive water impact replenishing the quantity and quality of fresh water 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.

RELATED CREDITS

RA2.1 Reduce Energy Consumption

RA3.2 Reduce Potable Water Consumption

NW1.2 Preserve Wetlands And Surface Water

NW1.4 Avoid Karst Topography

NW1.5 Preserve Floodplain Functions

NW2.1 Manage Stormwater

NW2.2 Reduce Pesticide And Fertilizer Impacts

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) 25% reduction. The design team focuses on reduction of potable water use, to reduce non-replenishable potable water use by at least 25%. Reductions are estimated over industry norms. (A, B, C)	**(9) 50% reduction.** The design team focuses on reduction of potable water use, to reduce non-replenishable potable water use by at least 50%. Reductions are estimated over industry norms. (A, B, C)	**(13) 75% reduction.** The design team focuses on reduction of potable water use, to reduce non-replenishable potable water use by at least 75%. Reductions are estimated over industry norms. (A, B, C)	**(17) 100% reduction.** The design team focuses on reduction of potable water use, to reduce non-replenishable potable water use, to zero. Reductions are estimated over industry norms. (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 quickly becoming a precious resource. Estimates are that over 40 countries will become embroiled in water related conflicts in the next twenty years. The over use of water not only depletes water bodies 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 non-potable water. Advanced recycling and reuse is encouraged. Project teams should verify water supply and replenishment if supply and wastewater is 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 should be considered alternatives to potable water use. If projects choose to filter water to up-cycle they should take into consideration the potential energy tradeoffs.

As mentioned in credits RA1.5 and RA2.1, it is recommended, but not required, that project teams conduct a streamlined life cycle assessment to assess the operation and maintenance phase, in accordance with the ISO14040, and ISO14044 standards. This LCA presents among the results the overall water consumption during this phase. The results of a streamlined LCA to assess are also used for credits RA1.5, RA2.1, NW2.3 CR1.1, and CR1.2. Conducting this LCA will help project teams better understand relations between RA, NW2, and CR1 credits and aid in advancing to higher levels of achievement.

For projects pursuing the Envision rating during subsequent phases (construction and operations) the complete results of these LCA will be requested. Project teams pursuing a multiple phase rating, or multiple credits that require assessment, may find conducting a single, thorough, and 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 projects end of life.

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: Strategies in the design to not only include water efficient equipment and fixtures but utilize opportunities to reuse stormwater or greywater. Reductions may be accomplished through design, construction and operational changes through conservation and/or the ability to use, treat and/or reuse non-potable water. Reductions are estimated over industry norms.

EVALUATION CRITERIA AND DOCUMENTATION

A. To what extent 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 non-potable water, recycled greywater, and stormwater?

1. *Reports, memoranda, minutes of meetings with project teams and owner regarding water reduction strategies.*
2. *Design documents of the projects water needs. Submissions may reference documents RA3.1 B.*

METRIC:

Percentage of water reduction.

B. Have the owner and project team conducted feasibility and cost analysis to determine the most effective methods for potable water reduction and incorporated them into 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 into 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. The appropriateness of the comparison will be assessed by the project verifier.*
2. *Calculations of the estimated annual water consumption over the life of the project. Document the percentage reduction over the industry norm benchmark. Calculations may omit non-potable water use such as recycled greywater, or natural surface water and groundwater withdrawals and rainwater, if abundant, with minimal or no impact on site or adjacent sites. Designs for utilization of greywater and, rainwater if appropriate, should be encouraged. Note the use of surface and groundwater reduces the energy necessary to treat and transport potable water but should not be considered if the use of these waters will have impact on water availability or quality (see credit RA3.1 Protect Water Availability).*

D. Does the project result in a net positive generation of water, and water upcycling, as a result of on-site 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 non-potable sources, and provides an available source of useable water (potable or non-potable) for neighboring projects or communities to offset their own water needs.*

RELATED CREDITS

RA2.1 Reduce Energy Consumption

RA3.1 Protect Water Availability

NW2.1 Manage Stormwater

RA3.3 MONITOR WATER SYSTEMS

INTENT:

Implement programs to monitor water systems performance during operations and their impacts 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 in order to validate the 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 into the design and operation of the project to enable long-term water quality monitoring and reporting of surface and groundwater quantity and quality. Data will be submitted to the International Stormwater BMP Database. 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 a responsive management improving efficiency, reducing negative impacts and conserving water resources both in quantity and quality. (A, B, C)	

DESCRIPTION

Monitoring water systems and ensuring the proper and efficient operation helps both finances 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 validation is the first step toward achieving sustainability goals. Monitoring programs should also be 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. Has the owner and project team engaged an independent entity to monitor or oversee the monitoring of the whole system or 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 is periodically checked by an independent authority.*

B. To what extent 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 of monitoring the water flow of, at a minimum, all major project functions.*
2. *Design documents and specifications identifying the installation of leak detection systems, when appropriate, and water quality collection points.*

C. To what extent 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 BMPs 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.

METRIC:

Documentation of system in the design

RELATED CREDITS

RA3.1 Protect 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 which advance the state of the art for sustainable infrastructure.

LEVELS OF ACHIEVEMENT

INNOVATION
(+8) Innovate or exceed credit requirements. 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, novel either in their use, their application, or within the local regulatory or cultural climate.

DESCRIPTION

This objective 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 in regards to sustainability. These points are not calculated in the overall available points and therefore act as 'bonus' points. Given the nature of the credit, whose broad format is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Verifiers will take a more involved role in assessing achievement and project teams should be confident in the project's ability to meet expectations before applying.

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For example, project 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 case exceptional performance may be pursued by projects whose magnitude of preservation, and investment in restoration, is a significant percentage of the project budget and a primary objective of the project. Verifiers will determine whether the magnitude of the effort exceeds the expectations for the current Restorative achievement level.

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 whose 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 major contribution to the quality of the community.
- A project whose impact will fundamentally change the ability of community residents to access and use sustainable means of transportation on a large scale.

Innovation is not encouraged for the sake of novelty. Projects should demonstrate that through the innovative approach the project has achieved at least one of two 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 utilize innovative technology, methods, or application. For example, 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.

Possible areas of achievement in innovation may include, but are not limited to, the following:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs.
- The project employs 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

METRIC:

Whether project achievement qualifies as exceptional performance or innovation.

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 highest levels of achievement or implement innovative methods in meeting infrastructure needs 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 Resource Allocation credit.*

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

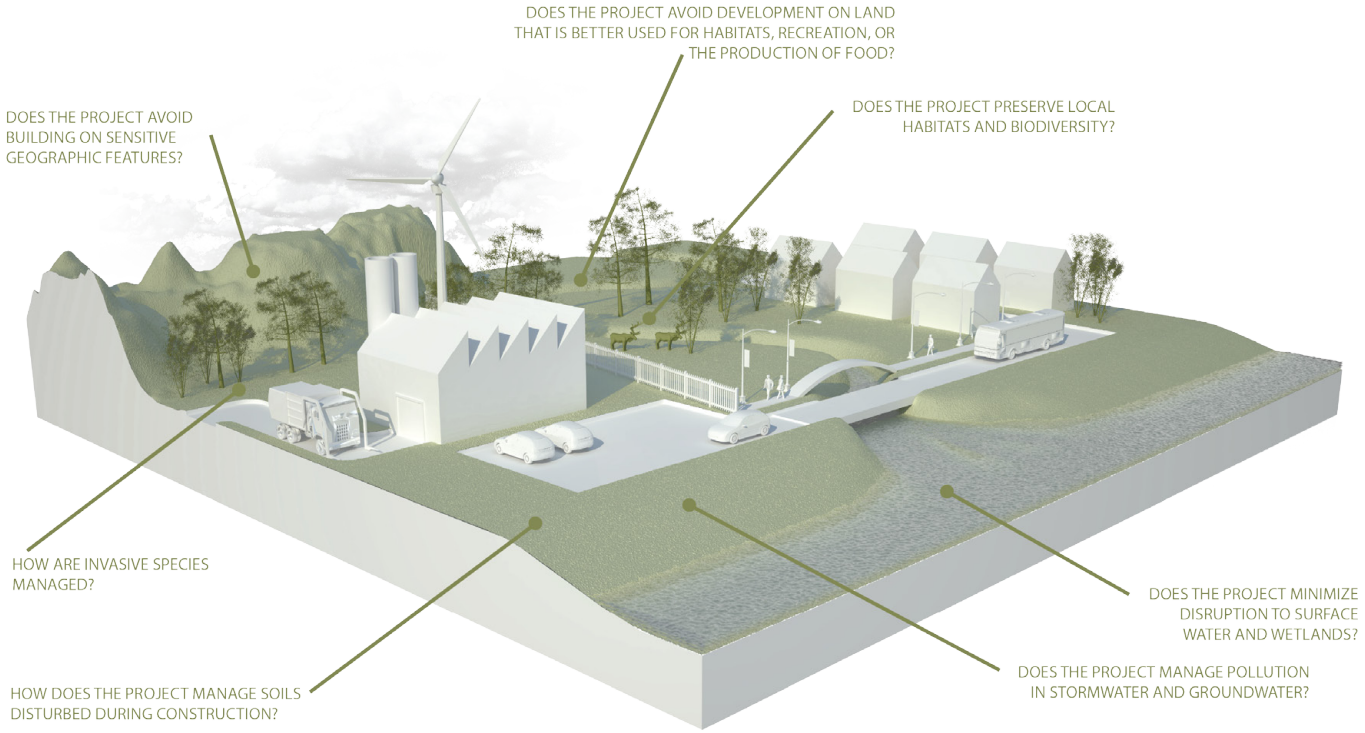
1. *Documentation of the application of innovative technologies or methods. Detailed description as to how this application will improve upon existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered 'innovative' either as a technology, a method, or its application 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 which 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— the habitats, species, and non-living natural systems. The way a project is located within these systems and what new elements they may introduce into 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 the three sub-categories of *Siting*, *Land and Water,* and *Biodiversity*.

SITING

Infrastructure should be sited to avoid direct and indirect impacts on important ecological areas. Projects should avoid areas of high ecosystem value or that serve as a diverse habitat, such as water bodies, wetlands, or temporary waters (vernal pools, etc.). 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 have minimal impact on existing hydrologic and nutrient cycles. Special care should be taken to avoid the introduction of contaminants whether through stormwater runoff or pesticides and fertilizers. With proper forethought 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 each project and site shares in the responsibility for protecting the quality of the larger system.

BIODIVERSITY

Infrastructure projects should also minimize negative impacts on natural species and their habitats; on and near the site. Care should be taken to avoid introducing invasive species or inadvertently facilitating their spread. Infrastructure projects should minimize habitat fragmentation and promote habitat connectivity and animal movement. Species of new vegetation should be carefully selected and appropriate for the location. Infrastructure should not adversely impact wetland surface water quality, as these tend to provide ecosystems that support a high degree of natural biodiversity.

1 SITING

NW1.1 Preserve Prime Habitat

NW1.2 Preserve 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 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 the use 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 ft. 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 should involve 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 due to 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. All play important roles in maintaining biodiversity by providing crucial habitat for wildlife.

Through construction, noise, light pollution, removal of vegetation, and other practices, infrastructure projects can have negative effects on these areas and local biodiversity. Infrastructure impacts can affect off-site areas as well.

Siting infrastructure projects to prevent and minimize direct and indirect impacts is crucial. Problems associated with a poorly sited project are very difficult to correct after construction; preventing impacts by selecting appropriate sites during planning is significantly more effective.

Multiple third parties already have identified and defined definitions and programs for forestry protection, including the Sustainable Forestry Initiative, Forest Stewardship Council, and the Canadian Standards Association. These standards may be used in this credit for definitions of 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 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)?

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, or national prime habitat information.*
2. *Documentation demonstrating no areas of prime habitat are located on-site or within the specified distance of developed areas.*

B. Does the project preserve, at 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 requirements above, 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.*

METRIC:

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

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 who 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 CREDITS

QL22 Minimize Noise and Vibration

QL2.3 Minimize Light Pollution

NW1.2 Preserve Wetlands and Surface Water

NW1.2 PROTECT WETLANDS AND SURFACE WATER

INTENT:

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

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Avoid development or buffer >50 feet. Avoid development on sites that contain or are located within 50 feet of wetlands, shorelines, or water bodies. 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, non-native vegetation removal, and grading, filling, dredging, or excavation. (A, B)	**(4) Buffer > 100 feet.** Establish a vegetation and soil protection zone (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) Buffer > 200 feet.** Establish a vegetation and soil protection zone (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) Buffer >300 feet.** Establish a vegetation and soil protection zone (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 points awarded for buffering, project may earn up to 4 points for restoring previously degraded buffer zones to a natural state as part of establishing the VSPZ. (A, B, C)

DESCRIPTION

Wetlands, shorelines, and water bodies provide a number of important ecological services, including mitigating flooding, improving water quality, and providing wildlife habitat. Maintaining the integrity of water bodies and wetlands requires more than simply protecting the water body itself from adverse impacts of infrastructure and related development; protecting upland areas is critical as well. A buffer zone around wetlands and water bodies plays particularly important roles in:

- 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 surfaces sources into 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 ground water 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 soil protection zones (VSPZ) while shifting from protection to restoration. Delineate and protect wetlands and other aquatic habitats regardless of size or connectivity.

EVALUATION CRITERIA AND DOCUMENTATION

A. Is the project located on a site that neither contains nor is located within the specified distance of vernal pools, wetlands, shorelines, or water bodies unless located on a previously developed site?

   1. *Documentation that the proposed site neither contains nor is within the specified distance of a wetland, vernal pool, shoreline or water body or other aquatic resource.*

B. If the site contains wetlands or water bodies, has the project team established a vegetation and soil protection zone (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, water body, or shoreline.*

METRIC:

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

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 including, at a minimum a site map outlining locations of restoration, and proof that both required action types were taken. Restoration must include:

- *Stabilization of stream channel or shoreline. (Bulkheads are not an acceptable stabilization measure for this objective), and*
- *Re-vegetation with native plant communities. Stream channel restoration must include a geomorphic analysis of the reach and the planning for dynamical stable stream banks, based on channel dynamics and sediment transport.*

SOURCES

- Adapted from 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 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

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 percent 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 percent 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. (C)

DESCRIPTION

America's agricultural land provides the nation—and world—with an unparalleled abundance of food and fiber products. The dominant role of U.S. agriculture in the global economy has been likened to OPEC's in the field of energy. The food and farming system is important to the balance of trade and the employment of nearly 23 million people. Across the country, farmland supports the economic base of many rural and suburban communities.

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, ground- water recharge and carbon sequestration.

Yet despite its importance to individual communities, the nation and the world, American farmland is at risk. It is imperiled by poorly planned development, especially in urban- influenced areas, and by the complex forces driving conversion. USDA's Economic Research Service (ERS) 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 percent of dairy products and 86 percent 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 almost doubled. Most of this land is outside of existing urban areas. Since 1994, lots of 10 to 22 acres accounted for 55 percent of the growth in housing area. The NRI 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 SSURGO soil surveys (http://soildatamart.nrcs.usda.gov/). For areas of 10,000 acres or less use the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). [Taken from "Why Save Farmland", Farmland Information Center Fact Sheet, American Farmland Trust, 1200 18th Street, NW, Suite 800 Washington, DC 20036. January 2003, accessed at http://www.farmlandinfo.org/documents/28562/Why_Save_Farmland_1-03.pdf]

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team checks to see if any of the soils on site have been designated by the NRCS as prime farmland, unique farmland, or farmland of statewide importance.

