

# **Washington Sustainable Schools Protocol**

## **Criteria for High Performance Schools**

FINAL DRAFT January 15, 2006, V.2

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# ACKNOWLEDGEMENTS

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The Washington Sustainable Schools Protocol was developed under a collaboration of many agencies and organizations within the State of Washington and the Pacific Northwest.

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## Development Team

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# Table of Contents

<b>Acknowledgements</b>	<b>ii</b>
Table of Contents	iii
<b>Overview</b>	<b>6</b>
Protocol Scorecard	9
<b>Site</b>	<b>11</b>
Site Selection	11
S1.0: Code Compliance	11
S1.1: Sensitive Areas	11
S1.2: Greenfields	12
S1.3: Central Location	13
S1.4: Joint Use On-Site	13
S1.5: Joint Use Off-Site	13
S1.6: Minimal Footprint	14
Transportation	15
S2.1: Public Transportation	15
S2.2: Bicycles	15
S2.3: Minimize Parking	15
Stormwater Management	16
S3.0: Sedimentation and Erosion Control	16
S3.1: On-Site Infiltration	17
S3.2: Stormwater Treatment	18
S3.3: Enhanced Treatment	18
Outdoor Surfaces	20
S4.1: Reduce Heat Islands - Site	20
S4.2: Reduce Heat Islands - Roof	20
Outdoor Lighting	21
S5.1: Light Pollution Reduction	21
<b>Water</b>	<b>22</b>
Outdoor Systems	22
W1.0: Create Water Use Budget	22
W1.1: Irrigation Water Reduction	23
W1.2: Scheduling Controller	23
Indoor Systems	25
W2.1: Water Use Reduction for Sewage Conveyance	25

W2.2: Water Use Reduction	27
<b>Materials</b>	<b>29</b>
Waste Reduction and Efficient Material Use	29
M1.0: Minimum Recycling	29
M1.1: Site Waste Management	29
M1.2: Building Reuse	30
M1.3: Building Reuse, Non-shell	31
M1.4: Resource Reuse - Materials	31
M1.5: Resource Reuse - Furniture	32
Environmental Procurement	33
M2.1: Recycled Content	33
M2.2: Rapidly Renewable Materials	34
M2.3: Certified Wood	35
M2.4: Eliminate Ozone-Depleting Materials	36
M2.5: Regional/Local Materials	36
<b>Energy</b>	<b>38</b>
Efficiency	38
E1.0: Minimum Energy Performance	38
E1.1: Superior Energy Performance	39
Controls	41
E2.1: HVAC and Operable Windows	41
E2.2: Daylight-Responsive Controls	42
On-Site Alternative Sources	43
E3.1: Renewable Energy	43
E3.2: Distributed Generation	44
Commissioning	45
E4.0: Fundamental Commissioning	45
E4.1: Additional Commissioning	46
Management	48
E5.1: Energy Management Systems	48
<b>Indoor Environmental Quality</b>	<b>50</b>
Daylighting	50
IEQ1.0: Minimum Daylighting	50
IEQ1.1: Daylighting	50
IEQ1.2: Fixed-position Shading	51
IEQ1.3: Views	51

Electric Lighting Quality	52
IEQ2.1: Electric Lighting Quality	52
Indoor Air Quality	53
IEQ3.0: Minimum Requirements	54
IEQ3.1: Low-Emitting Interior Finishes	55
IEQ3.2: Low-Emitting Furniture	56
IEQ3.3: Source Control	57
IEQ3.4: Ducted HVAC Returns	57
IEQ3.5: Particle Arrestance Filtration	57
IEQ3.6: Construction IAQ Management	58
IEQ3.7: Natural Cooling	58
Acoustics	60
IEQ4.0: Acoustic Performance	60
IEQ4.1: Improved Acoustic Performance	61
IEQ4.2: Audio Enhancement	62
Thermal Comfort	63
IEQ5.0: ASHRAE 55 Code Compliance	63
User Control	64
IEQ6.1: User Control - Windows	64
IEQ6.2: User Control – Temperature & Lights	64
<b>Extra Credit</b>	<b>65</b>
Integrated Design	65
EX1.1: Eco-Charette	65
Operations	67
EX2.1: Green Power Contract	67
EX2.2: Post Occupancy Evaluation	67
EX2.3: Life Cycle Cost Analysis	68
Education	70
EX3.1: Green Building Learning Opportunities	70
Project and District Level Innovations	71
EX4.1: Innovation	71

## OVERVIEW

The Washington Sustainable Schools Protocol is based on the California Collaborative for High Performance Schools (CHPS) Criteria, but explicitly defines a high performance school for the State of Washington. The Protocol was created by members of the Washington Sustainable Schools Protocol Committee and vetted by members of the Washington Sustainable Schools Protocol Team. Both groups were broad-based, and included professionals that plan, design, and construct schools in Washington with considerations for process, economics, and climates unique to Washington.

The Protocol is useful as a goal-setting and planning tool. Districts can use it to clearly communicate their design goals. The Protocol is designed to be flexible and relevant. It allows designers to deliver a Washington Sustainable School while addressing the regional, district, and site-specific constraints relevant to a particular school capital improvements project. In addition, achieving WSSP Certification is acceptable as meeting the requirements of SB 5509, the Washington State's High Performance Public Buildings Legislation enacted as of July 14, 2005.

In using the Protocol, districts are cautioned to work with their local jurisdictions to ensure they are meeting local requirements when implementing innovative strategies suggested in the Protocol. In addition, local jurisdictions may set higher requirements than the State, and therefore those expressed in the Required Credits of the Protocol.

## Certification and Documentation

The Protocol addresses the multiple facets of high performance schools by providing credits in the environmental categories of energy efficiency, water efficiency, site planning, materials and indoor environmental quality. In addition, it offers an "extra credit" section that emphasizes comprehensive planning and evaluation actions that cross the environmental categories, as well as innovative actions that go above and beyond what is described in existing credits offered within the environmental categories.

For each of the environmental categories, the Protocol comprises both required and optional credits. A number of points are assigned to each optional credit. For a school to achieve certification a school must meet all of the required credits and earn at least 40 points. At least 4 points must be from the Energy Performance Credit (E1.1) and no more than 5 points (of the 40) can be derived from the Extra Credit category. The Washington Sustainable Schools Protocol is pass/fail. However, school district planners are encouraged to earn as many points possible and appropriate for a given project above the required threshold. In other words, Protocol users should treat the 40 point threshold as a minimum to beat.

Each design team or building owner is expected to document compliance with the Protocol through a process of self-certification. However, the Washington State's Office of Superintendent of Public Instruction (OSPI) may require documentation for schools participating in its Volunteer Program or D-Form Process.

A Protocol Scorecard is provided following this introduction. The Scorecard summarizes the requirements and applicable points for each credit. In addition, a separate electronic tool, the "WSSP Workbook" has been developed to accompany this document that includes an excel-based workplan, which links to a scorecard and worksheets for calculating water, materials, and on-site energy credits. As the workplan is edited through the phases of a project, the points on the electronic scorecard are recalculated. This workplan and scorecard may be used as part of the documentation required by OSPI. (Since this draft (January 15, 2006, V.2) precedes complete development of the documentation process you are urged to contact OSPI for documentation requirements.)

## Washington Sustainable Schools and LEED™

The Washington Sustainable Schools (WSS) Protocol is similar to the US Green Building Council's (USGBC) LEED™ NC Rating System. However, no interchangeability between the two systems is

expressed or implied. A school qualifying for Washington Sustainable Schools may contain many of the elements needed for LEED™ certification, but there is *no reciprocity* between the two systems at this time. Schools qualifying for WSSP may or may not qualify for LEED and vice versa. Teams wishing to pursue a LEED™ rating must do so independently. The USGBC has developed excellent support materials that are useful for anyone pursuing a LEED rating, and could be useful as background for understanding related Protocol credits. See the USGBC's web site at <http://www.usgbc.org> for more information on how to join the organization and obtain technical resources.

## Priorities

Sustainability and high performance are broad topics. As noted above, Washington Sustainable Schools Protocol spans a wide variety of areas, from site planning and energy use, to material specifications and indoor environmental quality. Required credits in the Protocol generally reflect actions that are required by state law, although they may exceed those requirements slightly if the Protocol Team felt the action could and should be met by most projects.

All of the credits included in the reflect actions that are considered to provide a positive environmental impact. However there are credits that relate directly to high priorities expressed by school planners, designers, and our legislators. The intent of these credits is to ensure schools that are healthy, operate efficiently, increase student productivity, and reduce large scale environmental impact.

Listed below are design areas and credits that are recommended as high priorities by the Washington Sustainable Schools Protocol to optimize performance of schools in the State. The points ascribed to each credit are the amount of points possible.

**Daylighting.** Quality daylighting designs have been proven to improve student productivity. When integrated properly with the electric lighting system, daylighting saves significant amounts of energy.

IEQ Credit 1: Daylighting in Classrooms (5 possible points).

**Energy Efficiency.** Energy efficiency should be a cornerstone of a Washington Sustainable School to reduce operational expenses, conserve natural resources, and reduce local and global pollution. All schools should be commissioned to ensure that the design meets the expectations of the district, and that the school is built as it was designed. Modern schools are complex buildings. Commissioning ensures that all building systems are working properly, and that the school staff knows how to operate and maintain them.

Energy Credit 1: Superior Energy Performance (12 possible points).

Energy Credit 2: Controls (2 possible points).

Energy Credit 4: Commissioning (2 possible points).

Energy Credit 5: Management (1 possible point).

**Indoor Air Quality.** Schools must protect student health, and good indoor air quality is essential for healthy schools. Because indoor air quality can be impacted both by design and construction choices, each of the credits below should be addressed to achieve good indoor air quality.

IEQ Credit 3: Indoor Air Quality (13 possible points).

**Acoustics.** If not controlled to appropriate levels, noise from loud ventilation systems, outdoor sources, and neighboring rooms can significantly impede communication between teachers and students. Young learners, students with hearing difficulties, and those learning English as a second language are particularly vulnerable. Classrooms should be designed to enable all students to hear clearly.

IEQ Credit 4: Improved Acoustical Performance (2 possible points).

**Sustainable Materials.** Hidden within all materials are the resources, energy, chemicals, and environmental damage involved in their production. Where sustainable alternatives are available

## OVERVIEW

they should be used as much as possible. In addition, it is now possible to recycle, compost, or salvage a majority of construction and demolition waste instead of disposing it in landfills. Cost savings are available with effective construction waste management. When reuse is possible (of either building materials or the building itself), this can represent avoided costs for new materials and disposal, as well as avoided environmental impacts of producing new building materials.

Materials Credit 1: Waste Reduction and Efficient Use (1-8 points).

Materials Credit 2: Environmental Procurement (1-9 points).

**Site Responsive.** As much as possible, a high performance school will avoid degrading natural ecosystems, while seeking to incorporate natural conditions to enhance the building's performance. In addition, the school design will encourage non-polluting transportation alternatives.

Site Credit 1: Selection & Use (8 possible points).

Site Credit 2: Transportation (3 possible points).

Site Credit 3: Stormwater Management (2 possible points).

Energy Credit 3: On-Site Alternative Sources (7 possible points).

**Water Efficiency.** Basic efficiency measures can reduce a school's water use by 30% or more. These reductions help the local environment, while reducing a school's operating expenses. While cost savings may be modest now, these savings will likely rise over time due to climate changes and the rising importance of water levels.

Water Credit 1: Outdoor Systems (1-3 points).

Water Credit 2: Indoor Systems (1-3 points).

## Extra Credits

Your project may earn up to 5 points (as part of the minimum 40) from the Extra Credit Section. There are several "Designated" Extra Credits: Integrated Design, Operations, and Education. Of these, the Washington Sustainable Schools Protocol highly recommends three actions that are worth 1 point each:

Extra Credit 1.1: Holding a high performance workshop or eco-charette to kick off design.

Extra Credit 2.2: Conducting a post-occupancy evaluation.

Extra Credit 2.3: Performing a Life-Cycle Cost Analysis.

In addition, there are three Undesignated Extra Credits. These are available for innovations at the Project and/or District Level. Examples of acceptable innovations are included with the Credit.

## Resources

For most credits, resources are listed to assist you in finding more information regarding strategies that may help you achieve the credit. In addition to these resources, you may want to consult with the CHPS Best Practices Manual (you can download the document at [chps.net](http://chps.net)), and the LEED® Reference Guide (available for purchase from the USGBC). Note that a LEED Application Guide for Schools is under development. Both the Cascadia Chapter of the USGBC and Better Bricks have and continue to developed case studies of high performance schools in the northwest that are useful to get ideas for what schools can do. Several credits refer to the "WSSP Workbook" which is an Excel file with calculation worksheets and a scorecard and workplan template, available through OSPI.

# Protocol Scorecard

Category	Group	Credit Name	Points	Achieved
<b>Site</b> 17 points	1) Selection & Use	S1.0 Code Compliance	R	
		S1.1 Sensitive Areas	1	
		S1.2 Greenfields	1	
		S1.3 Central Location	1	
		S1.4 Joint Use of On-Site Facilities	1-2	
		S1.5 Joint Use of Off Site Facilities	1	
		S1.6 Minimal Footprint	1-2	
	2) Transportation	S2.1 Public	1	
		S2.2 Bicycles	1	
		S2.3 Parking	1	
	3) Stormwater Management	S3.0 Temporary Sedimentation and Erosion Control	R	
		S3.1 Onsite Infiltration	1	
		S3.2 Runoff Treatment or Reduction	1	
		S3.3 Enhanced Treatment	1	
	4) Outdoor Surfaces	S4.1 Heat Island Reduction Through Landscaping	1	
		S4.2 Heat Island Reduction Through Roof Design	1	
	5) Outdoor Lighting	S5.1 Light Pollution Reduction	1	
<b>Water</b> 6 points	1) Outdoor Systems	W1.0 Water Use Budget	R	
		W1.1 Irrigation Water Reduction (50%, 100%)	1-2	
		W1.2 Scheduling Controller	1	
	2) Indoor Systems	W2.1 Potable Water Use for Bldg Sewage Reduction (45%)	1	
		W2.2 Potable Water Use Reduction (20%, 30%)	1-2	
<b>Materials</b> 17 Points	1) Waste Reduction & Efficient Use	M1.0 Storage and Collection of Recyclables	R	
		M1.1 Waste Reduction (50%,75%)	1-2	
		M1.2 Bldg. Structure/Shell Reuse (50%, 75%)	1-2	
		M1.3 Bldg. Non-Shell Reuse (50%)	1	
		M1.4 Salvaged or Refurbished Bldg. Materials (5%, 10%)	1-2	
		M1.5 Salvaged or Refurbished Furn. & Equip. (30%)	1	
	2) Environmental Procurement	M2.1 Recycled Content (5%/4 mtls, 10%/8 mtls)	1-2	
		M2.2 Rapidly Renewable Materials	1	
		M2.3 Certified Wood (20%, 50%, Chain of Custody)	1-3	
		M2.4 Eliminate Ozone-Depleting Substances	1	
		M2.5 Regional/Local Manufactured Materials (20%, also raw materials)	1-2	
<b>Energy</b> 24 Points	1) Efficiency	E1.0 Minimum Energy Performance	R	
		E1.1 Superior Energy Performance	4-12	
	2) Controls	E2.1 HVAC and Operable Windows	1	
		E2.2 Daylight-Responsive Controls	1	
	3) On-Site Alternative Sources	E3.1 Renewable Energy (5-10% bldg supply)	1-4	
		E3.2 Distributed Generation (5-10% bldg supply)	1-3	
	4) Commissioning	E4.0 Fundamental Commissioning	R	
		E4.1 Additional Commissioning	2	
	5) Management	E5.1 Energy Management Systems	1	

Continued

## Protocol Scorecard cont.

Category	Group	Credit Name	Points	Achieved
<b>Indoor Environmental Quality</b> 24 points	1) Daylighting	IEQ1.0 2% Daylight Factor (New const. 50% critical visual spaces)	R	
		IEQ1.1 2% Daylight Factor (75%, 100% critical visual spaces)	1-3	
		IEQ1.2 Fixed-position Shading	1	
		IEQ1.3 Direct Line of Vision Glazing	1	
	2) Electric Lighting Quality	IEQ2.1 Electric Lighting Quality	1	
	3) Indoor Air Quality	IEQ3.0 Ventilation, Filtration, & Moisture Control Minimums	R	
		IEQ3.1 Low-Emitting Interior Finishes	1-4	
		IEQ3.2 Low-Emitting Materials Furniture & Seating	1	
		IEQ3.3 Source Control	1	
		IEQ3.4 Ducted HVAC Returns	1	
		IEQ3.5 Particle Arrestance Filtration	1	
		IEQ3.6 IAQ Management (construction, pre-occupancy)	1-2	
		IEQ3.7 Natural Cooling	3	
	4) Acoustics	IEQ4.0 Minimum Acoustic Performance	R	
		IEQ4.1 Improved Acoustical Performance	1-2	
		IEQ4.2 Enhanced Audio	1	
	5) Thermal Comfort	IEQ5.0 ASHRAE 55 Code Compliance	R	
	6) User Controls	IEQ6.1 User Control (operable windows)	1	
		IEQ6.2 User Control (temperature and lighting controls)	1	
	<b>Extra Credits</b> 8 points	1) Integrated Design	EX1.1 Eco-Charette	1
2) Operations		EX2.1 Green Power	1	
		EX2.2 Post Occupancy Evaluation	1	
		EX2.3 Life Cycle Cost Analysis	1	
3) Education		EX3.1 Green Building Learning Opportunities	1	
4) Innovation		EX4.1 Project and/or District	1-3	
Total Possible Points			96	
Minimum required for Washington Sustainable School (4 points must be from Energy Performance Credit E1.1 and no more than 5 points (of the minimum 40) from the Extra Credit category)			40	

# SITE

## Site Selection

**Purpose:** Choose sites that protect students and staff from outdoor pollution and minimally impact the environment. Channel development to centrally located areas, with existing infrastructure, to protect greenfields, minimize transportation requirements, and preserve habitat and natural resources.

