

# LEED 2009 FOR SCHOOLS NEW CONSTRUCTION AND MAJOR RENOVATIONS

For Public Use and Display

LEED 2009 for Schools New Construction and Major Renovations Rating System

USGBC Member Approved November 2008 (Updated July 2016)



# PREFACE FROM USGBC

The built environment has a profound impact on our natural environment, economy, health, and productivity. Breakthroughs in building science, technology, and operations are now available to designers, builders, operators, and owners who want to build green and maximize both economic and environmental performance.

Through the LEED® green building certification program, the U.S. Green Building Council (USGBC) is transforming the built environment. The green building movement offers an unprecedented opportunity to respond to the most important challenges of our time, including global climate change, dependence on non sustainable and expensive sources of energy, and threats to human health. The work of innovative building professionals is a fundamental driving force in the green building moment. Such leadership is a critical component to achieving USGBC's mission of a sustainable built environment for all within a generation.

## **USGBC MEMBERSHIP**

USGBC's greatest strength is the diversity of our membership. USGBC is a balanced, consensus based nonprofit with more than 18,000 member companies and organizations representing the entire building industry. Since its inception in 1993, USGBC has played a vital role in providing a leadership forum and a unique, integrating force for the building industry. USGBC's programs have three distinguishing characteristics:

### **Committee-based**

The heart of this effective coalition is our committee structure, in which volunteer members design strategies that are implemented by staff and expert consultants. Our committees provide a forum for members to resolve differences, build alliances, and forge cooperative solutions for influencing change in all sectors of the building industry.

### **Member-driven**

Membership is open and balanced and provides a comprehensive platform for carrying out important programs and activities. We target the issues identified by our members as the highest priority. We conduct an annual review of achievements that allows us to set policy, revise strategies, and devise work plans based on members' needs.

### **Consensus-focused**

We work together to promote green buildings, and in doing so, we help foster greater economic vitality and environmental health at lower costs. We work to bridge ideological gaps between industry segments and develop balanced policies that benefit the entire industry.

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## ACKNOWLEDGMENTS

The LEED 2009 Rating System has been made possible only through the efforts of many dedicated volunteers, staff members, and others in the USGBC community. The Rating System improvement work was managed and implemented by USGBC staff and included review and input by many Technical Advisory Group (TAG) members with oversight by the LEED Steering Committee. We extend our deepest gratitude to all of our LEED committee members who participated in the development of this rating system, for their tireless volunteer efforts and constant support of USGBC's mission:

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The LEED 2009 for Schools Rating System builds on the work of those who helped create previous versions:

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# LEED 2009 FOR SCHOOLS NEW CONSTRUCTION AND MAJOR RENOVATIONS PROJECT CHECKLIST

## Sustainable Sites

## 24 Possible Points

<input checked="" type="checkbox"/> Prerequisite 1	Construction Activity Pollution Prevention	Required
<input checked="" type="checkbox"/> Prerequisite 2	Environmental Site Assessment	Required
<input type="checkbox"/> Credit 1	Site Selection	1
<input type="checkbox"/> Credit 2	Development Density and Community Connectivity	4
<input type="checkbox"/> Credit 3	Brownfield Redevelopment	1
<input type="checkbox"/> Credit 4.1	Alternative Transportation—Public Transportation Access	4
<input type="checkbox"/> Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
<input type="checkbox"/> Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2
<input type="checkbox"/> Credit 4.4	Alternative Transportation—Parking Capacity	2
<input type="checkbox"/> Credit 5.1	Site Development—Protect or Restore Habitat	1
<input type="checkbox"/> Credit 5.2	Site Development—Maximize Open Space	1
<input type="checkbox"/> Credit 6.1	Stormwater Design—Quantity Control	1
<input type="checkbox"/> Credit 6.2	Stormwater Design—Quality Control	1
<input type="checkbox"/> Credit 7.1	Heat Island Effect—Nonroof	1
<input type="checkbox"/> Credit 7.2	Heat Island Effect—Roof	1
<input type="checkbox"/> Credit 8	Light Pollution Reduction	1
<input type="checkbox"/> Credit 9	Site Master Plan	1
<input type="checkbox"/> Credit 10	Joint Use of Facilities	1

## Water Efficiency 11 Possible Points

<input checked="" type="checkbox"/> Prerequisite 1	Water Use Reduction	Required
<input type="checkbox"/> Credit 1	Water Efficient Landscaping	2-4
<input type="checkbox"/> Credit 2	Innovative Wastewater Technologies	2
<input type="checkbox"/> Credit 3	Water Use Reduction	2-4
<input type="checkbox"/> Credit 4	Process Water Use Reduction	1

## Energy and Atmosphere

## 33 Possible Points

<input checked="" type="checkbox"/> Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required
<input checked="" type="checkbox"/> Prerequisite 2	Minimum Energy Performance	Required
<input checked="" type="checkbox"/> Prerequisite 3	Fundamental Refrigerant Management	Required
<input type="checkbox"/> Credit 1	Optimize Energy Performance	1-19
<input type="checkbox"/> Credit 2	On-site Renewable Energy	1-7
<input type="checkbox"/> Credit 3	Enhanced Commissioning	2
<input type="checkbox"/> Credit 4	Enhanced Refrigerant Management	1
<input type="checkbox"/> Credit 5	Measurement and Verification	2
<input type="checkbox"/> Credit 6	Green Power	2

## Materials and Resources

## 13 Possible Points

<input checked="" type="checkbox"/> Prerequisite 1	Storage and Collection of Recyclables	Required
<input type="checkbox"/> Credit 1.1	Building Reuse—Maintain Existing Walls, Floors and Roof	1-2
<input type="checkbox"/> Credit 1.2	Building Reuse—Maintain Existing Interior Nonstructural Elements	1

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<input type="checkbox"/>	Credit 2	Construction Waste Management	1-2
<input type="checkbox"/>	Credit 3	Materials Reuse	1-2
<input type="checkbox"/>	Credit 4	Recycled Content	1-2
<input type="checkbox"/>	Credit 5	Regional Materials	1-2
<input type="checkbox"/>	Credit 6	Rapidly Renewable Materials	1
<input type="checkbox"/>	Credit 7	Certified Wood	1

### Indoor Environmental Quality

### 19 Possible Points

<input checked="" type="checkbox"/>	Prerequisite 1	Minimum Indoor Air Quality Performance	Required
<input checked="" type="checkbox"/>	Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	Required
<input checked="" type="checkbox"/>	Prerequisite 3	Minimum Acoustical Performance	Required
<input type="checkbox"/>	Credit 1	Outdoor Air Delivery Monitoring	1
<input type="checkbox"/>	Credit 2	Increased Ventilation	1
<input type="checkbox"/>	Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	1
<input type="checkbox"/>	Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	1
<input type="checkbox"/>	Credit 4	Low-Emitting Materials	1-4
<input type="checkbox"/>	Credit 5	Indoor Chemical and Pollutant Source Control	1
<input type="checkbox"/>	Credit 6.1	Controllability of Systems—Lighting	1
<input type="checkbox"/>	Credit 6.2	Controllability of Systems—Thermal Comfort	1
<input type="checkbox"/>	Credit 7.1	Thermal Comfort—Design	1
<input type="checkbox"/>	Credit 7.2	Thermal Comfort—Verification	1
<input type="checkbox"/>	Credit 8.1	Daylight and Views—Daylight	1-3
<input type="checkbox"/>	Credit 8.2	Daylight and Views—Views	1
<input type="checkbox"/>	Credit 9	Enhanced Acoustical Performance	1
<input type="checkbox"/>	Credit 10	Mold Prevention	1

### Innovation in Design

### 6 Possible Points

<input type="checkbox"/>	Credit 1	Innovation in Design	1-4
<input type="checkbox"/>	Credit 2	LEED Accredited Professional	1
<input type="checkbox"/>	Credit 3	The School as a Teaching Tool	1

### Regional Priority4 Possible Points

<input type="checkbox"/>	Credit 1	Regional Priority	1-4
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## LEED 2009 for Schools New Construction and Major Renovations

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

Certified	40–49 points
Silver	50–59 points
Gold	60–79 points
Platinum	80 points and above








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# INTRODUCTION

## I. LEED® GREEN BUILDING RATING SYSTEM

### **Background on LEED®**

Following the formation of the U.S. Green Building Council (USGBC) in 1993, the organization's members quickly realized that the sustainable building industry needed a system to define and measure "green buildings." USGBC began to research existing green building metrics and rating systems. Less than a year after formation, the members acted on the initial findings by establishing a committee to focus solely on this topic. The composition of the committee was diverse; it included architects, real estate agents, a building owner, a lawyer, an environmentalist, and industry representatives. This cross section of people and professions added a richness and depth both to the process and to the ultimate product.

The first LEED Pilot Project Program, also referred to as LEED Version 1.0, was launched at the USGBC Membership Summit in August 1998. After extensive modifications, LEED Green Building Rating System Version 2.0 was released in March 2000, with LEED Version 2.1 following in 2002 and LEED Version 2.2 following in 2005.

As LEED has evolved and matured, the program has undertaken new initiatives. In addition to a rating system specifically devoted to building operational and maintenance issues (LEED for Existing Buildings: Operations & Maintenance), LEED addresses the different project development and delivery processes that exist in the U.S. building design and construction market, through rating systems for specific building typologies, sectors, and project scopes: LEED for Core & Shell, LEED for New Construction, LEED for Schools, LEED for Neighborhood Development, LEED for Retail, LEED for Healthcare, LEED for Homes, and LEED for Commercial Interiors.

Project teams interact with the Green Building Certification Institute (GBCI) for project registration and certification. GBCI was established in 2008 as a separately incorporated entity with the support of the U.S. Green Building Council. GBCI administers credentialing and certification programs related to green building practice. These programs support the application of proven strategies for increasing and measuring the performance of buildings and communities as defined by industry systems such as LEED.

The green building field is growing and changing daily. New technologies and products are being introduced into the marketplace, and innovative designs and practices are proving their effectiveness. The LEED rating systems and reference guides will evolve as well. Project teams must comply with the version of the rating system that is current at the time of their registration.

USGBC will highlight new developments on its website on a continual basis at [www.usgbc.org](http://www.usgbc.org).

### **Features of LEED®**

The LEED Green Building Rating Systems are voluntary, consensus-based, and market-driven. Based on existing and proven technology, they evaluate environmental performance from a whole building perspective over a building's life cycle, providing a definitive standard for what constitutes a green building in design, construction, and operation.

The LEED rating systems are designed for rating new and existing commercial, institutional,

and residential buildings. They are based on accepted energy and environmental principles and strike a balance between known, established practices and emerging concepts. Each rating system is organized into 5 environmental categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. An additional category, Innovation in Design, addresses sustainable building expertise as well as design measures not covered under the 5 environmental categories. Regional bonus points are another feature of LEED and acknowledge the importance of local conditions in determining best environmental design and construction practices.

## The LEED Credit Weightings

In LEED 2009, the allocation of points between credits is based on the potential environmental impacts and human benefits of each credit with respect to a set of impact categories. The impacts are defined as the environmental or human effect of the design, construction, operation, and maintenance of the building, such as greenhouse gas emissions, fossil fuel use, toxins and carcinogens, air and water pollutants, indoor environmental conditions. A combination of approaches, including energy modeling, life-cycle assessment, and transportation analysis, is used to quantify each type of impact. The resulting allocation of points among credits is called credit weighting.

LEED 2009 uses the U.S. Environmental Protection Agency's TRACI<sup>1</sup> environmental impact categories as the basis for weighting each credit. TRACI was developed to assist with impact evaluation for life-cycle assessment, industrial ecology, process design, and pollution prevention.

LEED 2009 also takes into consideration the weightings developed by the National Institute of Standards and Technology (NIST); these compare impact categories with one another and assign a relative weight to each. Together, the 2 approaches provide a solid foundation for determining the point value of each credit in LEED 2009.

The LEED 2009 credit weightings process is based on the following parameters, which maintain consistency and usability across rating systems:

- All LEED credits are worth a minimum of 1 point.
- All LEED credits are positive, whole numbers; there are no fractions or negative values.
- All LEED credits receive a single, static weight in each rating system; there are no individualized scorecards based on project location.
- All LEED rating systems have 100 base points; Innovation in Design (or Operations) and Regional Priority credits provide opportunities for up to 10 bonus points.

Given the above criteria, the LEED 2009 credit weightings process involves 3 steps:

1. A reference building is used to estimate the environmental impacts in 13 categories associated with a typical building pursuing LEED certification.
2. The relative importance of building impacts in each category are set to reflect values based on the NIST weightings.<sup>2</sup>
3. Data that quantify building impacts on environmental and human health are used to assign points to individual credits.

Each credit is allocated points based on the relative importance of the building-related impacts that it addresses. The result is a weighted average that combines building impacts and the relative value of the impact categories. Credits that most directly address the most important impacts are given the greatest weight, subject to the system design parameters described above. Credit weights also reflect a decision by LEED to recognize the market implications of point allocation. The result is a significant change in allocation of points compared with previous LEED rating systems. Overall, the changes increase the relative emphasis on the reduction of energy consumption and greenhouse gas emissions associated with building systems, transportation, the embodied energy of water, the embodied energy of materials, and where applicable, solid waste.

The details of the weightings process vary slightly among individual rating systems. For example, LEED for Existing Buildings: Operations & Maintenance includes credits related to

solid waste management but LEED for New Construction does not. This results in a difference in the portion of the environmental footprint addressed by each rating system and the relative allocation of points. The weightings process for each rating system is fully documented in a weightings workbook.

The credit weightings process will be reevaluated over time to incorporate changes in values ascribed to different building impacts and building types, based on both market reality and evolving scientific knowledge related to buildings. A complete explanation of the LEED credit weightings system is available on the USGBC website, at [www.usgbc.org](http://www.usgbc.org).

### **Regional Priority Credits**

To provide incentive to address geographically specific environmental issues, USGBC regional councils and chapters have identified 6 credits per rating system that are of particular importance to specific areas. Each regional priority credit is worth an additional 1 point, and a total of 4 regional priority points may be earned. Upon project registration, LEED Online automatically determines a project's regional priority credits based on its zip code. If the project achieves more than 4 regional priority credits, the team can choose the credits for which these points will apply. The USGBC website also contains a searchable database of regional priority credits.

## **II. OVERVIEW AND PROCESS**

The LEED 2009 Green Building Rating System for Schools New Construction and Major Renovations is a set of performance standards for certifying the design and construction of commercial or institutional buildings and high-rise residential buildings of all sizes, both public and private. The intent is to promote healthful, durable, affordable, and environmentally sound practices in building design and construction.

Prerequisites and credits in the LEED Green Building Rating Systems address 7 topics:

- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (IEQ)
- Innovation in Design (ID)
- Regional Priority (RP)

LEED 2009 for Schools New Construction and Major Renovations certifications are awarded according to the following scale:

<i>Certified</i>	<i>40–49 points</i>
<i>Silver</i>	<i>50–59 points</i>
<i>Gold</i>	<i>60–79 points</i>
<i>Platinum</i>	<i>80 points and above</i>

GBCI will recognize buildings that achieve 1 of these rating levels with a formal letter of certification.

### **When to Use LEED 2009 for Schools**

LEED for Schools addresses design and construction activities for both new school buildings and major renovations of existing school buildings.

LEED for Schools must be used for the new construction or major renovation of an academic building. While LEED for Schools was designed for K-12 facilities, it may also be used for postsecondary academic buildings or prekindergarten buildings. Please see the Rating System Selection Policy, located in the LEED resources section of [www.usgbc.org](http://www.usgbc.org), for more information about choosing a rating system.

### **Registration**

Project teams interested in earning LEED certification for their buildings must first register the project with GBCI. Projects can be registered on the GBCI website ([www.gbci.org](http://www.gbci.org)). The website also has information on registration costs for USGBC national members as well as nonmembers. Registration is an important step that establishes contact with GBCI and provides access to software tools, errata, critical communications, and other essential information.

### **Certification**

To earn LEED certification, the applicant project must satisfy all the prerequisites and qualify for a minimum number of points to attain the established project ratings as listed below. Having satisfied the basic prerequisites of the program, applicant projects are then rated according to their degree of compliance within the rating system.

LEED 2009 for Schools provides the option of splitting a certification application into two phases: design and construction. Documentation for design phase credits, identified in LEED Online, can be submitted for review at the end of the design phase; the submittals for these credits can be fully evaluated based on documentation available during this phase of the project. For example, if a project site meets the requirements of LEED for Schools SS Credit 3, Brownfield Redevelopment, the likelihood of credit achievement can be assessed before construction is complete. The LEED credit itself, however, is not awarded at the design review stage.