Performance improvement: Shift from protection to preservation, e.g., no development on prime farmland. Note that restoration of land to prime farmland is very difficult.

EVALUATION CRITERIA AND DOCUMENTATION

A. Have the project owner and the project team assessed the project site and determined whether or not the on-site soils have been identified as prime

METRIC:

Percentage of prime farmland avoided during development.

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 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

- Adapted from 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), http://www.nrcs.usda.gov/programs/fppa/pdf_files/FPPA_Law.pdf.

RELATED CREDITS

QL1.1 Improve Community Quality of Life

QL1.2 Stimulate Sustainable Growth and Development

QL3.2 Preserve Views and Local Character

RA1.6 Reduce Excavated Materials Taken Off Site

NW1.4 AVOID ADVERSE GEOLOGY

INTENT:

Avoid development in adverse geologic formations and safeguard aquifers to reduce natural hazards risk and preserve high quality groundwater resources.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Comprehensive delineation. Prior to 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 due to ground motion, tsunami flooding and collapse of karst areas and associated aquifer damage, or from the hazards of these areas, e.g., subsidence, sinkholes, flooding. Operating procedures for the constructed works 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. (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. In contrast, karst topography can be considered a green infrastructure resource, as it may 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.

Karst hydrogeology is made up of a complex network of interconnected fissures, fractures and conduits formed in a low-permeability limestone. Groundwater flows through and is stored within this formation. Faults and cavities can also form an efficient conduit for contamination from landfills, hazardous material spills, stormwater runoff, and uncontrolled dumping. Once contaminated, aquifers are extremely difficult to clean up.

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 location of the project site relative to these features.*

B. Has the project team developed plans and designs to reduce the risk of damage, establish operating procedures, and establish a monitoring program for adverse geologic settings?

   1. *Documentation of design of the project that illustrates strategies used to avoid damage to or damage, 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 illustrating 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 and 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 maintained.

SOURCES

- I-69 Planning Toolbox, http://www.in.gov/indot/div/projects/i69planningtoolbox/natres.html

RELATED CREDITS

CR 2.4 Prepare for Short-Term Hazards

NW1.5 PRESERVE FLOODPLAIN FUNCTIONS

INTENT:

Preserve floodplain functions by limiting development and development impacts 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 water dependent infrastructure that must cross or be adjacent to a waterway. Design water dependent infrastructure to minimize floodplain impacts or waterway crossings. 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 the vegetation and soil protection zones (VSPZs). 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 storm water 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 floodplain. (A, B, C)	**(14) Enhance connectivity and sediment transport.** Modify or remove structures frequently damaged by floods. The project is designed to not inadvertently trap sediment and allow fish passage through project reach. If repeatedly damaged structures are in project reach they are removed or modified to reduce potential for flood damages. (A, B, C, D)	

DESCRIPTION

Impervious surfaces increase storm water runoff volume, increase stream temperatures, and increase 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 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 due to 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 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 that pre- and post-floodplain storage and floodplain elevations and show that the project does not increase flood elevations outside of project easements and maintain floodplain storage.*

B. Does the project maintain pre-development floodplain infiltration and water quality?

1. *Documentation of strategies used to maintain pre-development floodplain infiltration, such as amount of impervious surfaces, established vegetation and soil protection zones, and other strategies 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 above-described strategies.*

C. Does the project maintain or enhance riparian and aquatic habitat and the maintenance or enhancement of the riparian and in-channel physical and vegetative habitat to support threatened and endangered or otherwise desirable species? Has a flood emergency plan been prepared for all infrastructure in the floodplain accounting for emergency operations and/or evacuation?

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

METRIC:

Efforts to avoid floodplains or maintain predevelopment floodplain functions.

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

D. Does the project maintain or enhance aquatic habitat connectivity and sediment transport? Is infrastructure subject to frequent damage by floods being modified or removed?

1. *Documentation of strategies used to maintain or enhance aquatic habitat connectivity, fish and sediment transport, including removal of barriers and traps.*
2. *Inventory of flood damaged infrastructure and plan/design to modify or remove flood-damaged infrastructure.*

SOURCES

- Adapted from 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 CREDITS

NW1.2 Protect Wetlands and Surface Water

NW2.1 Manage Stormwater

NW2.3 Prevent Surface and Groundwater Contamination

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 in order to avoid exposures and risks from erosion and landslides, and other natural hazards.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) Best practices. 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 works to control erosion and prevent landslides. Add protection to downslope buildings, facilities and infrastructure from erosion and landslides. (A)		**(4) Optimal project siting.** 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. (A, B)	**(6) Steep slopes avoided.** 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. No hillsides or steep slopes to contend with in the design and operation. (C)	

DESCRIPTION

Hillsides and steep slopes are part of the natural beauty of the 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. However, if improperly developed, hillsides and steep slopes can increase the potential for erosion and landslides. These features also present a greater danger from fires, as 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, are also more expensive due to the challenges of the terrain.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Follow local regulations and 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 selection of site.*

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 final site selected.*

SOURCES

- I-69 Planning Toolbox, Hillside/Steep Slope Protection, http://www.in.gov/indot/div/projects/i69planningtoolbox/_pdf/Hillside_Steep%20Slope%20Protection.pdf

RELATED CREDITS

QL3.2 Preserve Views and Local Character

NW1.4 Avoid Karst Topography

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 constructed works as well as other downslope structures.

NW1.7 PRESERVE GREENFIELDS

INTENT:

Conserve undeveloped land by locating projects on previously developed greyfield sites and/or sites classified as brownfields.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) At least 25% greyfield site. At least 25% of the developed area of the project is to be located on a greyfield site. (A)	**(6) At least 50% greyfield site.** At least 50% of the developed area of the project is to be located on a greyfield site. (A)	**(10) At least75% greyfield site.** At least 75% of the developed area of the project is to be located on a greyfield site. (A)	**(15) 100% greyfield site.** 100% of the developed area of the project is to be located on a greyfield site. (A)	**(23) Use a brownfield.** The project is located on a brownfield site; a site documented as contaminated by means of an ASTM E1903-11 Phase II Environmental Site Assessment or a local voluntary cleanup program; or defined as a brownfield by a local, state, or federal government agency. Remediation measurers should be sufficient for the planned future use of the site. (B, C)

DESCRIPTION

Selecting previously developed sites rather than greenfield sites often has reduced impacts on wildlife (minimizes likelihood of new habitat fragmentation and reduces 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; greenfield sites may not be); and reduces the pressures on development for greenfield sites. This does not apply to a street, roadway, or altered landscapes resulting from current agricultural use, forestry use, or use as preserved natural area.

While the term greyfield in some contexts may mean underutilized or abandoned sites, this credit defines all previously developed sites as greyfields. Previously developed sites consist of at least 75% of the site area that has preexisting paving, construction, or altered landscapes. This does not apply to a street, roadway, or altered landscapes resulting from current agricultural use, forestry use, or use as preserved natural area.

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 under-utilized sites can pose environmental and health risks to their communities (including water contamination and illness). Cleaning up contamination benefits the local environment and community.

Additional considerations:

- If possible, projects should be located in areas designated or recognized as urban core/desired development zones.
- Projects should promote urban development channel development to urban areas to reduce pressure on undeveloped land, reduce resource consumption, and promote social and economic urban and neighborhood revitalization. This includes improvement of safety, creation of short- and long-term local jobs, and creation of, preservation of, or addition of parks or other recreational property used for nonprofit purposes.
- Projects should include restoration of impaired drainageways and other damaged or stressed natural resources.
- Projects should positively impact historically- and economically-disadvantaged urban populations.
- Projects should make adaptive use of existing underground and aboveground structures, including buildings, utility and roadway infrastructure.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project site selected is a greenfield site, i.e., a site where no previous development is taking place. Little or no efforts were made to location the project on a greyfield or brownfield site.

Performance improvement: Site the project to include increasing amounts of previously developed site or select a brownfield site and conduct the necessary cleanup or mitigation measures.

METRIC:

Percentage of site that is a greyfield or the use and cleanup of a site classified as a brownfield.

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 according to a ASTM E1903-11 Phase II Environmental Assessment or on a site deemed a brownfield by local, state, or federal government agencies?

1. Documentation of brownfield status of site. Either documentation of the local, state, or federal agency designation or results from an ASTM E1903-11 Phase II Environmental Assessment of the site confirming contamination will suffice.

C. Has a brownfield remediation plan been prepared according to the ASTM report?

1. Documentation that the controlling public authority has approved proposed remediation measures for the site.

SOURCES

- Adapted from 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

RELATED CREDITS

QL3.2 Preserve Views and Local Character

NW1.1 Preserve Prime Habitat

NW1.3 Preserve Prime Farmland

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. Project employs low impact development (LID) measures to reduce generation of storm runoff to pre-development conditions. The target water storage capacity for greyfields, 30% improvement in water storage capacity. For brownfields, 20% improvement. Greenfields site maintains 100%. (A)	**(9) Extended storage capacity.** Project employs low impact development (LID) measures to reduce generation of storm runoff to pre-development conditions. The target water storage capacity for greyfields, 60% improvement in water storage capacity. For brownfields, 40% improvement. Greenfields site maintains 100%. (A)	**(17) Sustainable stormwater management.** Project employs low impact development (LID) measures to reduce generation of storm runoff to pre-development conditions. The target water storage capacity for greenfields is the pre-development water storage capacity. For greyfields, 90% improvement in water storage capacity. For brownfields, 60% improvement. (A)	**(21) Enhanced stormwater management.** Project employs substantial low impact development (LID) measures to reduce generation of storm runoff. Runoff is maintained on site and/or exceeds undisturbed climax ecosystem. Stormwater management programs and storm water handling structures are designed to capture and repurpose more than 100% of storm water 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 surface reduces the amount of stormwater that infiltrates into 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%

Adapted from 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 draining into waterbodies, 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 (LID) measures can be incorporated into the design to reduce these negative impacts associated with increased runoff. Designs attempt to maintain or restore the water storage/infiltration ability of a site through infiltration, evapotransporation, water harvesting, and cistern storage. These may include: 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, pollution prevention and good housekeeping. Many of these features also provide some level of treatment of the runoff, filtering pollutants and cooling runoff water before reaching the receiving waterway, maintaining or restoring groundwater input to the waterway. LID measures do not include stormwater ponds that store but do not infiltrate stormwater, increasing the temperature of stormwater discharged to receiving waterways.

The TR-55 methodology can be used in conjunction with previously published work to determine target percent improvement in a site's infiltration/evapotranspiration/water harvest capacity or that these methods 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 CNs or other continuous simulation modeling methods to describe site conditions. Adequate documentation regarding the methods employed and the results obtained must be submitted. For the purposes of this credit, the target water storage capacity is defined as follows:

- 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 CNs has been established for the various climates across the US to represent pre-development conditions.

METRIC:

Infiltration and evapotranspiration capacity of the site and return to pre-development capacities.

- Humid East Coast (e.g. Raleigh) - 70
- Humid Midwest (e.g. Chicago) - 70
- Humid West Coast (e.g. Portland) - 70
- Semiarid West (e.g. Denver) - 60
- Arid Southwest (e.g. Los Angeles) - 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 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 baseflow, nutrient cycling, sediment transport and groundwater recharge occur. For example, water harvesting techniques should not be used that "starve" the receiving systems of adequate flows necessary to maintain the ecological function of the downstream waters.

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 SWPPP (Stormwater Pollution Prevention Plan) or ESC (Erosion and Sedimentation Control Plan)—for all construction activities associated with the project. The plan (SWPPP or ESC) shall conform to erosion and sedimentation requirements of the 2003 (or most current version) EPA 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 established for pre-development conditions.

EVALUATION CRITERIA AND DOCUMENTATION

A. What percentage 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 CNs or other continuous simulation modeling methods to describe site conditions.*

B. Is 100% of the target water storage capacity is achieved for greyfield and brownfield sites, or does the greenfield site exceed 100% target water capacity so as 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 CNs or other continuous simulation modeling methods to describe site conditions.*

SOURCES

- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 3.5: Manage stormwater onsite.

RELATED CREDITS

NW2.3 Prevent Surface and Groundwater Contamination

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, or by eliminating the need for the use of these materials.

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 as not to over-apply. Runoff controls are put in place to minimize contamination of ground 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 increased 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 the landscaping to incorporate plant species that require no pesticides, herbicides and fertilizers. Increased use of composting. Practice integrated pest management. (D)	

DESCRIPTION

Pesticides and fertilizers are a major non-point source pollutant and whenever possible their use should be reduced or eliminated. A persistent problem is the over-application of pesticides and fertilizers. These chemicals can contaminate runoff and pollute streams, rivers, lakes and groundwater. If they are necessary it is often possible to source less toxic pesticides and fertilizers. Often better-suited plants 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 usage 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, 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 measured of their toxicity, persistence and bioavailability.

D. Has the project team designed the landscaping to incorporate plant species that require no pesticides, herbicides and fertilizers, or use integrated pest management approaches?

1. Documentation of plans for landscaping showing the mix of plant species.

SOURCES

- Adapted from 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.

RELATED CREDITS

NW2.3 Prevent Surface and Groundwater Contamination

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.

NW2.3 PREVENT SURFACE AND GROUNDWATER CONTAMINATION

INTENT:

Preserve fresh water 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) Long term monitoring.** Measures have been incorporated into the design and operation of the project to enable long-term water quality monitoring and reporting. Monitoring will include surface and groundwater quantity and quality. Data will be submitted to the International Stormwater Best Management Practices (BMP) Database. Monitored data includes water quality data and temperature data. (A, B)	**(9) Design for prevention.** At 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 employed. (A, B, C, D, E)	**(14) Design for source elimination.** Designers focus on eliminating potentially polluting substances from operations. If unable, 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 locating equipment and facilities containing potentially polluting substances are located away from sensitive environments. (A, B, C, D, E)	**(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, E, F, G)

DESCRIPTION

Aquatic ecosystems depend on a particular set of water conditions and 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 the natural water purification processes. Design and operation of the constructed works 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 demolition of previously constructed works.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Meet basic regulatory requirements for water quality and spill prevention planning, e.g., SPCC 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.

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 may have already 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 long-term surface and groundwater quality monitoring programs. Appropriate data will be submitted to the International Stormwater Best Management Practices (BMP) Database. The database web site also provides guidance on BMP monitoring.*
4. *Documentation that the constructed works cannot reasonably have any impact on receiving waters. Show that there is no direct connection to receiving waters from the site of the construct works, or pollutant BMP are implemented and both the discharges to receiving waters and the receiving waters are monitored to verify pollutant loading, biological impact and impact on receiving water flow.*

B. Have spill and leak prevention and response plans and design been incorporated into the design?

METRIC:

Designs, plans and programs instituted to prevent and monitor surface and groundwater contamination.

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 the construction and operation of the completed works?

1. *Efforts to reduce the use of, or replacement of hazardous and/or potentially polluting materials with non-hazardous or non-polluting 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 alter receiving water flow.*

E. Have spill and leak prevention and response plans and design 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.*

F. Has the project team reduced or eliminated potentially polluting substances from the construction and operation of the completed works?