The site is a crucial element in determining the overall sustainability of the school design. Sites are sometimes purchased years in advance, and some of these credits may be out of the control of the districts and/or designers at the time the school is being built. In addition, some of these credits may be more difficult for rural/suburban areas where distances between home and school can be significant. However, districts that are considering multiple sites can substantially lower the environmental impact of the school by choosing centrally located sites, sharing parks or facilities with community organizations, preserving open space, and protecting environmentally sensitive areas.

### S1.0: Code Compliance

Required	School Facilities Compliance. Comply with all siting and environmental impact study requirements of the most current edition of the School Facilities Manual, issued by the Washington State Office of the Superintendent of Public Instruction.
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## Resources

Health and Safety Guide for K-12 Schools in Washington. Jointly published by the Washington State Office of the Superintendent of Public Instruction and the Department of Health, available online at <http://www.k12.wa.us/schfacilities/healthsafetyguide.aspx>

School Facilities Manual, Washington State Office of the Superintendent of Public Instruction, available online at <http://www.k12.wa.us/SchFacilities/pubdocs/SFMANUAL/intro.pdf>

### S1.1: Sensitive Areas

1 point	<p>Environmentally sensitive or important spaces should be avoided. Do not develop buildings or improvements on sites that meet any of the following criteria:</p> <ol style="list-style-type: none"> <li>1. Important farmland as defined by the US Department of Agriculture.</li> <li>2. Land whose elevation is lower than five feet above the elevation of the 100-year flood as defined by FEMA.</li> <li>3. Land that provides habitat for any species on the federal or state threatened or endangered list.</li> <li>4. Within 100 feet of any wetland as defined by 40 CFR, Parts 230-233 and Part 22, OR as defined by local or state rule or law, whichever is more stringent.</li> </ol>
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## References

**Important Soils:** The Natural Resources Conservation Services (NRCS) division of the United States Department of Agriculture maintains the definitions and soil surveys that designate areas as “important farmland.” Lists of Prime and Statewide Important Farmland Soils are maintained for each soil survey area and may be obtained from the Field Office Technical Guide (FOTG) located in each NRCS field office. County and state offices of the NRCS keep maps showing the status of maps within their jurisdiction. County offices can be located at <http://offices.sc.egov.usda.gov/locator/app>.

**100-Year Flood Plains:** Washington is in FEMA's Region X (<http://www.fema.gov/regions/x/index.shtml>). To request a map showing the 100-year flood elevations (called Flood Insurance Rate Maps, or FIRM Maps) contact a Region X Map Specialist toll-free by phone at 1-877-FEMA MAP, or by email at [bakermail@mbakercorp.com](mailto:bakermail@mbakercorp.com). Unofficial maps by ESRI are available online at <http://www.geographynetwork.com>.

**Wetlands:** The term wetlands is defined in Title 40 as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.” [Source: CFR: Title 40. 330.4]. The US Army Corps of Engineers, the Washington State Department of Ecology, Fish and Wildlife and the Department of Natural Resources all work in parallel to regulate waterways (which include wetlands) in Washington. Federally, the primary laws are the Clean Water Act and the Coastal Zone Management Act. The main state laws are the State Water Pollution Control Act, the Growth Management Act, and the Shoreline Management Act. (Resource: How Ecology Regulates Wetlands, Washington State Department of Ecology, Publication 97-112, April 1998.)

**\*CFR:** The Code of Federal Regulations (CFR) is a publication of the United States Federal Government that lists rules authorized by the executive departments and agencies.

## S1.2: Greenfields

1 point

Do not build on greenfields. Greenfields are defined as those sites that are undeveloped except for agricultural use.

When choosing between multiple sites, use previously developed sites instead of greenfields.

**Greenfields** are semi-rural or rural properties that are undeveloped except for agricultural use, and considered as a site for expanding urban development.

Urban redevelopment reduces environmental impacts by utilizing established infrastructure and preserving undeveloped lands. If the site already contains a building, additional points may be earned with Materials Credit 2: Building Reuse.

### S1.3: Central Location

1 point	<p>Locate sites where at least 50% of students live within the following distances from the school:</p> <ul style="list-style-type: none"> <li>Elementary Schools: within one mile.</li> <li>Middle Schools: within two miles.</li> <li>Junior High School: within three miles.</li> <li>High Schools: within four miles.</li> </ul>
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Over the lifetime of the building, school districts and families invest significant time, energy, and money transporting students to and from school. Cars driven by parents, guardians, or the students themselves are the largest resource users and sources of transportation-related pollution. Centrally located sites allow more students to walk or bike to school, while reducing the distance cars must travel.

For rural districts, this credit may be difficult to achieve since distances between home and school are much larger.

To earn this point, calculations must be based on the estimated school population when the school opens. Additional transportation-related points are covered in Site Credit 2: Transportation, as well as an innovation credit transportation options (see Extra Credit 4).

### S1.4: Joint Use On-Site

Shared Use = 1 point  Dedicated Use = 2 points	<p>Make portion(s) of the school building or grounds available for either shared or dedicated use by community and other appropriate organizations. One point if the space is "shared" use. An additional point (total of two points) if the space is dedicated for use by the community and other appropriate organizations.</p>
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Across the country, schools are being integrated with a variety of facilities, from laundromats and coffee shops to police stations and park districts. These credits apply to both existing and newly created parks. Joint use can have significant benefits, including increased campus security, improved community integration, and reduced site acquisition and construction costs. School districts should have formal agreements for all building users in place before occupancy. Dedicated use does not preclude school use if it is appropriate, but the other organization should be the primary and priority user. A formal written agreement is required to achieve this credit.

### S1.5: Joint Use Off-Site

1 point	<p>Share park or recreation space with local park boards or other organizations (off-site).</p>
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Using parks or other spaces off-site may help reduce the development footprint of the school project and make better use of existing community assets. School or district must have a letter of agreement with the off-site facilities management.

## S1.6: Minimal Footprint

60% = 1 point

40% = 2 points

Provide multi-story construction to reduce the area of the site disturbed by construction. Receive 1 point for ground floor footprint that does not exceed 60% of the building's total square footage, or 2 points for a ground floor footprint that does not exceed 40% of the total building area.

A multi-story building reduces the ground floor footprint, minimizing the impact of construction and overall site disturbance. Design the building such that the floor area of the ground floor (not including any overhangs) is 41-60% of the total building area for 1 point, or 40% or less for 2 points.

## Transportation

**Purpose:** Reduce dependence on fossil fuels, and reduce pollution and land development impacts from automobile use.

### S2.1: Public Transportation

1 point	In urban areas, locate building within 1/4 mile of a commuter rail or light rail station, or within 1/8 mile of one or more bus lines. In rural and suburban areas, with limited or non-existent rail/bus service, provide busing to the school.
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When available, public transportation can provide significant reductions in energy impacts. Some school districts offer reduced or subsidized fares for students and staff using public transportation. If sufficient capacity exists, schools can use public transportation to replace district-provided bus service.

Notes: Schools near high traffic areas must ensure safe student access. In addition, transportation-related pollution (and the site's air quality) must be considered when investigating the project's potential for natural ventilation.

### S2.2: Bicycles

1 point	Provide bike lanes or sidewalks that extend to the end of the property, AND provide suitable means for securing bicycles for at least 5% of building occupants in an elementary or middle school, and 3% of building occupants in a high school.
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Bicycles are a popular and pollution-free form of transportation. To protect pedestrians and bicyclists, bike lanes and sidewalks must extend to the end of the school property. Work with local planners to develop safe pedestrian and bike connections to likely destinations, e.g., public transportation and town centers.

### S2.3: Minimize Parking

1 point	<p>Provide preferred parking totaling 5% of staff and student spaces for carpools or vanpools and alternative fuel vehicles, and size parking capacity not to exceed 2.25 spaces per classroom plus parking for 20% of students at Junior and High Schools; or three spaces per classroom for Elementary and Middle Schools</p> <p>OR, add no new parking for rehabilitation projects and provide preferred parking totaling 5% of staff and student spaces for carpools, vanpools, and alternative fuel vehicles.</p>
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Excess parking spaces encourage increased automobile use, contribute to urban heat island effects, and can increase pollution from stormwater runoff. To accommodate overflow parking, strategies include dual use of school space (e.g. playgrounds), using pervious paving (e.g. grass pavers), and/or developing inter-local agreements with neighboring businesses and institutions. Pervious paving will not be counted as part of the percentage of parking area. Design parking so as not to exceed listed amounts and include clearly marked, preferred parking areas for carpools and alternative fuel vehicles. Stand-alone alternative fuel vehicles such as electric hybrid vehicles use less fuel per mile traveled than conventional gasoline vehicles, and reduce the pollution associated with automobile use.

An innovation point can be earned for projects that undertake a substantial transportation options planning process (see Extra Credit 4.1).

## Stormwater Management

**Purpose:** Manage stormwater during and after construction to control erosion and runoff, reducing the negative impacts on water and air quality.

### S3.0: Sedimentation and Erosion Control

Required	<p>Design to a site sediment and erosion control plan that follows the best management practices outlined by the Washington State Department of Ecology's Stormwater Management Manuals (Ecology's Stormwater Management Manual for Western Washington: Volume II -- Construction Stormwater Pollution Prevention, and the Final Draft Stormwater Management Manual for Eastern Washington), or the local ordinance, whichever is more stringent. The plan shall meet the following objectives:</p> <p>Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.</p> <p>Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.</p>
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Construction site stormwater runoff is regulated at the state and local levels. Check with your local agencies for local permit requirements.

A variety of best practices address this prerequisite, including:

Runoff Control	<p>Minimize clearing: land grading, permanent diversions, preserving natural vegetation.</p> <p>Stabilize drainage ways: check dams, filter berms, grass-lined channel, and riprap.</p>
Erosion Control	<p>Stabilize exposed soils: chemical stabilization, mulching, permanent seeding, sodding, soil roughening.</p> <p>Protect steep slopes: geotextiles, gradient terraces, soil retention, temporary slope drain.</p> <p>Protect waterways: temporary stream crossings, vegetated buffer.</p> <p>Phase construction: construction sequencing, dust control.</p>
Sediment Control	<p>Install perimeter controls: temporary diversion dikes, wind fences and sand fences, brush barrier, silt fence.</p> <p>Install sediment-trapping devices: sediment basins and rock dams, sediment filters and sediment chambers, sediment trap.</p> <p>Storm drain inlet protection: sandbags, concrete blocks, gravel barriers.</p>

## Resources

"Compost Filter Berms and Blankets Take on the Silt Fence", Biocycle, January 2001.

EPA Stormwater Management for Construction Activities, EPA Document No. EPA-833-R-92-001.

Innovative Uses of Compost: Erosion Control, Turf Remediation, and Landscaping. EPA Document No. EPA530-F-97-043. <http://www.epa.gov/epaoswer/non-hw/compost/erosion.pdf>

Washington State Department of Ecology's Final Draft Stormwater Management Manual for Eastern Washington, Chapters 1-4, available online at: <http://www.ecy.wa.gov/biblio/0310038A.html>

Washington State Department of Ecology's Stormwater Management Manual for Western Washington: Volume II -- Construction Stormwater Pollution Prevention, September 2001, available online at <http://www.ecy.wa.gov/biblio/9912.html>

## S3.1: On-Site Infiltration

1 point

Promote on-site infiltration. No net increase in the rate or quantity of stormwater runoff from existing to developed conditions.

OR if existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff.

Stormwater runoff is rainwater that flows over surfaces on the site and enters either the sewage system or receiving waters. Stormwater carries sediment and pollutants from the site into the sewage system and/or local bodies of water. In addition, the cumulative runoff throughout the local area requires significant investments in municipal infrastructure to handle peak runoff loads.

On-site infiltration reduces the rate and quantity of stormwater runoff. Stormwater treatment reduces the contaminants leaving the site, thus addressing water quality. Reducing the amount of runoff is the most effective way to minimize its negative impacts.

Low impact development (LID) is an integrated approach to site development and storm water management that emphasizes strategies to mimic natural site hydrology rather than using conventional "pipe and pond" techniques. In practice, a site will use multiple, small-scale LID strategies distributed across the site. LID strategies include:

- Maximize on-site stormwater infiltration by directing site water through use of bioretention/rain gardens and infiltration facilities.
- Maximize retention of stormwater in soil by protecting existing soils on site that have high infiltration, and by using bioretention/rain gardens.
- Reduce impervious surfaces while increasing pervious and vegetated areas.
- Capture rainwater from impervious areas of the building for irrigation or reuse within the building.
- Install green/vegetated roofs.
- Reduce building footprint.
- Decrease street widths.

Seattle's pilot Street Edge Alternatives Project (SEA Streets) was designed to provide drainage that more closely mimics the natural landscape prior to development than traditional piped systems. They reduced impervious surfaces to 11% less than a traditional street, provided surface detention in swales, and added over 100 evergreen trees and 1100 shrubs. Two years of monitoring showed that this demonstration project reduced the total volume of stormwater leaving the street by 98% for a 2-year storm event.

## S3.2: Stormwater Treatment

1 point	<p>Treat runoff or effectively reduce it to zero for average conditions.</p> <p>Install treatment systems designed to remove 80% of the average annual post-development total suspended solids (TSS) by implementing best management practices outlined in Washington State's Department of Ecology's (WSDOE) Stormwater Management Manual's for either Western or Eastern Washington or in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA 840-B-92- 002 1/93).</p> <p>OR, reduce stormwater runoff to zero at 10-year storm event flow level.</p>
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Total suspended solids (TSS) are particles that are too small or light to be removed from stormwater by gravity settling alone, and must typically be removed with filtration methods. An alternative to measuring TSS for this credit is to design the system to reduce storm water to zero at 10-year storm event flow level.