For more information on the LEED certification process including LEED Online, Credit Interpretation Requests and Rulings, Appeals, and Fees please see the LEED Reference Guide for Green Building Design and Construction, 2009 Edition and visit [www.usgbc.org](http://www.usgbc.org) or [www.gbci.org](http://www.gbci.org).



### III. MINIMUM PROGRAM REQUIREMENTS

The LEED 2009 Minimum Program Requirements (MPRs) define the minimum characteristics that a project must possess in order to be eligible for certification under LEED 2009. These requirements define the categories of buildings that the LEED rating systems were designed to evaluate, and taken together serve three goals: to give clear guidance to customers, to protect the integrity of the LEED program, and to reduce challenges that occur during the LEED certification process. It is expected that MPRs will evolve over time along with LEED rating system improvements. The requirements will apply only to those projects registering under LEED 2009.

To view the MPRs and the MPR Supplemental Guidance, visit the LEED Resources and Tools section of [www.usgbc.org/projecttools](http://www.usgbc.org/projecttools).

### IV. EXEMPLARY PERFORMANCE STRATEGIES

Exemplary performance strategies result in performance that greatly exceeds the performance level or expands the scope required by an existing LEED 2009 for School credit. To earn exemplary performance credits, teams must meet the performance level defined by the next step in the threshold progression. For credits with more than 1 compliance path, an Innovation in Design point can be earned by satisfying more than 1 compliance path if their benefits are additive.

The credits for which exemplary performance points are available through expanded performance or scope are noted in the LEED Reference Guide for Green Design & Construction, 2009 Edition and in LEED Online.

#### Endnotes

- <sup>1</sup> Tools for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). U.S. Environmental Protection Agency, Office of Research and Development. <http://www.epa.gov/nrmrl/std/sab/traci/>.
- <sup>2</sup> Relative impact category weights based on an exercise undertaken by NIST (National Institute of Standards and Technology) for the BEES program. <http://www.bfrl.nist.gov/oe/software/bees/>.

# SUSTAINABLE SITES

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## **SS Prerequisite 1: Construction Activity Pollution Prevention Required**

### **Intent**

To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation.

### **Requirements**

Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit OR local standards and codes, whichever is more stringent. The plan must describe the measures implemented to accomplish the following objectives:

- To prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- To prevent sedimentation of storm sewers or receiving streams.
- To prevent pollution of the air with dust and particulate matter.

The EPA's construction general permit outlines the provisions necessary to comply with Phase I and Phase II of the National Pollutant Discharge Elimination System (NPDES) program. While the permit only applies to construction sites greater than 1 acre (0.4 hectare), the requirements are applied to all projects for the purposes of this prerequisite. Information on the EPA construction general permit is available at <http://cfpub.epa.gov/npdes/stormwater/cgp.cfm>.

### **Potential Technologies & Strategies**

Create an erosion and sedimentation control plan during the design phase of the project. Consider employing strategies such as temporary and permanent seeding, mulching, earthen dikes, silt fencing, sediment traps and sediment basins.

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## **SS Prerequisite 2: Environmental Site Assessment Required**

### **Intent**

To ensure that the site is assessed for environmental contamination and if contaminated, that the environmental contamination has been remediated to protect children's health.

### **Requirements**

Conduct a Phase I Environmental Site Assessment (as described in ASTM E1527-05) to determine whether environmental contamination exists at the site. If contamination is suspected conduct a Phase II Environmental Site Assessment (as described in ASTM E1903-97, 2002). Projects outside the U.S. may use a local equivalent to ASTM E1527-05 Phase I Environmental Site Assessment and ASTM E 1903-97 Phase II Environmental Site Assessment.

Schools sites that are contaminated by past use as a landfill are ineligible for LEED certification. If a site is otherwise contaminated, it must be remediated to meet local, state, or federal EPA region residential (unrestricted) standards, whichever is most stringent. Documentation from the authority (such as EPA's "Ready for Reuse" document) must be provided to prove that safe levels of contamination have been achieved. Because the remediation process leads to significant environmental benefit, 1 point in SS Credit 3: Brownfield Redevelopment can be achieved for successful documented remediation of the site.

### **Potential Technologies and Strategies**

To discover if the site has any chemical contaminants, research current and past site land using:

- Federal, state and local regulatory agencies' databases and files
- Private records of current and past land uses
- Review of historical aerial photographs
- Review of privately held environmental databases
- Interviews conducted with people familiar with the site's history (including past and present owners)

Many local agencies have databases regarding the use of the land. For example, Oregon Department of Environmental Quality has a database of buried fossil fuel storage tanks. This Department also has other databases (e.g., dry cleaner locations) that can be used to determine the historical usage of the site. These lists can be compiled to determine if potential environmental contaminants exist at the schools proposed site.

Develop and implement a site remediation plan using strategies such as pump-and-treat, bioreactors, land farming and in-situ remediation. Contact your state environmental protection agency to find out about remediation standards for residential (unrestricted) use. It is strongly recommended that projects use standards equivalent or more stringent than EPA Region 9 clean-up standards, as these are set at the most appropriate level for protecting children's health and safety.

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## **SS Credit 1: Site Selection**

### **1 Point**

#### **Intent**

To avoid the development of inappropriate sites and reduce the environmental impact from the location of a building on a site.

#### **Requirements**

Do not develop buildings, hardscape, roads or parking areas on portions of sites that meet any of the following criteria:

- Prime farmland as defined by the U.S. Department of Agriculture in the United States Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (citation 7CFR657.5). Projects outside the U.S. may use a local equivalent.
- Previously undeveloped land whose elevation is lower than 5 feet (1.5 meters) above the elevation of the 100-year flood as defined by the Federal Emergency Management Agency (FEMA), an equivalent local regulatory agency, or a professional hydrologist.
- Land specifically identified as habitat for any species on federal or state threatened or endangered lists. Projects outside the U.S. may use a local equivalent.
- Land within 100 feet (30 meters) of any wetlands as defined by the U.S. Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22 or a local equivalent definition outside the U.S., and isolated wetlands or areas of special concern identified by state or local rule, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent.
- Previously undeveloped land that is within 50 feet (15 meters) of a water body, defined as seas, lakes, rivers, streams and tributaries that support or could support aquatic life,, recreation or industrial use, consistent with the terminology of the Clean Water Act.
- Land that prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (park authority projects and projects which are operated by and support the function of the park are exempt).

#### **Potential Technologies & Strategies**

During the site selection process, give preference to sites that do not include sensitive elements or restrictive land types. Select a suitable building location and design the building with minimal footprint to minimize disruption of the environmentally sensitive areas identified above.

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## **SS Credit 2: Development Density and Community Connectivity**

### **4 Points**

#### **Intent**

To channel development to urban areas with existing infrastructure, protect greenfields and preserve habitat and natural resources.

#### **Requirements**

##### **OPTION 1. Development Density**

Construct or renovate a building on a previously developed site AND in a community with a minimum density of 60,000 square feet per acre net (13,800 square meters per hectare net). The density calculation is based on a typical two-story downtown development and must include the area of the project being built.

For the purposes of this option, physical education spaces that are part of the project site, such as playing fields and associated buildings used during sporting events only (e.g., concession stands) and playgrounds with play equipment, are excluded from the development density calculations.

#### **OR**

##### **OPTION 2. Community Connectivity**

Construct or renovate a building on a site that meets the following criteria:

- Is located on a previously developed site
- Is within 1/2 mile (800 meters) of a residential area or neighborhood with an average density of 10 units per acre net (10 units per 0.4 hectare net)
- Is within 1/2 mile (800 meters) of at least 10 basic services
- Has pedestrian access between the building and the services.

For mixed-use projects, no more than 1 service within the project boundary may be counted as 1 of the 10 basic services, provided it is open to the public. No more than 2 of the 10 services required may be anticipated (i.e. at least 8 must be existing and operational). In addition, the anticipated services must demonstrate that they will be operational in the locations indicated within 1 year of occupation of the applicant project.

Examples of basic services include the following::

- |                       |                            |                    |
|-----------------------|----------------------------|--------------------|
| ▪ Bank                | ▪ Hardware                 | ▪ Restaurant       |
| ▪ Place of Worship    | ▪ Laundry                  | ▪ School           |
| ▪ Convenience Grocery | ▪ Library                  | ▪ Supermarket      |
| ▪ Day Care Center     | ▪ Medical or Dental Office | ▪ Theater          |
| ▪ Cleaners            | ▪ Senior Care Facility     | ▪ Community Center |
| ▪ Fire Station        | ▪ Park                     | ▪ Fitness Center   |
| ▪ Beauty Salon        | ▪ Pharmacy                 | ▪ Museum           |
|                       | ▪ Post Office              |                    |

Proximity is determined by drawing a 1/2-mile (800-meter) radius around any building entrance on a site map and counting the services within that radius.

**Potential Technologies & Strategies**

During the site selection process, give preference to urban sites with pedestrian access to a variety of services.

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## **SS Credit 3: Brownfield Redevelopment**

### **1 Point**

#### **Intent**

To rehabilitate damaged sites where development is complicated by environmental contamination to reduce pressure on undeveloped land.

#### **Requirements**

Projects can achieve this point only via SS Prerequisite 2: Environmental Site Assessment and remediating site contamination.

For projects where asbestos is found and remediated also earn this credit. Testing should be done in accordance with EPA Reg 40CFR part 763, when applicable.

#### **Potential Technologies & Strategies**

Identify tax incentives and property cost savings. Coordinate site development plans with remediation activity, as appropriate.

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## **SS Credit 4.1: Alternative Transportation—Public Transportation Access**

### **4 Points**

#### **Intent**

To reduce pollution and land development impacts from automobile use.

#### **Requirements**

##### **OPTION 1. Rail Station Bus Rapid Transit Station & Ferry Terminal Proximity**

Locate the project within 1/2-mile (800-meter) walking distance measured from a main building entrance of an existing or planned and funded commuter rail, light rail, subway station, bus rapid transit<sup>1</sup> station or commuter ferry terminal..

**OR**

##### **OPTION 2. Bus Stop Proximity**

Locate project within 1/4-mile (400-meter) walking distance (measured from a main building entrance), of 1 or more stops for 2 or more public, campus, or private bus lines usable by building occupants. A school bus system may count as 1 of these lines.

**OR**

##### **OPTION 3. Pedestrian Access**

Show that the school has an attendance boundary such that at least 80% of students live within no more than 3/4-mile (1,200-meter) walking distance for grades 8 and below, and 1 1/2-mile (2,400-meter) walking distance for grades 9 and above. In addition, locate the project on a site that allows pedestrian access to the site from all residential neighborhoods that house the planned student population.

**OR**

##### **OPTION 4. Rideshare Proximity**

*Projects outside the U.S. may locate the project within 1/4-mile (400-meter) walking distance (measured from a main building entrance) of 1 or more stops for 2 or more existing rideshare options<sup>2</sup> that meet the definition of public transportation and are authorized by the local transit authority if one exists.*

##### **ALL OPTIONS**

For all options, provide dedicated walking or biking lanes to the transit lines that extend from the school building at least to the end of the school property in 2 or more directions without any barriers (e.g., fences) on school property.

#### **Potential Technologies & Strategies**

Perform a transportation survey of future building occupants to identify transportation needs. Locate the building near mass transit.

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<sup>1</sup> Bus rapid transit an enhanced bus system that operates on exclusive bus lanes or other transit rights-of-way; it is designed to combine the flexibility of buses with the efficiency of rail.

<sup>2</sup> Rideshare is a transit service that involves sharing a single vehicle with multiple people, excluding large-scale vehicles such as buses and trains. The rideshare transit facility must include a signed stop and a clearly defined waiting area. Additionally, the rideshare must include an enclosed passenger seating area, fixed route service, fixed fare structure, continuous daily operation, and the ability to pick up and drop off multiple riders. Rideshare options must hold 4 or more passengers, except for human-powered conveyances which must hold 2 or more passengers.

*Updated to reflect the 07/01/2016 document addenda for the LEED 2009 for Schools New Construction and Major Renovations Rating System*



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## **SS Credit 4.2: Alternative Transportation—Bicycle Storage and Changing Rooms**

### **1 Point**

#### **Intent**

To reduce pollution and land development impacts from automobile use.

#### **Requirements**

Provide secure bicycle racks and/or storage within 200 yards (200 meters) of a building entrance for 5% or more of all building staff and students above grade 3 level (measured at peak periods).

Provide shower and changing facilities in the building, or within 200 yards (200 meters) of a building entrance, for 0.5% of full-time equivalent (FTE) staff.

Provide dedicated bike lanes that extend at least to the end of the school property in 2 or more directions with no barriers (e.g., fences) on school property.

#### **Potential Technologies & Strategies**

Design the building with transportation amenities such as bicycle racks and shower/changing facilities. School administrators should be aware of issues with students and staff sharing shower/changing facilities, and ensure that both groups have access to facilities and feel comfortable using them. Administrators may consider providing separate shower facilities if there are no programmatic ways to provide privacy for staff in shared shower/ changing facilities.

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## **SS Credit 4.3: Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles**

### **2 Points**

#### **Intent**

To reduce pollution and land development impacts from automobile use.

#### **Requirements**

##### **OPTION 1**

Provide preferred parking<sup>1</sup> for low-emitting and fuel-efficient vehicles<sup>3</sup> for 5% of the total vehicle parking capacity of the site and at least 1 designated carpool drop-off area for low-emitting and fuel-efficient vehicles.

##### **OR**

##### **OPTION 2**

Develop and implement a plan for the buses and maintenance vehicles serving the school to use 20% (by vehicles, fuel or both) natural gas, propane or biodiesel or to be low-emitting and fuel-efficient vehicles<sup>2</sup>.

#### **Potential Technologies & Strategies**

Provide transportation amenities such as alternative-fuel refueling stations. Consider sharing the costs and benefits of refueling stations with neighbors. Using B-20 biodiesel in all buses and maintenance vehicles is one way to obtain this point through Option 1.

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<sup>1</sup> For the purposes of this credit preferred parking" refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped persons) or parking passes provided at a discounted price. To establish a meaningful incentive in all potential markets, the parking rate must be discounted at least 20%. The discounted rate must be available to all eligible customers (i.e. not limited to the number of customers equal to 5% of the vehicle parking capacity), publicly posted at the entrance of the parking area, and available for a minimum of 2 years.

<sup>2</sup> For the purposes of this credit, low-emitting and fuel-efficient vehicles are defined as vehicles that are classified as Zero Emission Vehicles (ZEV) by the California Air Resources Board. Fuel-efficient vehicles are defined as vehicles that have achieved a minimum green score of 40 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide.

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## **SS Credit 4.4: Alternative Transportation—Parking Capacity**

### **2 Points**

#### **Intent**

To reduce pollution and land development impacts from automobile use.

#### **Requirements**

##### **OPTION 1**

Size parking capacity to meet but not exceed minimum local zoning requirements.

Provide preferred parking<sup>1</sup> for carpools or vanpools for 5% of the total parking spaces.

**OR**

##### **OPTION 2**

Provide no new parking.

**OR**

##### **OPTION 3**

For projects that have no minimum local zoning requirements, provide 25% fewer parking spaces than the applicable standard listed in the 2003 Institute of Transportation Engineers (ITE) “Parking Generation” study at <http://www.ite.org>.

**OR**

#### **Potential Technologies & Strategies**

Minimize parking lot/garage size. Consider sharing parking facilities with adjacent buildings. Consider alternatives that will limit the use of single occupancy vehicles.

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<sup>1</sup> For the purposes of this credit “preferred parking” refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped persons) or parking passes provided at a discounted price.

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## **SS Credit 5.1: Site Development—Protect or Restore Habitat**

### **1 Point**

#### **Intent**

To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

#### **Requirements**

##### **CASE 1. Greenfield Sites<sup>1</sup>**

Limit all site disturbance to the following parameters:

- 40 feet (12 meters) beyond the building perimeter and parking garages;
- 10 feet (3 meters) beyond surface walkways, patios, surface parking and utilities less than 12 inches (30 centimeters) in diameter;
- 15 feet (4.5 meters) beyond primary roadway curbs and main utility branch trenches;
- 25 feet (8 meters) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities and playing fields) that require additional staging areas to limit compaction in the constructed area.

##### **CASE 2. Previously Developed or Graded Sites**

Restore or protect a minimum of 50% of the site area (excluding the building footprint) or 20% of the total site area (including building footprint), whichever is greater, with native or adapted vegetation<sup>2</sup>. Projects earning SS Credit 2: Development Density and Community Connectivity may include vegetated roof surface in this calculation if the plants are native or adapted, provide habitat and promote biodiversity.