1. *Efforts to reduce the use of, or replacement of hazardous and/or potentially polluting materials with non-hazardous or non-polluting materials.*

G. 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.*

SOURCES

- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.3.1, 6.3.2.
- I-69 Planning Toolbox, http://www.in.gov/indot/div/projects/i69planningtoolbox/_pdf/Groundwater%20Wellhead%20Protection.pdf

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, ensure that existing habitats are not harmed, and compensate for losses. Mitigation measures should maintain net habitat quality and area, and provide means for animals to access pre-development habitat after development is complete. (A)			**(13) Improve habitat.** Project team works with state and local agencies to identify existing habitats in or near the project site. Efforts are made during the course of the project to not only protect existing habitats but to upgrade. Efforts are made to reinstate 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 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.** Project team works with state and local agencies to identify existing habitats in or near the project site. Efforts are made during the course of the project to not only protect and upgrade existing habitats, but to restore and create new habitats. Efforts are made to reinstate appropriate vegetation, improve and expand wildlife corridors, and link existing habitats. (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 a population of a species, connectivity between patches is critical for survival. Preserving and linking habitat is critical to biodiversity by:

- Allowing species to move between patches of different types: species may require more than one type of habitat.
- Providing sufficient habitat for large-range species: some animals require a large "home range."
- Promoting 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 should be 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 are targets for repopulation. When selecting the species, priority should be given to species that:

- Have habitat preferences similar to other species.
- Represent a range of animal classes – mammal, 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 creating new habitats.

EVALUATION CRITERIA AND DOCUMENTATION

A. Does the project demonstrate that it does not impact natural habitat and movement corridors or 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 (GIS analysis and surveys can inform this step). Identify potential and/or likely movement corridors*

METRIC:

Degree of habitat protection.

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 measurers taken to provide new habitat, improve connectivity or mitigate adverse impacts of the project.*
4. *A monitoring plan to ensure mitigation measurers are effective for preserving animal access. Document collaboration with local and state agencies*

B. Does the project facilitate movement between habitats, provide new connections, or otherwise improve existing habitat?

1. *Documentation of habitat improvement strategies, including all elements listed above.*

C. Does the project increase available habitat, increase connectivity between habitat areas by providing new connections that were not available before, or by removing existing barriers to movement and habitat?

1. *Documentation of habitat expansion strategies, including all elements listed above.*

SOURCES

- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 4.3, 4.4.

NW3.2 CONTROL INVASIVE SPECIES

INTENT:

Use appropriate non-invasive species and control or eliminate existing invasive species.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
		(5) Locally appropriate and non-invasive. 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.** Programs and actions to eliminate existing invasive species from the project site. (A, B, C)

DESCRIPTION

Invasive species include non-indigenous or non-native flora and fauna that adversely affect the habitats or bioregions they invade. The species may dominate the new region, forcing out existing species by outcompeting the native species for nutrients, light, physical space, water, or food.

Invasive species may invade and overcome native species through several mechanisms, including rapid reproduction, high ability to disperse, tolerance to or 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 major factor in the distribution and establishment of invasive species colonies. Many non-native species may not become established and "invasive" until it has been introduced several times, for example through cars constantly driving to the site from another location.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark. No willful spreading of invasive species but no active management plans either. Invasive species avoided but no active consideration of choice of non-invasive 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 non-invasive plants on the site?

1. *A list of invasive species in the region, and map all invasive species found on or within 2/3 mile (1000 m) of the site.*
2. *Documentation that all species introduced to the site are non-invasive; include a site plan of the landscaping strategy including 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:*

- *Prediction and Prevention: Strategies for minimizing potential for invasive species, both plants and animals, to re-appear after initial removal and/or enter the site from nearby areas.*
- *Detection and Management: Strategies for monitoring for and removing invasive species that emerge on-site in the future.*

C. Does the project actively eliminate existing invasive species and ensure that invasive species stay off the site?

1. *In addition to documentation above, a management plan that includes:*

- *Removal: Elimination of any invasive species on-site*
- *Rehabilitation and Restoration: Methods to restore habitats to pre-invasive state*

METRIC:

Degree to which invasive species have been reduced or eliminated.

SOURCES

- Adapted from 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, non-invasive plants.
- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.3.1, 6.3.2.

RELATED CREDITS

QL3.2 Preserve Views and Local Character

NW1.1 Preserve Prime Habitat

NW3.1 Preserve Species Biodiversity

NW3.3 RESTORE DISTURBED SOILS

INTENT:

Restore soils 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). (B)

DESCRIPTION

Restoring soils disturbed during construction in areas that will be re-vegetated (all areas surrounding the constructed works) improves the soil's ability to support healthy plants, biological communities, water storage, and water infiltration. Previously developed sites may also benefit from soil restoration.

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 the construction of the project, extended to 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

- Adapted from 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.

RELATED CREDITS

NW1.1 Preserve Prime Habitat

NW1.5 Preserve Floodplain Functions

NW1.6 Avoid Unsuitable Development on Steep Slopes

NW3.1 Preserve Species Biodiversity

METRIC:

Percentage of disturbed soils restored.

NW3.4 MAINTAIN WETLAND AND SURFACE WATER FUNCTIONS

INTENT:

Maintain and restore the ecosystem functions of streams, wetlands, water bodies 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 so as 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. The first is to maintain or enhance hydrologic connections. The second is to maintain or enhance water quality. Many healthy waterways and wetlands receive much of the 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 (BMPs) that will help remove pollutants and cool stormwater, discharging to the water body through groundwater.

Other ways include maintaining or enhancing habitat. Past infrastructure projects may have removed the natural riffle, pool, and meander sequence of rivers and streams important to provide a healthy ecosystem. Lakes and watercourses may have had structures built on their shoreline destroying the shoreline habitat for plants and animals. Lastly, maintain or enhance sediment transport. Waterways not only move water but sediment. Natural in-waterway sediment transport is important to a healthily functioning ecosystem.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: No meaningful action 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 upon 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 six-month to two-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 or 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.*

C. *Does the project maintain or enhance habitat?*

1. *A habitat survey of the waterbody and reference areas, 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?

METRIC:

Number of functions maintained and restored.

1. *Documentation demonstrating that sediment transport will not be disrupted by the proposed project and existing sources of sediment obstruction are removed or mitigated and, if appropriate, sediment is removed. Reports from qualified resource professionals are required as part of the documentation.*

E. Does the project maintain all four ecosystem functions and any fully restore any disturbed functions?

1. *Documentation provided by a resource professional team outlining strategies for ecosystem functions and 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 CREDITS

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

NW0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

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

LEVELS OF ACHIEVEMENT

INNOVATION
(+8) Innovate or exceed credit requirements. 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, novel either in their use, their application, or within the local regulatory or cultural climate.

DESCRIPTION

This objective 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 in regards to sustainability. These points are not calculated in the overall available points and therefore act as 'bonus' points. Given the nature of the credit, whose broad format is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Verifiers will take a more involved role in assessing achievement and project teams should be confident in the project's ability to meet expectations before applying.

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For example, project 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 case exceptional performance may be pursued by projects whose magnitude of preservation, and investment in restoration, is a significant percentage of the project budget and a primary objective of the project. Verifiers will determine whether the magnitude of the effort exceeds the expectations for the current Restorative achievement level.

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 whose 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 major contribution to the quality of the community.
- A project whose impact will fundamentally change the ability of community residents to access and use sustainable means of transportation on a large scale.

Innovation is not encouraged for the sake of novelty. Projects should demonstrate that through the innovative approach the project has achieved at least one of two 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 utilize innovative technology, methods, or application. For example, 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.

Possible areas of achievement in innovation may include, but are not limited to, the following:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs.
- The project employs 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

METRIC:

Whether project achievement qualifies as exceptional performance or innovation.

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 highest levels of achievement or implement innovative methods in meeting infrastructure needs 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 Resource Allocation credit.*

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

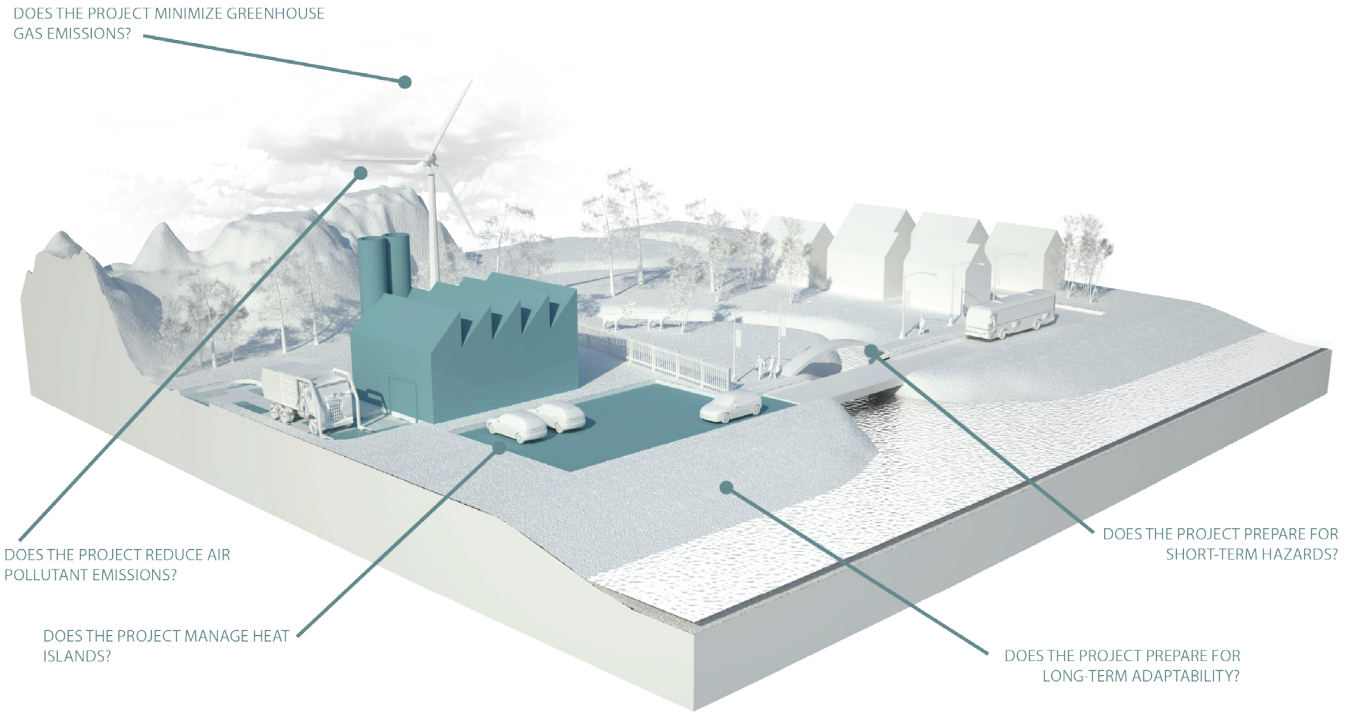
1. *Documentation of the application of innovative technologies or methods. Detailed description as to how this application will improve upon existing conventional practice either globally or within the unique context of the project. Provide justification as to why this application should be considered 'innovative' either as a technology, a method, or its application 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 which 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



CLIMATE AND RISK

The general scope of *Climate and Risk* is two-fold; to minimize emissions that may contribute to increased short and long-term risks and to ensure infrastructure projects are resilient to short-term hazards or altered long-term future conditions. The *Climate and Risk* category is divided into two sub-categories: *Emissions* and *Resilience*.

EMISSIONS:

The goal of this subcategory is the understanding and reduction of dangerous emissions — both greenhouse gas emissions as well as 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 increase the life cycle of the project. While reducing greenhouse gas emissions may not have a direct impact on the consequences to the particular project, it can help to reduce overall global risk and has contributions 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 and informed project design that anticipates and withstands or adapts to these risks, minimizing its overall vulnerability. Increased adaptability and decreased vulnerability ensures a longer useful life and ensures 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 has been undertaken in order to estimate the carbon emissions due to materials extraction and processing, material transportation (for the key materials to be used during construction and operation), and project maintenance and operation including vehicle traffic. The assessment related to materials includes the 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 in the completed works. (A)	**(7) 10 to 40% reduction.** Using a completed life-cycle carbon assessment, the project team works to design the project so that it produces 10 to 40% reductions in carbon emissions as compared to regulatory requirements (B)	**(13) 41 to 80% reduction.** Using a completed life-cycle carbon assessment, the project team works to design the project so that it produces 41 to 80% reductions in carbon emissions as compared to regulatory requirements (B)	**(18) Carbon neutral.** The completed works is carbon neutral (does not produce any net carbon emissions, or 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. (B)	**(25) Net carbon negative.** The completed works is carbon negative (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. (B)

DESCRIPTION

In the past century, increases of the release of CO2 and other greenhouse gases, due primarily to the burning of carbon-based coal have caused a significant increase in the concentration of CO2 in our atmosphere. These greenhouse gases absorb and emit infrared radiation, creating the called greenhouse effect.. The increase of these gases enhance the greenhouse effect, very likely causing the Earth's surface and lower layer of the atmosphere average temperature to rise. In particular, in 2007 the UN Intergovernmental Panel on Climate Change stated that it was now 90 percent certain that most of the warming observed over the previous half century could be attributed to greenhouse gas emissions produced by human activities 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, draught from lack of rain in others, ocean acidification, changing crops and crop production, and sea level rise. Reducing the emission of greenhouse gases now helps to mitigate the possible human contribution to climate change in the future.

Greenhouse gases are factored according to their global warming potential (GWP) resulting in a CO2 equivalency (CO2e). Reducing world production of C02e will be a great challenge to this, and future, generations.

Greenhouse gas emissions are primarily associated with direct non-renewable energy consumption, transportation fuel consumption, and the embodied energy of products and goods.

Unavoidable CO2e emissions can be countered by the 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 can also come in the form of planting new forests, which absorb and use the CO2 for their growth.

In order to estimate the carbon emission due to materials extraction and processing, material transportation and project maintenance and operation, consider the means indicated at Credit Appendix.

As mentioned in credits RA1.1, RA1.5, RA2.1,RA3.2 and NW2.3 it is recommended, but not required, that project teams consider streamlined life cycle assessments to assess material extraction and processing stage (RA1.1) and project maintenance and operation stage (RA1.5, RA2.1 and RA3..2, NW2.3), in accordance with the ISO14040, and ISO14044 standards. These LCA present among the results the overall CO2 emissions on the indicated stages that are required in this credit. Results of a streamlined LCA to assess the material extraction and processing phase are also used at RA1.1, CR1.2. Results of a streamlined LCA to assess the project operation and maintenance phase are also used at credits RA1.5, RA2.1, RA3.2, NW2.3, CR1.2. Additionally, conducting LCA help project teams better understand the relation between RA, NW2.3, and CR1 credits and aid in advancing to higher levels of achievement. For projects pursuing the Envision rating during subsequent phases (construction and operations) the complete results of these LCA will be requested. Project teams pursuing a multiple phase rating, or multiple credits that require assessment, may find conducting a single, thorough, and 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 projects end of life.

METRIC:

Life-cycle net carbon dioxide equivalent (CO2e) emissions.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: Life-cycle carbon assessment 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.*

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.