Common treatment systems include infiltration basins and trenches, porous pavement, vegetated filter strips, grassy swales, filtration basins, constructed wetlands, rain gardens and compost amended filter strips.

## S3.3: Enhanced Treatment

1 point	<p>Provide the equivalent of "Enhanced Treatment" as described in the WSDOE Manual for Western Washington for at least 50% of the volume of water required to be treated by your jurisdiction.</p> <p>AND, implement the WSDOE BMP T5.13 "Post-Construction Soil Quality and Depth" which provides guidelines for amending soils with compost.</p>
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Enhanced treatment is intended to provide a combination of infiltration, retention and treatment. Significant data is available regarding the benefit of using compost amended soil to treat stormwater.

Comprehensive descriptions of innovative strategies for treating stormwater on-site are available in the resources listed below.

### Resources

Low Impact Development: Technical Guidance Manual for Puget Sound, January 2005, Published by Puget Sound Action Team and Washington State University, available [http://www.psat.wa.gov/Publications/LID\\_tech\\_manual05/lid\\_index.htm](http://www.psat.wa.gov/Publications/LID_tech_manual05/lid_index.htm)

Seattle's pilot Street Edge Alternatives (SEA Street) information, [http://www.seattle.gov/util/About\\_SPU/Drainage\\_&\\_Sewer\\_System/Natural\\_Drainage\\_Systems/Street\\_Edge\\_Alternatives/index.asp](http://www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Natural_Drainage_Systems/Street_Edge_Alternatives/index.asp)

Washington State Department of Ecology's Stormwater Management Manual for Eastern Washington - DRAFT FINAL - Chapters 5 and 6, June 2003, available online at <http://www.ecy.wa.gov/biblio/0310038B.html>

Washington State Department of Ecology's Stormwater Management Manual for Western Washington: Volume V -- Runoff Treatment BMPs, September 2001, available online at <http://www.ecy.wa.gov/biblio/9915.html>

Washington State Department of Ecology's 2005 Stormwater Management Manual for Western Washington: Volume V – Runoff Treatment BMPS available online at:  
<http://www.ecy.wa.gov/biblio/0510029.html>

Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington, Second Edition, 2005. Available online at  
[www.soilsforsalmon.org](http://www.soilsforsalmon.org)

## Outdoor Surfaces

**Purpose:** Reduce heat islands to minimize impact on microclimate, and human and wildlife habitat.

### S4.1: Reduce Heat Islands - Site

1 point	<p>Provide shade (at plant maturity) on at least 30% of non-roof, impervious surfaces on the site, including parking lots, walkways, plazas, etc.</p> <p>OR use light-colored/ high-albedo materials (reflectance of at least 0.3) for 30% of the site's non-roof, impervious surfaces.</p> <p>OR use an open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area.</p>
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Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials. Note albedo/reflectance requirements in the drawings and specifications. Provide shade using native or climate-tolerant trees and large shrubs, vegetated trellises, or other exterior structures supporting vegetation. Substitute vegetated surfaces for hard surfaces. Use concrete, or explore elimination of blacktop and the use of new coatings and integral colorants for asphalt to achieve light colored surfaces. Use pervious pavers or pervious concrete.

### S4.2: Reduce Heat Islands - Roof

1 point	<p>On low-sloped roofs (2:12 or less) in climate zone 5 install an ENERGY STAR® labeled Cool Roof with an emissivity of at least 0.9 for a minimum of 75% of the roof surface.</p> <p>OR install a "green" (vegetated) roof for at least 50% of the roof area.</p>
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Cool roofs can significantly reduce school cooling loads and urban heat island effects by reflecting the sun's energy, instead of absorbing, retaining, and radiating it into the occupied spaces below. With cool roofs, both the reflectivity and emissivity are important. Solar reflectance is the ratio of the electromagnetic energy reflected by a surface to the total amount incident upon it. A solar reflectance of 0.0 means all the solar energy hitting the surface is absorbed and none is reflected. Emissivity is the ability of a material to shed infrared radiation. In other words, surfaces with high emissivities lower their surface temperatures by shedding infrared radiation. Bare metals, for example, have low emissivities and stay hotter for longer periods than materials with high emissivity. The EPA's ENERGY STAR® program includes a database of high-reflectance roofing materials. To ensure high emissivity, do not use bare metal roofing products.

## Resources

Lawrence Berkeley Labs Heat Island Group, <http://eetd.lbl.gov/HeatIsland/>

Green Roofs for Healthy Cities, <http://www.greenroofs.net>

Cool Roofs Rating Council, <http://www.coolroofs.org/>

EPA Heat Island Pavement strategies, <http://www.epa.gov/heatisland/strategies/coolpavement.html>

## Outdoor Lighting

**Purpose:** Eliminate light trespass from the building site, improve night sky access, and reduce development impact on nocturnal environments.

### S5.1: Light Pollution Reduction

1 point	<p>Do not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the IESNA RP-33 Recommended Practice for Exterior Environmental Lighting or applicable sections of the IESNA Lighting Handbook, Current Edition;</p> <p>AND design interior and exterior lighting (excluding sports fields) such that zero direct-beam illumination leaves the building site.</p>
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Consult IESNA Recommended Practice Manual: Lighting for Exterior Environments for CIE zone and pre- and post-curfew hour descriptions and associated ambient lighting level requirements. Ambient lighting for pre-curfew hours for CIE zones range between 0.01 footcandles for areas with dark landscapes such as parks, rural, and residential areas, and 1.5 footcandles for areas with high ambient brightness such as urban areas with high levels of nighttime activity. Design site lighting and select lighting styles and technologies to have minimal impact off-site and minimal contribution to sky glow. Minimize lighting of architectural and landscape features. There are fixtures that are certified dark sky compliant listed at the International Dark Sky Association web site (below). Lighter colored surfaces used to achieve credit S4.1 may also help reduce lighting requirements.

### Resources

The International Dark Sky Association: <http://www.darksky.org/ida/index.html>. The International Dark Sky Association Lighting Handbook is available on line at [http://www.nofs.navy.mil/about\\_NOFS/staff/cbl/LC\\_Handbook.html](http://www.nofs.navy.mil/about_NOFS/staff/cbl/LC_Handbook.html)

# WATER

## Outdoor Systems

**Purpose:** Reduce water use for landscaping and ornamentation.

### W1.0: Create Water Use Budget

Required	Develop and design a landscape and ornamental water-use budget that conforms to local water efficient landscape ordinances. If no local ordinance exists, use the landscape and ornamental budget ordinance developed by the City of Bellevue.
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To comply with this credit, calculate the estimated water use (EWU) landscape and the Maximum Applied Water Allowance (MAWA) for the landscape. The EWU must not exceed the MAWA. Once a water budget is established, design the landscape to meet established budget baselines.

MAWA is the most irrigation water allowed for the landscape on an annual basis. It takes into account local conditions and the size of the landscape area and is calculated as follows:

$$\text{MAWA} = (\text{ET}) (\text{LA}) (0.8) (0.62)$$

Where:

MAWA = Maximum Applied Water Allowance (gallons per year).

ET = Evapotranspiration Rate for the site (inches per year): The amount of water that transpires from plants and evaporates from adjacent soil surfaces. ET takes into account local soil conditions and the local, average annual net rainfall (total rainfall minus runoff).

LA = Landscaped Area (ft<sup>2</sup>).

0.8 = ET Adjustment Factor. This factor adjusts for plant factors and irrigation efficiency.

0.62 = Conversion Factor. This converts the maximum applied water allowance to units of gallons per year.

To estimate total annual irrigation water use, calculate the EWU for each plant zone according to the equation below, then sum up the EWUs for all zones in the landscaped area:

$$\text{EWU} = (\text{ET}) (\text{PF}) (\text{LA}) (0.62)/\text{IE}$$

Where:

EWU = Estimated Water Use (gallons per year).

ET = Evapotranspiration Rate for the site (inches per year).

PF = Plant Factor for the zone (For low water use plants PF = 0 to 0.3, medium water use plants, PF = 0.4 to 0.6, high water use plants, PF = 0.7 to 1; all irrigated turfgrass, PF = 0.8 to 1).

LA = Landscape Area (ft<sup>2</sup>) for the zone.

0.62 = Conversion Factor (to gallons per ft<sup>2</sup>). This converts EWU to units of gallons per year.

IE = Irrigation Efficiency (0.625 for conventional overhead spray systems, 0.925 for low volume or drip irrigation systems).

Sports or activity fields are considered recreational areas and may require water in addition to the MAWA. A statement should be included with the landscape design plan, designating recreational areas to be used for such purposes and specifying any needed amount of additional water above the MAWA.

## Resources

WSSP Workbook has a sheet for calculating your water use budget and evaluating if you reach the 50% threshold for Credit 1.1 Irrigation Water Use Reduction.

City of Bellevue, Washington landscape budget ordinance example: Municipal Code Section 24.02.205 <http://www.cityofbellevue.org> and Water Engineering Standards, section W3-12, <http://www.cityofbellevue.org/page.asp?view=4749>

Good sources for site-specific data to calculate the net evapotranspiration:

- Golf course weather stations.
- Local weather stations.
- Parks departments.
- Washington State University, the Agricultural Extension Office.
- USDA Natural Resources Conservation Service.

## W1.1: Irrigation Water Reduction

<p>50% = 1 point</p> <p>100% or no permanent = 2 points</p>	<p>Reduce potable and river or groundwater irrigation district water consumption for irrigation by 50% over landscape budget baselines with the use of water-efficient native (or adapted) climate-tolerant plantings, high-efficiency irrigation technologies, or using captured rain or municipally provided reclaimed water.</p> <p>For an additional point, reduce potable and river or groundwater irrigation district water for site irrigation by additional 50% (a total of 100% reduction in water use) from water budget baselines; OR do not install permanent landscape irrigation systems.</p>
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Water resources are a growing concern in Washington, even in the rain-drenched west, as expanding populations and multiple uses increase the demand for limited supplies. Precipitation patterns in much of Washington make it difficult to store enough rainwater for irrigation through the dry summers, though school grounds may not require irrigation during summer months. High efficiency irrigation technologies such as micro irrigation, moisture sensors, and weather-data based controllers save water by reducing evaporation losses or operating only when needed. However, these systems require careful design, as well as additional operations and maintenance requirements. For example, some drip irrigation systems may be more vulnerable to vandalism; moisture sensors must be carefully placed to represent the soil type and exposure of individual irrigation zones accurately; and timers and controls, if not weather-data based, need to be adjusted seasonally.

### Resources

Local water utility staff, water efficient landscape consultants, Certified Irrigation Designers (<http://www.irrigation.org>), and Master Gardeners would also be good resources for helping achieve this credit.

Washington Native Plant Society, <http://www.wnps.org/>

## W1.2: Scheduling Controller

<p>1 point</p>	<p>Create a schedule for the irrigation controller based on historical rates of rainfall and evapotranspiration, combined with watering requirements for the different planting zones (e.g. shrub and tree vs. lawn) and soil types.</p>
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Irrigation design takes the following into consideration: DU - Distribution uniformity; root zone depth of plants; intake rate and water holding capacity of soils; precipitation rates of emitters, sprays or rotors; efficiency of irrigation system; soil characteristics, including the percentages of sand, loam and clay - and depth of soil, combined with the percentage of volume of organics, and the hydraulic conductivity of the soil; plant types (lawn vs ornamental); slopes of planting beds or lawn areas; rainfall patterns; climate factors; and evapo-transpiration.

To properly manage water usage a seasonally dependent time factor needs also to be managed - namely when the system is on or off, and how much, how often and when irrigation water needs to be delivered during different periods of the year. The management of this time sequence is done by setting the irrigation controller's schedule for the months of operation relative to the factors listed above. Commonly the establishment and implementation of such a schedule for each site can realize upwards of 40% savings. All automatic irrigation systems have an irrigation controller. This credit requires that detailed calculations are made and input into the controller.

Using the formulas as provided by the Irrigation Association or others calculate the yearly schedule for the irrigation controller. Establish the date at which the irrigation system is turned on and turned off, and determine the appropriate schedule for irrigation during the watering system for a minimum of four different watering programs. Controllers should provide at least four separate programs in order to establish a minimum of four separate periods during the watering season. For example in Puget Sound Lowlands calculate the appropriate schedule for a monthly grouping of April, May and June as one period, July and August as a second, September and October as a third, and the period that the system is off as a fourth. Input the soil, plant and climate characteristics, especially the evapotranspiration rates for each of the program periods, as outlined in the Irrigation Association's Landscape Irrigation Scheduling and Water Management, March 2005.

## Resources

Landscape Irrigation Scheduling and Water Management  
[http://www.irrigation.org/gov/pdf/IA\\_LISWM\\_MARCH\\_2005.pdf](http://www.irrigation.org/gov/pdf/IA_LISWM_MARCH_2005.pdf) (see [www.irrigation.org](http://www.irrigation.org) under the BMP's for the Irrigation Association <http://www.irrigation.org/> or via <http://www.iwms.org/Links.html>)

Local water utility staff, water efficient landscape consultants, Certified Irrigation Designers (<http://www.irrigation.org/>), and Master Gardeners would also be good resources for helping achieve this credit.

Washington Native Plant Society, <http://www.wnps.org/>

## Indoor Systems

**Purpose:** Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

### W2.1: Water Use Reduction for Sewage Conveyance

1 point	Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 45% beyond the baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992's fixture performance requirements.
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Well-designed, water efficient systems can earn one point by reducing the amount of potable water used for sewage conveyance.

Use water-efficient fixtures and/or municipally supplied reclaimed water to reduce the amount of potable water used for sewage conveyance. Only those fixtures that convey sewage, such as toilets and urinals, are included in this credit. The use of reclaimed water for flushing toilets and urinals automatically qualifies the project for this point because it results in a 100% reduction in the use of municipally provided potable water for this purpose.

Calculate and compare the baseline and design water uses as described below. To qualify for the credit, the calculated design water use must be at least 45% less than the baseline.

**EXAMPLE:** A water-efficient design for a 1,000-student school.

**Baseline Water Use.** For baseline calculations, assume flow rates outlined by the Energy Policy Act of 1992's fixture performance requirements:

Fixture	EPA Requirements
Toilets	1.6 gal/flush
Urinals	1.0 gal/flush
Showerheads	2.5 gal/min
Faucets	2.5 gal/min
Replacement Aerators	2.5 gal/min
Metering Faucets	0.25 gal/cy

To calculate the baseline water use:

1. Calculate Daily Water Use per fixture based on occupancy and estimated frequency of use:
 

$$\text{Daily Water Use} = (\text{Flow-rate}) (\text{Duration})(\text{Occupants})(\text{Daily Uses})$$
2. Sum Daily Water Volumes for each fixture to find Total Daily Volume.
3. Multiply the Total Daily Volume by the number of school days for Total Annual Volume.

In this example:

Fixture Type	Flow-rate	Occupants	Daily uses	Water use (gal)
Conventional Toilet (male)	1.6 gal/flush	500	1	800
Conventional Urinal (male)	1.0 gal/flush	500	2	1000
Conventional Toilet (female)	1.6 gal/flush	500	3	2400
Total Daily Volume				4200
Number of School Days				180
Baseline Total Annual Volume				756,000

**Design Water Use (Efficient Fixtures).** Now assume the design case is based on the use of extra-efficient fixtures. In this case:

Fixture Type	Flow-rate	Occupants	Daily Uses	Water Use (gal)
Low Flow Toilet (male)	1.1 gal/flush	500	1	550
Waterless Urinal (male)	0.0 gal/flush	500	2	0
Low Flow Toilet (female)	1.1 gal/flush	500	3	1650
Total Daily Volume				2200
Number of School Days				180
Design Total Annual Volume				396,000

Comparing the two calculations, the water-efficient fixtures reduced potable water use for sewage conveyance by:

$$\begin{aligned} \% \text{ Savings} &= 1 - (\text{Design Total Annual Volume} / \text{Baseline Total Annual Volume}) \\ &= 1 - (396,000/756,000) = 0.476 = 48\% \end{aligned}$$

Therefore, this design would earn one point because potable water used for sewage conveyance has been reduced by more than 45% through the use of extra-efficient toilets and urinals.