Projects with limited landscape opportunities may also donate offsite land in perpetuity, equal to 60% of the previously developed area (including the building footprint), to a land trust within the same EPA Level III Ecoregion identified for the project site. The land trust must adhere to the Land Trust Alliance 'Land Trust Standards and Practices' 2004 Revision.

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<sup>1</sup> Greenfield sites are sites not previously developed or graded that could support open space, habitat, or agriculture.

<sup>2</sup> Native or adapted plants are plants indigenous to a locality or cultivars of native plants that are adapted to the local climate and are not considered invasive species or noxious weeds.

## **Potential Technologies & Strategies**

Survey greenfield sites, to identify site elements and adopt a master plan for developing the project site. Carefully site the building to minimize disruption to existing ecosystems and design the building to minimize its footprint. Strategies include stacking the building program, tuck-under parking and sharing parking facilities with neighbors. Establish clearly marked construction boundaries to minimize disturbance of the existing site and restore previously degraded areas to their natural state. For previously developed sites, use local and regional governmental agencies, consultants, educational facilities and native plant societies as resources for the selection of appropriate native or adapted plant. Prohibits plant listed as invasive or noxious weed species. Once established native/adapted plants require minimal or no irrigation do not require active maintenance such as mowing or chemical inputs such as fertilizers, pesticides or herbicides, and provide habitat value and promote biodiversity through avoidance of monoculture plantings.

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## **SS Credit 5.2: Site Development—Maximize Open Space**

### **1 Point**

#### **Intent**

To promote biodiversity by providing a high ratio of open space to development footprint.

#### **Requirements**

##### **CASE 1. Sites with Local Zoning Open Space Requirements**

Reduce the development footprint<sup>1</sup> and/or provide vegetated open space within the project boundary such that the amount of open space exceeds local zoning requirements by 25%.

##### **CASE 2. Sites with No Local Zoning Requirements (e.g. some university campuses, military bases)**

Provide vegetated open space area adjacent to the building that is equal in area to the building footprint.

##### **CASE 3. Sites with Zoning Ordinances but No Open Space Requirements**

Provide vegetated open space equal to 20% of the project's site area.

#### **ALL CASES**

For projects in urban areas that earn SS Credit 2: Development Density and Community Connectivity, vegetated roof areas can contribute to credit compliance.

For projects in urban areas that earn SS Credit 2: Development Density and Community Connectivity, pedestrian-oriented hardscape areas can contribute to credit compliance. For such projects, a minimum of 25% of the open space counted must be vegetated.

Wetlands or naturally designed ponds may count as open space and the side slope gradients average 1:4 (vertical: horizontal) or less and are vegetated.

#### **Potential Technologies & Strategies**

Perform a site survey to identify site elements and adopt a master plan for developing the project site. Select a suitable building location and design the building with a minimal footprint to minimize site disruption. Strategies include stacking the building program, tuck-under parking and sharing parking facilities with neighbors to maximize the amount of open space on the site.

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<sup>1</sup> Development footprint is defined as the total area of the building footprint, hardscape, access roads and parking.

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## **SS Credit 6.1: Stormwater Design—Quantity Control**

### **1 Point**

#### **Intent**

To limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants.

#### **Requirements**

##### **OPTION 1. Design Storms**

###### **CASE 1. Sites with Existing Imperviousness 50% or Less**

###### **PATH 1**

Implement a stormwater management plan that prevents the post development peak discharge rate and quantity from exceeding the predevelopment peak discharge rate and quantity for the 1- and 2-year 24-hour design storms.

###### **OR**

###### **PATH 2**

Implement a stormwater management plan that protects receiving stream channels from excessive erosion. The stormwater management plan must include a stream channel protection strategy and quantity control strategies.

###### **OR**

###### **CASE 2. Sites with Existing Imperviousness Greater Than 50%**

Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the 2-year 24-hour design storm.

###### **OR**

##### **OPTION 2. Percentile Rainfall Events**

###### **CASE 1. Non-Zero Lot Line Projects**

*In a manner best replicating natural site hydrology<sup>1</sup> processes, manage onsite<sup>2</sup> the runoff from the developed site for the 95th percentile of regional or local rainfall events using Low Impact Development (LID)<sup>3</sup> and green infrastructure<sup>4</sup>.*

*Use daily rainfall data and the methodology in the United States Environmental Protection Agency's Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal*

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<sup>1</sup> Natural Site Hydrology is defined as the natural land cover function of water occurrence, distribution, movement, and balance.

<sup>2</sup> "Manage Onsite" refers to capturing and retaining the specified volume of rainfall to mimic natural hydrologic function. This includes, but is not limited to, strategies that manage volume through evapotranspiration, infiltration, or capture and reuse.

<sup>3</sup> Low Impact Development (LID) is defined as an approach to managing stormwater runoff that emphasizes on-site natural features to protect water quality by replicating the natural land cover hydrologic regime of watersheds and addressing runoff close to its source. Examples include better site design principles such as minimizing land disturbance, preserving vegetation, minimizing impervious cover, and design practices like rain gardens, vegetated swales and buffers, permeable pavement, rainwater harvesting, and soil amendments. These are engineered practices that may require specialized design assistance.

<sup>4</sup> Green Infrastructure is a soil and vegetation-based approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies (US EPA).

*Updated to reflect the 07/01/2016 document addenda for the LEED 2009 for Schools New Construction and Major Renovations Rating System*

*Projects under Section 438 of the Energy Independence and Security Act to determine the 95th percentile amount.*

#### **CASE 2. Zero Lot Line Projects**

*For zero lot line projects located in urban areas with a minimum density of 1.5 FAR (13,800 square meters per hectare net), in a manner best replicating natural site hydrology processes, manage onsite the runoff from the developed site for the 85th percentile of regional or local rainfall events using LID<sup>1</sup> and green infrastructure.*

#### **Potential Technologies & Strategies**

Design the project site to maintain natural stormwater flows by promoting infiltration. Specify vegetated roofs, pervious paving and other measures to minimize impervious surfaces. Reuse stormwater for nonpotable uses such as landscape irrigation, toilet and urinal flushing, and custodial uses.

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## **SS Credit 6.2: Stormwater Design—Quality Control**



# 1 Point

## Intent

To limit disruption and pollution of natural water flows by managing stormwater runoff.

## Requirements

Implement a stormwater management plan that reduces impervious cover, promotes infiltration and captures and treats the stormwater runoff from 90% of the average annual rainfall<sup>1</sup> using acceptable best management practices (BMPs).

BMPs used to treat runoff must be capable of removing 80% of the average annual postdevelopment total suspended solids (TSS) load based on existing monitoring reports. BMPs are considered to meet these criteria if:

- They are designed in accordance with standards and specifications from a state or local program that has adopted these performance standards,

## OR

- There exists infield performance monitoring data demonstrating compliance with the criteria. Data must conform to accepted protocol (e.g., Technology Acceptance Reciprocity Partnership [TARP], Washington State Department of Ecology) for BMP monitoring.

## Potential Technologies & Strategies

Use alternative surfaces (e.g., vegetated roofs, pervious pavement grid pavers) and nonstructural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration and thereby reduce pollutant loadings. Consider pervious materials for physical education spaces, such as wood mulch, recycled rubber mulch and pervious paving.

Use sustainable design strategies (e.g., low-impact development, environmentally sensitive design) to create integrated natural and mechanical treatment systems such as constructed wetlands, vegetated filters and open channels to treat stormwater runoff.

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<sup>1</sup> There are 3 distinct climates in the United States that influence the nature and amount of annual rainfall. Humid watersheds are defined as those that receive at least 40 inches (102 centimeters) of rainfall each year. Semiarid watersheds receive between 20 and 40 inches (51 and 102 centimeters) of rainfall per year, and arid watersheds receive less than 20 inches (51 centimeters) of rainfall per year. For this credit, 90% of the average annual rainfall is equivalent to treating the runoff from the following (based on climate):

- Humid Watersheds — 1 inch (2.5 centimeters) of rainfall
- Semiarid Watersheds — 0.75 inches (1.9 centimeters) of rainfall
- Arid Watersheds — 0.5 inches (1.3 centimeters) of rainfall

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## **SS Credit 7.1: Heat Island Effect—Nonroof**

### **1 Point**

#### **Intent**

To reduce heat islands<sup>1</sup> to minimize impacts on microclimates and human and wildlife habitats.

#### **Requirements**

##### **OPTION 1**

Use any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots):

- Provide shade from the existing tree canopy or within 5 years of landscape installation. Landscaping (trees) must be in place at the time of occupancy.
- Provide shade from structures covered by solar panels that produce energy used to offset some nonrenewable resource use.
- Provide shade from architectural devices or structures that have a solar reflectance index<sup>2</sup> (SRI) of at least 29.
- Use hardscape materials with an SRI of at least 29.
- Use an open-grid pavement system (at least 50% pervious).

#### **OR**

##### **OPTION 2**

Place a minimum of 50% of parking spaces under cover<sup>3</sup>. Any roof used to shade or cover parking must have an SRI of at least 29, be a vegetated green roof or be covered by solar panels that produce energy used to offset some nonrenewable resource use.

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<sup>1</sup> Heat islands are defined as thermal gradient differences between developed and undeveloped areas.

<sup>2</sup> The solar reflectance index (SRI) is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.

<sup>3</sup> For the purposes of this credit, under cover parking is defined as parking underground, under deck, under roof or under a building.

### **Potential Technologies & Strategies**

Employ strategies, materials and landscaping techniques that reduce the heat absorption of exterior materials. Use shade (calculated on June 21, noon solar time) from native or adapted trees and large shrubs, vegetated trellises, or other exterior structures supporting vegetation. Consider using new coatings and integral colorants for asphalt to achieve light-colored surfaces instead of blacktop. Position photovoltaic cells to shade impervious surfaces.

Consider replacing constructed surfaces (e.g., roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials, such as concrete, to reduce heat absorption.

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## SS Credit 7.2: Heat Island Effect—Roof

### 1 Point

#### Intent

To reduce heat islands<sup>1</sup> to minimize impacts on microclimates and human and wildlife habitats.

#### Requirements

##### OPTION 1

Use roofing materials with a solar reflectance index<sup>2</sup> (SRI) equal to or greater than the values in the table below for a minimum of 75% of the roof surface.

Roofing materials having a lower SRI value than those listed below may be used if the weighted rooftop SRI average meets the following criteria:

$$\frac{\text{Area Roof Meeting Minimum SRI}}{\text{Total Roof Area}} \times \frac{\text{SRI of Installed Roof}}{\text{Required SRI}} \geq 75\%$$

Alternatively, the following equation may be used to calculate compliance:

$$\frac{\left[ \frac{\text{Area of Roof A}}{\text{Required SRI}} \times \text{SRI of Roof A} \right] + \left[ \frac{\text{Area of Roof B}}{\text{Required SRI}} \times \text{SRI of Roof B} \right] + \dots}{0.75} \geq \text{Total Roof Area}$$

Roof Type	Slope	SRI
Low-sloped roof	≤ 2:12 (15%)	78
Steep-sloped roof	> 2:12 (15%)	29

OR

##### OPTION 2

Install a vegetated roof that covers at least 50% of the roof area.

OR

##### OPTION 3

Install high-albedo and vegetated roof surfaces that, in combination, meet the following criteria:

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<sup>1</sup> Heat islands are defined as thermal gradient differences between developed and undeveloped areas.

<sup>2</sup> The Solar Reflectance Index (SRI) is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.

$$\frac{\text{Area Roof Meeting Minimum SRI}}{0.75} + \frac{\text{Area of Vegetated Roof}}{0.5} \geq \text{Total Roof Area}$$

Alternatively, a weighted average approach may be used to calculate compliance for multiple materials:

$$\frac{\left[ \frac{\text{Area of Roof A} \times \frac{\text{SRI of Roof A}}{\text{Required SRI}} \right] + \left[ \frac{\text{Area of Roof B} \times \frac{\text{SRI of Roof B}}{\text{Required SRI}} \right]}{0.75} + \frac{\text{Area of Vegetated Roof}}{0.5} \geq \text{Total Roof Area}$$

Roof Type	Slope	SRI
Low-sloped roof	≤ 2:12 (15%)	78
Steep-sloped roof	> 2:12 (15%)	29

### Potential Technologies & Strategies

Consider installing high-albedo and vegetated roofs to reduce heat absorption. Default values will be available in the LEED Reference Guide for Green Building Design and Construction, 2009 Edition.

Product information is available from the Cool Roof Rating Council Web site at

<http://www.coolroofs.org> and the ENERGY STAR® Web site at <http://www.energystar.gov>.

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## SS Credit 8: Light Pollution Reduction

### 1 Point

#### Intent

To minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction and reduce development impact from lighting on nocturnal environments.

#### Requirements

Project teams must comply with 1 of the 2 options for interior lighting AND the requirement for exterior lighting.

#### For Interior Lighting

##### OPTION 1

Reduce the input power (by automatic device) of all nonemergency interior luminaires with a direct line of sight to any openings in the envelope (translucent or transparent) by at least 50% between 11 p.m. and 5 a.m. After-hours override may be provided by a manual or occupant-sensing device provided the override lasts no more than 30 minutes.

##### OR

##### OPTION 2

All openings in the envelope (translucent or transparent) with a direct line of sight to any nonemergency luminaires must have shielding (controlled/closed by automatic device for a resultant transmittance of less than 10% between 11 p.m. and 5 a.m.).

#### For Exterior Lighting

Light areas only as required for safety and comfort. Exterior lighting power densities shall not exceed those specified in ANSI/ASHRAE/IESNA Standard 90.1-2007 with Addenda i for the documented lighting zone. Justification shall be provided for the selected lighting zone. Lighting controls for all exterior lighting shall comply with section 9.4.1.3 of ANSI/ASHRAE/IESNA Standard 90.1-2007, without amendments<sup>1</sup>.

Classify the project under 1 of the following zones, as defined in IESNA RP-33, and follow all of the requirements for that zone:

##### **LZ1: Dark (developed areas within national parks, state parks forest land and rural areas)**

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.01 horizontal and vertical footcandles (0.1 horizontal and vertical lux) at the LEED project boundary and beyond. Document that 0% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

##### **LZ2: Low (primarily residential zones, neighborhood business districts, light industrial areas with limited nighttime use and residential mixed-use areas)**

Design exterior lighting so that all site and building-mounted luminaires produce a maximum

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<sup>1</sup> The requirement to use ASHRAE Addenda i is unique to this credit and does not obligate Project teams to use ASHRAE approved addenda for other credits.

initial illuminance value no greater than 0.10 horizontal and vertical footcandles (1.0 horizontal and vertical lux) at the LEED project boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal lux) 10 feet (3 meters) beyond the LEED project boundary. Document that no more than 2% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

**LZ3: Medium (all other areas not included in LZ1, LZ2 or LZ4, such as commercial/industrial, and high-density residential)**

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.20 horizontal and vertical footcandles (2.0 horizontal and vertical lux) at the LEED project boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal lux) 15 feet (4.5 meters) beyond the site. Document that no more than 5% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

**LZ4: High<sup>1</sup> (high-activity commercial districts in major metropolitan areas)**

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.60 horizontal and vertical footcandles (6.5 horizontal and vertical lux) at the LEED project boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal lux) 15 feet (4.5 meters) beyond the site. Document that no more than 10% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

**LZ2, LZ3 and LZ4** - For LEED project boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the LEED project boundary.

**For All Zones**

Illuminance generated from a single luminaire placed at the intersection of a private vehicular driveway and public roadway accessing the site is allowed to use the centerline of the public roadway as the LEED project boundary for a length of 2 times the driveway width centered at the centerline of the driveway.

**Sports Field Lighting (Physical Education Spaces)**

Physical education spaces (playing fields) do not need to comply with the lighting power density requirements of this credit, as per ANSI/ASHRAE/IESNA Standard 90.1-2007 section 9.4.5, exception E.

**Automatic Shutoff:** All sports lighting must be automatically controlled to shut off no later than 11 p.m.. Manual override must be provided to avoid disruption of school sponsored sporting events.

**Trespass Calculations**

All trespass calculations must be submitted for 2 conditions: (1) with the sports lighting turned off and all other site lighting turned on, the light trespass requirements are as stated above, and (2) with just the sports lighting turned on, the light trespass requirements for horizontal and vertical footcandles (fc) may be increased to the following illuminance levels:

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<sup>1</sup> To be LZ4, the area must be so designated by an organization with local jurisdiction, such as the local zoning authority.