RELATED CREDITS

RA1.1 Reduce Net Embodied Energy

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

RA3.2 Reduce Potable Water Consumption

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, lead, and noxious odors.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Improved air quality standards. California's standards are more stringent than NAAQS, and address additional pollutants beyond the six common air pollutants. Meet CAAQS 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 SCAQM 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 implements measures to improve existing air quality to a level higher than pre-development. (C)

DESCRIPTION

The six criteria pollutants are part of the National Ambient Air Quality Standards (NAAQS) set by the EPA under the Clean Air Act. The pollutants damage human health, property, and the environment. According to the 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.

Dust and odors can also cause a nuisance for nearby residents, as well as reduce property values and aggravate lung conditions listed above.

Other areas have implemented standards more stringent than NAAQS, including California and the South Coast Air Quality Management (SCAQM) District in Southern California. The California Ambient Air Quality Standards (CAAQS) 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.

As mentioned in credits RA1.1, RA1.5, RA2.1, RA3.2, NW2.3 and CR1.1, it is recommended, but not required, that project teams conduct streamlined life cycle assessments (LCA) to assess material extraction and processing stage (RA1.1, CR1.1), maintenance and operation stage (RA1.5, RA2.1 and RA3..2, NW2.3, CR1.1), in accordance with the ISO14040, and ISO14044 standards. These LCA present among the results the overall air pollutant emissions on the mentioned stages that can be used in this credit. In order to estimate the air pollutant emissions due to materials extraction and processing and project maintenance and operation, consider the means indicated at Credit Appendix. Results of a streamlined LCA to assess the material extraction and processing phase are also used at RA1.1, CR1.1. Results of a streamlined LCA to assess the operation and maintenance phase are also used at credits RA1.5, RA2.1, RA3.2, NW2.3, CR1.1. Additionally, conducting LCA help project teams better understand the relation between RA, NW2.3, and CR1 credits and aid in advancing to higher levels of achievement. For projects pursuing the Envision rating during subsequent phases (construction and operations) the complete results of these LCA will be requested. Project teams pursuing a multiple phase rating, or multiple credits that require assessment, may find conducting a single, thorough, and 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 projects end of life.

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 what's required, if anything.

Performance improvement: Addition of active controls, monitoring systems and mitigation measures at the design stage. Shift in emphasis to location selection and siting, source reduction. Ambient air quality is substantially improved over previous levels.

METRIC:

Measurements of air pollutants as compared to standards used.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team designed the project follow the California Ambient Air Quality Standards?

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 South Coast Air Quality Management Rules?

1. *Documentation of applicable rules and strategies for compliance.*

C. Does the project reduce air pollution to the required level, or improve existing air quality to a higher than pre-development level?

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, http://www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm
- South Coast Air Quality Management District Rules and Regulations, http://www.aqmd.gov/rules/rulesreg.html

RELATED CREDITS

QL2.1 Protect Public Health and Safety

CR2.1 ASSESS CLIMATE THREAT

INTENT:

Develop a comprehensive Climate Impact Assessment and Adaptation Plan.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
			(15) Impact assessment and adaptation plan. A comprehensive climate impact assessment and adaptation plan has been developed. The plan should include the following components: • Vulnerability Assessment • Risk Assessment • Adaptation Assessment The process should include collaborations with the local emergency management department and meetings with the local community. (A)	

DESCRIPTION

The first line of defense against climate change should always be the mitigation and management of greenhouse gas emissions to reduce CO2e concentrations in the atmosphere and mitigate against future climate changes. However, existing CO2e levels are enough to present long-term climate changes, and variations in our climate that may likely be due to greenhouse gases and other changes are beginning to be noticeable.

The U.S. Environmental Protection Agency notes 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 agriculture irrigation, hydropower, flood management, fisheries, recreation and navigation (Source: U.S. EPA, "Water Availability", http://epa.gov/climatechange/effects/water/availability.html).

While the exact effects of climate change are still uncertain, most anticipated impacts of climate change 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, or gradual increases in temperature or decreases in precipitation may increase pressures on energy or water systems, respectively. Communities rely on infrastructure projects; failure of systems can cause devastating consequences. Consequently, understanding potential impacts from climate change is critical to ensure designs can be resilient to future conditions.

In fulfilling this credit owners and designers should conduct a life-cycle assessment of the project to determine the net carbon emissions. It is recommended, but not required, that project teams conduct a single comprehensive life cycle assessment in accordance with the ISO14040, and ISO14044 standards. This will meet the initial criteria for credits RA1.1, RA2.1, RA3.2, CR1.1, and CR 1.2. Teams may choose to conduct independent life cycle assessments for each credit but should meet ISO14044 requirements. Conducting a single assessment will help project teams better understand the relation between the above credits as well as RA1.3, RA1.4, RA1.5, RA2.2, and RA3.1 and aid in advancing to higher levels of achievement.

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: N/A. This is a yes/no credit.

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 which meets the requirements outlined above, i.e. calculate or locate expected changes in flood elevations and sea rise for proposed project location; inventory structures in the areas of possible inundation that are important to successful operation of proposed project; develop plan for proposed project to address expected change in inundation, including the adaptation required because of the impact on other critical existing infrastructure in the area.*
2. *Documentation of community outreach during the process.*
3. *Documentation of local emergency management department input.*

RELATED CREDITS

CR1.3 Avoid Traps and Vulnerabilities

CR1.1 Manage Life-Cycle Carbon Emissions

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 due to 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, 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 raised. Basic plans 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. Determine the 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 the project design. Considerations include how the project contributes to the community's assessment of resource demands and supplies, 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

The purpose of this credit is to recognize projects and their designers for taking a long view of effects of resource depletion and climate change. 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 add additional risk and vulnerabilities to the affected communities.

The consequences of our non-sustainable operating environment and its effects are disrupting the 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. 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.

Climate change is also having its effect, not only as the cause of a rise in ambient temperature, but as 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 altering substantially the practice of infrastructure design. Long-held assumptions regarding expected averages, variances and possible extremes of infrastructure design variables may no longer be valid. In addition new variables are now coming into play that had never before been taken into account.

For civil works, e.g., roads, bridges, water treatment systems, etc., that have expected useful lives of 30 to 50 years or more, these expected changes will require a major 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 constructed works (this assessment is done in CR2.1 Assess Climate Threat). 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 very scarce and expensive. For example, adding an additional highway to a community in which already suffers from urban sprawl and 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 in coastal lowlands or in river floodplains places the community at high risk for sea surges or flooding, given changing climate conditions.

METRIC:

The extent of the assessment of potential long-term traps, vulnerabilities and risks due to long-term changes such as climate change and the degree to which these were addressed in the project design and in community design criteria.

- 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 rating 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 increased community 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 OR documentation for CR2.1 Assess Climate Threat.*

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, i.e., 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.*

SOURCES

- W. A. Wallace, Project Sustainability Management Guidelines, Unpublished manuscript, September 2010.

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 waver, and increased ambient temperature. (A)	**(20) Recovery from adverse effects.** Restoration 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, etc.

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. Drought conditions make this situation worse, increasing soil erosion. Reductions in vegetative cover also increase the formation of aerosols and dust. According to the US Bureau of Land Management, about 40% of the continental United States is considered vulnerable to desertification.

Other conditions such as fires, earthquakes, hurricanes, or a changing water table may also 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 retain its fundamental characteristics/functions despite stresses. Adaptive capacity means the system has the able to respond to changing conditions over time to better withstand them. Flexibility is a key part of adaptive capacity. Redundancy, possible from back-up systems or decentralized, distributed networks, helps systems remain function even if one component fails.

Strategies for managing long-term changes may include:

- Structural changes – expand the range of conditions in which the system can function.
- Decentralized systems – depend upon many small facilities instead of one large one; distributed networks spread risk.
- Natural systems – choose "green infrastructure" solutions for infrastructure provision; for instance, using wetlands to treat stormwater also help 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 (further away from coasts to reduce impact of increasing sea levels; at higher elevations where flooding is less likely, etc.).

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

METRIC:

The degree to which the project has been designed for long-term resilience and adaptation.

materials supplies, 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, etc.*
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, etc.*
3. *Identification of siting or design features that increase alternative supply options for water, energy or other materials critical to the operation of the constructed works.*

B. Has the project team made substantial efforts to restore or rehabilitate any existing effects of long-term change, e.g., desertification, beach erosion, loss of wetlands, etc.?

1. *Plans, designs, documents that show restoration and rehabilitation efforts.*

RELATED CREDITS

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 man-made short-term hazards.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(3) Hazards assessment. Thorough analysis of likely natural and man-made 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. (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. (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. (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 increase their occurrence or severity due to outside risk factors, but additional development in risk-prone areas can magnify their impacts on local communities.

Urban areas are increasingly vulnerable to man-made hazards as well, such as hazardous materials spills, terrorist attacks, epidemics, and biohazards. Managing and preparing for short-term hazards helps to secure the longevity of infrastructure projects, protect investments, and secure the well-being of the surrounding community.

Infrastructure projects will be subject to the direct effects of these disasters (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 resource).

For example, in areas prone to wildfires the project location should be selected so as to reduce the risk of wildfires. Access for firefighting equipment and personnel should be provided for in the design. Highly flammable materials and vegetation should be cleared from the area. Fire-resistant or non-combustible materials should be incorporated in the design and construction of structures. Sources of ignition should be kept away from flammable materials. Flammable materials should be stored in an approved safety containers. Team should follow the Firewise Construction Checklist.

Key components to resiliency from hazards include the ability to withstand hazards (for example through physical fortification against flooding or hurricanes) or the ability to adapt with the hazard. Adapting to the hazard can include redundancy, through back-up systems or decentralized, distributed networks, which help systems 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 against long-term change.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team considered which types of natural and man-made 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*

METRIC:

Steps taken to improve protection measures beyond existing regulations.

- *Floods*
- *Tornadoes*
- *Hurricanes*
- *Earthquakes*
- *Tsunamis*
- *Man-made 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

- Firewise Construction Checklist, http://www.forestry.state.al.us/WUI/Firewise/FirewiseConstructionChecklist.pdf
- Firewise Landscaping Checklist, http://www.gohsep.la.gov/factsheets/firelandscaping.pdf
- U.S. Department of Homeland Security, Federal Emergency Management Agency, "Prepare for a Wildfire", http://www.fema.gov/hazard/wildfire/wf_prepare.shtm

RELATED CREDITS

CR2.3 Prepare for Long-Term Adaptability

CR2.5 MANAGE HEATH ISLAND EFFECTS

INTENT:

Minimize surfaces with a high solar reflectance index (SRI) to reduce localized heat accumulation and manage microclimates.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(1) 10-30% heat-producing surface reduction. Achieve a 10 to 30% reduction in surfaces with low solar reflectance index (SRI). Achieve a 10 to 30% reduction insurfaces with low solar reflectance index (SRI) . 10-30% of hardscape surfaces meet shading or SRI requirements. (A)	**(2) 31-60% heat-producing surface reduction.** 31 to 60% reduction in surfaces with low solar reflectance index (SRI). Achieve a 31 to 60% reduction in surfaces with low solar reflectance index (SRI). 31-60% of hardscape surfaces meet shading or SRI requirements. (A)	**(4) 61-90% heat-producing surface reduction.** 61 to 90% reduction in surfaces with low solar reflectance index (SRI). Achieve a 61 to 90% reduction in surfaces with low solar reflectance index (SRI). 61-90% of hardscape surfaces meet shading or SRI requirements. (A)	**(6) 91-100% heat-producing surface reduction.** 91 to 100% reduction in surfaces with low solar reflectance index (SRI). Achieve a 91 to 100% reduction in surfaces with low solar reflectance index (SRI) . 91-100% of hardscape surfaces meet shading or SRI requirements. (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 alter the microclimate around them. This can lead to an increase in energy consumption for additional cooling, and can impact local vegetation and wildlife, as well as community comfort. The cumulative impact of heat island effects across large areas can also contribute to larger climate related effects.

This effect, known as the urban heat island effect, can be minimized and managed for the purpose of this credit through the use of materials with high solar reflectance index (SRI), (see SRI description below), increased vegetation, which cools through evapotranspiration, and increased shade, either through structures such as shade panels, or trees that provide shade within five years of planting (as measured at 12 noon on summer solstice).

The Solar Reflectance Index (SRI.) is a measure of the surface's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black is 0 and a standard white is 100.

SRI equal or larger than 29, are considered adequately high for the purpose of this study. It is important to note that in certain climates, increased surface heat may be desirable at certain times; therefore the goal should be 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 minimum SRI requirements for the designated percentage of hardscapes?

1. *Drawings showing all non-roof non-vegetated areas of the site and the surfacing material.*
2. *Calculations demonstrating at least 40%, 70%, or 90% of the hardscape project area meets the requirements below.*

- *Documentation of all shaded areas, assumed at noon on summer solstice, and a list of species used and expected growth rates showing projected shading five years from planting.*
- *Documentation of roof or surface areas, surface material and corresponding SRI.*

SOURCES

- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Sections 7.1.3, 7.1.4, 7.3.
- Adapted from The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 4.12: Reduce urban heat island effects.

METRIC:

Percentage of site area that meets SRI criteria.

RELATED CREDITS

RA1.1 Reduce Net Embodied Energy

RA2.1 Reduce Energy Consumption

RA2.2 Use Renewable Energy

RA3.2 Reduce Potable Water Consumption

CR2.1 Assess Climate Threat

CR2.3 Prepare for Long-Term Adaptability

CR0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS

INTENT:

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

LEVELS OF ACHIEVEMENT

INNOVATION
(+8) Innovate or exceed credit requirements. 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, novel either in their use, their application, or within the local regulatory or cultural climate.

DESCRIPTION

This objective 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 in regards to sustainability. These points are not calculated in the overall available points and therefore act as 'bonus' points. Given the nature of the credit, whose broad format is intended to encourage creative infrastructure solutions, a more thorough documentation is expected. Verifiers will take a more involved role in assessing achievement and project teams should be confident in the project's ability to meet expectations before applying.

To qualify for exceptional performance points, projects must meet the highest level of achievement within the relevant credit. For example, project 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 case exceptional performance may be pursued by projects whose magnitude of preservation, and investment in restoration, is a significant percentage of the project budget and a primary objective of the project. Verifiers will determine whether the magnitude of the effort exceeds the expectations for the current Restorative achievement level.

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 whose 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 major contribution to the quality of the community.
- A project whose impact will fundamentally change the ability of community residents to access and use sustainable means of transportation on a large scale.

Innovation is not encouraged for the sake of novelty. Projects should demonstrate that through the innovative approach the project has achieved at least one of two 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 utilize innovative technology, methods, or application. For example, 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.

Possible areas of achievement in innovation may include, but are not limited to, the following:

- The project is an early adopter of new technology or methods that can demonstrably improve project performance without negative trade-offs.
- The project employs 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

METRIC:

Whether project achievement qualifies as exceptional performance or innovation.

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 highest levels of achievement or implement innovative methods in meeting infrastructure needs 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 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 as to 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, a method, or its application 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 which 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.

D. Does the project contribute to the advancement of the profession and greater knowledge of the industry in regards to sustainability?

GLOSSARY

Adaptation. Adaptation is the collective set of actions taken to respond to climate change and variability. These actions include alterations in behavior as well as changes in the use of resources and the application of technologies.

Affected community. Any community, in addition to the host community, that may experience positive or negative effects from the project's design, planning, construction, operation, or demolition.