**Design Water Use (Waterless Urinals & Reclaimed or Rainwater Supplementation).** Now assume the design case is based on the use of waterless urinals and the use of 166,000 gallons per year of reclaimed water or captured rain water. In this case:

Fixture Type	Flow-rate	Occupants	Daily Uses	Water Use (gal)
Conventional Toilet (male)	1.6 gal/flush	500	1	800
Waterless Urinal (male)	0.0 gal/flush	500	2	0
Conventional Toilet (female)	1.6 gal/flush	500	3	2400
Total Daily Volume				3200
Number of School Days				180
Design Total Annual Volume				576,000
Supplemental Non-Potable Water Use				166,000
				410,000

Comparing the two calculations, the water-efficient fixtures reduced potable water use for sewage conveyance by:

$$\begin{aligned} \% \text{ Savings} &= 1 - (\text{Design Total Annual Volume} / \text{Baseline Total Annual Volume}) \\ &= 1 - (410,000/756,000) = 0.457 = 46\% \end{aligned}$$

Therefore, this design would earn one point because potable water used for sewage conveyance has been reduced by more than 45% through the use of waterless urinals and supplemental non-potable water for toilet flushing.

## W2.2: Water Use Reduction

20% = 1 point	Employ strategies that, in aggregate, reduce potable water use by at least 20% (or 30%) beyond the baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992's fixture performance requirements.
30% = 2 points	

Develop a water-use baseline including all water consuming fixtures, equipment, and seasonal conditions according to methodology outlined below. Specify water conserving plumbing fixtures that exceed the Energy Policy Act of 1992's fixture requirements in combination with ultra high efficiency or dry fixture and control technologies. Specify high water-efficiency equipment and appliances (dishwashers, laundry, cooling towers).

Because water-efficient devices can vary in quality and performance, specify only durable, high performance fixtures. Design and maintenance issues will be different with low flow toilets compared to toilets with higher flow.

These credits award reductions in total water use, therefore all water-consuming fixtures uses are included in the calculations. To quantify water use reductions, calculate and compare baseline and design water uses. List each water-using appliance or fixture, the amount of daily uses, number of occupants, and calculate the total water use. Any reclaimed water used for sewage conveyance is subtracted from the total amount of water used as shown above. A water-efficient design for the school shown in the previous example is shown below.

Fixture Type	Flow-rate	Duration	Automatic Controls	Occupants	Daily uses	Water use
Low Flow Toilet (male)	1.1 gal/flush	1 flush	-	500	1	550
Waterless Urinal (male)	0.0 gal/flush	1 flush	-	500	2	0
Low Flow Toilet (female)	1.1 gal/flush	1 flush	-	500	3	1650
Bathroom Sink	2.5 gal/min	0.25 min	20% saved	1000	3	1500
Low Flow Shower	1.8 gal/min	5 min	-	100	1	900
Low Flow Kitchen Sink	1.8 gal/min	45 min	-	2	2	324
Efficient Washing Machine	20 gal/load	1 load	-	-	10	200
Total Daily Volume						5124
Number of School Days						180
Subtotal						922,320

For the baseline calculation, create a similar spreadsheet but change only the type of fixture and its associated design details. The baseline calculation for this example would therefore be:

Fixture Type	Flow-rate	Duration	Automatic Controls	Occupants	Daily uses	Water use
Conventional Toilet (male)	1.6 gal/flush	1 flush	-	500	1	800
Conventional Urinal (male)	1.0 gal/flush	1 flush	-	500	2	1000
Conventional Toilet (female)	1.6 gal/flush	1 flush	-	500	3	2400
Bathroom Sink	2.5 gal/min	0.25 min	-	1000	3	1875
Conventional Shower	2.5 gal/min	5 min	-	100	1	1250
Kitchen Sink	2.5 gal/min	45 min	-	2	2	450
Clothes Washer	40 gal/load	1 load	-	-	10	400
Total Daily Volume						8175
Number of School Days						180
Baseline Total Annual Volume						1,471,500

Comparing the two spreadsheets, the water-efficient fixtures reduced potable water use by:

$$\begin{aligned} \% \text{ Savings} &= 1 - (\text{Design Total Annual Volume} / \text{Baseline Total Annual Volume}) \\ &= 1 - (922,320/1,471,500) = 0.37 = 37\% \end{aligned}$$

Therefore, this design would earn a total of two points because total potable water use has been reduced by over 30%.

Additional potable water-saving measures may also be included in a similar manner; for example, geo-exchange water source heat pumps. A common HVAC system for schools is a water source heat pump. The system consists of compressorized heat pumps, boilers, and cooling towers. The cooling towers traditionally use large amounts of potable water as make-up water for the evaporation process. Using a subset of this technology (such as earth-coupled, lake-coupled, or aquifer coupled) replaces the cooling tower with a geo-heat exchanger. If this alternate technology is employed, the traditional water use of a cooling tower would be modeled and included as part of the baseline. This kind of closed loop system has other benefits such as lower maintenance and reduced chemical use (and discharge into the sanitary sewer system).

Rainwater harvesting presents some challenges on large scale systems. The use of water, even before it enters a stream system, is governed under Water Rights law. Check with your local jurisdiction and Department of Ecology to ascertain any legal issues associated with rainwater harvest at your site.

## Resources

WSSP Workbook has a sheet for calculating your water use budget and evaluating if you reach the thresholds for Water Use Reduction.

American Rainwater Catchment System Association (ARCSA) <http://www.arcsa-usa.org/default.aspx>  
See publication page.

# MATERIALS

## Waste Reduction and Efficient Material Use

**Purpose:** Reduce the amount of construction and occupant waste entering the landfill and promote the efficient reuse of materials and buildings.

### M1.0: Minimum Recycling

Required	<p>The building/school shall meet local ordinance requirements for recycling space;</p> <p>AND provide an easily accessible area serving the entire school that is dedicated to the separation, collection, and storage of materials for recycling including—at a minimum—paper (white ledger, mixed, and cardboard), glass, plastics, and metals.</p> <p>AND</p> <p>Meet local ordinance requirements for managing construction and demolition materials at construction sites, if applicable.</p>
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In Washington, some local municipalities have ordinances requiring areas for collection and loading of recyclable materials in development projects. Areas without local ordinances should refer to the Resource Venture’s Occupant Recycling Guide, <http://www.resourceventure.org/rv/publications/building/Occupant-Recycling.pdf>, which is based on the City of Seattle’s ordinance.

Reserve space for recycling functions early in the building occupancy programming process and show areas dedicated to the collection of recycled materials on space utilization plans. Collection bins should accommodate a 75% diversion rate and be easily accessible to custodial staff and recycling collection workers. Consider bin designs that allow for easy cleaning to avoid health concerns. Ensure that the spaces are compatible with the policies of local waste handling companies. Control odors by separately venting these areas.

Schools are encouraged to go beyond the minimum and design for collection and storage of newspaper, organic waste (food and soiled paper), and dry waste. An innovation credit can be earned for designing a food waste minimization and diversion space program.

### Resources

Resource Venture’s Occupant Recycling Guide:  
<http://www.resourceventure.org/rv/publications/building/Occupant-Recycling.pdf>

### M1.1: Site Waste Management

50% - 1 point	Develop and implement a waste management plan, quantifying material diversion by weight to: recycle, compost, and/or salvage at least 50% (or 75%) by weight of construction, demolition, and land clearing waste.
75% - 2 points	

Develop and specify a waste management plan that identifies licensed haulers and processors of recyclables; identifies markets for salvaged materials; employs deconstruction, salvage, and recycling strategies and processes; includes waste auditing; and documents the cost for recycling, salvaging, and reusing materials. Source reduction on the job site should be an integral part of the plan.

The plan should address recycling of corrugated cardboard, metals, concrete, brick, asphalt, land clearing debris (if applicable), beverage containers, clean dimensional wood, plastic, glass, gypsum board, and carpet. It must also evaluate the cost-effectiveness of recycling rigid insulation, engineered wood products, and other materials.

Compliance calculations for this credit must be based on weight. Many recycling and landfill facilities weigh incoming materials. Shipments that cannot be weighed can be estimated based on their volume and density. Land-clearing debris that is composted or recycled as mulch on-site may be counted, using volume and density estimates as well. Burning is not allowed.

$$\text{Recycle Rate (\%)} = \frac{\text{Recycled Waste [Tons]}}{\text{Recycled Waste [Tons] + Garbage [Tons]}} \times 100$$

## Resources

WSSP Workbook has a sheet for calculating your construction waste recycling.

Construction Recycling, a web page of the Business and Industry Resource Venture.  
<http://www.resourceventure.org/>

## M1.2: Building Reuse

50% -1 point 75% – 2 points	Maintain a minimum of 50%, (or 75%) of existing building structure and shell (exterior skin and framing, excluding window assemblies).
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Reusing parts of the building can save significant money and resources, while greatly reducing the amount of construction waste. When materials are reused, the environmental benefits start with resource savings and extend down through the entire lifecycle of the material: less energy is spent extracting, processing, and shipping the materials to the site. Depending on the amount of building reused, school districts can significantly reduce their construction and material costs. However, the building envelope will significantly affect many important high performance areas, such as space programming, energy performance, opportunities for daylighting, and indoor air quality. In addition, care must be taken to ensure that any environmental hazards such as toxins, lead, and asbestos have been identified and addressed. Develop a list of benefits and tradeoffs, and make the decision based upon the overall, integrated design tradeoffs.

Calculating the percent of building reused is a three-step process.

Step 1. Approximate total structural materials and reused structural materials (foundation, slab on grade, beams, floor and roof decks, etc) in terms of cubic feet. Divide the reused structural materials (cf), by the total structural materials (cf), to get the percent of structural materials that are reused.

Step 2. Approximate total shell materials and reused shell materials (roof and exterior walls) in terms of square feet. Divide the reused shell materials (ft<sup>2</sup>), by the total shell materials (ft<sup>2</sup>), to get the percent of shell materials that are reused.

Step 3. Calculate the approximate building reuse percentage, by adding together the structural and shell reuse percentages from Step 1 and Step 2, and dividing the sum by two.

$$\text{Building Reuse (\%)} = \frac{\text{Structural Materials Reused [\%] from Step 1} + \text{Shell Materials Reused [\%] from Step 2}}{2}$$

Here is a look at the whole calculation.

$$\text{Building Reuse (\%)} = \frac{\frac{\text{Reused Structural Materials [cf]}}{\text{Total Structural Materials[cf]} + \frac{\text{Reused Shell Materials[ft}^2\text{]}}{\text{Total Shell Materials[ft}^2\text{]}}}{2}}$$

## Resources

WSSP Workbook has a sheet for calculating your building reuse.

### M1.3: Building Reuse, Non-shell

1 point

Reuse at least 50% of non-shell (walls, floor coverings, and ceiling systems).

Percentage of reused, non-shell building portions will be calculated as the total area (ft<sup>2</sup>) of reused walls, floor covering, and ceiling systems, divided by the existing total area (ft<sup>2</sup>) of walls, floor covering, and ceiling systems.

## Resources

WSSP Workbook has a sheet for calculating your non-shell reuse.

### M1.4: Resource Reuse - Materials

5% = 1 point

Install salvaged or refurbished materials for 5% (or 10%) of building materials.

10% = 2 points

Calculate percentages for these credits using total and salvaged materials costs. Exclude all labor costs, all mechanical and electrical material costs, and project overhead and fees. If the cost of the salvaged or refurbished material is below market value, use replacement cost to estimate the material value; otherwise use actual cost to the project.

Re-used materials or products are salvaged from a previous use or application and then used in a new use or application with only minor modification, finishing, or repair. Commonly salvaged building materials include wood flooring/paneling/cabinets, doors and frames, mantels, ironwork and decorative lighting fixtures, brick, masonry, heavy timbers, and on-site concrete used as aggregate. Ensure the salvaged materials, especially structural elements, comply with all applicable codes.

Calculate percentages using materials costs, as illustrated below:

$$\text{Salvage Rate [\%]} = \frac{\text{Salvaged Material Cost[\$]}}{\text{Total Material Cost[\$]}} \times 100$$

## Resources

WSSP Workbook has a sheet for calculating your salvaged materials use.

**M1.5: Resource Reuse - Furniture**

1 point

Install salvaged, refurbished, or used furniture and equipment for at least 30% of total furniture and equipment budget.

In order to reduce the demand for virgin materials and reduce waste, and the associated impacts of harvesting, processing and manufacturing new materials, purchase used and refurbished furniture and equipment. Furniture and equipment would include items like case pieces, desks and chairs, tables, filing systems, decorative lighting and accessories, as well as computers, printers, copiers, fax machines, and other electrical equipment common in schools.

As above, calculate percentages using materials costs:

$$\text{Salvaged F\&E Rate [\%]} = \frac{\text{Salvaged Furniture and Equipment Cost[\$]}}{\text{Total Furniture and Equipment Cost[\$]}} \times 100$$

**Resources**

WSSP Workbook has a sheet for calculating your salvaged furniture use.

## Environmental Procurement

**Purpose:** Increase demand for building products that have incorporated recycled content material, reducing the impacts resulting from extraction of new material; reduce the use and depletion of finite raw and long-cycle renewable materials by replacing them with rapidly renewable materials; encourage environmentally-responsible forest management; and avoid materials that accumulate in the atmosphere.

### M2.1: Recycled Content

<p>5% = 1 point</p> <p>10% = 2 points</p> <p>OR</p> <p>4 materials = 1 point</p> <p>8 materials = 2 points</p>	<p>Performance Approach: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 5% (or 10%) of the total value of the materials in the project.</p> <p>Recycled content materials shall be defined in accordance with the Federal Trade Commission document, Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e)</p> <p>OR Prescriptive Approach: Install at least four (or 8) major materials from the Construction Products category of the EPA Comprehensive Procurement Guidelines 2000 Buy-Recycled Series. For the higher threshold, at least six of the 8 building materials must be from the Construction Products Category.</p>
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The number and variety of products using recycled content materials expands every year. Using these materials closes the recycling loop by creating markets for materials collected through recycling programs across the country. It also reduces the use of virgin materials and landfill waste. Recycled-content alternatives exist for all major building materials and surfaces.

Recycled content is classified as either post-consumer (collected from end users) or post-industrial. Post-industrial (also known as secondary material or pre-consumer) is collected from manufacturers and industry. The objective is to maximize post consumer recycled content.

The US EPA's Comprehensive Procurement Guideline program provides fact sheets for various product categories as well as a list of materials with recommended recycled content levels.

#### Performance Approach.

The total recycled content value is calculated in five steps. Mechanical and electrical components shall not be included in these calculations. These calculations are consistent with methodology discussed in LEED NC Version 2.1 Reference Guide, pp 217-219.

Step 1. For each material, identify the percentage of post-consumer recycled content (by weight), the percentage of post-industrial recycled content (by weight), and the material cost.

Step 2. For each material, use info from Step 1 to calculate the Post Consumer Recycled Content Value, as shown below

$$\text{Post Consumer Recycled Content Value } [\$] = \text{Material Cost } [\$] \times \text{Post Consumer Recycled Content } [\%]$$

Step 3. For each material, use info from Step 1 to calculate the Post Industrial Recycled Content Value, as shown below

$$\text{Post Industrial Recycled Content Value } [\$] = \text{Material Cost } [\$] \times \text{Post Industrial Recycled Content } [\%]$$

Step 4. Sum the total value of all materials.