**LZ1** = 0.10 fc (1.0 lux) at the LEED project boundary, dropping to 0.01 fc (0.1 lux) within 10 feet (3 meters) of the boundary

**LZ2** = 0.30 fc (3.0 lux) at the LEED project boundary, dropping to 0.01 fc (0.1 lux) within 10 feet (3 meters) of the boundary

**LZ3** = 0.80 fc (8.0 lux) at the LEED project boundary, dropping to 0.01 fc (0.1 lux) within 15 feet (4.5 meters) of the boundary

**LZ4** = 1.50 fc (16.0 lux) at the LEED project boundary, dropping to 0.01 fc (0.1 lux) within 15 feet (4.5 meters) of the LEED project boundary

### **Potential Technologies & Strategies**

Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution. Minimize site lighting where possible and use computer software to model the site lighting. Technologies to reduce light pollution include full cutoff luminaires, low-reflectance surfaces and low-angle spotlights.



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## **SS Credit 9: Site Master Plan**

### **1 Point**

#### **Intent**

To ensure that the environmental site issues included in the initial development of the site and project are continued throughout future development caused by changes in programs or demography.

#### **Requirements**

The project must achieve at least 4 out of the following 7 credits using the associated calculation methods. This credit then requires that the achieved credits be recalculated using the data from the master plan. The 7 credits include:

- SS Credit 1: Site Selection
- SS Credit 5.1: Site Development—Protect or Restore Habitat
- SS Credit 5.2: Site Development—Maximize Open Space
- SS Credit 6.1: Stormwater Design—Quantity Control
- SS Credit 6.2: Stormwater Design—Quality Control
- SS Credit 7.1: Heat Island Effect—Nonroof
- SS Credit 8: Light Pollution Reduction

A site master plan for the school must be developed in collaboration with the school board or other decision-making body. Previous sustainable site design measures should be considered in all master-planning efforts, with intent to retain existing infrastructure whenever possible. The master plan, therefore, must include current construction activity plus future construction (within the building's lifespan) that affects the site. The master plan development footprint must also include parking, paving, and utilities.

Projects where no future development is planned are not eligible for this credit.

#### **Potential Technologies & Strategies**

Site development should include all potential expansion of the school to accommodate future needs while adhering to and maintaining the environmental site conditions referenced above and explicitly noted on the site plan as future expansion. Include in this master plan locations of temporary classroom facilities that will not impact the selected environmental conditions. Use geographic information systems (GIS) data and other similar technologies to establish the site capacity and characteristics. Design considerations should include future vertical or horizontal heating, ventilating and air conditioning (HVAC), electrical, and structural loads based on the master plan.

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## **SS Credit 10: Joint Use of Facilities**

### **1 Point**

#### **Intent**

To make the school a more integrated part of the community by enabling the building and its playing fields to be used for nonschool events and functions.

#### **Requirements**

##### **OPTION 1**

In collaboration with the school board or other decision-making body, ensure that at least 3 of the following types of spaces included in the school are accessible to and available for shared use by the general public: auditorium, gymnasium, cafeteria/cafetorium, 1 or more classrooms, playing fields, and/or joint parking.

Provide a separate entry to the spaces intended for joint use. The entry can be from a school lobby or corridor near an entrance convenient to public access, which can be secured from the rest of the school after normal school hours and has toilets available.

**OR**

##### **OPTION 2**

In collaboration with the school board or other decision-making body, engage in a contract with community or other organizations to provide at least 2 types of dedicated-use spaces in the building.

Dedicated-use spaces include, but are not limited to:

- Commercial office
- Health clinic
- Community service centers (provided by state, city, or county offices)
- Police offices
- Library or media center
- Parking lot
- One or more commercial sector businesses

Provide a separate entry to the spaces intended for joint use. The entry can be from a school lobby or corridor near an entrance convenient to public access, which can be secured from the rest of the school after normal school hours and which has toilets available.

**OR**

##### **OPTION 3**

In collaboration with the school district or other decision-making body, ensure that at least 2 of the following

6 spaces that are owned by other organizations/agencies are accessible to students:

- Auditorium
- Gymnasium

- Cafeteria
- One or more classrooms
- Swimming pool
- Playing field

Provide direct pedestrian access to these spaces from the school. In addition, provide signed agreements with the other organizations/ agencies that stipulate how they and the school district and organizations or agencies will share these spaces.

### **Potential Technologies & Strategies**

Contact other public agencies and organizations that may wish to use school facilities. For example, parks and recreation departments may need use of additional fields, while school districts may need use of a community pool.

# WATER EFFICIENCY

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## WE Prerequisite 1: Water Use Reduction Required

### Intent

To increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

### Requirements

Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation).

Calculate the baseline according to the commercial and/or residential baselines outlined below.<sup>1</sup>

Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves.

Commercial Fixtures, Fittings, and Appliances	Current Baseline (Imperial Units)	Current Baseline (Metric units)
Commercial toilets	1.6 gallons per flush (gpf)* Except blow-out fixtures: 3.5 (gpf)	6 liters per flush (lpf) Except blow-out fixtures: 13 lpf
Commercial urinals	1.0 (gpf)	4 lpf
Commercial lavatory (restroom) faucets	2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets	8.5 liters per minute (lpm) at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Showerheads	2.5 (gpm) at 80 (psi) per shower stall ****	9.5 lpm at 5 bar (58 psi)
For projects with commercial pre-rinse spray valves, the flow rate must comply with the ASME A112.18.1 standard of 1.6 gpm or less.		

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<sup>1</sup> Tables adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.

Residential Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Residential toilets	1.6 (gpf)***	6 liters per flush (lpf) Except blow-out fixtures:
Residential lavatory (bathroom) faucets	2.2 (gpm) at 60 psi	8.5 lpm at 4 bar (58 psi),
Residential kitchen faucet		
Residential showerheads	2.5 (gpm) at 80 (psi) per shower stall****	9.5 lpm at 5.5 bar (80 psi) per shower stall
<p>* EPA 1992 standard for toilets applies to both commercial and residential models.</p> <p>** In addition to EPA 1992 requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (2.0 lpm at 4 bar (58 psi)) (ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code.</p> <p>*** EPA 1992 standard for toilets applies to both commercial and residential models.</p> <p>**** Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above (2.5 gpm/ 9.5 lpm) per shower compartment, where the floor area of the shower compartment is less than 2,500 square inches (1.5 square meters). For each increment of 2,500 square inches (1.5 square meters) of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated nonpotable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.</p>		

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation:

- Commercial Steam Cookers
- Commercial Dishwashers
- Automatic Commercial Ice Makers
- Commercial (family-sized) Clothes Washers
- Residential Clothes Washers
- Standard and Compact Residential Dishwashers

### Potential Technologies & Strategies

WaterSense-certified fixtures and fixture fittings should be used where available. Use high-efficiency fixtures (e.g., water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce potable water demand. Consider using alternative on-site sources of water (e.g., rainwater, stormwater, and air conditioner condensate) and graywater for nonpotable applications such as custodial uses and toilet and urinal flushing. The quality of any alternative source of water used must be taken into consideration based on its application or use.

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## **WE Credit 1: Water Efficient Landscaping**

### **2–4 Points**

#### **Intent**

To limit or eliminate the use of potable water or other natural surface or subsurface water resources available on or near the project site for landscape irrigation.

#### **Requirements**

##### **OPTION 1. Reduce by 50% (2 points)**

Reduce potable water consumption for irrigation by 50% from a calculated midsummer baseline case or using the month with the highest irrigation demand.

Reductions must be attributed to any combination of the following items:

- Plant species, density and microclimate factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for nonpotable uses

Groundwater seepage that is pumped away from the immediate vicinity of building slabs and foundations may be used for landscape irrigation to meet the intent of this credit. However, the project team must demonstrate that doing so does not affect site stormwater management systems.

#### **OR**

##### **OPTION 2. No Potable Water Use or Irrigation<sup>1</sup> (4 points)**

Meet the requirements for Option 1.

#### **AND**

##### **PATH 1**

Use only captured rainwater, recycled wastewater, recycled graywater or water treated and conveyed by a public agency specifically for nonpotable uses for irrigation.

#### **OR**

##### **PATH 2**

Install landscaping that does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment are allowed only if removed within a period not to exceed 18 months of installation.

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<sup>1</sup> If the percent reduction of potable water is 100% AND the percent reduction of total water is equal to or greater than 50%, both Option 1 & Option 2 are earned.

**Potential Technologies & Strategies**

Perform a soil/climate analysis to determine appropriate plant material and design the landscape with native or adapted plants to reduce or eliminate irrigation requirements. Where irrigation is required, use high-efficiency equipment and/or climate-based controllers.

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## **WE Credit 2: Innovative Wastewater Technologies**

### **2 Points**

#### **Intent**

To reduce wastewater generation and potable water demand while increasing the local aquifer recharge.

#### **Requirements**

##### **OPTION 1**

Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (e.g., water closets, urinals) or nonpotable water (e.g., captured rainwater, recycled graywater, and on-site or municipally treated wastewater).

##### **OR**

##### **OPTION 2**

Treat 50% of wastewater on-site to tertiary standards. Treated water must be infiltrated or used on-site.

#### **Potential Technologies & Strategies**

Specify high-efficiency fixtures and dry fixtures (e.g., composting toilet systems, nonwater-using urinals) to reduce wastewater volumes. Consider reusing stormwater or graywater for sewage conveyance or on-site mechanical and/or natural wastewater treatment systems. Options for on-site wastewater treatment include packaged biological nutrient removal systems, constructed wetlands and high-efficiency filtration systems.



## WEQat 3 Water Use Reduction 24 Points

### Intent

To further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

### Requirements

Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation). The minimum water savings percentage for each point threshold is as follows:

Percentage Reduction	Points
30%	2
35%	3
40%	4

Calculate the baseline according to the commercial and/or residential baselines outlined below.<sup>1</sup>

Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves.

Commercial Fixtures, Fittings, and Appliances	Current Baseline (Imperial Units)	Current Baseline (Metric units)
Commercial toilets	1.6 gallons per flush (gpf)* Except blow-out fixtures: 3.5 (gpf)	6 liters per flush (lpf) Except blow-out fixtures: 13 lpf
Commercial urinals	1.0 (gpf)	4 lpf
Commercial lavatory (restroom) faucets	2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets	8.5 liters per minute (lpm) at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Showerheads	2.5 (gpm) at 80 (psi) per shower stall ****	9.5 lpm at 5 bar (58 psi)
For projects with commercial pre-rinse spray valves, the flow rate must comply with the ASME A112.18.1 standard of 1.6 gpm or less.		

<sup>1</sup> Table adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.

Residential Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Residential toilets	1.6 (gpf)***	6.1 liters per flush (lpf)
Residential lavatory (bathroom) faucets	2.2 (gpm) at 60 psi	8.5 lpm at 4 bar (58 psi)
Residential kitchen faucet		
Residential showerheads	2.5 (gpm) at 80 (psi) per shower stall****	9.5 lpm at 5.5 bar (80 psi) per shower stall
<p>* EPAAct 1992 standard for toilets applies to both commercial and residential models.</p> <p>** In addition to EPAAct requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code.</p> <p>*** EPAAct 1992 standard for toilets applies to both commercial and residential models.</p> <p>**** Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above (2.5 gpm/ 9.5 lpm) per shower compartment, where the floor area of the shower compartment is less than 2,500 square inches. For each increment of 2,500 square inches of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated nonpotable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.</p>		

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation:

- Commercial Steam Cookers
- Commercial Dishwashers
- Automatic Commercial Ice Makers
- Commercial (family-sized) Clothes Washers
- Residential Clothes Washers
- Standard and Compact Residential Dishwashers

### Potential Technologies & Strategies

Use WaterSense-certified fixtures and fixture fittings where available. Use high-efficiency fixtures (e.g., water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce the potable water demand. Consider using alternative on-site sources of water (e.g., rainwater, stormwater, and air conditioner condensate, graywater) for nonpotable applications (e.g., toilet and urinal flushing, custodial uses). The quality of any alternative source of water being used must be taken into consideration based on its application or use.

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## WE Credit 4: Process Water Use Reduction

### 1 Point

#### Intent

To maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

#### Requirements

To receive this credit, buildings must have the following:

- No refrigeration equipment using once-through cooling with potable water
- No garbage disposals
- All appliances within at least 4 equipment types where water use is at or below the levels shown in the table below. Inclusion of any equipment not listed in the table below must be supported by documentation showing a 20% reduction in water use from a benchmark or industry standard.

Equipment Type	Maximum Water Use (Imperial units)	Maximum Water Use (Metric units)	Other Requirements
<i>Clothes washers*</i>	<i>7.5 gallons/ft<sup>3</sup>/cycle</i>	<i>12 liters/kg wash load</i>	
<i>Dishwashers with racks</i>	<i>1.0 gallons/rack</i>	<i>4.0 liters/rack</i>	
<i>Ice machines**</i>	<i>lbs/day&gt;175 20 gallons/100lbs</i>	<i>kg/day&gt;80 75 liters/45 kg</i>	<i>No water-cooled machines</i>
	<i>lbs/day&lt;175 30 gallons/100/lbs</i>	<i>lbs/day&lt;175 30 gallons/100/lbs</i>	<i>No water-cooled machines</i>
<i>Food steamers</i>	<i>2 gallons/hour</i>	<i>8 liters/hour</i>	<i>Boilerless steamers only</i>
<i>Prerinse spray valves</i>	<i>1.4 gallons per minute</i>	<i>5.3 liters per minute</i>	
<i>* Commercial CEE Tier 3a—Residential CEE Tier 1 ** CEE Tier 3</i>			

#### Potential Technologies & Strategies

Assess the process water equipment needs for the project, based on programmatic considerations and size of the school. Specify the use of high-efficiency equipment, appropriately sized, to reduce the potable water demand.

# ENERGY & ATMOSPHERE

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## **EA Prerequisite 1: Fundamental Commissioning of Building Energy Systems Required**

### **Intent**

To verify that the project's energy-related systems are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents.

Benefits of commissioning include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant productivity and verification that the systems perform in accordance with the owner's project requirements.

### **Requirements**

The following commissioning process activities must be completed by the project team:

- Designate an individual as the commissioning authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
  - The CxA must have documented commissioning authority experience in at least 2 building projects.
  - The individual serving as the CxA must be independent of the project's design and construction management, though the CxA may be an employee of any firm providing those services. The CxA may be a qualified employee or consultant of the owner.
  - The CxA must report results, findings and recommendations directly to the owner.
  - For projects smaller than 50,000 gross square feet (4,600 gross square meters), the CxA may be a qualified person on the design or construction team who has the required experience.
- The owner must document the owner's project requirements. The design team must develop the basis of design. The CxA must review these documents for clarity and completeness. The owner and design team must be responsible for updates to their respective documents.
- Develop and incorporate commissioning requirements into the construction documents.
- Develop and implement a commissioning plan.
- Verify the installation and performance of the systems to be commissioned.
- Complete a summary commissioning report.

### **Commissioned Systems**

Commissioning process activities must be completed for the following energy-related systems, at a minimum:

- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls
- Lighting and daylighting controls
- Domestic hot water systems
- Renewable energy systems (e.g. wind, solar).

## **Potential Technologies & Strategies**

Engage a CxA as early as possible in the design process. Determine the owner's project requirements, develop and maintain a commissioning plan for use during design and construction, and incorporate commissioning requirements in bid documents. Assemble the commissioning team, and prior to occupancy verify the performance of energy consuming systems. Complete the commissioning reports with recommendations prior to accepting the commissioned systems.

Owners are encouraged to seek out qualified individuals to lead the commissioning process. Qualified individuals are identified as those who possess a high level of experience in the following areas:

- Energy systems design, installation and operation
- Commissioning planning and process management
- Hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation and maintenance procedures
- Energy systems automation control knowledge

Owners are encouraged to consider including water-using systems, building envelope systems and other systems in the scope of the commissioning plan as appropriate. The building envelope is an important component of a facility that impacts energy consumption, occupant comfort and indoor air quality. While this prerequisite does not require building envelope commissioning, an owner can achieve significant financial savings and reduce risk of poor indoor air quality by including it in the commissioning process.

The LEED Reference Guide for Green Building Design and Construction, 2009 Editions provides guidance on the rigor expected for this prerequisite for the following:

- Owner's project requirements.
- Basis of design.
- Commissioning plan.
- Commissioning specification.
- Performance verification documentation.
- Commissioning report.

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## **EA Prerequisite 2: Minimum Energy Performance Required**

### **Intent**

To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.