Aquifer. A 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. (Source: USGS)

Area of influence. The area surrounding a well within which the potentiometric surface has been lowered due to aquifer pumping. This may be a transient or steady-state condition depending on the volume and duration of pumping. (Source: Hydrology Handbook, ASCE)

ASHRAE. 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 required operations and maintenance procedures needed to maintain performance.

Benchmark. A standard by which something can be measured or judged. In the case of the rating system, it stands for conventional or state of the practice procedures and methodologies used in infrastructure design and construction.

Best Management Practice. A Best Management Practice (BMP) is a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge. BMPs include simple nonstructural methods, such as good housekeeping and preventive maintenance. BMPs may also include structural modifications, such as the installation of bioretention measures. BMPs 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. The focus of EPA's general permits is on preventive BMPs, which limit the release of pollutants into storm water discharges. BMPs can also function as treatment controls. (Source: U.S. EPA)

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 health of ecosystems. Biological diversity can include species diversity, ecosystem diversity, and genetic diversity.

Biom. Major 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. It is 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 layer or mulch layer, planting soil, and plants. Runoff passes first over or through a sand bed, which slows the runoff's velocity, distributes it evenly along the length of the ponding area, which consists of a surface organic layer and/or groundcover and the underlying planting soil. The ponding area is graded, its center depressed. Water is ponded to a depth of 15 cm (5.9 in) and gradually infiltrates the bioretention area or is evapotranspired. The bioretention area is graded to divert excess runoff away from itself. Stored water in the bioretention area planting soil exfiltrates over a period of days into the underlying soils.

BMP. See Best Management Practices.

BPS See By-product synergy.

Brownfields. Abandoned or underused industrial and commercial sites usually containing low levels of environmental pollution, such as hazardous waste or industrial by-products. 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. A zonal area that lies between two or more other areas to segregate them to enhance the protection of areas under management, typically for their biodiversity importance. 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.

By-product synergy. By-Product Synergy (BPS) is the matching of under-valued waste or by-product streams from one facility with potential users 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 climate-changing emissions. These are quantifiable benefits to the environment, economy and communities.

The BPS process breaks down the barriers to cross-industry communication, as well as the barriers between government and industry and between small and large companies, by fostering dialogue and working across groups to identify supply chain localization and waste minimization opportunities. (Source: Bridging the Gap®, http://www.bridgingthegap.org/egap.php?id=125, accessed on March 7, 2012)

C2C See Cradle to Cradle

"BENCHMARK. A standard by which something can be measured or judged. In the case of the rating system, it stands for conventional or state of the practice procedures and methodologies used in infrastructure design and construction."

Candela. A unit of luminous intensity in a given direction, defined by a physical process that will produce one candela of luminous intensity. The candela is the "luminous intensity of a source that emits monochromatic radiation of frequency 540 x 10 ^ 12 hertz and that has a radiant intensity in that direction of 1/683 watt per steradian."

Carbon dioxide equivalent (expressed as CO2Eq, CO2e, CDE). The measure of how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide as the reference.

Carbon sequestration. The capture of carbon dioxide, including the removal from the atmosphere and depositing in a reservoir. This long-term storage of carbon dioxide can help mitigate or defer global warming and avoid climate change and slow the atmospheric and marine accumulation of greenhouse gases.

CEEQUAL. The assessment and awards scheme for improving sustainability in civil engineering, infrastructure, landscaping and public realm projects based in the UK. It is promoted by the Institution of Civil Engineers. CEEQUAL is available in three versions - for UK and Ireland projects, for International projects, and for Term Contracts. Projects are awarded points to achieve levels of awards. CEEQUAL covers topics such as project management, ecology and biodiversity, history, nuisances for neighbors, and relationships with the community, as well as typical markers of sustainability such as water and energy use.

Climate. Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. In various chapters in this report different averaging periods, such as a period of 20 years, are also used. See: climate system.

Climate Change. Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and 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 change the atmosphere's composition (e.g. through burning fossil fuels) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.)

The Earth's climate has changed frequently over geological history. But at the present time of particular concern is the issue known as global warming. Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the lowest layer of the atmosphere. Past climate information suggests the warmth of the last half century is unusual in at least the previous 1,300 years in the Northern Hemisphere. Global warming can occur from a variety of causes, both natural and human induced. The Intergovernmental Panel of Climate Change (IPCC) scientists, U.S. Climate Change Science Program researchers, among other scientists, published findings indicating that there is a greater than 90 percent chance that most of the warming we have experienced since the 1950s is due to the increase in greenhouse gas emissions from human activities. Increases in temperatures in our Earth's atmosphere can contribute to further changes in global climate patterns. In particular, a considerable number of scientists predict that such an increase in temperature would impact global climate in three key ways: changes in long-term average annual conditions (mean temperature or annual precipitation), increases in climate variability (fluctuations in precipitation), and increases in more extreme weather events (frequency and severity); also that such an increase of temperature would cause polar ice caps and mountain glaciers to melt rapidly, significantly raising the levels of coastal waters. Other scientists maintain that such or some of such predictions are overstated. A considerable number of efforts have been undertaken to decrease greenhouse gas emissions from human activities and to prevent the damaging effects of climate change due to global warming, as for example the 1992 Earth Summit and the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change.

Note that the usage of the term Climate Change in this document aligns with the usage of the term by IPCC, USEPA, among others. Alternatively, this usage differs from that in other contexts, as the United Nations Framework Convention on Climate Change (UNFCCC). In particular at UNFCCC, in its Article 1, defines "climate change" as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The UNFCCC thus makes a distinction between "climate change" attributable to human activities altering the atmospheric composition, and "climate variability" attributable to natural causes.

See: global warming, greenhouse gases, greenhouse effect.

Climate system. The climate system is the highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations and anthropogenic (i.e. relating to, or resulting from the influence of human beings on nature) forcings such as the changing composition of the atmosphere and land use change.

CNEL. Community Noise Equivalent Level or CNEL is defined as the average level during a 24-hour day obtained by adding an additional 5 decibels to hourly noise levels in the evening (7 PM to 10 PM) and 10 decibels to hourly noise levels

> **"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 the availability of natural resources and ecosystems"**

measured during the night (10 pm to 7 am).Noise measurements are taken at the nearest property boundary of the affected land use.

Community. See Host community, Affected community.

Configuration trap. Projects that create configurations highly vulnerable to extreme weather events, natural disasters, economic conditions, and/or actions by others. For example, placing infrastructure in coastal lowlands or in river floodplains places the community at high risk for sea surges or flooding, given changing climate conditions.

Cradle to cradle. Cradle to cradle principles include: (1) keeping harmful materials away from contact with humans or the environment, (2) recycling inorganic or synthetic materials (technical nutrients) in a continuous production-consumption loop without any loss of quality, and recycling organic materials to the extent practical (biological nutrients), then returning them to the natural environment where they can decompose into basic nutrients in the ecological cycle.

Credit. Each credit represents a focused action or series of actions to be taken to pursue points towards a final score. Credits are divided into five sections according to topic, and are worth a varying amount of points. Each credit contains multiple levels of achievement and one or more specific requirements that must be accomplished to meet each level of achievement and gain the specified points.

Credit, Related. Other credits within the Envision system that may have synergies, either in issues considered or actions for achievement. All related credits should be read and considered when pursuing the original credit. This allows for a greater holistic understanding of the sustainability of the entire project, and may make achievement of multiple credits easier.

Dark Sky. The night sky without man-made light pollution. For more information see the International Dark Sky Association's website at http://www.darksky.org/.

Deconstruction. Selective dismantling of building components, typically for re-use, recycling, and waste management. Differs from demolition, where a site is cleared by 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" above, implying the maintenance of subsequent parts for value extraction through reuse or recycling. Differs from deconstruction, where the building or construction was not designed to be taken apart. Disassembly is used when the system, building or construction were 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.

Ecological aspects. The ecological aspects of the project involve the impacts of the project local wildlife (plants, animals).

Economic development. Efforts that seek to improve the economic well-being 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.

Embodied energy. The embodied energy of a material or product is the sum of energy 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.

EPA U.S. Environmental Protection Agency

ESC Erosion and Sedimentation Control Plan

Farmland that is of statewide or local importance. Farmland, other than prime or unique farmland, used for the production of food feed, fiber, forage, or oilseed crops, as determined by the appropriate State or unit of local government agency or agencies and that the U.S. Secretary of Agriculture determines should be considered as farmland.

Five Capital model. "The Five Capitals model of Sustainable Development was developed by Forum for the Future in the 1990's. It provides a way of looking at the various component parts of the development equation in such a way that decision makers, businessmen and developers can form balanced, 'capital enhancing' plans. The model describes the five capitals thus:

- Natural capital: The natural resources (energy, environment and matter) and processes needed by organizations to produce their products and deliver their services.
- Social capital: Any value added to the activities and economic outputs of an organization by human relationships, partnerships and co-operation.
- Human capital: Incorporates the health, knowledge, skills, intellectual outputs, motivation and capacity for relationships of the individual.
- Manufactured capital: Refers to material goods and infrastructure owned, leased or controlled by an organization such as tools, technology, machines, buildings and all forms of infrastructure.
- Financial capital: Reflects the productive power and value of the other four types of capital and includes those assets of an organization that exist in a form of currency that can be owned or traded.

The Five Capitals approach provides a basis for understanding sustainable development in terms of the economic concept of wealth creation or 'capital'. All organizations utilize these five types of capital to deliver their products or services. A sustainable organization will maintain and, where possible, enhance these stocks of capital assets, including the natural resources and the environment, rather than contribute to their depletion or degradation."

(Source: http://www.5capitals.com/background.htm)

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 further 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 represents areas likely to experience regular flooding.

Forest Stewardship Council. An international not-for-profit organization to promote responsible management of the world's forests through tools such as a forest management certification and a chain of custody certification, providing third-party verification for consumer products.

FSC. See Forest Stewardship Council.

Greenfields. Undeveloped land in a city or rural area being considered for urban development. This land may contain natural landscape, natural amenities, or agricultural land.

Global Warming. Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere (lowest layer of the atmosphere). In particular, the Intergovernmental Panel of Climate Change (IPCC) determined that warming of the Earth's climate system is now "unequivocal" (i.e., "definite"). The IPCC bases this conclusion on observations of increases in average air and ocean temperatures, melting of snow and ice, and average sea level across the globe. Specifically, the global temperature record shows an average warming of about 1.3°F over the past century. Global warming can occur from a variety of causes, both natural and human induced.

Past climate information suggests the warmth of the last half century is unusual in at least the previous 1,300 years in the Northern Hemisphere. In its 2007 Fourth Assessment, the IPCC stated that it was now 90 percent certain that most of the warming observed over the previous half century could be attributed to greenhouse gas emissions produced by human activities (i.e. industrial processes and transportation). Further scientists, as for example the U.S. Climate Change Science Program researcher, published findings in agreement with this statement.

Global warming is part of climate change. Further increases in temperatures in our Earth's atmosphere can contribute to further changes in global climate patterns. See: greenhouse gases, greenhouse effect, climate change.

Global Warming Potential (GWP). An index, describing the radiative characteristics of well-mixed greenhouse gases, that represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. This index 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. See: greenhouse gas and global warming

Greenfields. Undeveloped land in a city or rural area being considered for urban development. This land may contain natural landscape, natural amenities, or agricultural land.

Greenhouse gases. Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic (i.e. resulting from the influence of human beings on nature), that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect, that helps regulate the temperature of the earth. Water vapor (H2O), carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), and ozone (O3) are the primary greenhouse gases in the Earth's atmosphere. Moreover there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Besides CO2, N2O, and CH4, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). See greenhouse effect.

Greenhouse effect. The Earth 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 (including downward to the Earth's surface) by greenhouse gases. This effect helps to regulate the temperature of the earth's surface and the lower atmosphere. Increases in these gases, increase the heat trapped in the earth's surface and atmosphere. (Detailed explanations on the radiative effects that occur in the earth´s surface and atmosphere related to the greenhouse effect can be found in numerous references, as for example IPCC web site: http://www.ipcc.ch/publications_and_data/publications_and_data_glossary.shtml#.T1VxUvEf74g).

In particular, human activities have added greenhouse gases to the atmosphere, enhancing the natural greenhouse effect. The enhanced greenhouse effect due to human activities very likely causes the Earth's surface and lower atmosphere average temperature to rise. Specifically, in 2007 the UN Intergovernmental Panel on Climate Change (IPCC) stated that it was now 90 percent certain that most of the warming observed over the previous half century (see global warming) could be attributed to greenhouse gas emissions produced by human activities. These additional greenhouse gases come from burning fossil fuels such as coal, natural gas, and oil to power our cars, factories, power plants, homes, offices, schools, etc. Other human activities as, generating waste also produce greenhouse gases. See greenhouse gases, global warming.

Greyfields. Economically obsolescent, outdated, failing, moribund, and/or underused previously developed land. They are distinct from brownfields in that they typically do not require remediation in order to redevelop, but offer value through existing infrastructure and minimizing 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 which a species population influences and is utilized by.

HCVF. High conservation value forest is a FSC forest management designation used to describe forests which meet criteria defined by FSC Principles and Criteria of Forest Stewardship.

Heat islands (heat island effects). An urban area that is significantly warmer than its surrounding rural areas due to materials that cause heat accumulation and lack of vegetation, which cools through evapotranspiration. While the heat island effect has not proven to influence Earth´s global temperatures, 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 and which it directly affects.

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 standards for a particular 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 well-being of a community. Typically, they are long-lived, expected to last 30-70 years, depending on the type of structure and how it is maintained. In addition, their performance efficiency and effectiveness depends 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 which may create difficult conditions within the life of the infrastructure, such as excess consumption of money, energy, or increased vulnerability to changing conditions. The three types of infrastructure traps are resource traps, configuration traps, or standards traps.

Integrated Pest Management. An effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination 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. The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides. In contrast, organic food production applies many of the same concepts as IPM but limits the use of pesticides to those that are produced from natural sources, as opposed to synthetic chemicals. (Reference: U.S. Environmental Protection Agency, Integrated Pest Management (IPM) Principles, http://www.epa.gov/opp00001/factsheets/ipm.htm)

Integrated project delivery. A project delivery approach that integrates people, systems, business structures, and practices in a way that collaboratively harnesses the talents of all participants at all stages to optimize results and maximize efficiency.

Karst topography. A geologic formation shaped by the dissolution of layers of bedrock, such as limestone or dolomite. Karst regions often display distinctive surface features such as sinkholes or caves, and may have limited surface water due to subterranean drainage.

Key stakeholders. Those people who are directly influential or will be directly influential on the outcome of the project, and whose input must be considered if the process is to be considered complete and transparent.

Knowledge capital. Health, knowledge, skills and motivation required for relationships of the individuals and productive work. Knowledge capital or Human capital is one of the capitals defined by the Five Capital model of sustainable development.

Leadership in Energy and Environmental Design. A suite of rating systems for the design, construction, and operation of sustainable buildings, homes, and neighborhoods developed by the U.S. Green Building Council (USGBC).

LCA. Life Cycle Assessment. A technique to assess environmental impacts associated with all stages of a product's life from raw material extraction through disposal or recycling.

LEED See Leadership in Energy and Environmental Design

Levels of Achievement. Varying steps, increasing in difficulty, scope, effort, and/or complexity, that constitute the ways in which a user can achieve points within each credit. Levels of achievement build upon one another, and each subsequent level assumes the completion of the level below it in addition to the requirements for the higher level. Increasing levels of achievement reward increasing numbers of points.