Step 5. Calculate Recycled Content Percentage for this Credit, which equals the combined value of post consumer recycled content (from Step 2) plus one-half of post industrial recycled content (from Step 3) as a percentage of total value of all materials, as shown below.

$$\text{Recycled Content Percentage for this Credit \%} = \frac{\text{Total Post Consumer Recycled Content Value [\$]} + (1/2) \text{ Post Industrial Recycled Content Value [\$]}}{\text{Total Project Material Cost [\$]}} \times 100$$

Earn 1 point if: Recycled Content Percentage for this Credit (%) = 5% or more

Earn an additional 1 point if: Recycled Content Percentage for this Credit (%) = 10% or more.

**Prescriptive Approach.**

Install at least four major materials from the Construction Products category of the EPA Comprehensive Procurement Guidelines 2000 Buy-Recycled Series. A “major” material is defined as those materials covering more than 50% of a major building surface (such as parking areas, floor, roof, partitions, walls), or serving a structural function throughout the majority of the building. EPA’s Comprehensive Procurement Guidelines are available at: <http://www.epa.gov/cpg>.

For the purposes of these prescriptive points, nylon carpeting with at least 50% recycled-content materials can be used in addition to the carpet with recycled polyester (PET resin) materials listed on the EPA’s site. (Some PET carpets are not sufficiently durable for school applications.)

For the additional point, eight major materials must be installed from the EPA’s Comprehensive Procurement Guidelines, and at least six must be from the construction products category.

**Resources**

WSSP Workbook has a sheet for calculating your recycled content materials use.

EPA’s Comprehensive Procurement Guideline Program: [http://www.epa.gov/cpg/products.htm - construct](http://www.epa.gov/cpg/products.htm-construct)

Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e), Federal Trade Commission document, available at [www.ftc.gov/bcp/grnrule/guides980427.htm](http://www.ftc.gov/bcp/grnrule/guides980427.htm)

King County Guide to Recycled Building Materials: <http://www.metrokc.gov/procure/green/bul33.htm>

Resource Venture’s “Buy Recycled” resource page:  
<http://www.resourceventure.org/rv/publications/waste/BuyingRecycled.pdf>

Greenspec Directory of Green Building Materials, <http://www.buildinggreen.com>

**M2.2: Rapidly Renewable Materials**

1 point	Install rapidly renewable building materials for 5% of total building materials.
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Rapidly renewable resources are those materials that substantially replenish themselves faster than traditional demand (planted and harvested in less than a 10-year cycle). Products in this category include, but are not limited to, bamboo products, wheat grass cabinetry, and other wood products made from fast-growing poplar and Monterey pine trees, and linoleum. Ensure that the products are low emitting and are durable.

To earn this credit, determine the percentage of total building materials from rapidly renewable sources. Exclude all labor costs, all mechanical and electrical material costs, and project overhead and fees.

$$\text{Rapidly Renewable Material Portion [\%]} = \frac{\text{Rapidly Renewable material cost[\$]}}{\text{Total material cost[\$]}} \times 100$$

## Resources

WSSP Workbook has a sheet for calculating your rapidly renewable materials use.

### M2.3: Certified Wood

20% = 1 point 50% = 2 points Chain of Custody Verification = 1 point	At least 20% (or 50%) of the cost of wood-based materials and products are from a sustainable forest certified by a third party.  Add an additional point to either threshold if the third-party certification offers chain of custody verification for the project.
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In the recent past, certified wood has frequently been difficult to procure in large quantities. However, certified wood mills, distributors and vendors have responded to the increased market demand and the products are becoming more available. It is still important to order certified wood as early as possible to ensure the product is available when needed.

Certified wood is available for a variety of applications including framing and interior finishes (wood ceilings, casework, millwork, and flooring).

Compliance for this credit is based on cost of the certified wood as a percentage of total wood-based products. The following equation can be used to determine point level.

$$\text{Certified Wood Portion [\%]} = \frac{\text{Certified wood cost[\$]}}{\text{Total wood based cost[\$]}} \times 100$$

Wood-based products includes all wood consumed by the overall project including, but not limited to: casework, formwork, shoring, structural framing and general dimensional framing, flooring, finishes, furnishings, and non-rented temporary pedestrian barriers used in construction.

The Forest Stewardship Council (FSC) system provides standards for the sustainable growth and harvest, and provides a chain-of-custody process for certified wood products that tracks the wood from harvesting, through milling, distribution, and retail. The sustainable forests in the FSC system are certified by a third party. As of August 2003, the FSC is the only sustainable forestry management system with a complete chain of custody verification in the United States.

In August 2003, there were four FSC certified forests (four companies) in Washington State covering 88,819 acres, with wood species including Western Red Cedar, Douglas Fir, Alder, Hemlock and Maple. There are mills, distributors and retailers of certified wood in both Eastern and Western Washington.

There are three other sustainable forestry management systems in North America. While currently none of these systems have a complete chain of custody verification process, the market for certified wood products is quickly changing, and these sustainable forestry systems may add a chain of custody verification process. The other certification systems include:

Sustainable Forestry Initiative (SFI). SFI is required for all American Forest & Paper Association (AF&PA) members. Third-party certification is optional. Chain of custody is not available.

CSA International. CSA is an independent non-profit organization accredited by the Standards Council of Canada. CSA is primarily focused on Canadian forests. Third-party certification is required. Chain of custody is available on a limited scale.

American Tree Farm System is a program of the American Forest Foundation, and is primarily focused on non-industrial forests in the US. Third-party certification is required. Chain of custody is not available.

Forests regulated under chapter 76.09 RCW, the Washington forest practices act will also be recognized as complying.

## Resources

Forest Certification Resource Center. Online database for search for certified wood products, <http://www.certifiedwood.org/search-mo56+dules/SearchProducts.aspx>

WSSP Workbook has a sheet for calculating your certified wood use.

## M2.4: Eliminate Ozone-Depleting Materials

1 point

All new base building equipment must be free of HCFCs and halons.

When released to the atmosphere, refrigerant compounds such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and halon photochemically react and cause depletion of ozone in the stratospheric ozone layer. CFCs and HCFCs are commonly used as refrigerants in HVAC equipment. HCFCs are not as reactive as CFCs. They have a lower "ozone depleting potential" (ODP), but they are still detrimental and, as such, are scheduled for eventual phase-out under the provisions of the US-adopted Montreal Protocol. Alternatives include HFC-based cooling equipment, which is increasingly available, cost effective, and energy efficient. However, at present, most existing and many new systems still use R-22, which is an HCFC scheduled for phase-out by 2010.

Halons are used in fire suppression systems and fire extinguishers. These compounds have three to 10 times the ODP of HCFC compounds.

## Resources

EPA Lists of Substitutes for Ozone-Depleting Substances, <http://www.epa.gov/ozone/snap/lists/index.html#refac>

## M2.5: Regional/Local Materials

Manufacture =  
1 point

Also extracted,  
etc. = 2 points

Install materials that are manufactured within a 500-mile radius for 20% of building materials. Add a point if the materials are also extracted, harvested or recovered from within a 500-mile radius.

Manufacturing, using the LEED Reference Manual definition, refers to "the final assembly of components into the building product that is furnished and installed by the tradesmen. For example, if the hardware comes from Seoul, South Korea, the lumber from Vancouver, British Columbia and the joist is assembled in Kent, Washington; then the location of the final assembly is Kent, Washington."

Regional and locally produced materials support the local economy while helping to reduce resource and energy consumption by minimizing transportation distances.

Buying regional/local materials is only one aspect of sustainable purchasing. Some materials may be local, but are not chosen because more distant products have higher recycled content, longer lifespan, or lower costs. It will be up to the team to determine the project's priorities.

Base percentage calculations in terms of dollar value:

$$\text{Regional Material Portion [\%]} = \frac{\text{Regional material cost[\$]}}{\text{Total material cost[\$]}} \times 100$$

## Resources

Northwest Builders Network Directory of NW Building Supply Manufacturers.

<http://www.nwbuildnet.com/stores/>

WSSP Workbook has a sheet for calculating your regional materials use.

# ENERGY

## Efficiency

**Purpose:** To reduce the amount of energy used to operate the building through better building design and more efficient equipment. Reducing the building load both reduces the associated costs and environmental impacts of using non-renewable energy sources.

### E1.0: Minimum Energy Performance

Required	The school design must meet the Washington State's Non-Residential Energy Code 2004 Edition (NREC) efficiency standards.
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Energy-efficient schools save money while conserving non-renewable energy resources and reducing atmospheric emissions of pollutants and greenhouse gases. The 2004 NREC has been a major factor in advancing energy efficiency in schools. Support for the NREC is provided by the Northwest Energy Efficiency Council (NEEC).

While the NREC is considered an aggressive baseline for energy efficient construction practices, there are numerous cost-effective, practical, and straightforward measures that can reduce energy use by 10-20% from the 2004 NREC. Please refer to E1.1 for some strategies to achieve this.

Regardless of whether you are meeting the code or going beyond the code, it will be important to ensure that the energy efficiency you design in is actually achieved in practice. Commissioning, maintenance and training are vitally important to the performance of the school and its systems. Commissioning ensures that operability and maintenance are considered in the design of the building, and after construction, systems operate to their design intent. Once built, no building can perform optimally without maintenance. In addition, training is critically important to ensure that teachers and facilities staff understand how to operate and maintain building systems. When turnover occurs, appropriate documentation must be on hand to ensure that new staff is properly trained.

## Resources

Advanced Building Guidelines E-Benchmark: 2003 Edition, <http://www.newbuildings.org/>

Advanced Lighting Guidelines: 2003 Edition, New Buildings Institute. <http://www.newbuildings.org/>

BetterBricks. <http://www.betterbricks.com/>

Energy Design Resources, <http://www.energydesignresources.com/>

The Northwest Energy Efficiency Council (NEEC) provides support for Washington's Non-Residential Energy Code and offers compliance forms (Excel and pdf) and information on obtaining a comprehensive Technical Reference Manual, <http://www.neec.net/resources/resources.html>

Public Interest Energy Research Project, California Energy Commission, <http://www.newbuildings.org/pier/index.html>

## E1.1: Superior Energy Performance

10% = 4 points 15% = 5 points 20% = 6 points 25% = 7 points 30% = 8 points 35% = 9 points 40% = 10 points 45% = 11 points 50% = 12 points	Reduce the source energy of the proposed design to be below what is required by Non-Residential Energy Code (NREC) by increasing energy efficiency through the integrated design of system components. 10%-50% reduction in total net energy use compared to NREC baseline.
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Investments in energy efficiency measures provide good long term value, and net reductions of 10% to 20% are feasible. When energy efficiency goals are established (and followed) in the design process, a wide array of measures can reduce energy use. The amount of energy saved depends on local climate, the quality of the design, whether the interactions between the building systems have been optimized, the extent of commissioning, and the amount of training given to teachers and facilities staff. Consider opportunities throughout the school in the following areas:

**Daylighting:** Optimize daylighting to reduce reliance on electric lighting during daylight hours. Use daylighting controls designed to dim or turn off electric lights when sufficient daylight is available. Remember to minimize glare and eliminate direct beam light in the classroom.

**HVAC systems:** Use high efficiency equipment, correctly sized for the estimated demands of the facility; use economizers and other controls that optimize system performance.

**Electric lighting:** Use high efficiency products, optimize the number of light fixtures in each room, use occupant sensors and other control devices that ensure peak system performance, successfully integrate electric lighting and daylighting strategies.

**Enclosure:** Ensure that walls, floors, roofs, and windows of the school are as energy efficient as cost-effectively possible.

**Commissioning.** Commissioning is increasingly important as more savings are expected through energy conservation measures. Commissioning ensures that operability and maintenance are considered in the design of the building, and after construction, systems operate to their design intent. See Energy Credit 4: Commissioning for more information.

Include additional integrated design measures to increase the energy efficiency of the school. Perform an annual energy analysis comparing a standard design to the proposed design using design criteria and assumptions contained in RS-29 of the Washington State Energy Code. The unit of measure for performance is source energy. The design earns from four to 12 points, based on the level of savings achieved. It is permissible to round up to the whole interval. For example, 22.5% savings would earn 7 points in the Protocol (interpreting it as if it was 25% savings).

### Resources

Advanced Buildings, [http://advancedbuildings.org/frames/fr\\_links.htm](http://advancedbuildings.org/frames/fr_links.htm)

Advanced Building Guidelines E-Benchmark: 2003 Edition, <http://www.newbuildings.org/>

Advanced Lighting Guidelines: 2003 Edition, <http://www.newbuildings.org/>

Building Operator Certification, formally recognized by WAMOA, includes facilities' operator training that has been proven to result in energy savings for school districts in the state. More information at [www.TheBOC.info](http://www.TheBOC.info)

Portland, Oregon Office of Sustainable Development, <http://www.sustainableportland.org/>

## ENERGY>EFFICIENCY

Energy Scheming Software, developed to assist in building design for energy efficiency. Article at Better Bricks

<http://www.betterbricks.com/default.aspx?pid=article&articleid=586&typeid=8&topicname=integrateddesign&indextype>

Another overview and ordering info at Oikos - <http://oikos.com/esb/37/scheming.html>

## Controls

**Purpose:** To reduce the amount of energy used to operate the building through the use of user-friendly or automatic controls of energy using fixtures and equipment. Reducing the building load both reduces the associated costs and environmental impacts of using non-renewable energy sources. It often also serves an educational function, in that it makes obvious the District's value of energy conservation.

### E2.1: HVAC and Operable Windows

1 point

Install controls/devices on HVAC systems that are responsive to operable windows or doors when opened.

The Protocol recognizes the benefit of providing natural ventilation (IEQ3.7) and user control (IEQ6.1) by providing each classroom with an operable window. However, care must be taken to avoid energy penalties due to exterior windows or doors being opened while HVAC systems are operating. Controls or devices on HVAC systems that respond when operable windows or doors are opened can prevent energy penalties and actually support the energy savings that can occur with a naturally ventilated space.

Controls should be installed to set back HVAC systems to unoccupied settings when windows and doors are opened for extended periods. The controls should be set so that normal use of doors does not cause HVAC systems to cycle on and off unnecessarily. The controls should not turn off ventilation fans, but adjust the thermostat settings to unoccupied levels or what is commonly called the "night set-back" when windows and doors are opened. Adequate amounts of ventilation must be supplied to the classroom at all times. Insufficient ventilation can have serious health effects on students, teachers, and other staff members.

Also, see Credit IEQ6.2 (user control of temperature and lighting). Overall system as detailed in this credit may not account for CO<sub>2</sub> sensors that may provide additional energy savings. Design (and energy use calculations) should consider the impact of multiple strategies when proposed.

## Resources

WAC 51-13, Fresh air replacement

WAC 246-366, Relevant specifications for schools

## E2.2: Daylight-Responsive Controls

1 point

In daylit areas, automatic daylight responsive lighting controls shall be installed that automatically reduce electrical lighting power in response to available daylight in a daylit area by either:

- A combination of dimming ballasts and daylight-sensing automatic controls that are capable of automatically reducing the power of general lighting in the daylit zone continuously to less than 35% of rated power at maximum light output. OR
- A combination of multi-level switching and daylight-sensing controls that are capable of reducing the lighting power automatically. If the control is a switching control, it shall provide at least two control channels per zone and be installed in a manner such that at least one control step shall reduce power of general lighting in the daylit zone by 30% to 50% of rated power and another control step shall reduce lighting power by 65% to 100%. This control shall be capable of automatically reducing the general lighting in the daylit area in multiple steps in response to available daylight while maintaining a reasonably uniform and appropriate level of illumination.

The light sensor shall be separate from the location where set-point adjustments are made, and the controls for calibration adjustments to the lighting control device shall be readily accessible to authorized personnel.