### **Requirements**

The project must establish an energy performance rating goal for the facility design using EPA's Target Finder rating tool.

#### **OPTION 1. Whole Building Energy Simulation**

Demonstrate a 10% improvement in the proposed building performance rating for new buildings or a 5% improvement in the proposed building performance rating for major renovations to existing buildings compared with the baseline building performance rating.

For projects that registered after April 7, 2016 and are subject to the four point mandatory minimum, demonstrate an 18% improvement in the proposed building performance rating for new buildings, or a 14% improvement in the proposed building performance rating for major renovations to existing buildings, compared with the baseline building performance rating.

Calculate the baseline building performance rating according to the building performance rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) using computer stimulation model for the whole building project. Projects outside the U.S. may use a USGBC approved equivalent standard.<sup>2</sup>

Appendix G of Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all energy costs associated with the building project. To achieve points using this credit, the proposed design must meet the following criteria:

- Compliance with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent.
- Inclusion of all the energy costs within and associated with the building project.
- Comparison against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent. The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment), and other (e.g., waterfall pumps).

Regulated (nonprocess) energy includes lighting (for the interior, parking garage, surface parking,

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<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

<sup>2</sup> Projects outside the U.S. may use an alternative standard to ANSI/ASHRAE/IESNA Standard 90.1-2007 if it is approved by USGBC as an equivalent standard using the process located at [www.usgbc.org/leedisglobal](http://www.usgbc.org/leedisglobal)

*Updated to reflect the 07/01/2016 document addenda for the LEED 2009 for Schools New Construction and Major Renovations Rating System*

façade, or building grounds, except as noted above), heating, ventilating, and air conditioning (HVAC) for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.) and service water heating for domestic or space heating purposes.

Process loads must be identical for both the baseline building performance rating and for the proposed building performance rating. However, project teams may follow the Exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) or USGBC approved equivalent to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and the proposed design, and theoretical or empirical information supporting these assumptions.

Projects in California may use Title 24-2005, Part 6 in place of ANSI/ASHRAE/IESNA Standard 90.1-2007 Option 1.

### **OROPTION 2. Prescriptive Compliance Path: Advanced Energy Design Guide for K-12 School Buildings**

**\*Please note that Option 2 currently is not an eligible compliance option for projects that registered after April 7, 2016 to meet the four point mandatory minimum.**

Comply with all of the prescriptive measures identified in the Advanced Energy Design Guide for K-12 school buildings. Comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located. Projects outside the U.S. may use ASHRAE/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

Projects using Option 2 must be less than 200,000 square feet (18,000 square meters).

**OR**

### **OPTION 3. Prescriptive Compliance Path: Advanced Buildings™ Core Performance™ Guide**

**\*Please note that Option 3 currently is not an eligible compliance option for projects that registered after April 7, 2016 to meet the four point mandatory minimum.**

Comply with the prescriptive measures identified in the Advanced Buildings™ Core Performance™ Guide developed by the New Buildings Institute. The building must meet the following requirements:

- Less than 100,000 square feet (9,300 square meters).
- Comply with Sections 1, Design Process Strategies, and 2, Core Performance Requirements.
- Health care, warehouse and laboratory projects are ineligible for this path.

Projects outside the U.S. may use ASHRAE/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

### **Potential Technologies & Strategies**

Design the building envelope and systems to meet baseline requirements. Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency

measures. Quantify energy performance compared with a baseline building.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy (DOE) standard process for commercial energy code determination, then the results of that analysis may be used to correlate local code performance with ASHRAE/ASHRAE/IESNA Standard 90.1-2007. Details on the DOE process for commercial energy code determination can be found at [http://www.energycodes.gov/implement/determinations\\_com.stm](http://www.energycodes.gov/implement/determinations_com.stm).



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## **EA Prerequisite 3: Fundamental Refrigerant Management Required**

### **Intent**

To reduce stratospheric ozone depletion.

### **Requirements**

Zero use of chlorofluorocarbon (CFC)-based refrigerants in new base building heating, ventilating, air conditioning and refrigeration (HVAC&R) systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion prior to project completion. Phase-out plans extending beyond the project completion date will be considered on their merits.

Existing small HVAC units (defined as containing less than 0.5 pounds of refrigerant) and other equipment, such as standard refrigerators, small water coolers and any other equipment that contains less than 0.5 pounds of refrigerant, are not considered part of the base building system and are not subject to the requirements of this prerequisite.

### **Potential Technologies & Strategies**

When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC-based refrigerants and provide a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment in the base building that uses no CFC-based refrigerants.

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## EA Credit 1: Optimize Energy Performance

### 1–19 Points (4 points mandatory for projects registered after April 7, 2016)

#### Intent

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

#### Requirements

Select 1 of the 3 compliance path options described below. Project teams documenting achievement using any of the

3 options are assumed to be in compliance with EA Prerequisite 2: Minimum Energy Performance.

#### OPTION 1. Whole Building Energy Simulation (1 – 19 points)

Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda<sup>1</sup>) using a computer simulation model for the whole building project. Projects outside the U.S. may use a USGBC approved equivalent standard<sup>2</sup>. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	4
20%	16%	5
22%	18%	6
24%	20%	7
26%	22%	8
28%	24%	9
30%	26%	10
32%	28%	11
34%	30%	12
36%	32%	13
38%	34%	14
40%	36%	15

4 points mandatory for projects registered after April 7, 2016

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<sup>1</sup>Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

<sup>2</sup> Projects outside the U.S. may use an alternative standard to ANSI/ASHRAE/IESNA Standard 90.1-2007 if it is approved by USGBC as an equivalent standard using the process located at [www.usgbc.org/leedisglobal](http://www.usgbc.org/leedisglobal).

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42%	38%	16
44%	40%	17
46%	42%	18
48%	44%	19

Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all the energy costs associated with the building project. To achieve points under this credit, the proposed design must meet the following criteria:

- Compliance with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda<sup>23</sup>) or USGBC approved equivalent.
- Inclusion of all the energy costs within and associated with the building project.
- Comparison against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda) or USGBC approved equivalent. The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment), and other (e.g., waterfall pumps).

Regulated (nonprocess) energy includes lighting (for the interior, parking garage, surface parking, façade, or building grounds, except as noted above), heating, ventilating and air conditioning (HVAC) (space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.) and service water heating for domestic or space heating purposes.

For this credit, process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) or USGBC approved equivalent to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

Projects in California may use Title 24-2005, Part 6 in place of ANSI/ASHRAE/IESNA Standard 90.1-2007 Option 1.

**OR**

#### **OPTION 2. Prescriptive Compliance Path: Advanced Energy Design Guide for K-12 School Buildings (1 point)**

**\*Please note that Option 2 currently is not an eligible compliance option for projects that registered after April 7, 2016 to meet the four point mandatory minimum.**

Comply with all the prescriptive measures identified in the Advanced Energy Design Guide for K-12 School buildings. Project teams must comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located. Projects outside the U.S. may use ASHRAE/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.

- Projects using Option 2 must be less than 200,000 square feet (18,000 square meters).

**OR**

**OPTION 3. Prescriptive Compliance Path: Advanced Buildings™ Core Performance™ Guide (1-3 points)**

**\*Please note that Option 3 currently is not an eligible compliance option for projects that registered after April 7, 2016 to meet the four point mandatory minimum.**

Comply with the prescriptive measures identified in the Advanced Buildings™ Core Performance™ Guide developed by the New Buildings Institute. e building must meet the following requirements:

- Less than 100,000 square feet (9,300 square meters).
- Comply with Sections 1, Design Process Strategies, and 2, Core Performance Requirements.

Points achieved under Option 3 (1 point):

- 1 point is available for all projects (office, school, public assembly, and retail projects) less than 100,000 square feet (9,300 square meters) that comply with Sections 1 and 2 of the Core Performance Guide.
- Up to 2 additional points are available to projects that implement performance strategies listed in Section 3, Enhanced Performance. For every 3 strategies implemented from this section, 1 point is available.
- The following strategies are addressed by other aspects of LEED and are not eligible for additional points under EA Credit 1:
  - 3.1 — Cool Roofs
  - 3.8 — Night Venting
  - 3.13 — Additional Commissioning

*Projects outside the U.S. may use ASHRAE/ASHRAE/IESNA Standard 90.1-2007 Appendices B and D to determine the appropriate climate zone.*

**Potential Technologies & Strategies**

Design the building envelope and systems to maximize energy performance. Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance compared with a baseline building.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy (DOE) standard process for commercial energy code determination the

results of that analysis may be used to correlate local code performance with ANSI/ASHRAE/IESNA Standard 90.1-2007. Details on the DOE process for commercial energy code determination can be found at [http://www.energycodes.gov/implement/determinations\\_com.stm](http://www.energycodes.gov/implement/determinations_com.stm).

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## EA Credit 2: On-site Renewable Energy

### 1–7 Points

#### Intent

To encourage and recognize increasing levels of on-site renewable energy self-supply to reduce environmental and economic impacts associated with fossil fuel energy use.

#### Requirements

Use on-site renewable energy systems to offset building energy costs. Calculate project performance by expressing the energy produced by the renewable systems as a percentage of the building's annual energy cost and use the table below to determine the number of points achieved.

Use the building annual energy cost calculated in EA Credit 1: Optimize Energy Performance or the U.S. Department of Energy's Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use.

The minimum renewable energy percentage for each point threshold is as follows:

Percentage Renewable Energy	Points
1%	1
3%	2
5%	3
7%	4
9%	5
11%	6
13%	7

#### Potential Technologies & Strategies

Assess the project for nonpolluting and renewable energy potential, including solar, wind, geothermal, low-impact hydro, biomass and bio-gas strategies. When applying these strategies, take advantage of net metering with the local utility.

Schools should contact their local utilities and state energy offices to identify potential financial incentives that can pay for some or all of the renewable energy system. In addition, some companies offer design, construction, maintenance and financing of renewable energy systems if the school buys all the energy output of the system for a set fee and time period.

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## **EA Credit 3: Enhanced Commissioning**

### **2 Points**

#### **Intent**

To begin the commissioning process early in design process and execute additional activities after systems performance verification is completed.

#### **Requirements**

Implement, or have a contract in place to implement, the following additional commissioning process activities in addition to the requirements of EA Prerequisite 1: Fundamental Commissioning of Building Energy Systems and in accordance with the LEED Reference Guide for Green Building Design and Construction, 2009 Edition:

- Prior to the start of the construction documents phase, designate an independent commissioning authority (CxA) to lead, review, and oversee the completion of all commissioning process activities.
  - The CxA must have documented commissioning authority experience in at least 2 building projects.
  - The individual serving as the CxA:
    - Must be independent of the work of design and construction.
    - Must not be an employee of the design firm, though he or she may be contracted through them.
    - Must not be an employee of, or contracted through, a contractor or construction manager holding construction contracts.
    - May be a qualified employee or consultant of the owner.
  - The CxA must report results, findings and recommendations directly to the owner.
- The CxA must conduct, at a minimum, 1 commissioning design review of the owner's project requirements basis of design, and design documents prior to the mid-construction documents phase and back-check the review comments in the subsequent design submission.
- The CxA must review contractor submittals applicable to systems being commissioned for compliance with the owner's project requirements and basis of design. This review must be concurrent with the review of the architect or engineer of record and submitted to the design team and the owner.
- The CxA or other project team members must develop a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
- The CxA or other project team members must verify that the requirements for training operating personnel and building occupants have been completed.
- The CxA must be involved in reviewing the operation of the building with operations and maintenance (O&M) staff and occupants within 10 months after substantial completion. A plan for resolving outstanding commissioning-related issues must be included.

## **Potential Technologies & Strategies**

Although it is preferable that the CxA be contracted by the owner, for the enhanced commissioning credit the CxA may also be contracted through the design firms or construction management firms not holding construction contracts.

The LEED Reference Guide for Green Building Design and Construction, 2009 Edition provides detailed guidance on the rigor expected for the following process activities:

- Commissioning design review.
- Commissioning submittal review.
- Systems manual.



## EA Credit 4: Enhanced Refrigerant Management

### 1 Point

#### Intent

To reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to climate change.

#### Requirements

##### OPTION 1

Do not use refrigerants.

##### OR

##### OPTION 2

Select refrigerants and heating, ventilating, air conditioning and refrigeration (HVAC&R) that minimize or eliminate the emission of compounds that contribute to ozone depletion and global climate change. The base building HVAC&R equipment must comply with the following formula, which sets a maximum threshold for the combined contributions to ozone depletion and global warming potential:

Imperial units	Metric units
$LCGWP + LCODP \times 10^5 \leq 100$	$LCGWP + LCODP \times 10^5 \leq 13$
<b>Calculation definitions for <math>LCGWP + LCODP \times 10^5 \leq 100</math> (Imperial units)</b>	<b>Calculation definitions for <math>LCGWP + LCODP \times 10^5 \leq 13</math> (Metric units)</b>
$LCODP = [ODPr \times (Lr \times Life + Mr) \times Rc] / Life$	$LCODP = [ODPr \times (Lr \times Life + Mr) \times Rc] / Life$
$LCGWP = [GWPr \times (Lr \times Life + Mr) \times Rc] / Life$	$LCGWP = [GWPr \times (Lr \times Life + Mr) \times Rc] / Life$
<i>LCODP: Lifecycle Ozone Depletion Potential (lb CFC 11/Ton-Year)</i>	<i>LCODP: Lifecycle Ozone Depletion Potential (kg CFC 11/(kW/year))</i>
<i>LCGWP: Lifecycle Direct Global Warming Potential (lb CO<sub>2</sub>/Ton-Year)</i>	<i>LCGWP: Lifecycle Direct Global Warming Potential (kg CO<sub>2</sub>/(kW/year))</i>
<i>GWPr: Global Warming Potential of Refrigerant (0 to 12,000 lb CO<sub>2</sub>/lbr)</i>	<i>ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 kg CFC 11/kg r)</i>
<i>ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 lb CFC 11/lbr)</i>	<i>GWPr: Global Warming Potential of Refrigerant (0 to 12,000 kg CO<sub>2</sub>/kg r)</i>
<i>Lr: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)</i>	<i>Lr: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)</i>
<i>Mr: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)</i>	<i>Mr: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)</i>
<i>Rc: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of gross ARI rated cooling capacity)</i>	<i>Rc: Refrigerant Charge (0.065 to 0.65 kg of refrigerant per kW of ARI rated or Eurovent Certified cooling capacity)</i>
<i>Life: Equipment Life (10 years; default based on equipment type, unless otherwise</i>	<i>Life: Equipment Life (default based on equipment type, unless otherwise demonstrated)</i>

demonstrated)

For multiple types of equipment, a weighted average of all base building HVAC&R equipment must be calculated using the following formula:

Imperial units	Metric units
$\frac{\sum (LCGWP + LCODP \times 10^5) \times Q_{unit}}{Q_{total}} \leq 100$	$\frac{\sum (LCGWP + LCODP \times 10^5) \times Q_{unit}}{Q_{total}} \leq 13$

Calculation definitions for [ $\sum (LCGWP + LCODP \times 10^5) \times Q_{unit}$ ] / $Q_{total} \leq 100$ (Imperial units)	Calculation definitions for [ $\sum (LCGWP + LCODP \times 10^5) \times Q_{unit}$ ] / $Q_{total} \leq 13$ (Metric units)
$Q_{unit}$ = Gross ARI rated cooling capacity of an individual HVAC or refrigeration unit (Tons)	$Q_{unit}$ = Eurovent Certified cooling capacity of an individual HVAC or refrigeration unit (kW)
$Q_{total}$ = Total gross ARI rated cooling capacity of all HVAC or refrigeration	$Q_{total}$ = Total Eurovent Certified cooling capacity of all HVAC or refrigeration (kW)

Small HVAC units (defined as containing less than 0.5 pounds [0.227 kg] of refrigerant) and other equipment, such as standard refrigerators, small water coolers and any other cooling equipment that contains less than 0.5 pounds (0.227 kg) of refrigerant, are not considered part of the base building system and are not subject to the requirements of this credit.

Do not operate or install fire suppression systems that contain ozone-depleting substances such as CFCs, hydrochlorofluorocarbons (HCFCs) or halons.

### Potential Technologies & Strategies

Design and operate the facility without mechanical cooling and refrigeration equipment. Where mechanical cooling is used, utilize base building HVAC&R systems for the refrigeration cycle that minimize direct impact on ozone depletion and climate change. Select HVAC&R equipment with reduced refrigerant charge and increased equipment life. Maintain equipment to prevent leakage of refrigerant to the atmosphere. Use fire suppression systems that do not contain HCFCs or halons.