LID (Low Impact Development). A method for managing stormwater runoff emphasizing conservation and the use of on-site natural features to protect water quality. LID 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.

Net benefit. The sum of both positive benefits and negative aspects of a project, assuming that the value of the positive benefits outweigh the value of the negative aspects, making the project overall beneficial to various social, cultural, and environmental systems.

Night sky. The dark nighttime sky free of excess light pollution. See also dark sky.

Officials with jurisdiction. The official with authority over the location or system which is being affected by the project.

Persistence. The measure of resistance to degradation through chemical, biological, and photolytic processes, in this case in pesticides and other pollutants.

Pest. Organisms are considered to be pests when they cause problems in crops or livestock, compete with humans for food and fiber, or otherwise cause economic or other problems for humans. The range of pests is wide, including 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 in agroclimatic and ecological conditions.

Pest management. Pest management should aim to manipulate the 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.

Plan-do-check-act PDCA. "Management by fact" or scientific method approach to continuous improvement (the Deming Wheel). PDCA creates a process-centered environment, because it involves studying the current process, collecting and analyzing data to identify causes of problems, planning for improvement, and deciding 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.

Potentiometric surface. An imaginary surface that represents the static head of groundwater and is defined by the level to which water will rise. Also known as isopotential level; piezometric surface; pressure surface.

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. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. 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. Users of the lists of prime farmland map units should recognize that soil properties are only one of several criteria that are necessary.

Prime habitat. The most ideal habitats for protecting wildlife biodiversity due to 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, but not limited to, engineers, designers, biologists, and contractors.

Public space. A social space that is open and accessible to all, regardless of gender, race, ethnicity, age, or socio-economic level, such as a commons, town square, or public park.

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.

RCRA. Resource Conservation and Recovery Act. Enacted in 1976, the principle Federal law in the United States governing the disposal of solid and hazardous waste.

Reflectance. The fraction of the incident radiation which is reflected by the surface.

Renewable energy. Energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat which are naturally replenished.

Resiliency. The ability to successfully adapt to and/or recover readily from a major disruption.

Resource trap. Projects that increase community dependence on resources that could become very scarce and expensive, for example, adding a highway to a community which 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.

Resource trap. Projects that increase community dependence on resources that could become very scarce and expensive, for example, adding a highway to a community which 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.

Social capital. Structures, institutions, networks and relationships that enables individuals to maintain and develop human capital. Includes families, communities, businesses, educational and voluntary organizations, legal/political systems. Social capital is one of the capitals defined by the Five Capital model of sustainable development.

Sources. Any external source of information that directly informed the concept, requirements, and/or background text of the credit.

SPCC. Spill Prevention, Control and Countermeasure. EPA rule that includes requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines. The rule requires the preparation, amendment, and implementation of SPCC plans.

SRI (Solar Reflectance Index). 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. SRI 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 direct or indirect stake in an organization because it can affect or be affected by the organization's actions, objectives, and policies. Key stakeholders in a business organization include creditors, customers, directors, employees, government (and its agencies), owners (shareholders), suppliers, unions, and the community from which the business draws its resources. Although stakeholding is usually self-legitimizing (those who judge themselves to be stakeholders are stakeholders), all stakeholders are not equal and different stakeholders are entitled to different considerations. For example, a company's customers are entitled to fair trading practices but they are not entitled to the same consideration as the company's employees. (Source: Business Dictionary.com, http://www.businessdictionary.com/)

Standards trap. 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.

Steep slopes. Generally, a steep slope is defined as 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, naturally replenished by precipitation and naturally lost through evaporation and sub-surface 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 the 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. Like an environmental management system, the system follows a continuous Plan-Do-Check-Act cycle. It first establishes a sustainability policy, followed by the setting of goals and objectives for adhering to that policy along with targets for improvement. Performance is reviewed in an established frequency and corrective actions are taken as needed.

SWPPP. Stormwater Pollution Prevention Plan. A plan required by the EPA for major construction projects for stormwater discharge that includes erosion prevention measures and sediment controls that will decrease soil erosion and decrease off-site nonpoint pollution.

Toxicity. The degree to which a substance can damage a living or non-living organisms.

Triple bottom line. A phrase coined by John Elkington in his 1998 book, Cannibals with Forks: the Triple Bottom Line of 21st Century Business. The concept is that business, traditionally concerned with the financial (economic) bottom line, should also be concerned with other performance metrics: environmental and social. The concept is often referred to as the three pillars of sustainability: economic, environmental and social.

Unique farmland. Land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary. 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 waster materials or useless products into new materials or products of better quality or a higher environmental value.

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 (ie, landfill). Can be used to describe waste materials that are either of a particular type (eg paper waste stream) or produced from a particular source (eg 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. Coined by Kevin Lynch in his 1960 book Image of the City," where he defined wayfinding as "a constant use and organization of the definite sensory cues from the external environment."

Wellhead protection area. "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 well or wellfield" (US EPA. 1987). A wellhead protection area is groundwater recharge area for a well. Ideally, it should encompass the entire recharge area for a well. However, in practical terms the entire recharge area is too large to be managed effectively. Therefore, a smaller area around a well may be chosen. The WHPA is then delineated so that the highest priority contaminant sources nearest to the well can be addressed.

Wetland. An area of land whose 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 which may not be found in other ecosystems.

APPENDIX

OVERVIEW

Guidance: Internally-generated information to assist users in the completion of the credit that was too lengthy or detailed to include in the original credit text. May not appear in every credit.

Associated Credits and Standards: Credits in other systems that may have some association or related purpose, or may provide additional insight and understanding. May not appear in every credit.

Resources and Tools: External sources that provide enhanced definitions, understanding, background, context, or tools for meeting requirements for the credit. May not appear in every credit.

QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE

Associated credits and standards

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

Resources and tools

- National Charrette Institute: Charrettes for Sustainability Planning, http://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

Associated credits and standards

- 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

Resources and tools

- 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
- LAWA Sustainable Airport Planning, Design and Construction Guidelines, v4.0, April 2009, PD4-LP-1

QL2.3 MINIMIZE LIGHT POLLUTION

Associated credits and standards

- 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

Resources and tools

- JOINT IDA-IES MODEL LIGHTING ORDINANCE (MLO), Illuminating Engineering Society, June 2010, http://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

Associated credits and standards

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND NPD Credit 7: Transit Facilities
- 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 non-motorized transportation and use of public transit
- PANYNY 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 NPD Prerequisite 1: Walkable Streets, Credit 14: Tree-Lined and Shaded Streets
- U.S. Green Building Council, Leadership in Energy and Environmental

Design (LEED) ND SLL Credit 4: Bicycle Network and Storage

QL2.6 IMPROVE SITE ACCESSIBILITY, SAFETY, AND WAYFINDING

Associated credits and standards

- 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

Resources and tools

- The National Register of Historic Places (http://www.nps.gov/nr/)
- Sections 106 and 110 of the National Historic Preservation Act (http://www.achp.gov/106summary.html)
- Section 4(f) of the Department of Transportation Act (http://environment.fhwa.dot.gov/4f/index.asp)
- HISTORIC PRESERVATION/SECTION 106 CONSULTATION CHECKLIST, http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_12987.pdf
- Section 106 Historic Preservation Fact Sheet, http://bphc.hrsa.gov/policiesregulations/section106.pdf
- National Conference of State Historic Preservation Officers, http://www.ncshpo.org/index.htm
- National Trust for Historic Preservation, http://www.preservationnation.org/
- Position Statement: Fostering Renewable Energy Development and Historic Preservation at All Scales, http://www.preservationnation.org/issues/sustainability/position-statements/renewable-energy.html
- 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

Resources and tools

- Exhibit C: Design Standards for Public View Corridors, City of Redmond, WA, http://www.ci.redmond.wa.us/workspaces/one.aspx?objectid=32015&contextId=9055
- Indiana Department of Transportation, I-69 Planning Toolbox, Protecting Natural Resources, Scenic Viewshed Protection, http://www.in.gov/indot/div/projects/i69planningtoolbox/natres.html

QL3.3 ENHANCE PUBLIC SPACE

Resources and tools

- 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

Resources and tools

- Denver Metro Chamber of Commerce, "The Impact of I-70 Congestion on Colorado – Denver to Grand Junction," April 2007, http://www.drcog.org/documents/I70 Impact_042507.pdf

RA1.1 REDUCE NET EMBODIED ENERGY

Guidance

In order to estimate the embodied energy of materials, consider the following means:

1. The task to carry out a streamlined LCA of the actual materials extraction and processing has been undertaken by the supplier. It is required that LCA were conducted in accordance with the ISO14040, and ISO14044 standards. Then, the material provider offers the LCA results to the clients. In this case, the embody energy of the actual material provided by the supplier is considered.
2. Material databases, such as GRANTA-CES Selector (Granta, 2012), publish LCA results for material extraction and processing, for a large number of materials. Among other LCA results, materials embodied energy data estimated by means of streamlined LCA of average actual practice are published. It is required that the LCA were conducted in accordance with the ISO14040, and ISO14044 standards. In this case, embodied energy data presented in recognized material databases, such as the cited one, are considered. .
3. When the material or product is not included in material databases, such as the cited one, project owner and designers could conduct a streamlined LCA of materials extraction and processing. It is required, that project teams conduct a LCA in accordance with the ISO14040, and ISO14044 standards. The materials embody energy estimation by means of this LCA is considered.

As mentioned in point 3, project owner and designers could conduct a streamlined LCA of materials extraction and processing. The definition of streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

This single LCA presents results that can be used at several Envision Credits, specifically: RA1.1, CR1.2, CR1.3. In particular, this study will quantify those loadings and impacts requested in related credits of the Envision Rating System v 1.0: Embody energy (Credit RA 1.1), CO2 emissions (Credit CR1.2), particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3)

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athena Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commission –Joint Research Center ELCD database.

Associated credits and standards

- PANYJ Sustainable Infrastructure Guidelines: IM-4 Use Durable Materials

RA1.2 SUPPORT SUSTAINABLE PROCUREMENT PRACTICES

Associated credits and standards

- McDonough Braungart Design Chemistry, LLC (MBDC) Cradle to Cradle (C2C).

Resources and tools

- Forest Stewardship Council, PRINCIPLES AND CRITERIA for Forest Stewardship, http://www.fscus.org/images/documents/FSC_Principles_Criteria.pdf

RA1.3 USE RECYCLED MATERIALS

Associated credits and standards

- Sustainable Infrastructure Guidelines PANYNJ; Credit IM-1 Use Recycled Materials

Resources and tools

- Green Building Research Guide's: 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, http:epa.gov/industrial materials

RA1.4 USE REGIONAL MATERIALS

Associated credits and standards

- Pearl Community Rating Systems- 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.

RA1.5 DIVERT WASTE FROM LANDFILLS

Guidance

As mentioned on Credit Description RA1.5, it is recommended, but not required, that project teams conduct a streamlined life cycle assessment (LCA) to assess ongoing replacement, maintenance and operation stage, in accordance with the ISO14040, and ISO14044 standards. The definition of Streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also at Credits Description RA1.5, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.5, RA2.1, RA3.1, CR1.1, CR1.2. In particular, this LCA study will quantify those loadings and impacts requested or useful in related credits of the Envision Rating System v 1.0. They are: Energy consumption (Credit RA 2.1), water consumption (Credit RA 3.1); CO2 emissions (Credit CR1.2); particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3); waste (Credit RA1.5).

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athena Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commision –Joint Research Center ELCD database.

RA1.6 REDUCE EXCAVATED MATERIALS TAKEN OFF SITE

Associated credits and standards

- 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

Resources and tools

- Green Building Research Guide's: 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

RA2.1 REDUCE ENERGY CONSUMPTION

Guidance

As mentioned on Credit Descriptions: RA2.1 and RA1.5, it is recommended, but not required, that project teams conduct a streamlined life cycle assessment (LCA) to assess ongoing replacement, maintenance and operation stage, in accordance with the ISO14040, and ISO14044 standards. The definition of Streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also at Credits Description RA2.1 and RA1.5, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.5,

RA2.1, RA3.1, CR1.1, CR1.2. In particular, this LCA study will quantify those loadings and impacts requested or useful in related credits of the Envision Rating System v 1.0. They are: Energy consumption (Credit RA 2.1), water consumption (Credit RA 3.1); CO2 emissions (Credit CR1.2); particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3); waste (Credit RA1.5).

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athena Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commision –Joint Research Center ELCD database.

Resources and tools

- Paul Hawken, Amory Lovins, L. Hunter Lovins, Natural Capitalism: Creating the Next Industrial Revolution, Little, Brown and Company, 1999.

RA2.2 USE RENEWABLE ENERGY

Associated credits and standards

- PANYJ Sustainable Infrastructure Guidelines: IE-4 Use On-Site Renewable Energy

Resources and tools

- EPA eGRID - www.epa.gov/cleanrgy/egrid/

RA2.3 COMMISSION AND MONITOR ENERGY SYSTEMS

Associated credits and standards

- 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 WATER AVAILABILITY

Resources and tools

- 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. http://www.fema.gov/library/viewRecord.do?id=3336 (last accessed March 28, 2011.)

RA3.2 REDUCE POTABLE WATER CONSUMPTION

Guidance

As mentioned on Credits Description: RA3.2 and RA1.5, RA2.1, it is recommended, but not required, that project teams conduct a streamlined life cycle assessment (LCA) to assess ongoing replacement, maintenance and operation stage, in accordance with the ISO14040, and ISO14044 standards. The definition of streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also at Credits Description: RA3.2 and RA1.5, RA2.1, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.5, RA2.1, RA3.1, CR1.1, CR1.2. In particular, this LCA study will quantify those loadings and impacts requested or useful in related credits of the Envision Rating System v 1.0. They are: Energy consumption (Credit RA 2.1), water consumption (Credit RA 3.1); CO2 emissions (Credit CR1.2); particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3); waste (Credit RA1.5).

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athena Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commision –Joint Research Center ELCD database.

Associated credits and standards

- CEEQUAL Assessment Manual for Projects Version 4, December 2008, Roger K. Venables, Section 6.3.1, 6.3.2.
- Pear 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
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) NC- WE c3.1- Water use Reduction: 20%-30%
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) NC- WE c2-Innovative Wastewater Technologies

RA3.3 MONITOR WATER SYSTEMS AND RECEIVING WATERS

Associated credits and standards

- PANYNJ Sustainable Infrastructure Guidelines: IW-4 Utilize End Use Metering – Water
- InfraGuide: The National Guide to Sustainable Infrastructure, "Establishing a Metering Plan to Account for Water Use and Loss".

Resources and tools

- InfraGuide Best Practices Reports:
- "Establishing a Metering Plan to Account for Water Use and Loss" http://gmf.fcm.ca/files/Infraguide/Potable_Water/establish_metering_plan_

account.pdf

- "Water Use and Loss in the Water Distribution System" http://gmf.fcm.ca/files/Infraguide/Potable_Water/Water_Use_Loss_distrib_syst.pdf

NW1.1 PRESERVE PRIME HABITAT

Associated credits and standards

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) BD+C 2009 Site Selection Credit 1, p. 17
- SSI Guidelines and Performance Benchmarks 2009 Site Selection Credit 1.5, p. 26
- Pearl Community Rating System NS-1: Reuse of Land, p. 40
- LAND Code Preserving and Restoring Habitat, p. 69
- Forest Stewardship Council, "FSC Certification: Protection of Biodiversity and High Conservation Value Forests (HCVF)." http://www.fsc.org/
- Forest Stewardship Council, FSC Principles and Criteria for Forest Stewardship, FSC-STD-01-001 (version 4-0) EN.