Exceptions:

Daylight spaces enclosed by floor to ceiling partitions containing only one luminaire.

Lighting required by a health or life safety statute, ordinance or regulation, including but not limited to emergency lighting.

Lighting for steps or stairs that require illumination during daylight hours.

Lighting for theatrical purposes, including performances, stage, film production and video.

In addition to providing natural illumination, an important aspect of indoor environmental quality daylighting can be a source of energy savings, potentially reducing the annual lighting budget from 10% to 50%. However, this only occurs when electric lighting is adjusted to account for the illumination daylighting is providing.

This can be done manually. However, more institutions are finding it more reliable to use automatic daylighting controls. These regulate the level of illumination provided by electric lights in response to the presence of daylight. They usually consist of a sensing device that monitors either the total light level in the space or the available daylight level at the daylight opening, and a control module that than switches or dims the electric lighting to maintain the required illumination.

### Resources

Advanced Lighting Guidelines: 2003 Edition, New Buildings Institute. <http://www.newbuildings.org/>

BetterBricks. <http://www.betterbricks.com/>

CHPS Best Practices Manual, Volume II. Electric Lighting Controls.

## On-Site Alternative Sources

**Purpose:** To increase the amount of renewable energy used in place of finite and polluting non-renewable energy sources. On-site sources of energy reduce transmission losses, and also serve an educational function.

### E3.1: Renewable Energy

5% = 2 points

7.5% = 3 points

10% = 4 points

Use on-site renewable energy for a portion of a school's energy use; point levels correspond to the percentage of net energy use supplied by this method.

Employ on-site renewable energy technologies to supply part of the building energy. Renewable Energy Systems include:

Photovoltaics

Wind

Geothermal (does not include air source heat pumps)

Fuel cells utilizing biogas

On-site renewable energy has many benefits. Renewable sources, such as photovoltaics, wind turbines, and geothermal sources, use the sun, air, and earth instead of non-renewable, polluting sources, such as coal or natural gas. Fuel cells can be powered by (renewable) biogas (as well as non-renewable natural gas, see Credit E3.2).

Sources covered under this credit must be located at the school site, eliminating the environmental impacts and transmission losses associated with remote sources. On-site sources can become effective components of school curriculums, educating students on a wide variety of energy and science issues.

The costs and feasibility of on-site renewables and distributed generation vary significantly with location, technology, site-specific constraints, and maintenance concerns. Typical school installations supply less than 5% of total energy. Renewable systems generally reach a point of diminishing returns before they supply 100% of total energy. Incentive or "buy-down" programs from state or local energy providers can substantially reduce startup costs.

Sources should be installed using net metering. Net metering attaches the on-site system to the electrical power grid. When the school produces more energy than it uses, the excess energy is traded back to the local energy provider. In essence, this "spins the meter backwards" and is vital to the cost-effectiveness of the system. In general, facilities with on-site renewables and net metering can only receive credit up to the amount of energy they use. In other words, buildings can only "zero-out" their utility bill and not make a profit from selling their excess energy. For some utilities (for example Seattle City Light) this credit expires after one year, while others (for example Puget Sound Energy) do not have a deadline for use of the credit. You should check with your utility to determine if they participate in net metering and how they would account for your building's net contribution to the grid.

To earn points with this credit:

Model the school building systems (no plugloads) to estimate the amount of energy used annually (Qschool). Employ figures from E1.0 or E1.1.

Calculate the amount of energy the particular on-site renewable system can supply annually (Qalternative).

Calculate the net amount of energy provided by renewables ( $Q_{\text{alternative}}/Q_{\text{school}}$ ).

## Resources

WSSP Workbook has a sheet for calculating your on-site energy use.

How to Buy an Energy-Efficient Ground Source Heat Pump, U.S. Department of Energy, Energy Efficiency and Renewable Energy, Federal Energy Management Program (FEMP), [www.eere.energy.gov/femp/technologies/eep\\_groundsource\\_heatpumps.cfm](http://www.eere.energy.gov/femp/technologies/eep_groundsource_heatpumps.cfm)

## E3.2: Distributed Generation

5% = 1 point

7.5% = 2 points

10% = 3 points

Use on-site distributed generation for a portion of a school's energy use; point levels correspond to the percentage of net energy use supplied by this method.

### Distributed Generation Systems

Fuels cells utilizing non-renewable fuels and waste heat recovery.

Microturbine utilizing waste heat recovery.

The distributed generation systems listed above use non-renewable fuels. However, their improved efficiencies and technologies produce less air pollutants than traditional, centrally located coal or natural gas plants. Fuel cells can be powered by either renewable (biogas) or non-renewable (natural gas) sources, see Credit E3.1.

Sources covered under this credit must be located at the school site, eliminating the environmental impacts and transmission losses associated with remote sources. On-site sources can become very effective components of school curriculums, educating students on a wide variety of energy and science issues.

The costs and feasibility of distributed generation sources vary significantly with location, technology, site-specific constraints, and maintenance concerns. To earn points with this credit:

Model the school building systems (no plugloads) to estimate the amount of energy used annually ( $Q_{\text{school}}$ ). Employ figures from E1.0 or E1.1.

Calculate the amount of energy the particular on-site distributed generation system can supply annually ( $Q_{\text{alternative}}$ ).

Calculate the net amount of energy provided by distributed generation ( $Q_{\text{alternative}}/Q_{\text{school}}$ ).

## Resources

WSSP Workbook has a sheet for calculating your on-site energy use.

## Commissioning

**Purpose:** To optimize the building's performance by verifying that fundamental building elements and systems are designed, installed, and operate as intended by the construction documents.

### E4.0: Fundamental Commissioning

Required	<p>The design team and the school district shall comply with completion requirements outlined in Section 1416 of Washington's NREC and WAC 180-27-080 regarding:</p> <ul style="list-style-type: none"> <li>Drawings</li> <li>Manuals</li> <li>System balancing</li> <li>Systems commissioning</li> </ul> <p>And in conformance with ESSB 5509, commissioning shall be performed for projects over 5,000 s.f.</p>
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**Drawings:** Construction documents shall require that within 90 days after the date of system acceptance, record drawings of the actual installation be provided to the building owner. Record drawings shall include as a minimum the location and performance data on each piece of equipment, general configuration of duct and pipe distribution system including sizes, and the terminal air and water design flow rates.

**Manuals:** Construction documents shall require that an operating manual and a maintenance manual be provided to the building owner. The manuals shall be in accordance with industry accepted standards and shall include, at a minimum, the following:

Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.

Operation and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.

Names and addresses of at least one service agency.

HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings at control devices, or, for digital control systems, in programming comments.

A complete narrative of how each system is intended to operate including suggested set points.

**System Balancing:** Construction documents shall require that all HVAC systems be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10% of design rates, except that variable flow distribution systems need not be balanced upstream of the controlling device (for example, VAV box or control valve). Construction documents shall require a written balance report be provided to the owner.

**Air System Balancing:** Air systems shall be balanced in a manner to first minimize throttling losses. For fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

**Hydronic System Balancing:** Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or have test ports at each side of each pump.

Exceptions:

Pumps with pump motors of 10 hp or less.

When throttling results in no greater than 5% of the nameplate horsepower draw above that which would be required if the impeller were trimmed.

**Systems Commissioning:** Commissioning shall include documentation, reports, and acceptance as specified by Washington’s NREC and WAC 180-27-080. Per 180-27-080, the commissioning agent (CxA), must be a professional agent or authority not contractually or otherwise associated with the project design team or contractor. In addition, per WAC 180-29-067, the commissioning program shall include the attributes outlined by the Building Commissioning Association. In conformance with ESSB, commissioning is required for projects over 5,000 s.f.

**Resources:**

Commissioning Process, <http://www.peci.org/>

EPA Target Finder, <http://www.energystar.gov/>

Guide to Building Commissioning, Energy Design Resources, <http://www.energydesignresources.com/>.

International Performance Measurement and Verification Protocol, <http://www.ipmvp.org/>

PIER Construction Specifications, see <http://www.archenergy.com/lrp/>

School Facilities Manual, Washington State Office of the Superintendent of Public Instruction, 4th Edition, March 2000, available online at <http://www.k12.wa.us/SchFacilities/pubdocs/SFMANUAL/intro.pdf>

Building Commissioning Association, [www.bcxa.org](http://www.bcxa.org)

**E4.1: Additional Commissioning**

1 point	<p>The Independent Commissioning Agent (CxA) required by E4.0 and State regulations as referenced in E4.0 shall:</p> <p>Conduct a commissioning design review of the Owner’s Project Requirements (OPR), Basis of Design (BOD), and design documents prior to mid-construction documents phase and back-check the review comments in the subsequent design submission.</p> <p>Review contractor submittals applicable to systems being commissioned for compliance with OPR and BOD. This review shall be concurrent with A/E reviews and submitted to the design team and the owner.</p> <p>Prepare a final commissioning report following the WSEC 2004 - Building Commissioning Final Report Guidelines available from NEEC and review with the school district, verifying that systems are operational to the OPR and BOD and work is completed.</p>
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1 point	<p>The CxA shall:</p> <ul style="list-style-type: none"> <li>• Verify functional and maintenance training of O&amp;M Staff, and verify that such training is completed in the Final Commissioning Report.</li> <li>• Verify that training of building occupants regarding optimal operation of commissioned systems they interface with has been completed.</li> <li>• Assure through contractual arrangements involvement by the CxA in reviewing building operation after one academic year of building use with O&amp;M staff and occupants. Include a plan for resolving outstanding commissioning-related issues.</li> </ul>
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Buildings, even simple structures, are complex systems of electrical, mechanical, and structural components. High performance buildings are healthy, efficient, environmentally sensitive structures whose performance can be significantly affected if the building has not been designed following the district's intent or constructed according to the designers' specifications. Commissioning is a rigorous quality assurance program administered by a knowledgeable third party that ensures the building performs as expected.

This credit ensures that the design is developed in a way that meets the objectives of the building program including, in particular, its mechanical systems and energy requirements. However, it is important to coordinate the Cx program with the overall environmental goals of the project. The Protocol highly recommends a facilitated eco-charrette (See Credit EX1.1) BEFORE the schematic design process has concluded. This credit assumes that the CxA either participates in the eco-charrette or is familiar with the results of the eco-charrette.

## Resources

The Northwest Energy Efficiency Council (NEEC) provides support for Washington's Non-Residential Energy Code and has developed a Commissioning Report Template available for free  
<http://www.neec.net/resources/resources.html>

Building Operator Certification, formally recognized by WAMOA, includes facilities' operator training that has been proven to result in energy savings for school districts in the state. More information at  
[www.TheBOC.info](http://www.TheBOC.info)

Building Commissioning Association, [www.bcx.org](http://www.bcx.org)

ENERGY STAR® for Business,  
[http://www.energystar.gov/index.cfm?c=tools\\_resources.bus\\_energy\\_management\\_tools\\_resources](http://www.energystar.gov/index.cfm?c=tools_resources.bus_energy_management_tools_resources)

EPA ENERGY STAR® Target Finder,  
[http://www.energystar.gov/index.cfm?c=target\\_finder.bus\\_target\\_finder](http://www.energystar.gov/index.cfm?c=target_finder.bus_target_finder)

EZ-Sim Billing Simulation Tool, <http://www.ezsim.com/>

Green Building Services, [http://www.greenbuildingservices.com/services/eco\\_charrette.asp](http://www.greenbuildingservices.com/services/eco_charrette.asp)

Guide to Building Commissioning, Energy Design Resources, <http://www.energydesignresources.com/>

International Performance Measurement and Verification Protocol, <http://www.ipmvp.org/>

Portland Energy Conservation, Inc., <http://www.peci.org/>

## Management

**Purpose:** To optimize the building's performance and comfort by monitoring and managing systems delivering heat, cooling, ventilation, lighting, and other services.

### E5.1: Energy Management Systems

1 point	<p>Install an energy management system (EMS) to monitor the energy use of the following systems throughout the school (including all portables).</p> <ul style="list-style-type: none"> <li>Lighting (Internal and external)</li> <li>Equipment (plug loads)</li> <li>HVAC (heating, cooling, fans)</li> <li>Hot water</li> </ul>
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Energy management systems (EMS) are typically installed in new schools. However, care must be taken to specify and install an appropriate system for the district and maintenance staff. An appropriate EMS is the simplest system that adequately addresses the school's needs. Increased complexity does not always mean increased value for the district. EMS systems can potentially save significant energy, but only if the staff understands how to operate it. Proper training of district staff is critical, and high turnover rates continue to challenge school districts.

Control systems design shall include:

1. Sensors should be provided as follows:

- a) Sensors to monitor and trend (create trend logs) at the operator interface controlled variables. Control variables may include air and/or water flow, temperature, pressure, CO<sub>2</sub>, and pump or fan speed.
- b) Sensors to trend outdoor air temperature.
- c) In marine and humid climates, sensors to trend humidity.
- d) Sensors to monitor and trend equipment status for all equipment with motors greater than 1/2 hp.
- e) Indication and trending of damper and valve commanded position.
- f) Sensors to monitor building electrical and natural gas demand and consumption.
- g) Sensors to monitor indoor and outdoor CO<sub>2</sub>.

Relevant multiplexed data from microprocessors located in chillers, boilers, humidifiers, VAV box controllers, variable speed drives, and other HVAC equipment with multiplexing capabilities may be used in lieu of specifying separate sensors.

Wells and other ports shall be specified for the installation of calibration devices to facilitate calibration of sensors.

Exceptions:

Unit heaters, cabinet heaters, radiation and convectors located in vestibules, storage rooms, janitor closets, and other unoccupied areas.

Natural gas demand sensors not required on buildings under 50,000 ft<sup>2</sup>.

2. Points Matrix: A points matrix including all hardwired input and output devices connected to the automation system, all setpoints, upper and lower control limits.

3. Trend Capabilities: Trend requirements including a trend point list and preprogrammed sample of point (performed by controls contractor), sample rate, storage interval, upload interval, custom trend abilities, alarms, and automated trend data review and notification (automated diagnostics).

4. System Architecture: A system architecture capable of allowing sampling of these points to facilitate building commissioning and diagnostics without significantly affecting system performance.

5. Data Storage: A data storage system with adequate capacity to record trend data for use by building operators. Data export requirements must facilitate user-friendly data access and manipulation.

6. Operator Interface: An operator interface designed for remote/web access, monitoring requirements, trend-log reporting and diagnosing building problems through a user-friendly interface. This includes providing a visual (non-text based) operations and reporting interface to facilitate rapid system assessment that utilizes color coding, diagrams of floor plans and graphing capabilities.

Monitoring capabilities should allow for comparison between various types of building loads throughout all spaces of the school (including portables). This information is valuable and can be used to manage and optimize energy use.

Energy savings can result by optimizing a building's ventilation control through effective air quality monitoring. New systems are now available that integrate indoor air quality monitoring with your building management system.

## Resources

School Facilities Manual, Washington State Office of the Superintendent of Public Instruction, 4th Edition, March 2000, available online at <http://www.k12.wa.us/SchFacilities/pubdocs/SFMANUAL/intro.pdf>

# INDOOR ENVIRONMENTAL QUALITY

## Daylighting

**Purpose:** Improve student productivity and building energy efficiency through quality daylighting designs that minimize glare and direct sunlight penetration, and integrate views in daylighted spaces. Provide a connection between indoor spaces and the outdoor environment through the introduction of daylight and views into the occupied areas of the building. Daylighting is fundamentally important to high performance design, from the standpoint of student and teacher preference, and should be the primary source of illumination in classrooms.