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## **EA Credit 5: Measurement and Verification**

### **2 Points**

#### **Intent**

To provide for the ongoing accountability of building energy consumption over time.

#### **Requirements**

##### **OPTION 1**

Develop and implement a measurement and verification (M&V) plan consistent with Option D: Calibrated Simulation (Savings Estimation Method 2) as specified in the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April, 2003.

The M&V period must cover at least 1 year of post-construction occupancy.

Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.

#### **OR**

##### **OPTION 2**

Develop and implement a measurement and verification (M&V) plan consistent with Option B: Energy Conservation Measure Isolation, as specified in the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April, 2003.

The M&V period must cover at least 1 year of postconstruction occupancy.

Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.

#### **OR**

##### **OPTION 3 (1 point)**

Meet MPR 6 through compliance Option1: Energy and Water Data Release Form. Projects must register an account in ENERGY STAR's Portfolio Manager tool and share the project file with the USGBC master account.

#### **Potential Technologies & Strategies**

Develop an M&V plan to evaluate building and/or energy system performance. Characterize the building and/or energy systems through energy simulation or engineering analysis. Install the necessary metering equipment to measure energy use. Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate. Evaluate energy efficiency by comparing actual performance to baseline performance.

While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this LEED credit expands upon typical IPMVP M&V objectives. Measurement & verification activities should not necessarily be confined to energy systems where ECMs or energy conservation strategies have been implemented. The IPMVP provides guidance on M&V strategies and their appropriate applications for various situations. These strategies should be used in conjunction with monitoring and trend logging of significant energy systems to provide for the

ongoing accountability of building energy performance.

For the corrective action process, consider installing diagnostics within the control system to alert the staff when equipment is not being optimally operated. Conditions that might warrant alarms to alert staff could include:

- Leaking valves in the cooling and heating coils within air handling units.
- Missed economizer opportunities (e.g., faulty economizer damper controls).
- Software and manual overrides allowing equipment to operate 24 hours a day/7 days a week.
- Equipment operation during unusual circumstances (e.g., boiler on when outside air temperature is above 65° F(18°C)).

Besides control diagnostics, consider employing retro-commissioning services or dedicating staff to investigate increases in energy usage (such a staff member is usually a resource conservation manager — see <http://www.energy.state.or.us/rcm/rcmhm.htm> for additional information).

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## **EA Credit 6: Green Power**

### **2 Points**

#### **Intent**

To encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.

#### **Requirements**

Engage in at least a 2-year renewable energy contract to provide at least 35% of the building's electricity from renewable sources, as defined by the Center for Resource Solutions' Green-e Energy product certification requirements or an equivalent.

All purchases of green power shall be based on the quantity of energy consumed, not the cost.

If the green power is not Green-e Energy certified, equivalence must exist for both major Green-e Energy program criteria: 1) current green power performance standards, and 2) independent, third-party verification that those standards are being met by the green power supplier over time.

#### **OPTION 1. Determine Baseline Electricity Use**

Use the annual electricity consumption from the results of EA Credit 1: Optimize Energy Performance.

#### **OR**

#### **OPTION 2. Estimate Baseline Electricity Use**

Use the US Department of Energy's Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use.

School districts can purchase green power on a centralized basis and allocate the green power to a specific project. However, the same power cannot be credited to another LEED project. Submit a letter from the company owner attesting to this.

#### **Potential Technologies & Strategies**

Determine the energy needs of the building and investigate opportunities to engage in a green power contract. Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources. Visit [www.green-e.org/energy](http://www.green-e.org/energy) for details about the Green-e Energy program. The green power product purchased to comply with credit requirements need not be Green-e Energy certified. Other sources of green power are eligible if they satisfy the Green-e Energy program's technical requirements. Renewable energy certificates (RECs), tradable renewable certificates (TRCs), green tags and other forms of green power that comply with the technical requirements of the Green-e Energy program may be used to document compliance with this credit.

# MATERIALS & RESOURCES

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## **MR Prerequisite 1: Storage and Collection of Recyclables Required**

### **Intent**

To facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

### **Requirements**

Provide an easily-accessible dedicated area or for the collection and storage materials for recycling for the entire building. Materials must include at a minimum paper, corrugated cardboard, glass, plastics and metals.

### **Potential Technologies & Strategies**

Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area. Identify local waste handlers and buyers for glass, plastic, metals, office paper, newspaper, cardboard and organic wastes. Instruct occupants on recycling procedures. Consider employing cardboard balers, aluminum can crushers, recycling chutes and other waste management strategies to further enhance the recycling program.

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## **MR Credit 1.1: Building Reuse—Maintain Existing Walls, Floors and Roof 1–2 Points**

### **Intent**

To extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

### **Requirements**

Maintain the existing building structure (including structural floor and roof decking) and envelope (the exterior skin and framing, excluding window assemblies and nonstructural roofing material). The minimum percentage building reuse for each point threshold is as follows:

Building Reuse	Points
75%	1
95%	2

Hazardous materials that are remediated as a part of the project scope must be excluded from the calculation of the percentage maintained. If the project includes an addition that is more than 2 times the floor area of the existing building, this credit is not applicable.

### **Potential Technologies & Strategies**

Consider reusing existing, previously occupied building structures, envelopes and elements. Remove elements that pose a contamination risk to building occupants and upgrade components that would improve energy and water efficiency, such as windows, mechanical systems and plumbing fixtures.

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## **MR Credit 1.2: Building Reuse—Maintain Interior Nonstructural Elements**

### **1 Point**

#### **Intent**

To extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

#### **Requirements**

Use existing interior nonstructural elements (e.g., interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building including additions. If the project includes an addition with floor area more than 2 times the floor area of the existing building, this credit is not applicable.

#### **Potential Technologies & Strategies**

Consider reusing existing building structures, envelopes and interior nonstructural elements. Remove elements that pose a contamination risk to building occupants and upgrade components that would improve energy and water efficiency, such as mechanical systems and plumbing fixtures. Quantify the extent of building reuse.



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## MR Credit 2: Construction Waste Management

### 1–2 Points

#### Intent

To divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.

#### Requirements

Recycle and/or salvage nonhazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or comingled. Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume, but must be consistent throughout. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows:

Recycled or Salvaged	Points
50%	1
75%	2

#### Potential Technologies & Strategies

Establish goals for diversion from disposal in landfills and incineration facilities and adopt a construction waste management plan to achieve these goals. Consider recycling cardboard, metal, brick, mineral fiber panel, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Construction debris processed into a recycled content commodity that has an open market value (e.g., wood derived fuel (WDF), alternative daily cover material, etc.) may be applied to the construction waste calculation. Designate a specific area(s) on the construction site for segregated or comingled collection of recyclable materials, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

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## MR Credit 3: Materials Reuse

### 1–2 Points

#### Intent

To reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.

#### Requirements

Use salvaged, refurbished or reused materials, the sum of which constitutes at least 5% or 10% , based on cost, of the total value of materials on the project. The minimum percentage materials reused for each point threshold is as follows:

Reused Materials	Points
5%	1
10%	2

Mechanical, electrical and plumbing components, and specialty items such as elevators and equipment cannot be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

#### Potential Technologies & Strategies

Identify opportunities to incorporate salvaged materials into the building design and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick, and decorative items.

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## MR Credit 4: Recycled Content

### 1–2 Points

#### Intent

To increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

#### Requirements

Use materials with recycled content<sup>1</sup> such that the sum of postconsumer<sup>2</sup> recycled content plus 1/2 of the preconsumer<sup>3</sup> content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project. The minimum percentage materials recycled for each point threshold is as follows:

Recycled Content	Points
10%	1
20%	2

The recycled content value of a material assembly is determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

Mechanical, electrical and plumbing components, and specialty items such as elevators cannot be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

#### Potential Technologies & Strategies

Establish a project goal for recycled content materials and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

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<sup>1</sup> Recycled content is defined in accordance with the International Organization of Standards document, ISO 14021 — Environmental labels and declarations — Self-declared environmental claims (Type II environmental labeling).

<sup>2</sup> Postconsumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose.

<sup>3</sup> Preconsumer material is defined as material diverted from the waste stream during the manufacturing process. Reutilization of materials (i.e., rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it) is excluded.

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## MR Credit 5: Regional Materials

### 1–2 Points

#### Intent

To increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

#### Requirements

Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within a specified distance of the project site for a minimum of 10% or 20%, based on cost, of the total materials value. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) must contribute to the regional value. The minimum percentage regional materials for each point threshold is as follows:

Regional Materials	Points
10%	1
20%	2

#### OPTION 1

All building materials or products have been extracted, harvested or recovered, as well as manufactured within a 500 mile (800 kilometer) radius of the project site.

OR

#### OPTION 2

Building materials or products shipped by rail or water have been extracted, harvested or recovered, as well as manufactured within a 500 mile (800 kilometer) total travel distance of the project site using a weighted average determined through the following formula:

$(\text{Distance by rail}/3) + (\text{Distance by inland waterway}/2) + (\text{Distance by sea}/15) + (\text{Distance by all other means}) \leq 500 \text{ miles [800 kilometers]}$

Mechanical, electrical and plumbing components, and specialty items such as elevators and equipment must not be included in all calculations. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

#### Potential Technologies & Strategies

Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

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## **MR Credit 6: Rapidly Renewable Materials**

### **1 Point**

#### **Intent**

To reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials<sup>1</sup>.

#### **Requirements**

Use rapidly renewable building materials and products for 2.5% of the total value of all building materials and products used in the project, based on cost. Rapidly renewable building materials and products are made from agricultural products that are typically harvested within a 10-year or shorter cycle.

#### **Potential Technologies & Strategies**

Establish a project goal for rapidly renewable materials and identify products and suppliers that can support achievement of this goal. Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheatboard, strawboard and cork. During construction, ensure that the specified renewable materials are installed.

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<sup>1</sup> Rapidly renewable building materials and products are made from plants that are typically harvested within a 10-year or shorter cycle.

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## **MR Credit 7: Certified Wood**

### **1 Point**

#### **Intent**

To encourage environmentally responsible forest management.

#### **Requirements**

Use a minimum of 50% (based on cost) of wood-based materials and products that are certified in accordance with the Forest Stewardship Council's principles and criteria, for wood building components. These components include at a minimum, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

Include only materials permanently installed in the project. Wood products purchased for temporary use on the project (e.g., formwork, bracing, scaffolding, sidewalk protection, and guard rails) may be included in the calculation at the project team's discretion. If any such materials are included, all such materials must be included in the calculation. If such materials are purchased for use on multiple projects, the applicant may include these materials for only one project, at its discretion. Furniture may be included if it is included consistently in MR Credits 3. Materials Reuse, through MR Credit 7, Certified Wood.

#### **Potential Technologies & Strategies**

Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

# INDOOR ENVIRONMENTAL QUALITY

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## **IEQ Prerequisite 1: Minimum Indoor Air Quality Performance Required**

### **Intent**

To establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants.

### **Requirements**

Meet the minimum requirements of Sections 4 through 7 of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality (with errata but without addenda<sup>28</sup>).

### **AND**

#### **CASE 1. Mechanically Ventilated Spaces**

Mechanical ventilation systems must be designed using the ventilation rate procedure, as defined by ASHRAE 62.1-2007, or the applicable local code, whichever is more stringent.

##### **OPTION 1. ASHRAE Standard 62.1-2007 or Non-U.S. Equivalent**

*Meet the minimum requirements of Sections 4 through 7 of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality (with errata but without addenda<sup>28</sup>). Projects outside the U.S. may use a local equivalent to Sections 4 through 7 of ASHRAE Standard 62.1-2007.*

##### **OPTION 2. CEN Standards EN 15251: 2007 and EN 13779: 2007**

*Projects outside the U.S. may earn this prerequisite by meeting the minimum requirements of Annex B of Comité Européen de Normalisation (CEN) Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics; and the requirements of CEN Standard EN 13779: 2007, Ventilation for nonresidential buildings, Performance requirements for ventilation and room conditioning systems, excluding Section 7.3 – Thermal environment, 7.6 – Acoustic Environment, A.16, and A.17.*

### **OR**

#### **CASE 2. Naturally Ventilated Spaces**

Naturally ventilated buildings must comply with ASHRAE Standard 62.1-2007, Paragraph 5.1 (with errata but without addenda<sup>1</sup>).

### **Potential Technologies & Strategies**

Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard. Balance the impacts of ventilation rates on energy use and indoor air

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<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.



quality to optimize for energy efficiency and occupant comfort. Use the ASHRAE Standard 62.1-2007 Users Manual (with errata but without addenda<sup>28</sup>) for detailed guidance on meeting the referenced requirements.

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## **IEQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control Required**

### **Intent**

To eliminate exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke (ETS).

### **Requirements**

Prohibit smoking in the building .

Prohibit on-property smoking within 25 feet (8 meters) from entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

### **Potential Technologies & Strategies**

Prohibit smoking in schools.

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## **IEQ Prerequisite 3: Minimum Acoustical Performance Required**

### **Intent**

To provide classrooms that are quiet so that teachers can speak to the class without straining their voices and students can effectively communicate with each other and the teacher.

### **Requirements**

#### **Background Noise**

Achieve a maximum background noise level<sup>1</sup> from heating, ventilating and air conditioning (HVAC) systems in classrooms and other core learning spaces of 45 dBA.

#### **AND**

#### **Reverberation Time**

Design classrooms and other core learning spaces to include sound-absorptive finishes to sufficiently limit reverberation in classrooms and other core learning spaces.

#### **CASE 1. Classrooms and Core Learning Spaces < 20,000 Cubic Feet (560 Cubic Meters)**

For classrooms and core learning spaces less than 20,000 cubic feet (560 cubic meters), options for compliance include:

##### **OPTION 1. Minimum NRC**

For each room, confirm that the total surface area finished with a material with a Noise Reduction Coefficient (NRC) of 0.70 or higher equals or exceeds the total ceiling area (excluding lights, diffusers and grilles).

##### **OR**

##### **OPTION 2. Compliance with ANSI Standard S12.60-2002 or Non-U.S. Equivalent**

Confirm through calculations described in ANSI Standard S12.60-2002 that rooms are designed to meet reverberation time requirements as specified in that standard. Projects outside the U.S. may use a local equivalent to ANSI Standard S12.60-2002.

#### **CASE 2. Classrooms and Core Learning Spaces ≥ 20,000 Cubic Feet (560 Cubic Meters)**

For classrooms and core learning spaces 20,000 cubic feet (560 Cubic Meters) or greater, confirm through calculations described in ANSI Standard S12.60-2002 that rooms are designed to have a reverberation time of 1.5 seconds or less. Projects outside the U.S. may use a local equivalent to ANSI Standard S12.60-2002.

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<sup>1</sup> Recommended methodologies and best practices for mechanical system noise control are described in Annex B of ANSI Standard S12.60-2002 and the 2007 HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control (with errata but without addenda).

## Potential Technologies & Strategies

Reverberation time requirements can generally be met through the use of sound absorbent materials on ceilings and other surfaces. Consider using acoustical lay-in ceilings and/or other acoustical ceiling materials in combination with sound absorbent finishes such as acoustical panels.

Commercially-available software may be used to perform the calculations for core learning space noise levels, provided calculations are based on 2007 HVAC Applications ASHRAE Handbook, Chapter 47 (with errata but without addenda<sup>29</sup>) on Sound and Vibration Control. Control of classroom HVAC noise involves all potential noise sources and paths, including duct-borne, structure-borne and equipment radiated noise. Factors specific to the project site are also very important; examples include classroom/ mechanical room adjacencies, equipment located in ceilings above or near classrooms, and noise transmission via return air plenums when classroom walls do not extend to structure.

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## **IEQ Credit 1: Outdoor Air Delivery Monitoring**

### **1 Point**

#### **Intent**

To provide capacity for ventilation system monitoring to help promote occupant comfort and well-being.

#### **Requirements**

Install permanent monitoring systems to ensure that ventilation systems maintain design minimum requirements. Configure all monitoring equipment to generate an alarm when the airflow values or carbon dioxide (CO<sub>2</sub>) levels vary by 10% or more from the design values via either a building automation system alarm to the building operator or a visual or audible alert to the building occupants.

#### **AND**

##### **CASE 1. Mechanically Ventilated Spaces**

Monitor CO<sub>2</sub> concentrations within all densely occupied spaces i.e., those with a design occupant density of 25 people or more per 1,000 square feet (95 square meters). CO<sub>2</sub> monitors must be between 3 and 6 feet (between 1 and 2 meters) above the floor.

Provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow with an accuracy of plus or minus 15% of the design minimum outdoor air rate, based on the value determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, for mechanical ventilation systems where 20% or more of the design supply airflow serves nondensely occupied spaces.

##### **CASE 2. Naturally Ventilated Spaces**

Monitor CO<sub>2</sub> concentrations within all naturally ventilated spaces. CO<sub>2</sub> monitors must be between 3 and 6 feet (between 1 and 2 meters) above the floor. One CO<sub>2</sub> sensor may be used to monitor multiple spaces if the natural ventilation design uses passive stack(s) or other means to induce airflow through those spaces equally and simultaneously without intervention by building occupants<sup>1</sup>.

#### **Potential Technologies & Strategies**

Install CO<sub>2</sub> and airflow measurement equipment and feed the information to the heating, ventilating and air conditioning (HVAC) system and/or building automation system (BAS) to trigger corrective action, if applicable. If such automatic controls are not feasible with the building systems, use the measurement equipment to trigger alarms that inform building operators or occupants of a possible deficiency in outdoor air delivery.

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## **IEQ Credit 2: Increased Ventilation**

### **1 Point**

#### **Intent**

To provide additional outdoor air ventilation to improve indoor air quality (IAQ) and promote occupant comfort, well-being and productivity.

#### **Requirements**

##### **CASE 1. Mechanically Ventilated Spaces**

OPTION 1. ASHRAE Standard 62.1-2007 or Non-U.S. Equivalent

Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2007 (with errata but without addenda<sup>1</sup>) as determined by IEQ Prerequisite 1: Minimum IAQ Performance. Projects outside the U.S. may use a local equivalent to ASHRAE Standard 62.1-2007 if the same is used for IEQ Prerequisite 1: Minimum Indoor Air Quality Performance.

OR

OPTION 2. CEN Standard EN 15251: 2007

Projects outside the U.S. may earn this credit by increasing breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by Annex B of Comité Européen de Normalisation (CEN) Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, as determined by IEQ Prerequisite 1: Minimum Indoor Air Quality Performance,

##### **CASE 2. Naturally Ventilated Spaces**

Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 2.8 of the CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-domestic Buildings.

**AND**

##### **OPTION 1. CIBSE or Non-U.S. Equivalent**

Show that the natural ventilation systems design meets the recommendations set forth in the CIBSE manuals appropriate to the project space.

PATH 1. Use CIBSE Applications Manual 10: 2005, Natural Ventilation in Nondomestic Buildings. Projects outside the U.S, may use a local equivalent.

PATH 2. Use CIBSE AM 13:2000, Mixed Mode Ventilation. Projects outside the U.S, may use a local equivalent.

OR

##### **OPTION 2. Airflow Model**

Use a macroscopic, multizone, analytic model to predict that room-by-room airflows will

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<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE Standard 62.1-2007 section 6 (with errata but without addenda<sup>32</sup>), for at least 90% of occupied spaces. Projects outside the U.S. may use Annex B of Comité Européen de Normalisation (CEN) Standard EN 15251: 2007 or a local equivalent to section 6 of ASHRAE Standard 62.1-2007 to define the minimum ventilation rates.

### **Potential Technologies & Strategies**

For mechanically ventilated spaces: Use heat recovery, where appropriate, to minimize the additional energy consumption associated with higher ventilation rates.

For naturally ventilated spaces, follow the 8 design steps described in the Carbon Trust Good Practice Guide 237:

- Develop design requirements.
- Plan airflow paths.
- Identify building uses and features that might require special attention.
- Determine ventilation requirements.
- Estimate external driving pressures.
- Select types of ventilation devices.
- Size ventilation devices.
- Analyze the design.

Use public domain software such as NIST's CONTAM Multizone Modeling Software, along with LoopDA Natural Ventilation Sizing Tool, to analytically predict room-by-room airflows.

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## **IEQ Credit 3.1: Construction Indoor Air Quality Management Plan— During Construction**

### **1 Point**

#### **Intent**

To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.

#### **Requirements**

Develop and implement an (IAQ) management plan for the construction and preoccupancy phases of the building as follows:

- During construction meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
- Protect stored on-site and installed absorptive materials from moisture damage.
- If permanently installed air handlers are used during construction, filtration media must be used at each return air grille that meets one of the following criteria below. Replace all filtration media immediately prior to occupancy.
  - Filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda<sup>1</sup>).
  - Filtration media is Class F5 or higher, as defined by CEN Standard EN 779-2002, Particulate air filters for general ventilation, Determination of the filtration performance
  - Projects in East Asia may use filtration media classified as medium efficiency (中效过滤器) or higher as defined by Chinese standard GB/T 14295-2008 (空气过滤器).
  - Filtration media with a minimum dust spot efficiency of 30% or higher and greater than 90% arrestance on a particle size of 3–10 µg
- Prohibit smoking inside the building and within 25 feet (8 meters) of building entrances once the building is enclosed.

#### **Potential Technologies & Strategies**

Adopt an IAQ management plan to protect the heating, ventilating and air conditioning (HVAC) system during construction, control pollutant sources and interrupt contamination pathways. Sequence the installation of materials to avoid contamination of absorptive materials, such as insulation, carpeting, ceiling tile and gypsum wallboard. Coordinate with IEQ Credit 3.2: Construction Indoor Air Quality Management Plan — Before Occupancy and IEQ Credit 5: Indoor Chemical & Pollutant Source Control to determine the appropriate specifications and schedules for filtration media.

If possible, avoid using permanently installed air handlers for temporary heating/cooling during

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<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

*Updated to reflect the 07/01/2016 document addenda for the LEED 2009 for Schools New Construction and Major Renovations Rating System*



construction. Consult the LEED Reference Guide for Green Building Design and Construction, 2009 Edition for more detailed information on how to ensure the well-being of construction workers and building occupants if permanently installed air handlers must be used during construction.

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## **IEQ Credit 3.2 Construction Indoor Air Quality Management Plan—Before Occupancy**

### **1 Point**

#### **Intent**

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

#### **Requirements**

Develop an (IAQ)management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

#### **OPTION 1. Flush-Out<sup>1</sup>**

##### **PATH 1**

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15°C) and relative humidity no higher than 60%.

##### **OR**

##### **PATH 2**

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot of outside air (0.1 cubic meter of outside air per minute per square meter) or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters of outside air per square meter) of outside air has been delivered to the space.

##### **OR**

#### **OPTION 2. Air Testing**

Conduct baseline IAQ testing,after construction ends and prior to occupancy, using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air or the ISO method listed in the table below. Testing must be done in accordance with one standard; project teams may not mix requirements from the EPA Compendium of Methods with ISO.

Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

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<sup>1</sup> All finishes must be installed prior to flush-out.

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test, although it is not required.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.
- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.
- The number of sampling locations will depend on the size of the building and number of ventilation systems. The number of sampling locations must include the entire building and all representative situations. Include areas with the least ventilation and greatest presumed source strength.
- Air samples must be collected between 3 and 6 feet (between 1 and 2 meters) from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

### **Potential Technologies & Strategies**

Prior to occupancy, perform a building flush-out or test the air contaminant levels in the building. The flush-out is often used where occupancy is not required immediately upon substantial completion of construction. IAQ testing can minimize schedule impacts but may be more costly. Coordinate with IEQ Credit 3.1: Construction Indoor Air Quality Management Plan — During Construction and IEQ Credit 5: Indoor Chemical & Pollutant Source Control to determine the appropriate specifications and schedules for filtration media.

The intent of this credit is to eliminate IAQ problems that occur as a result of construction. Architectural finishes used in tenant build-outs constitute a significant source of air pollutants, and must be addressed to qualify for this credit.

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## **IEQ Credit 4: Low-Emitting Materials**

### **1–4 Points**

#### **Intent**

To reduce the quantity of indoor air contaminants that are odorous, irritating and/ or harmful to the comfort and well-being of installers and occupants.

#### **Requirements**

Projects may choose any of the following credits, with a maximum of 4 points.

##### **CREDIT 4.1. Adhesives and Sealants (1 point)**

All adhesives and sealants installed in the building interior (defined as inside the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

##### **CREDIT 4.2. Paints and Coatings (1 point)**

All paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

##### **CREDIT 4.3. Flooring Systems (1 point)**

All flooring elements installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.

##### **CREDIT 4.4. Composite Wood and Agrifiber Products (1 point)**

All composite wood and agrifiber products installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda. Wood and agrifiber products shall be treated as walls within the classroom scenario when determining compliance.

**OR**

##### **CREDIT 4.5. Furniture and Furnishings (1 point)**

Classroom furniture including all student and teacher desks, tables and seats that was manufactured, refurbished or refinished within 1 year prior to occupancy must meet 1 of the requirements below. Salvaged and used furniture that is more than 1 year old at the time of occupancy is excluded from the credit requirements.

#### **OPTION 1**

Classroom furniture and seating must meet the emission requirements of the GREENGUARD Children and Schools standards, with testing conducted in an independent third-party air quality testing laboratory.

**OR**

## **OPTION 2**

Calculated indoor air concentrations that shall be less than or equal to those established in Table 1 for classroom furniture and seating when determined by a procedure based on ANSI/BIFMA M7.1-2007 and ANSI/BIFMA X7.1-2007 testing protocol, when modeled using the classroom scenario of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda, with testing conducted in an independent third-party air quality testing laboratory.

**Table 1.** *Maximum Indoor Air Concentrations*

Chemical Contaminant	Classroom Furniture	Seating
Total VOCs	0.5 mg/m <sup>3</sup>	0.25 mg/m <sup>3</sup>
Formaldehyde	50 parts per billion	25 parts per billion
Total aldehydes	100 parts per billion	50 parts per billion
4—Phenylcyclohexene (4-PCH)	0.0065 mg/m <sup>3</sup>	0.00325 mg/m <sup>3</sup>

### **CREDIT 4.6: Ceiling and Wall Systems (1 point)**

All gypsum board, insulation, acoustical ceiling systems and wall coverings installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

### **Potential Technologies & Strategies**

Clearly specify requirements for product testing and/or certification in the construction documents. Some programs that offer verification of the cited standard for Options 1-4 and 6 are SCS Indoor Advantage Gold, GREENGUARD Children & Schools, the Resilient Floor Covering Institute's FloorScore program, the Carpet and Rug Institute's Green Label Plus program, and the Collaborative for High Performance Schools product list. SCS Indoor Advantage Gold offers verification of the ANSI/BIFMA standards cited in Option 2 of the Furniture Option (Credit 4.5).

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## IEQ Credit 5: Indoor Chemical and Pollutant Source Control

### 1 Point

#### Intent

To minimize building occupant exposure to potentially hazardous particulates and chemical pollutants.

#### Requirements

Design to minimize and control the entry of pollutants into buildings and later cross-contamination of regularly occupied areas through the following strategies:

- Employ permanent entryway systems at least 10 feet (3 meters) long in the primary direction of travel to capture dirt and particulates entering the building at regularly used exterior entrances. Acceptable entryway systems include permanently installed grates, grills and slotted systems that allow for cleaning underneath. Roll-out mats are acceptable only when maintained on a weekly basis by a contracted service organization or school maintenance staff.
- Sufficiently exhaust each space where hazardous gases or chemicals may be present or used (e.g. garages, housekeeping and laundry areas, science laboratories, prep rooms, art rooms, shops of any kind, and copying and printing rooms) to create negative pressure with respect to adjacent spaces when the doors to the room are closed. For each of these spaces, provide self-closing doors and deck-to-deck partitions or a hard-lid ceiling. The exhaust rate must be at least 0.50 cubic feet per minute (cfm) per square foot (0.15 cubic meters per minute per square meter), with no air recirculation. The pressure differential with the surrounding spaces must be at least 5 Pascals (Pa) (0.02 inches of water gauge) on average and 1 Pa (0.004 inches of water) at a minimum when the doors to the rooms are closed.
- In mechanically ventilated buildings, each ventilation system that supplies outdoor air shall comply with the following:
  - Particle filters or air cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces.
  - These filters or devices shall meet one of the following criteria:
    - Filtration media is rated a minimum efficiency reporting value (MERV) of 13 or higher in accordance with ASHRAE Standard 52.2.
    - Filtration media is Class F7 or higher, as defined by CEN Standard EN 779: 2002, Particulate air filters for general ventilation, Determination of the filtration performance.
    - Projects in East Asia may use filtration media classified as high efficiency (高中效过滤器) or higher as defined by Chinese standard GB/T 14295-2008 (空气过滤器).
    - Filtration media has a minimum dust spot efficiency of 80% or higher and greater than 98% arrestance on a particle size of 3–10 µg.
  - Clean air filtration media shall be installed in all air systems after completion of construction and prior to occupancy.

■

**Potential Technologies & Strategies**

Design facility cleaning and maintenance areas with isolated exhaust systems for contaminants. Maintain physical isolation from the rest of the regularly occupied areas of the building. Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne contaminants from entering the building. Install high-level filtration systems in air handling units processing outside supply air. Ensure that air-handling units can accommodate required filter sizes and pressure drops.

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## **IEQ Credit 6.1: Controllability of Systems—Lighting**

### **1 Point**

#### **Intent**

To provide a high level of lighting system control by individual occupants or groups in multi-occupant spaces (e.g., classrooms or conference areas) and promote their productivity, comfort and well-being.

#### **Requirements**

##### **CASE 1. Administrative Offices and Other Regularly Occupied Spaces**

Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences

##### **AND**

Provide lighting system controls for all learning spaces including classrooms, chemistry laboratories, art rooms, shops, music rooms, gymnasiums and dance and exercise studios to enable adjustments that meet group needs and preferences.

##### **CASE 2. Classrooms**

In classrooms, provide a lighting system that operates in at least 2 modes: general illumination and A/V.

#### **Potential Technologies & Strategies**

Design the building with occupant controls for lighting. Strategies to consider include lighting controls and task lighting. Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building.



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## **IEQ Credit 6.2: Controllability of Systems—Thermal Comfort**

### **1 Point**

#### **Intent**

To provide a high level of thermal comfort system control<sup>1</sup> by individual occupants or groups in multi-occupant spaces (e.g., classrooms or conference areas) and promote their productivity, comfort and well-being of building occupants

#### **Requirements**

Provide individual comfort controls for 50% (minimum) of the building occupants in workspaces to enable adjustments to meet individual needs and preferences. Operable windows may be used in lieu of controls for occupants located 20 feet (6 meters) inside and 10 feet (3 meters) to either side of the operable part of a window. The areas of operable window must meet the requirements of ASHRAE Standard 62.1-2007 paragraph 5.1 Natural Ventilation (with errata but without addenda<sup>2</sup>).

Provide comfort system controls for all shared multioccupant spaces to enable adjustments that meet group needs and preferences.

Conditions for thermal comfort are described in IEQ Credit 7.1: Thermal Comfort – Design and include the primary factors of air temperature, radiant temperature, air speed and humidity.

#### **Potential Technologies & Strategies**

Design the building and systems with comfort controls to allow adjustments to suit individual needs or those of groups in shared spaces. ASHRAE Standard 55-2004 (with errata but without addenda<sup>36</sup>) identifies the factors of thermal comfort and a process for developing comfort criteria for building spaces that suit the needs of the occupants involved in their daily activities. Control strategies can be developed to expand on the comfort criteria and enable individuals to make adjustments to suit their needs and preferences. These strategies may involve system designs incorporating operable windows, hybrid systems integrating operable windows and mechanical systems, or mechanical systems alone. Individual adjustments may involve individual thermostat controls; local diffusers at floor, desk or overhead levels, control of individual radiant panels, or other means integrated into the overall building, thermal comfort systems and energy systems design. Designers should evaluate the closely tied interactions between thermal comfort, as required by ASHRAE Standard 55-2004 (with errata but without addenda<sup>36</sup>), and acceptable indoor air quality as required by ASHRAE Standard 62.1-2007 (with errata but without addenda<sup>36</sup>), whether natural or mechanical ventilation.

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<sup>1</sup> For the purposes of this credit, comfort system control is defined as control over at least 1 of the following primary factors in the occupant's vicinity: air temperature, radiant temperature, air speed and humidity.

<sup>2</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

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## **IEQ Credit 7.1: Thermal Comfort—Design**

### **1 Point**

#### **Intent**

To provide a comfortable thermal environment that promotes occupant productivity and well-being.

#### **Requirements**

Design heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of one of the options below:

##### **OPTION 1. ASHRAE Standard 55-2004 or Non-U.S. Equivalent**

Meet the requirements of ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy (with errata but without addenda<sup>37</sup>). Demonstrate design compliance in accordance with the Section 6.1.1 documentation. Projects outside the U.S. may use a local equivalent to ASHRAE Standard 55-2004 Thermal Comfort Conditions for Human Occupancy Section 6.1.1.