Resources and tools

- New South Wales Government, Western Catchment Management Authority, High Value Ecological Communities, http://www.western.cma.nsw.gov.au/Pages/HighValueEcologicalCommunities.html
- 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. http://www.beginningwithhabitat.org/pdf/MARoadsWildlife-FINAL.pdf
- Theobald,David M, James R. Miller, and N. Thompson Hobbs. Estimating the cumulative effects of development on wildlife habitat. Landscape and Urban Planning 39 (1997): 25-36. http://warnercnr.colostate.edu/~davet/theobald_etal1997.pdf
- Seiler, Andreas. "Ecological Effects of Roads: A review." Introductory Research Essay No 9. Department of Conservation Biology SLU Uppsala 2001: 1-40 http://idd00s4z.eresmas.net/doc/transp/ecoeffectsonroads.pdf
- Trombulak, Stephen C. and Frissell, Christopher A. "Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities." Conservation Biology. vol 14 no 1. Feb 2000. pg 18-30 http://www.landsinfo.org/ecosystem_defense/Science_Documents/Trombulak_Frissell_2000.pdf
- City of Los Angeles L.A. CEQA Thresholds Guide .2006 . http://www.ci.la.ca.us/ead/programs/Thresholds/I-Noise.pdf
- "Chapter 16.16 - CRITICAL AREAS" . WHATCOM COUNTY CODE: A Codification of the General Ordinances of Whatcom County, Washington (2011) http://www.codepublishing.com/wa/whatcomcounty/html/whatco16/whatco1616.html#16.16.740
- "Noise Effect on Wildlife: Results and Discussion - Physics of Sound." US DOT – Federal Highway Administration. http://www.fhwa.dot.gov/environment/noise/noise_effect_on_wildlife/effects/wild04.cfm
- Kaseloo PA. 2006. Synthesis of noise effects on wildlife populations. IN: Proceedings of the 2005 International Conference on Ecology and Transportation, Eds. Irwin CL, Garrett P, McDermott KP. Center for Transportation and the Environment, North Carolina State University, Raleigh, NC: pp. 33-35. http://www.wombatforestcare.org.au/documents/Synthesis%20of%20noise%20effects%20on%20wildlife%20populations.pdf
- Kaseloo PA. Synthesis of Noise Effects on Wildlife Populations. Publication No. FHWA-HEP-06-016 September 2004. US DOT – Federal Highway Administration. http://www.fhwa.dot.gov/environment/noise/noise_effect_on_wildlife/effects/effects.pdf
- Forman, Richard T. T. and Alexander, Lauren E. ROADS AND THEIR MAJOR ECOLOGICAL EFFECTS. Annual Review Of Ecology And Systematics. 1998. 29:207–31

NW1.2 PROTECT WETLANDS AND SURFACE WATER

Associated credits and standards

- SITES Credit 3.3
- 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 Prerequisite 3: Wetland and Water Body Conservation
- 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
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) GB+D 2009 SS Credit 1: Site Selection
- LAND Code: Buffering Critical Habitats (p. 73)

Resources and tools

- Guidance on delineating wetlands: U.S. Army Corps of Engineers, http://www.usace.army.mil/CECW/Pages/techbio.aspx .
- National Wetlands Inventory, http://www.fws.gov/wetlands/ , source of digitally mapped and downloadable locations of designated wetlands.
- Low Impact Development: Technical Guidance Manual for Puget Sound, Chapter 4: Vegetation Protection, Reforestation, and Maintenance, Puget Sound Action Team
- Washington State University Pierce County Extension, 2005. http://www.psp.wa.gov/downloads/LID/LID_manual2005.pdf
- Wetland Laws, Regulations, Treaties: Policy and Technical Guidance Documents (EPA): http://water.epa.gov/lawsregs/lawsguidance/cwa/wetlands/index.cfm
- "Buffer Zones and Beyond: Wildlife use of Wetland Buffer Zones and their Protection under the Massachusetts Wetland Protection Act." Lynn Boyd. Wetland Conservation Professional Program, Department of Natural Resources Conservation, University of Massachusetts, July, 2001, http://www.umass.edu/nrec/pdf_files/final_project.pdf
- SOUTHEAST WATERSHED FORUM WETLAND FACT SHEET: Wetland

Buffer Zones - http://www.watershed-assistance.net/resources/files/SEWF_WetlandFactsheet_WetlandBuffer.pdf

- Castelle, A.J., C. Conolly, M. Emers, E.D. Metz, S. Meyer, M. Witter, S. Mauermann, T. Erickson, S.S. Cooke. 1992. Wetland Buffers: Use and Effectiveness. Adolfson Associates, Inc., Shorelands and Coastal Zone Management Program, Washington Department of Ecology, Olympia, Pub. No. 92-10. available: http://www.ecy.wa.gov/pubs/92010.pdf; appendices: http://www.ecy.wa.gov/pubs/9201a.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
- "Wetland and Stream Buffer Size Requirements." Castelle, A. J. Johnson, A. W. Conolly, C. JOURNAL OF ENVIRONMENTAL QUALITY, 1994, VOL 23; NUMBER 5, pages 878 http://www.mtaudubon.org/issues/wetlands/documents/Science%20Series/Setbacks_Castelle_wetlandandstreambuffersize1994.pdf
- Setting Buffer Sizes for Wetlands. James M McElfish, Jr., Rebecca L Kihslinger, and Sandra Nichols. National Wetlands Newsletter, vol. 30 no.2 2008 [Environmental Law Institute, Washington DC]
- "Chapter 16.16 - CRITICAL AREAS". WHATCOM COUNTY CODE: A Codification of the General Ordinances of Whatcom County, Washington (2011) http://www.codepublishing.com/wa/whatcomcounty/html/whatco16/whatco1616.html#16.16.740

NW1.3 PRESERVE PRIME FARMLAND

Resources and tools

- Farmland designations for most of the United States can now be accessed at the county level from SSURGO soil surveys, http://soildatamart.nrcs.usda.gov/ . For areas of 10,000 acres or less use the Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

NW1.4 AVOID SENSITIVE GEOLOGY

Resources and tools

- Karst." Encyclopædia Britannica. Encyclopædia Britannica Online. Encyclopædia Britannica, 2011. Web. 14 Jun. 2011. http://www.britannica.com/EBchecked/topic/312718/karst.
- USGS Karst Website, http://water.usgs.gov/ogw/karst/index
- Acta Carsologica, a journal dedicated to kars geography: http://carsologica.zrc-sazu.si/

NW1.5 PRESERVE FLOODPLAIN FUNCTIONS

Associated credits and standards

- ASTM E1903-97 Phase II Environmental Site Assessment
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SLL Credit 2: Brownfield Redevelopment, p. 26
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) BD+C 2009 Site Selection Credit 3: Brownfield Redevelopment, p. 35
- Pearl Community Rating System NS-2: Remediation of Contaminated Land, p. 41
- SSI Guidelines and Performance Benchmarks 2009 Site Selection Prerequisite 1.2: Protect floodplain functions, p. 22
- SSI Guidelines and Performance Benchmarks 2009 Site Selection Credit 1.5: Select brownfields or greyfields for redevelopment, p. 26
- SSI Guidelines and Performance Benchmarks 2009 Site Design - Water Credit 3.4: Rehabilitate lost streams, wetlands, and shorelines, p. 60
- SSI Guidelines and Performance Benchmarks 2009 Site Selection Credit 3.6: Protect and enhance on-site water resources and receiving water quality, p. 78

Resources and tools

- Natural and Beneficial Functions of Floodplains. FEMA. Publication 409, http://www.fema.gov/library/viewRecord.do?id=1546

NW1.6 AVOID UNSUITABLE DEVELOPMENT ON STEEP SLOPES

Associated credits and standards

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SLL Credit 6: Steep Slope Protection, p. 34

NW1.7 PRESERVE GREENFIELDS

Associated credits and standards

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) BD+C 2009 Site Selection Credit 2: Development Density and Community Connectivity, p. 50 PDF (23 of document)
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SSL Prerequisite 1: Smart Location, P. 1
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SSL Credit 1: Preferred Locations, P. 22
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 SSL Credit 2: Brownfields Redevelopment, P. 26
- The Pearl Rating System for Estidama Community Rating System: Design and Construction Credit NS-1: Reuse of Land, p. 40
- The Pearl Rating System for Estidama Community Rating System: Design and Construction Credit NS-2: Remediation of Contaminated Land, p. 41
- SSI Guidelines and Performance Benchmarks 2009 Site Selection Credit 1.5: Select brownfields or greyfields for redevelopment, p. 26)
- SSI Guidelines and Performance Benchmarks 2009 Site Selection Credit 1.6: Select sites within existing communities, p. 28)

Resources and tools

- U.S. EPA, Brownfields and Land Revitalization, http://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. http://www.usmayors.org/brownfields/library/greyfieldstogoldfields.pdf

- Brownfields Redevelopment Guide [Mass DEP] www.mass.gov/dep/cleanup/bftool.pdf - MA-specific info, but still good resource
- EPA Brownfields Website: http://epa.gov/brownfields/index.html
- Anatomy of a Brownfield Redevelopment [EPA] – describes process of brownfield redevelopment: epa.gov/brownfields/overview/anat_bf_redev_101106.pdf
- EPA - Types of Contaminated Sites http://www.epa.gov/compliance/cleanup/revitalization/site-types.html
- "How clean is clean - must a brownfield site be cleaned up to pristine conditions? The extent of cleanup will vary considerably depending on the type, amount and area of contamination, and the cleanup standards used by the specific regulatory program that governs the cleanup. In addition, a key factor in determining the level of cleanup is whether the use of the property is taken into account in setting cleanup standards. For example, if a property is slated for industrial use, the cleanup standards may be less stringent than if the property were to be used for residential purposes, because the level of exposure to the contaminants will be less." http://www.brownfieldscenter.org/big/faq.shtml

NW2.1 MANAGE STORMWATER

Associated credits and standards

- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND 2009 GIB Credit 8: Stormwater Management, P. 93
- The Pearl Rating System for Estidama Community Rating System: Design and Construction Credit PW-2: Stormwater Management, p. 104
- SSI Guidelines and Performance Benchmarks 2009 Site Design - Water Credit 3.5: Manage stormwater on site, p. 63

Resources and tools

- Urban Design Tools, Low Impact Development. http://www.lid-stormwater.net/index.html
- EPA's Stormwater Management reference page: http://www.epa.gov/oaintrnt/stormwater/index.htm
- Stormwater Journal for surface water quality professionals: http://www.stormh20.com/SW/SWhome.aspx
- International Stormwater BMP Database: http://www.bmpdatabase.org/

NW2.2 REDUCE PESTICIDE AND FERTILIZER IMPACTS

Associated credits and standards

- LAWA Sustainable Airport Planning, Design and Construction Guidelines, v4.0, April 2009, PD7-LD-2, Reduce Impact of Fertilizer Use.

NW2.3 PREVENT SURFACE AND GROUNDWATER CONTAMINATION

Associated credits and standards

- McDonough Braungart Design Chemistry, LLC (MBDC) Cradle to Cradle (C2C).

Resources and tools

- Natural and Beneficial Functions of Floodplains. FEMA. Publication 409, http://www.fema.gov/library/viewRecord.do?id=1546
- Wisconsin Department of Natural Resources, Wellhead protection, http://www.dnr.state.wi.us/org/water/dwg/wellhead.htm#protection%20area

NW3.1 PRESERVE SPECIES BIODIVERSITY

Associated credits and standards

- The Pearl Rating System for Estidama Community Rating System: Design and Construction Credit 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

Resources and tools

- 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 [http://www.fs.fed.us/pnw/sciencef/scifi79.pdf] –
- Habitat Connectivity Planning & Assessment - ASSESSING THE IMPACT OF ROADS ON ANIMAL POPULATION VIABILITY: http://www.icoet.net/downloads/03Planning&Assessment.pdf
- Habitat Connectivity Mapping Tools [Washington Wildlife Habitat Connectivity Group] - http://waconnected.org/habitat-connectivity-mapping-tools/
- Statewide assessment methodology –http://waconnected.org/wp-content/themes/whcwg/docs/statewide-connectivity/Chapter% resources page: http://waconnected.org/resources-and-information/ (links to other tools)
- UNICOR [Computational Ecology Laboratory – University of Montana]- http://cel.dbs.umt.edu/cms/index.php?option=com_content&view=article&id=50:unicor&catid=36&Itemid=56 – UNIversal CORridor Network Simulator (UNICOR) is "a species connectivity and corridor identification tool..."
- Habitat Fragmentation Research through Spatial Analysis - Annotated Bibliography: http://people.oregonstate.edu/~pfeiffev/Site_2/Annotated_Bibliography.html [seems like a very useful starting point for reading scientific papers about habitat connectivity/fragmentation]
- Circuitscape: A Tool for Landscape Ecology. Proceedings of the 7th Python in Science Conference (SciPy 2008) - http://gauss.cs.ucsb.edu/publication/Circuitscape_Python_Scipy08.pdf - Circuitscape is " a computational tool developed for modeling landscape connectivity using circuit theory."
- Connectivity Analyses:
  - California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California - http://www.dfg.ca.gov/habcon/connectivity /
  - Arizona's Wildlife Linkages Assessment - http://www.azdot.gov/Highways/OES/AZ_WildLife_Linkages/assessment.asp
  - South Coast Ecoregion Missing Linkages- http://www.scwildlands.org/reports/SCMLRegionalReport.pdf
  - Western Environmental Law Center, regional - http://www.westernlaw.org/our-work/wildlife-corridors

- Wildlife Connectivity Across Utah's Highways - http://escholarship.org/uc/item/3w44k0c4
- Linking Colorado's landscapes: http://nativeecosystems.org/campaigns/linking-colorados-landscapes
- 202%20-%20Methods%20WHCWG%20Statewide%20Analysis

NW3.2 CONTROL INVASIVE SPECIES

Associated credits and standards

- SSI Guidelines and Performance Benchmarks 2009 Site Design—Soil and Vegetation Credit 4.2: Use appropriate, non-invasive plants, p.90
- SSI Guidelines and Performance Benchmarks 2009 Site Design—Soil and Vegetation Credit 4.8: Preserve plant communities native to the ecoregion, p.111
- 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 (p.38)
- 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
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) BD+C 2009 SS Credit 5.1: Site Development—Protect or Restore Habitat
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) BD+C 2009 SS Credit 5.2: Site Development—Maximize Open Space
- Pearl Community Rating System NS-3: Ecological Enhancement, p.43
- LAND Code Preserving and Restoring Habitat, p.67
- Pearl Community Rating System PW-1.1: Community Water Use Reduction: Landscaping

Resources and tools

- U.S. Department of Agriculture, National Invasive Species Information Center, http://www.invasivespeciesinfo.gov/resources/lists.shtml
- State Noxious Weeds laws, and Federal Noxious Weeds laws.
- U.S. Department of Agriculture, National Invasive Species Information Center, http://www.invasivespeciesinfo.gov/resources/lists.shtml
- Invasive Species [EPA] http://water.epa.gov/type/oceb/habitat/invasive_species_index.cfm
- 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. http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf
- Identify Invasive Species http://www.discoverlife.org/mp/20q?guide=North_American_Invasives&btxt=Invasivespeciesinfo.gov&burl=www.invasivespeciesinfo.gov
- Invasive Species Research [USDA] - http://www.rmrs.nau.edu/invasive_species/
- Invasive Species Program [US Forest Service] - http://www.fs.fed.us/invasivespecies/
- Dangerous Travelers: Controlling Invasive Plants Along America's Roadways [US Forest Service]- video available: http://www.fs.fed.us/invasivespecies/prevention/dangeroustravelers.shtml
- Invasive and Noxious Weeds Lists [USDA]. http://plants.usda.gov/java/noxiousDriver#introduced

NW3.4 RESTORE WETLANDS AND SURFACE WATER

Associated credits and standards

- 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

Resources and tools

- "An Introduction to Wetland Restoration, Creation, and Enhancement" (2003), Federal Interagency Workgroup on Wetland Restoration.

http://www.epa.gov/owow/wetlands/restore/finalinfo.html.