### IEQ1.0: Minimum Daylighting

New Construction: 50% - Required	Achieve a 2% minimum daylight factor (DF) of uniformly distributed daylight in 50% of critical visual task spaces with no direct sunlight penetration to surfaces commonly visible from critical task areas. At a minimum, direct sun can be eliminated for daylit spaces with the use of operable shading devices (see IEQ 1.3 for additional shading opportunities). Lighting contrast is not to exceed 10:1.
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### IEQ1.1: Daylighting

New Construction: 75% - 1 point 100% - 2 points  Renovations: 50% -3 points	Achieve a 2% minimum daylight factor (DF) of uniformly distributed daylight in 75%, or 100% (or 50% for renovations) of critical visual task spaces with no direct sunlight penetration to surfaces commonly visible from critical task areas. At a minimum direct sun can be eliminated for daylit spaces with the use of operable shading devices (see IEQ 1.3 for additional shading opportunities). Lighting contrast is not to exceed 10:1.
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For new construction to meet this requirement as a pre-requisite, 50% of the critical visual task spaces must have a minimum daylight factor (DF) of 2%. Critical visual task spaces include classrooms, office spaces, and libraries, and may include gymnasiums and multi-purpose rooms. The DF is the ratio of horizontal exterior illumination under a standard overcast sky for the school's latitude to interior "task" illumination:

$$\text{Daylight Factor [\%]} = \frac{\text{Light at Task Levels in 'critical spaces' [fc or lux]}}{\text{Outdoor Daylight [fc or lux]}} \times 100$$

The percentage of space receiving the required daylight level should be calculated as the square feet of daylit space divided by the total square feet of critical visual task space.

Modeling, either physical modeling or digital (simulation), is required to estimate the daylight factor at task level for eligible spaces.

Additional points are awarded for achieving a 75% and 100% threshold. Renovations are not required to meet the prerequisite and will be awarded 3 points if they do. The building scope must be consistent across credits, so additions can only be calculated separate from the existing structure if the existing structure is excluded from all other credits. Renovations exceeding the 50% threshold can apply for points under "Extra Credit."

Follow the guidelines in the Daylighting Chapter of the CHPS Best Practices Manual to create a suitable daylighting strategy. Orient the school to maximize daylighting options. Do not over-glaze the space. Daylighting in classrooms, gyms or offices must be uniformly distributed, with no direct-beam sunlight penetration and minimal glare. Fixed or operable means of sun-glare control, such as roll down perforated shades for the view windows and horizontal louvered blinds for the upper daylight windows, must be specified for the period mid-September through mid March. The guidelines in the CHPS Daylighting Chapter thoroughly discuss several different approaches to classroom daylighting, including the use of clerestories, light shelves, and toplighting. There are several daylighting labs in the region, including two in Washington (Seattle and Spokane) that provide free daylighting analysis services.

## IEQ1.2: Fixed-position Shading

1 Point

Eliminate direct sun from daylit spaces from March 21<sup>st</sup> through the summer until September 21<sup>st</sup> through the use of fixed position shading devices.

Install fixed position shading devices such as various louvers, fins, lightshelves, etc. to eliminate direct sun for daylit spaces. The period for complete shading of direct sun is from March 21<sup>st</sup> through the summer until September 21<sup>st</sup> from 9 a.m. to 3 p.m. adjusting for daylight savings time.

## IEQ1.3: Views

New Construction:  
1 point

Provide a direct line of sight to vision glazing of no less than 40% visible from 90% of critical task areas, and office spaces, not including copy rooms, storage areas, mechanical, laundry and other low occupancy support areas. Windows below 2.5 ft or above 7.5 ft do not qualify.

## Resources

CHPS Best Practices Manual: Volume II: Daylighting and Fenestration Design Chapter. Guidelines and Design Patterns DL1 to DL8

Daylighting Lab | Seattle <http://www.daylightinglab.com/>

Daylighting Lab | Spokane, 509.358.7964, [jtheodorson@wsu.edu](mailto:jtheodorson@wsu.edu)

BetterBricks, Energy Efficient Design Links - [www.betterbricks.com](http://www.betterbricks.com)

WAC 246-366

## Electric Lighting Quality

**Purpose:** Promote improved visual performance through a high-efficacy, glare-free ambient lighting strategy.

### IEQ2.1: Electric Lighting Quality

1 point	<p>Install direct-indirect or semi-indirect luminaires mounted parallel to the window wall. Luminaires shall use high-lumen output (“Super”) T8 or T5 fluorescent lamps with a minimum color rendering index of 80.</p> <p>Lighting of task areas (chalkboard/whiteboards) can be supplemented with luminaires with a minimum initial system efficacy of 60 lumens per watt and controlled separately from general luminaires by occupancy sensors with or without dimmers.</p>
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The more that teachers teach and students learn by the glow of computers and video screens, the more critical the need for high-quality, adjustable-level lighting. The quality and quantity of light directly affect learning performance and the visual comfort of both student and instructor.

Glare-free ambient lighting provides an excellent visual environment for students and teachers to read, write, and interact with their peers. Direct-indirect and semi-indirect luminaires offer low-brightness while providing good definition of objects in the space.

This design approach is very energy efficient using high-lumen output “Super” T8 fluorescent lamps and program start electronic ballasts. This type of T8 lamp is readily available through all of the major lamp manufacturers, and offers higher light output per watt than standard T8 lamps. They also have better lumen maintenance over the life of the lamp.

T5 fluorescent lamps and electronic ballasts, which are also a good option, have an even higher lumen output than the “Super” T8’s with a smaller envelope, allowing for a better performing optic system in the luminaires. Both provide good color quality so that all of the brightly colored projects on the walls show their best.

In many cases, chalkboard/whiteboard lighting is not needed. When it is used, a high-efficacy fluorescent wall-wash luminaire provides efficient illumination and enhances the visual quality of the space.

Energy efficient, direct-indirect lighting reduces the lighting power density (LPD) directly by using less energy to deliver a better quality of light to the space. The recommended approach is to install three rows of “Super” T8 two-lamp suspended direct/indirect luminaires in a typical classroom. This will provide the recommended light levels needed. In the case of T5 systems, the recommended approach is to install three rows of T5 single-lamp suspended direct/indirect luminaires.

Care must be taken to integrate the daylight so that the electric lighting is reduced or turned off when natural light levels are adequate. IEQ6.2: User Controls is highly recommended as a complementary action. E2.3: Daylight Responsive Controls is an automated option. Sensors must be placed correctly to read the available daylight in the space.

### Resources

Advanced Lighting Guidelines: 2003 Edition, <http://www.newbuildings.org/lighting.htm>

Lighting Design Lab <http://www.lightingdesignlab.com/>

## Indoor Air Quality

**Purpose:** Achieve superior indoor air quality to protect student and staff health, performance, and attendance.

Supplying non-polluted outdoor air ventilation to classroom areas is critical to the protection of good indoor air quality. Ensure that the ventilation system's outdoor air capacity can meet the reference standards in all modes of operation. Locate building outdoor air intakes away from building exhausts, loading areas, building exhaust fans, cooling towers, and other sources of contamination. In addition, consider both current and future traffic and development patterns and consult the local Air Pollution Authority to locate nearby emission sources. Local air quality may impact decisions to use natural ventilation or may justify improved air filtration.

However, merely complying with code minimums during design and installation will not ensure good indoor air quality. It is also critical to use low-emitting materials (IEQ Credit 2), control the sources of indoor pollution (Credit 3), take protective measures during construction (IEQ Credit 4), commission the equipment (Energy Credit 4), and perform regular maintenance during occupancy.

Common indoor building materials, such as furniture, carpet, glues, paints, floor finishes, etc., contain and off gas compounds harmful to health. Because a single material can off gas enough to cause health problems, it is important to evaluate and specify materials that are low-emitting, non-irritating, nontoxic, and chemically inert. This is especially important in schools because children are more susceptible than adults to indoor air pollutants.

## IEQ3.0: Minimum Requirements

Required	<p>Meet the performance requirements of Washington Minimum Ventilation Standard, including:</p> <p><b>Minimum Ventilation:</b></p> <p style="padding-left: 40px;">Design building ventilation systems to ensure that the continuous delivery of outside air is no less than the governing design standard; AND will occur at all times rooms are occupied. The design must ensure that the supply operates in continuous mode and is not readily defeated (i.e., blocked registers or windows) during occupancy periods.</p> <p style="padding-left: 40px;">Meet the minimum requirements of voluntary consensus standard ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality for areas not covered by Washington Minimum Ventilation Standard.</p> <p>Meet the minimum standards in WAC 246-366 which supplements for schools the Washington Minimum Ventilation Standard.</p> <p><b>Moisture Control:</b></p> <p style="padding-left: 40px;">All surface grades, drainage systems, and HVAC condensate must be designed to prevent the accumulation of water under, in, or near buildings (including portables). Irrigation systems must not spray on buildings.</p> <p style="padding-left: 40px;">Building materials, especially wood, porous insulation, paper, and fabric, and other porous materials must be kept dry before, during, and after installation to prevent the growth of mold and bacteria. Before installation, store all materials in a manner which protects them from the weather if possible. If stored outside, cover with plastic to protect from the rain, and keep supported off of the ground. Immediately discard all water-damaged materials and replace with new, undamaged materials.</p> <p><b>Construction Filtration:</b></p> <p style="padding-left: 40px;">Temporary filters: If air handlers must be used during construction, install filtration media with a Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE 52.2-1999, at each return air grille.</p> <p style="padding-left: 40px;">Permanent filters: Replace all filtration media immediately prior to occupancy.</p>
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All regularly occupied spaces must be ventilated. Washington requires that the HVAC shall be operated continuously during working hours except:

During scheduled maintenance and emergency repairs.

During periods not exceeding a total of 90 hours per calendar year when a serving electric utility by contractual arrangement requests its customers to decrease electrical power demand.

During periods for which the employer can demonstrate that the quantity of outdoor air supplied by non-mechanical means meets the outdoor air supply rate required by the code.

For areas not covered by Washington State requirements, ventilation systems must meet the minimum requirements of voluntary consensus standard ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality. Naturally ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1.

Due to extreme health risks that can be caused by mold and microbial growth, all surface grades, drainage systems, and HVAC condensate must be designed to prevent the accumulation of water

under, in, or near buildings. Portables are particularly vulnerable, and must be placed on properly drained surfaces.

Permanent irrigation systems that spray on buildings can cause major structural damage and mold growth. Do not install irrigation systems in locations where they spray directly on buildings.

Construction activities affect indoor air quality. Mold protection and filtration are prerequisites; additional measures are covered under IEQ Credit 3.4.

## Resources

ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality, <http://www.ashrae.org/>. User's Manual Provides Better Understanding of ASHRAE 62.1, Release Date: 11/02/2005, Contact: [jdunlop@ashrae.org](mailto:jdunlop@ashrae.org) , Phone: 678-539-1140

Washington State Ventilation and Indoor Air Quality Requirements, <http://apps.leg.wa.gov/wac/default.aspx?cite=51-13>

School Indoor Air Quality Best Management Practices Manual <http://www.doh.wa.gov/ehp/ts/IAQ/schooliaqbmp.pdf>

WAC 246-366, L&I Hazardous Chemicals in Laboratories

DOH/OSPI K-12 Health & Safety Guide

## IEQ3.1: Low-Emitting Interior Finishes

1 to 4 points

Receive one point (up to a maximum of four points) for each of the following products complying with the listed protocols.

Interior adhesives, sealants, and concrete sealers (South Coast Air Quality Management District, SCAQMD, Rule 1168).

Interior carpet, resilient flooring (Carpet and Rug Institute Green Label Indoor Air Quality Test Program).

Interior paint (Green Seal GS-11 Standard).

Building insulation (Greenguard™ or specified as no added urea-formaldehyde resins).

Acoustical ceilings or wall panels (Greenguard™).

Interior wood flooring and composite wood products (specify no added urea-formaldehyde resins).

CHPS has developed sample material specifications to identify materials that will not compromise the health of students and staff. The CHPS material specifications (available from <http://www.chps.net/>) identify over 60 specific chemicals that have been found to impact human health and the maximum emission levels for each. Designers should request emissions test data from manufacturers to ensure that the chemical emissions are within safe exposure levels, or look for products that have been certified by a third party or otherwise indicate the standards they meet.

## Resources

Collaborative for High Performance Schools, <http://www.chps.net/>

Green Seal Standard GS-11, Paints. Online at <http://www.greenseal.org/standards/paints.htm>

Greenguard Product Directory, online at  
<http://www.greenguard.org/DesktopDefault.aspx?tabindex=1&tabid=12>

## IEQ3.2: Low-Emitting Furniture

1 point	<p>Use furniture systems and seating that are low-VOC, either Greenguard™ certified or registered.</p> <p>OR</p> <p>whose emissions meet or are lower than the best practice air emissions standards as established by the US EPA's Environmental Technology Verification (ETV) test method in a qualified testing laboratory.</p>
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When using the US EPA's Environmental Technology Verification (ETV) test method, the following emission levels must be reached within one week (seven days) of unpacking the product and installation in a building.

### Emission Limits for Furniture Systems:

- TVOC's <0.5 mg/m<sup>3</sup>
- Formaldehyde <0.05 ppm
- Total Aldehydes <0.1 ppm
- 4-PC (as an odorant) below the limits of detection

### Emission Limits for Office Seating:

- TVOC's <0.25 mg/m<sup>3</sup>
- Formaldehyde <0.025 ppm
- Total Aldehydes <0.05 ppm
- 4-PC (as an odorant) below the limits of detection

## Resources

Collaborative for High Performance Schools, <http://www.chps.net/>

Greenguard Product Directory, online at  
<http://www.greenguard.org/DesktopDefault.aspx?tabindex=1&tabid=12>

### IEQ3.3: Source Control

1 point	<p>Design to minimize contamination of occupied areas by dust and chemical pollutants:</p> <p>Control surface dust by covering all outside exposed dirt, providing walk-off mats at all entrances, and avoiding use of deep-pile carpets;</p> <p>AND where chemical use occurs (including housekeeping areas, chemical mixing areas, copying/print rooms), use structural deck-to-deck partitions with separate outside exhausting, no air recirculation, and negative pressure;</p> <p>AND install low-noise, vented range hoods for all cooking appliances (such as stoves, ovens) and chemical mixing areas in lab or prep spaces;</p> <p>AND install approved fume hoods in lab and prep spaces for working with chemicals and for demonstrations. Demonstration hoods should be clear on all sides and movable. All pottery kilns need to be vented to the outside.</p> <p>AND all plumbing in areas where hazardous compounds are being used must be resistant to corrosion and degradation if they were to inadvertently come in contact with those compounds.</p>
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Design to physically isolate activities associated with chemical contaminants from other areas of the building, and provide dedicated systems (direct exhaust, no return air, room under negative pressure) to contain and remove chemical pollutants at their source locations. Eliminate or isolate high hazard areas, and design all housekeeping chemical storage and mixing areas (central storage facilities and janitors' closets) to allow for secure product storage. Design copy/fax/printer/printing rooms with structural deck-to-deck partitions and dedicated exhaust ventilation systems.

#### Resources

WAC 246-366, L&I Hazardous Chemicals in Laboratories

WAC 296-828, DOH/OSPI K12 Health and Safety Guide.

### IEQ3.4: Ducted HVAC Returns

1 point	<p>Install ducted HVAC returns to avoid the dust and microbial growth issues associated with plenum returns.</p>
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Plenum returns are easily contaminated with dust and microbial growth. Ducted returns, though more expensive, will help prevent such problems and reduce maintenance and repairs.

### IEQ3.5: Particle Arrestance Filtration

1 point	<p>Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-2001 or the highest efficiency filter recommended by the manufacturer.</p>
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Filters rated at MERV 13 will remove more pollutants from the air used to ventilate the school. Manufacturers' recommendations should be followed.