##### **OPTION 2. ISO 7730: 2005 & CEN Standard EN 15251: 2007**

Projects outside the U.S. may earn this credit by designing heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of International Organization for Standardization (ISO) 7730: 2005 Ergonomics of the thermal environment, Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria; and CEN Standard EN 15251: 2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.

For natatoriums, demonstrate compliance with the “Typical Natatorium Design Conditions” defined in Chapter 4 (Places of Assembly) of the ASHRAE HVAC Applications Handbook, 2003 edition (with errata but without addenda<sup>1</sup>).

#### **Potential Technologies & Strategies**

Establish comfort criteria according to ASHRAE Standard 55-2004 (with errata but without addenda<sup>37</sup>) that support the desired quality and occupant satisfaction with building performance. In gymnasiums, if mechanical ventilation is not used, follow ASHRAE Standard 55-2004 (with errata but without addenda<sup>37</sup>) requirements for naturally ventilated spaces. Design building envelope and systems with the capability to meet the comfort criteria under expected environmental and use conditions. Evaluate air temperature, radiant temperature, air speed and relative humidity in an integrated fashion and coordinate these criteria with IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, IEQ Credit 1: Outdoor Air Delivery Monitoring, and IEQ Credit 2: Increased Ventilation.

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<sup>1</sup> Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

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## **IEQ Credit 7.2: Thermal Comfort—Verification**

### **1 point in addition to IEQ credit 7.1**

#### **Intent**

To provide for the assessment of building occupants' thermal comfort over time.

#### **Requirements**

Achieve IEQ Credit 7.1: Thermal Comfort—Design

Agree to conduct a thermal comfort survey of building occupants (adults and students of grades 6 and above) within 6 to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building, including an assessment of overall satisfaction with thermal performance and identification of thermal comfort problems. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with the standard used for design in IEQ Credit 7.1: Thermal Comfort – Design.

#### **Potential Technologies & Strategies**

ASHRAE Standard 55-2004 provides guidance for establishing thermal comfort criteria and documenting and validating building performance to the criteria. While the standard is not intended for purposes of continuous monitoring and maintenance of the thermal environment, the principles expressed in the standard provide a basis for the design of monitoring and corrective action systems.

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## IEQ Credit 8.1: Daylight and Views—Daylight

### 1–3 Points

#### Intent

To provide building occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

#### Requirements

Through 1 of the 4 options, achieve daylighting in at least the following spaces:

Classroom Spaces	Points
75%	1
90%	2

Other Regularly Occupied Spaces	Points
75%	1 additional <sup>f</sup>

#### OPTION 1. Simulation

Demonstrate through computer simulation that the applicable spaces achieve daylight illuminance levels of a minimum of 10 footcandles (fc) (110 lux) and a maximum of 500 fc (5,400 lux) in a clear sky condition on September 21 at 9 a.m. and 3 p.m.

Provide glare control devices to avoid high-contrast situations that could impede visual tasks. However, designs that incorporate view-preserving automated shades for glare control may demonstrate compliance for only the minimum 10 fc (110 lux) illuminance level.

OR

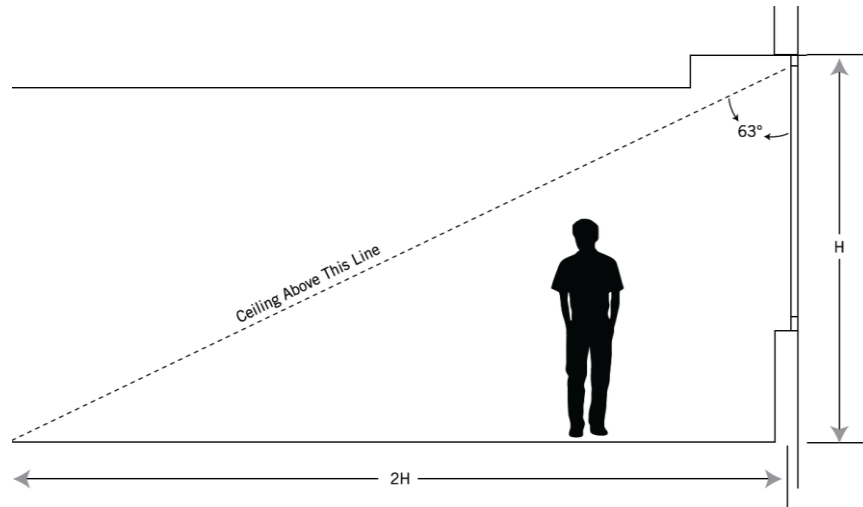
#### OPTION 2. Prescriptive

For sidelighting zones:

- Achieve a value, calculated as the product of the visible light transmittance (VLT) and window-to-floor area ratio (WFR) of daylight zone 0.150 and 0.180.

$$0.150 < VLT \times WFR < 0.180$$

- The window area included in the calculation must be at least 30 inches (0.8 meters) above the floor.
- In section, the ceiling must not obstruct a line that extends from the window-head to a point on the floor that is located twice the height of the window-head from the exterior wall as measured perpendicular to the glass (see diagram on next page).



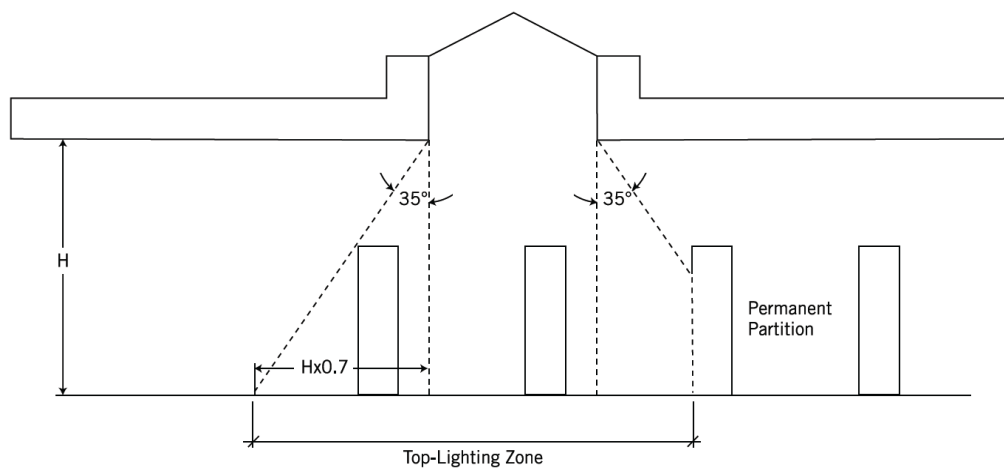
<sup>1</sup> Exceptions for areas where tasks will be hindered by the use of daylight will be considered on their merits.

<sup>2</sup> Project teams can achieve a point for these other spaces only if they have also achieved at least 1 point for classroom and core learning spaces.

- Provide glare control devices to avoid high-contrast situations that could impede visual tasks. However, designs that incorporate view-preserving automated shades for glare control may demonstrate compliance for only the minimum 0.150 value.

For toplighting zones:

- The toplighting zone under a skylight is the outline of the opening beneath the skylight, plus in each direction the lesser of (see diagram below):
  - 70% of the ceiling height,
  - 1/2 the distance to the edge of the nearest skylight,
  - The distance to any permanent partition that is closer than 70% of the distance between the top of the partition and the ceiling.



- Achieve skylight coverage for the applicable space (containing the toplighting zone) between 3% and 6% of the total floor area.

- The skylight must have a minimum 0.5 VLT.
- A skylight diffuser, if used, must have a measured haze value of greater than 90% when tested according to ASTM D1003.

**OR**

**OPTION 3. Measurement**

Demonstrate through records of indoor light measurements that a minimum daylight illumination level of 10 fc (110 lux) and a maximum of 500 fc (5,400 lux) has been achieved in the applicable spaces. Measurements must be taken on a 10-foot (3-meter) grid for all occupied spaces and shall be recorded on building floor plans.

Provide glare control devices to avoid high-contrast situations that could impede visual tasks. However, designs that incorporate view-preserving automated shades for glare control may demonstrate compliance for only the minimum 10 fc (110 lux) illuminance level.

**OR**

**OPTION 4. Combination**

**Any of the above calculation methods may be combined to document the minimum daylight illumination in the applicable spaces.**

**Potential Technologies & Strategies**

Design the building to maximize interior daylighting. Strategies to consider include building orientation, shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high-performance glazing, and high ceiling-reflectance values; additionally, automatic photocell-based controls can help to reduce energy use. Predict daylight factors via manual calculations or model daylighting strategies with a physical or computer model to assess footcandle (lux) levels and daylight factors achieved.

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## **IEQ Credit 8.2: Daylight and Views—Views**

### **1 Point**

#### **Intent**

To provide building occupants a connection to the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

#### **Requirements**

Achieve a direct line of sight to the outdoor environment via vision glazing between 30 inches and 90 inches (between 0.8 meters and 2.3 meters) above the finish floor for building occupants in 90% of all regularly occupied areas. Determine the area with direct line of sight by totaling the regularly occupied floor area that meets the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing.
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing.

The line of sight may be drawn through interior glazing. For private offices, the entire floor area of the office may be counted if 75% or more of the area has a direct line of sight to perimeter vision glazing. For classrooms and other multi-occupant spaces, the actual floor area with a direct line of sight to perimeter vision glazing is counted.

#### **Potential Technologies & Strategies**

Design the space to maximize daylighting and view opportunities. Strategies to consider include lower partition heights, interior shading devices, interior glazing and automatic photocell-based controls. See the LEED Reference Guide for Green Design & Construction, 2009 Edition for more information on which spaces are applicable for this point.

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## **IEQ Credit 9: Enhanced Acoustical Performance**

### **1 Point**

#### **Intent**

To provide classrooms that facilitates better teacher-to-student and student-to-student communications through effective acoustical design.

#### **Requirements**

##### **Sound Transmission**

Design the classrooms and other core learning spaces to meet the Sound Transmission Class (STC) requirements of ANSI Standard S12.60-2002, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, except windows, which must meet an STC rating of at least 35. Projects outside the U.S. may use a local equivalent to ANSI Standard S12.60-2002.

##### **AND**

##### **Background Noise**

Reduce background noise level<sup>1</sup> to 40 dBA or less from heating, ventilating and air conditioning (HVAC) systems in classrooms and other core learning spaces.

##### **Potential Technologies & Strategies**

Design considerations include reducing noise from exterior to interior spaces, between spaces within the building, and within the classroom space. External to internal noise transmission can be reduced by orienting classrooms away from external noise sources and using thick and/or massive materials in walls and roofs. Also, windows should be well-sealed and have adequate air gaps between sheets of glass. See IEQ Prerequisite 3: Minimum Acoustical Performance for more potential technologies and strategies.

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<sup>1</sup> Recommended methodologies and best practices for mechanical system noise control are described in Annex B of ANSI Standard S12.60-2002, and the 2007 HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control (with errata but without addenda).



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## **IEQ Credit 10: Mold Prevention**

### **1 Point**

#### **Intent**

To reduce the potential presence of mold in schools through preventive design and construction measures.

#### **Requirements**

Project teams must achieve the following credits:

- IEQ Credit 3.1: Construction Indoor Air Quality Management Plan—During Construction
- IEQ Credit 7.1: Thermal Comfort—Compliance
- IEQ Credit 7.2: Thermal Comfort—Verification

Provide heating, ventilating and air conditioning (HVAC) systems and controls designed to limit space relative humidity to 60% or less during all load conditions, both occupied and unoccupied.

Develop and implement on an ongoing basis an IAQ management program for buildings based on the U.S. Environmental Protection Agency (EPA) document, Building Air Quality: A Guide for Building Owners and Facility Managers, EPA reference number 402-F-91-102, December 1991.

#### **Potential Technologies & Strategies**

A complete guide to preventing mold and reducing the probability of it recurring can be found in the EPA's Mold Remediation in Schools and Commercial Buildings, EPA reference number 402-K-01-001. The GREENGUARD Environmental Institute offers its GREENGUARD Mold Protection Program™. The EPA Design Tools for Schools offers a comprehensive program for preventing mold during the design and construction phases of a school project. These documents contain a comprehensive overview of the principles and practices stated here and serve as valuable resources in constructing commissioning plans and operation and maintenance guides.

Project teams should be aware of potential differences in construction if portable classrooms and modular classroom units are being used.

# INNOVATION IN DESIGN

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## **ID Credit 1: Innovation in Design** **1–4 Points**

### **Intent**

To provide design teams and projects the opportunity to achieve exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System.

### **Requirements**

Credit can be achieved through any combination of the Innovation in Design and Exemplary Performance paths as described below:

#### **PATH 1. Innovation in Design (1-4 points)**

Achieve significant, measurable environmental performance using a strategy not addressed in the LEED 2009 for Schools Rating System.

One point is awarded for each innovation achieved. No more than 4 points under IDc1 may be earned through PATH 1—Innovation in Design.

Identify the following in writing:

- The intent of the proposed innovation credit.
- The proposed requirement for compliance.
- The proposed submittals to demonstrate compliance.
- The design approach (strategies) used to meet the requirements.

#### **PATH 2. Exemplary Performance (1-3 points)**

Achieve exemplary performance in an existing LEED 2009 for Schools prerequisite or credit that allows exemplary performance as specified in the LEED Reference Guide for Green Building Design & Construction, 2009 Edition. An exemplary performance point may be earned for achieving double the credit requirements and/or achieving the next incremental percentage threshold of an existing credit in LEED.

One point is awarded for each exemplary performance achieved. No more than 3 points under IDc1 may be earned through PATH 2—Exemplary Performance.

#### **PATH 3. Pilot Credit (1-4 points)**

Attempt a pilot credit available in the Pilot Credit Library at [www.usgbc.org/pilotcreditlibrary](http://www.usgbc.org/pilotcreditlibrary). Register as a pilot credit participant and complete the required documentation. Projects may pursue up to 4 Pilot Credits total.

### **Potential Technologies & Strategies**

Substantially exceed a LEED 2009 for Schools performance credit, such as energy performance or water efficiency. Apply strategies or measures that demonstrate a comprehensive approach and quantifiable environment and/or health benefits.

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## **ID Credit 2: LEED Accredited Professional**

### **1 Point**

#### **Intent**

To support and encourage the design integration required by LEED to streamline the application and certification process.

#### **Requirements**

At least 1 principal participant of the project team shall be a LEED Accredited Professional (AP).

#### **Potential Technologies & Strategies**

Educate the project team members about green building design and construction, the LEED requirements and application process early in the life of the project. Consider assigning integrated design and construction process facilitation to the LEED AP.

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## **ID Credit 3: The School as a Teaching Tool**

### **1 Point**

#### **Intent**

To integrate the sustainable features of a school facility with the school's educational mission.

#### **Requirements**

Design a curriculum based on the high-performance features of the building, and commit to implementing the curriculum within 10 months of LEED certification. The curriculum should not just describe the features themselves, but explore the relationship between human ecology, natural ecology and the building. Curriculum must meet local or state curriculum standards, be approved by school administrators and provide 10 or more hours of classroom instruction per year, per full-time student.

#### **Potential Technologies & Strategies**

It is highly recommended that project teams coordinate closely with school administration and faculty where possible, to encourage ongoing relationships between high-performance features of the school and the students. For curriculum development, engage the school in a program that integrates the school building with the curriculum in the school. Consider the National Energy Education Development (NEED) Project, the Alliance to Save Energy's Green Schools Program, and National Energy Foundation educational resources. A collection of energy education resources can also be found at the Energy Information Administration's Web site at: [www.eia.doe.gov/kids/onlineresources.html](http://www.eia.doe.gov/kids/onlineresources.html).

# REGIONAL PRIORITY

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## **RP Credit 1: Regional Priority** **1–4 Points**

### **Intent**

To provide an incentive for the achievement of credits that address geographically specific environmental priorities.

### **Requirements**

Earn 1-4 of the 6 Regional Priority credits identified by the USGBC regional councils and chapters as having environmental importance for a project's region. A database of Regional Priority credits and their geographic applicability is available on the USGBC website; <http://www.usgbc.org>.

One point is awarded for each Regional Priority credit achieved; no more than 4 credits identified as Regional Priority credits may be earned. The USGBC has prioritized credits for projects located in the U.S., Puerto Rico, the U.S. Virgin Islands, and Guam. All other international projects should check the database for eligible Regional Priority credits.

### **Potential Technologies & Strategies**

Determine and pursue the prioritized credits for the project location.