- Ground Water and Ecosystem Restoration Research, EPA. http://www.epa.gov/ada/

CR1.1 ASSESS LIFE-CYCLE CARBON EMISSIONS

Guidance

Material extraction and processing

In order to estimate the CO2 emissions due to material extraction and processing, consider the following means:

1) The task to carry out a streamlined LCA of the actual materials extraction and processing has been undertaken by the supplier. It is required that LCA were conducted in accordance with the ISO14040, and ISO14044 standards. Then, the material provider offers the LCA results to the clients. In this case, the CO2 emissions of the actual material provided by the supplier is considered.
2. Material databases, such as GRANTA-CES Selector (Granta, 2012), publish LCA results for material extraction and processing, for a large number of materials. Among other LCA results, CO2 emissions data are published. It is required that the LCA were conducted in accordance with the ISO14040, and ISO14044 standards. In this case, CO2 emissions data presented in recognized material databases, such as the cited one, are considered.
3. When the material or product is not included in material databases, such as the cited one, project owner and designers could conduct a streamlined LCA of materials extraction and processing. It is required, that project teams conduct a LCA in accordance with the ISO14040, and ISO14044 standards. The materials CO2 emissions estimation by means of this LCA is considered.

As mentioned in point 3, project owner and designers could conduct a streamlined LCA of materials extraction and processing. The definition of streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also at RA1.1, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.1, CR1.2, CR1.3. In particular, this study will quantify those loadings and impacts requested in related credits of the Envision Rating System v 1.0: Embody energy (Credit RA 1.1), CO2 emissions

(Credit CR1.2), particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3)

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athena Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commission –Joint Research Center ELCD database.

Maintenance and operation

As mentioned on Credits Description: CR1.1 and RA1.5, RA2.1, RA3.2, it is recommended, but not required, that project teams conduct a streamlined life cycle assessment (LCA) to assess ongoing replacement, maintenance and operation stage, in accordance with the ISO14040, and ISO14044 standards. The definition of Streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also at Credits Description: CR1.1 and RA1.5, RA2.1, RA3.2, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.5, RA2.1, RA3.1, CR1.1, CR1.2. In particular, this LCA study will quantify those loadings and impacts requested or useful in related credits of the Envision Rating System v 1.0. They are: Energy consumption (Credit RA 2.1), water consumption (Credit RA 3.1); CO2 emissions (Credit CR1.2); particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3); waste (Credit RA1.5).

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athina Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commision –Joint Research Center ELCD database.

CR1.2 REDUCE GREENHOUSE GAS EMISSIONS

Guidance

Material extraction and processing

In order to estimate the cited air pollutants emission, consider the following means:

1. The task to carry out a streamlined LCA of the actual materials extraction and processing has been undertaken by the supplier. It is required that LCA were conducted in accordance with the ISO14040, and ISO14044 standards. Then, the material provider offers the LCA results to the clients. In this case, the air pollutants emission of the actual material provided by the supplier is considered.
2. Material databases, such as GRANTA-CES Selector (Granta, 2012), publish LCA results for material extraction and processing, for a large number of materials. Among other LCA results, air pollutant emissions data are published. It is required that the LCA were conducted in accordance with the ISO14040, and ISO14044 standards. In this case, air pollutant emissions data presented in recognized material databases, such as the cited one, are considered. .
3. When the material or product is not included in material databases, such as the cited one, project owner and designers could conduct a streamlined LCA of materials extraction and processing. It is required, that project teams conduct a LCA in accordance with the ISO14040, and ISO14044 standards. The materials air pollutants emission estimation by means of this LCA is considered.

As mentioned in point 3, project owner and designers could conduct a streamlined LCA of materials extraction and processing. The definition of streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also in RA1.1, CR1.1, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.1, CR1.2, CR1.3. In particular, this study will quantify those loadings and impacts requested in related credits of the Envision Rating System v 1.0: Embody energy (Credit RA 1.1), CO2 emissions (Credit CR1.2), particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3)

Today, a substantial number of databases and corresponding LCA software tools are available to model the chain of production, maintenance and disposal processes. These also contain Life Cycle Inventory (LCI) databases with all the inputs and outputs of a large number of products or processes. Among the software tools that include LCI Databases: ATHENA (Athena Institute, 2011) and BEES (NIST Engineering Laboratory, 2010) (both focused in the built environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commission –Joint Research Center ELCD database.

Operation and maintenance

As mentioned on Credits Description: CR1.2 and RA1.5, RA2.1, RA3.1, CR1.1, it is recommended, but not required, that project teams conduct a streamlined life cycle assessment (LCA) to assess ongoing replacement, maintenance and operation stage, in accordance with the ISO14040, and ISO14044 standards. The definition of Streamlined LCA is included in the Introduction. Among the large number of LCA information and resources today available is the "LCA: Principles and Practice" document presented by EPA at: http://www.epa.gov/nrmrl/lcaccess/lca101.html

As mentioned also at Credits Description: CR1.2 and RA1.5, RA2.1, RA3.1, CR1.1, this single LCA presents results that can be used at several Envision Credits, specifically: RA1.5, RA2.1, RA3.1, CR1.1, CR1.2. In particular, this LCA study will quantify those loadings and impacts requested or useful in related credits of the Envision Rating System v 1.0. They are: Energy consumption (Credit RA 2.1), water consumption (Credit RA 3.1); CO2 emissions (Credit CR1.2); particulate matter, ground level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead emissions (Credit CR1.3); waste (Credit RA1.5).

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environment), GaBi (PE International 2010) and SimPro (Pre Consultants 2010). Further LCI databases exist, among them: NREL U.S Life Cycle Inventory (LCI) Database and the European Commission –Joint Research Center ELCD database.

Resources and tools

- Developing a Greenhouse Gas Inventory (EPA) - http://www.epa.gov/statelocalclimate/state/activities/ghg-inventory.html - includes links to data sources, etc.
- Assessing Air Quality, Greenhouse Gas, and Public Health Benefits (EPA) - http://www.epa.gov/statelocalclimate/state/activities/assessing-air-quality-and-public-health.html#a02-c – outlines method for estimating benefits of clean energy (includes both GHG and air quality info); includes list of data sources for establishing baselines and relevant tools/resources
- Co-Benefits Risk Assessment (COBRA) Screening Model - http://www.epa.gov/statelocalclimate/resources/cobra.html - COBRA is "a Screening Tool That Estimates Health Effects . . . the COBRA screening model is a stand–alone Windows application that enables policy analysts to quickly obtain a first–order approximation of the costs and benefits of different emission scenarios and to compare outcomes in terms of changes in ambient particulate matter (PM) concentrations, related health effects, and monetary impacts. It is designed to allow users to quickly and easily analyze the health effects of changes in emissions of PM, as well as pollutants associated with the secondary formation of PM (sulfur dioxide [S02], nitrogen oxides [NOX], ammonia [NH3], and volatile organic compounds [VOCs]), at the county, state, regional, or national level." [seems like a great tool, but unsure if it's intended to be used at larger scales than most infrastructure projects]
- PowerProfiler (EPA) - http://www.epa.gov/cleanenergy/energy-and-you/how-clean.html - energy composition by zipcode

CR1.3 REDUCE AIR POLLUTANT EMISSIONS

Associated credits and standards

- SSI Guidelines and Performance Benchmarks 2009 Operations and Maintenance 8.8: Reduce emissions and promote the use of fuel-efficient vehicles, p. 208

Resources and tools

- Transportation's impacts on Air quality over time in US graph - http://people.hofstra.edu/geotrans/eng/ch8en/conc8en/transpolcontrib.html - (page lists original source for image as BTS) "The most important transport emissions are related to carbon monoxide, Volatile Organic Compounds
- (VOC) and nitrogen oxides, while transportation plays a marginal role for particulates and sulfur oxides emissions. "
- Assessing Air Quality, Greenhouse Gas, and Public Health Benefits (EPA) - http://www.epa.gov/statelocalclimate/state/activities/assessing-air-quality-and-public-health.html#a02-c – outlines method for estimating benefits of clean energy (includes both GHG and air quality info); includes list of data sources for establishing baselines and relevant tools/resources
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- 6 Common Air Pollutants – EPA is required by the Clean Air Act to set acceptable levels for these pollutants - http://www.epa.gov/oaqps001/urbanair/ - Pollutants include: Ozone, Particulate Matter, Carbon Monoxide, Nitrogen Oxides, Sulfur Dioxide, Lead – website includes links to immense information about each of these pollutants
- Information about the Air Quality Index (AQI) - http://www.gaepd.org/air/information/aqi.html

CR2.1 ASSESS CLIMATE THREAT

Associated credits and standards

- 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
- NYC Green Codes Task Force 2010: BR 3: Study Adaptive Strategies to Flooding
- NYC Green Codes Task Force 2010: BR 4: Study Adaptive Strategies to Non-Flood Climatic Risks
- NYC Green Codes Task Force 2010: BR 5: Forecast Non-Flood Climatic Hazards to 2080
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) ND SLL: Perquisite 5: Floodplain Avoidance
- The Sustainable Sites Initiative, Site Selection: Credit 1.2. Protect Floodplain Functions
- Building infrastructure systems without complete knowledge of long-term climate risks may present future vulnerabilities to the local population, including loss of key lifeline services or loss of significant municipal dollars for repairs and fixes. Assessing climate threats prior to the construction of a project can help avoid future vulnerability and ensure that the project is robust and appropriate.
- Managing greenhouse gas emissions is the key to reducing climate change consequences long-term. Reducing emissions means that less adaptation has to occur long-term. Adaptation planning is incomplete without mitigation.

Resources and tools

- Impacts of Climate Variability and Change on Transportation Systems and Infrastructure Gulf Coast (http://www.climatescience.gov/Library/sap/sap4-7/final-report/)
- Major cities such as London, Seattle, San Francisco, and NYC are currently developing flood maps based on climate change and exploring the feasibility of updating the building code in relation to these flood maps (http://www.urbangreencouncil.org/greencodes/).

- Case study – Miami Dade County FL: http://www.csc.noaa.gov/digitalcoast/inundation/_pdf/Case_Study_Miami-Dade.pdf
- Coastal Inundation Toolkit (NOAA) - http://www.csc.noaa.gov/digitalcoast/inundation/
- University of Washington - Center for Science in the Earth System
  - o Conduct a climate change vulnerability assessment: http://cses.washington.edu/db/pdf/snoveretalgb574ch8.pdf
  - o Conduct a climate change risk assessment: http://cses.washington.edu/db/pdf/snoveretalgb574ch9.pdf
- NOAA - Roadmap for Adapting to Coastal Risk: updated method for conducting a community-based risk and vulnerability assessment. http://www.csc.noaa.gov/digitalcoast/training/roadmap/index.html
- Hazard Mitigation Planning Overview (FEMA) - http://www.fema.gov/plan/mitplanning/overview.shtm
- Climate Resilience Evaluation & Awareness Tool (CREAT) – EPA: a software tool to assist drinking water and wastewater utility owners and operators in understanding potential climate change threats and in assessing the related risks at their individual utilities; http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm ; fact sheet - http://water.epa.gov/infrastructure/watersecurity/climate/upload/CREAT_Fact_Sheet_FINAL_December-2010.pdf

CR2.2 AVOID TRAPS AND VULNERABILITIES

Resources and tools

- Southeastern Michigan Council of Governments, "Creating a Sustainable Infrastructure System in Southeast Michigan", July 2010., http://www.semcog.org/. Find under "Reports" on the Home page.
- Southeastern Michigan Council of Governments, "Confronting the infrastructure crisis", Semscope, Winter 2011.

CR2.3 PREPARE FOR LONG-TERM ADAPTABILITY

Resources and tools

- United Nations Convention to Combat Desertification, Home: http://www.unccd.int/convention/menu.php
- Climate Ready Utilities [EPA] – http://water.epa.gov/infrastructure/watersecurity/climate/
- Climate Ready Water Utilities Toolbox – beta version [EPA] – searchable database of information – http://www.epa.gov/safewater/watersecurity/climate/toolbox.html
- Climate Resilient Infrastructure: Preparing for a Changing Climate Summary Document – http://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- http://www.humgeog.mq.edu.au/staff/frank_thomalla%20PDFs/eva_wp09.pdf
- Adapting the road sector to climate change Presented by: Fang Xu, Economist, Africa Region Office, fxu@worldbank.orgKarstenSten Pedersen, Project Director, COWI A/S, [World Bank] ksp@cowi.dk http://siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1297096897336/7715763-1297096955872/Presentation-Xu.pdf
- Rotterdam Climate Initiative – 100% Climate Proof: http://www.rotterdamclimateinitiative.nl/en/100_climate_proof/rotterdam_climate_proof/introduction_rotterdam_climate_proof
- A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems [World Wildlife Federation]- http://www.worldwildlife.org/climate/Publications/WWFBinaryitem4922.pdf
- National Report on Efforts to Mitigate Desertification in the Western United States", United Nations Convention to Combat Desertification, http://www.unccd.int/cop/reports/otheraffected/national/2006/united_states_of_america-eng.pdf
- Millennium Ecosystem Assessment, Ecosystems and Human Well-Being: Desertification Synthesis, http://www.millenniumassessment.org/documents/document.355.aspx.pdf
- U.S. Department of Agriculture, Natural Resources Conservation Service, Global Desertification Vulnerability Map, http://soils.usda.gov/use/worldsoils/mapindex/desert.html

CR2.4 PREPARE FOR SHORT TERM HAZARDS

Associated credits and standards

- CEEQUAL, Land Use 2.3 Flood Risks
- NYC Green Codes Task Force 2010: BR 3: Study Adaptive Strategies to Flooding
- NYC Green Codes Task Force 2010: BR 5: Study Adaptive Strategies to Non-Flood Climatic Risks

CR2.5 MANAGE HEAT ISLAND EFFECTS

Associated credits and standards

- 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
- U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) NC 2009: Credit 7.2 Heat Island Effect-- Roof
- Pearl Estidama: RE-2 Urban Heat Reduction
- The Sustainable Sites Initiatives: Site Design, Credit 4.12 Reduce Urban Heat Island Effects

Resources and tools

- ASTM E1980 - 11 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

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