**IEQ3.6: Construction IAQ Management**

<p>1 point</p> <p>+1 point for 2 week flush-out</p>	<p>During construction, meet or exceed all of the following minimum requirements:</p> <p><b>Temporary construction ventilation:</b> Continuously ventilate affected spaces during installation of materials that emit volatile organic compounds (VOC) and for at least 72 hours after installation. Ventilate longer than 72 hours if necessary to completely remove odors. Exhaust the air directly to the outside; do not recirculate to other enclosed spaces. If continuous ventilation is not possible using the building’s HVAC system or temporary ventilation, then ventilate via open windows and temporary fans.</p> <p><b>Duct protection:</b> Turn the ventilation system off, and protect HVAC supply and return openings from debris generated during dust-producing activities such as drywall installation and finishing. Provide temporary ventilation as required.</p> <p><b>Preconditioning:</b> Allow products with odors and significant VOC content to off-gas off-site in dry, well-ventilated space for at least two weeks prior to delivery to the construction site. Remove products from their containers and packaging to maximize off-gassing of VOCs.</p> <p><b>Sequencing:</b> Install odorous and/or VOC-emitting products prior to installation of porous and fibrous materials.</p> <p><b>HEPA vacuuming (carpets and upholstery):</b> After installation, vacuum carpeted and soft surfaces with a high-efficiency particulate arrestor (HEPA) vacuum as needed and just prior to occupancy.</p> <p><b>HEPA duct cleaning:</b> Prior to installation, inspect ducting for dust and to confirm that the oil film has been completely removed. Remove any dust, dirt, and remaining oil. Prior to substantial completion and prior to using the system, inspect the ducts again for dust and other debris that may have collected during construction. Immediately remove any dust using a HEPA vacuum.</p> <p><b>FOR AN ADDITIONAL POINT:</b></p> <p>After construction, flush the building continuously, 24 hours per day, using 100% tempered outside air for at least two weeks after substantial completion of construction is achieved and before the building is occupied. If the contractor is required to perform touch-up work during this time, provide temporary construction ventilation during the work and extend the building flush-out by a minimum of four days after touch-up installation.</p>
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Each of the listed construction practices will improve indoor air quality by minimizing the amount of indoor pollutants that are distributed and retained by the surface materials and ventilation systems during construction. Flushing out the building with 100% outside air will help remove indoor pollutants prior to occupancy. Do not “bake out” the building by increasing the temperature of the space.

**Resources**

SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3.

**IEQ3.7: Natural Cooling**

<p>3 points</p>	<p>Design 90% of permanent classroom spaces with no air conditioning.</p>
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Prior to air conditioning, school buildings required natural ventilation and cooling. This defined the shape of the building as each office or room required an operable window. The T, H, or L-shaped floor plans, which allowed the maximum number of windows to provide natural light and ventilation, are still visible in most cities.

Sunlight and solar gain are major influences on buildings in mid to late afternoon when students typically are not present. This allows designers to minimize solar gains to keep students comfortable in non-air conditioned buildings by properly orienting and shading windows.

It is critically important to verify that required ventilation levels can be maintained through natural ventilation, and that no outdoor pollutants (from traffic, industrial sources, or the potential for air quality emergencies) eliminate its feasibility. To meet ASHRAE ventilation standards, all occupants must be within 20 feet of an operable window. For a standard classroom, this would require that operable windows be installed on both sides. If this design is not possible, ventilation systems with exhaust fans would need to be installed to provide the minimum required ventilation levels. In-line fans designed for radon removal provide one low-power option.

Air conditioning systems prohibited by this credit include air- and water-source packaged air conditioners or heat pumps. Direct/indirect evaporative systems without compressed refrigerant can be used and still receive this credit.

For natural ventilation, an eight step process is described by the Carbon Trust in their Good Practice Guide 237 "Natural Ventilation in Non-Domestic Buildings". The basic steps are to:

- 1) Develop the design brief, with attention to heat loads, future use and cultural factors like dress code.
- 2) Identify air flow paths, paying attention to season, time of day and pollutant source control.
- 3) Identify issues to mitigate (e.g. heat gain, pollutants).
- 4) Determine ventilation and thermal comfort requirements.
- 5) Estimate wind pressures.
- 6) Chose ventilation devices.
- 7) Size openings, (Chapter 5 of CIBSE, AM10)
- 8) Check the design. You may use public domain software such as NIST's CONTAM, Multi-zone Modeling Software, along with LOOPDA, Natural Ventilation Sizing Tool.

<http://www.bfrl.nist.gov/IAQanalysis/>

Design should use either clearly meet the intent of recommendations set forth in CIBSE AM10 (below) or be modeled using a multi-zone model to show that room-by-room air flows will effectively ventilate using minimums defined by ASHRAE 62.1-2004 Chapter 6 for at least 90% of occupied spaces.

Additional points for eliminating or reducing air conditioner use can be achieved under E1.1 Energy Performance.

Also see E2.1 HVAC and Operable Window controls, and IEQ6.1 User Control (operable windows).

## Resources

Natural Ventilation for Northwest Buildings, G.Z. Brown, et al, Energy Studies in Buildings Laboratory, University of Oregon (June 2004).

Chartered Institution of Building Services Engineers, Applications Manual 10 (CIBSE AM10), "Natural Ventilation in Non-Domestic Buildings",

<http://www.cibse.org/index.cfm?go=publications.view&PubID=297&L1=164>

Carbon Trust, "Good Practice Guide 237", Natural Ventilation in Non-Domestic Buildings

[http://www.thecarbontrust.co.uk/energy/pages/publication\\_search.asp](http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp) Search "GPG237". Registration is required, but download is free. 16 pgs

## Acoustics

### Purpose:

Provide the acoustical qualities necessary for good speech communication between students and teachers in classrooms and other learning spaces.

### IEQ4.0: Acoustic Performance

Required	<p>Classrooms must have:</p> <p>Maximum unoccupied background noise levels of 45 dBA at any student location within the classroom (measured as a noise average <math>Leq_x</math> where x is thirty seconds or more).</p> <p>0.6-second maximum (unoccupied) reverberation times at mid-frequencies (500, 1000, and 2000 Hertz).</p>
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Good acoustical qualities are essential in general classrooms in which speech communication is an important part of the learning process. Excessive background noise or reverberation in such spaces interferes with speech communication and thus presents an acoustical barrier to learning. With good classroom acoustics, learning is easier, deeper, more sustained, and less fatiguing. Teaching should be more effective and less stressful with good acoustical characteristics in a classroom. There can be more verbal interaction and less repetition between teacher and students when spoken words are clearly understood.

Although all those in a classroom, including teachers, will benefit, special beneficiaries are young children in early stages of language acquisition and persons with hearing difficulty, second language challenges, speech problems, attention deficit, or other learning disabilities. Conformance with the provisions of this credit will improve the quality of education by removing or significantly reducing any residual acoustical barriers for *all* students and teachers, including those with communication disabilities. Good architectural design practice and attention to detail throughout the construction or renovation process can ensure conformance to the requirements of this credit.

Compliance with this prerequisite must be determined with the classroom ventilation system and noise generating components, such as compressors and fans, in full operation. Specifications for noise measurement equipment and measurement procedures are defined in the American National Standard – “Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools” (ANSI S12.60-2002).

The prerequisite 45 dBA average background noise level is considered *not* conducive to effective instruction, and represents minimal compliance with the noise levels required by the State of Washington (WAC 246-366-110, *Sound Control*). School districts and designers are strongly encouraged to move beyond these prerequisites and achieve background noise levels of 35 dBA for all classrooms (see IEQ4.1).

### Resources

American National Standards Institute – “Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools” (ANSI S12.60-2002). <http://asastore.aip.org>

National Clearinghouse for Educational Facilities, <http://www.edfacilities.org>

Washington Administrative Code, WAC 246-366-110, *Sound Control*.

## IEQ4.1: Improved Acoustic Performance

Unoccupied = or < 35dBA = 1 point  PLUS  STC 50 = 2 points	<p>Classrooms must have:</p> <p style="padding-left: 40px;">Maximum unoccupied background noise levels of 35 dBA at any student location within the classroom (measured as a noise average <math>Leq_x</math> where x is thirty seconds or more for steady background noise).</p> <p>For an additional point, providing the preceding point is achieved:</p> <p style="padding-left: 40px;">Minimum Sound Transmission Class (STC) ratings of STC 50 for classroom single or composite partition wall, floor-ceiling, and roof-ceiling assemblies that separate an enclosed instructional space from an adjacent instructional space.</p>
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Background noise levels in the classroom are typically of two types, noise from outside and noise from within the classroom. Noise that intrudes into the classroom from sources outside of the school building envelope includes vehicular traffic, aircraft, industrial plants, and activity in schoolyards or from grounds maintenance. Control of noise in classrooms from such sources is accomplished through proper selection of materials and acoustical design for the exterior envelope of the school building. Each situation is unique with regard to distance to, and the extent and characteristics of, industrial sources, local traffic, or other transportation noise sources.

The most effective approach to outdoor-to-indoor noise control is to measure the current, or predict the future, noise levels of external sources at the proposed locations for each of the school building facades. The next step is to determine the necessary outdoor-to-indoor noise level reduction to achieve the required interior background noise level. Guidelines and methodologies for designing effective exterior source noise control are available in resources, below.

The second type of noise originates within the school building and intrudes into the classroom through classroom walls and partitions, floor-ceiling assemblies and ventilation systems. Interior noise sources can be isolated through the proper design and construction of school building elements and by effective noise control design measures applied to the building services and utilities. Compliance with the 35 dBA background noise level and the STC 50 sound rating for partitions and floor/ceiling assemblies can be demonstrated through testing as specified in ANSI Standard S12.60-2002. A measured Noise Isolation Class (NIC) rating of 45 or higher is considered to be in compliance with the STC requirement.

### Resources

American National Standards Institute – “Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools” (ANSI S12.60-2002). <http://asastore.aip.org>

National Clearinghouse for Educational Facilities, <http://www.edfacilities.org>

Air Movement and Control Association, International – “Fans and Systems” (AMCA Publication 201-02) <http://cart.amca.org/publications/>— A part of AMCA’s Fan Application Manual, aimed primarily at the designer of air moving systems, showing methods to improve fan inlet and outlet connections, resulting in reduced noise and energy consumption at optimum fan performance. Available at: <http://cart.amca.org/publications/>

## IEQ4.2: Audio Enhancement

1 point	<p>Classrooms must have:</p> <p style="padding-left: 40px;">A sound system in each classroom and instructional space to amplify the teacher's voice, via wired or wireless microphones, and to amplify pre-recorded program material associated with CD, DVD, VHS, or CATV sources.</p> <p style="padding-left: 40px;">Accommodation for a dedicated or portable assistive listening system to amplify the teacher's voice, via wired or wireless microphones, and to amplify pre-recorded program material associated with CD, DVD, VHS, or CATV sources.</p>
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A properly designed sound system is an effective method for increasing the speech level in a classroom, thereby increasing the SNR. In addition to improved speech intelligibility, the use of a sound system can significantly reduce voice fatigue for the teacher, and improve speech perception for impaired individuals, as noted above. It is important to note that amplified speech does not reduce the requirement for background noise control, because communication between students, and between student and teacher, must continue to be facilitated by a low background noise level.

For compliance with this credit, the sound system must:

Provide uniform sound distribution at all student seating and instructional areas. Uniformity is confirmed if measurements across all student seating and instructional areas are within +/- 2 dB in the 1/1-octave band centered on 2000 Hertz.

Provide distribution to all student seating and instructional areas utilizing either dedicated or portable assistive listening systems.

Provide a minimum signal-to-noise ratio of 15 dB across all student seating and instructional areas. Uniformity is confirmed if A-weighted amplified speech sound level measurements are 15 dB above background sound levels across all student seating and instructional areas.

In addition, designers are encouraged to meet the maximum unoccupied background noise levels of 35 dBA, as set in IEQ4.1. Relying solely on amplification is not considered best practice.

### Resources

Davis, Don, and Carolyn Davis. Sound System Engineering, Second Edition. Indianapolis, 1987.

Ballou, Glen, ed. Handbook for Sound Engineers, The New Audio Cyclopedia. Indianapolis, 1987.

ADA Home Page. 2005. 17 November 2005, [www.usdoj.gov/crt/ada/adahom1.htm](http://www.usdoj.gov/crt/ada/adahom1.htm)

Assistive Technology. 2005. 7 December 2005. The American Speech-Language-Hearing Association. [http://www.asha.org/public/hearing/treatment/assist\\_tech.htm](http://www.asha.org/public/hearing/treatment/assist_tech.htm)

## Thermal Comfort

**Purpose:** Provide level thermal comfort to support optimum health, productivity, and comfort.

### IEQ5.0: ASHRAE 55 Code Compliance

Required	Comply with ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy, for thermal comfort standards within established ranges per climate zone.
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Indoor design temperature conditions for general comfort applications shall be determined in accordance with ANSI/ASHRAE 55-2004 or Chapter 8 of the ASHRAE Handbook, 1993, Fundamentals volume. Note that winter humidification and summer dehumidification are no longer required.

### Resources

ASHRAE Standard 55-2004, <http://www.ashrae.org/>. Note there is an appendix addressing natural ventilation in the revised standard.

## User Control

**Purpose:** A significant factor in human comfort is the ability to make adjustments based on individual preference or immediate perception of conditions. Allowing teachers to manually control the windows, lights and thermostat, give both student and teachers an immediate way to affect their environment, reducing distraction and discomfort.

### IEQ6.1: User Control - Windows

1 point

Provide a minimum of one operable window in each classroom.

Operable windows are important for personal comfort and have been shown to improve student performance. In addition to providing fresh air, they provide a connection to the outdoors.

Provide at least one operable window in each classroom. It is recommended to interlock controls with the HVAC system to optimize energy efficiency. Train teachers on how to properly use the HVAC controls in their rooms and how opening door and windows affect ventilation and comfort.

Also see Credit E2.1, which provides a point for providing controls /devices or HVAC systems that can respond when windows or doors are opened. This strategy is important as it allows operable windows, yet mitigates energy penalties that might result. And see Credit IEQ3.7 which rewards natural ventilation (no air conditioning).

### IEQ6.2: User Control – Temperature & Lights

1 point

Provide temperature and lighting controls for each classroom.

Individual classrooms will vary in temperature depending on their orientation and other building conditions, as well as occupant preferences. Provide individual or integrated controls systems to allow teachers to regulate the lighting and temperature of their classrooms.

Also see Credit E2.1, HVAC and Operable Windows, and Credit IEQ3.7 Natural Cooling (natural ventilation).

## EXTRA CREDIT

### Integrated Design

**Purpose:** To involve the entire project team in incorporating sustainable building strategies in early programming and on-going design decision-making in order to maximize systems integration and associated efficiencies and cost-benefits as well as identify other sustainable opportunities.

#### EX1.1: Eco-Charette

1 point	High Performance Planning Workshop or Eco-Charette. Conduct a workshop or charette (minimum 3 hours) no later than mid-schematic design, with project stakeholders to collaboratively develop a range of sustainable building strategies for all five categories of the Protocol, document project's sustainable building goals, and incorporate as an ongoing part of programming and design decision-making.
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Sustainable building design requires new and often innovative design approaches, which cross boundaries of professional expertise and which need to be comprehensively considered to be successfully incorporated. Experience with project teams in Washington and across the country has shown that projects that most cost-effectively and successfully incorporate a wide range of sustainable building strategies are those that interactively involve project stakeholders in early design programming, analysis, and design decisions. For best results, this process should begin with a collaborative workshop or charette held no later than mid-schematic design.

Keep in mind that although a high performance workshop or eco-charette is an important step in achieving the benefits of integrated design, it is just the first step. A collaborative team process can carry out the ideals expressed in the workshop or charette, by continuing an interdisciplinary dialogue through the design process, by documenting design decisions related to this effort, and by ensuring sustainable building strategies are incorporated in construction documents and the construction process itself.

Although this credit requires a minimum of 3 hours for a workshop, if members of the stakeholder group are unfamiliar with sustainable building, and education on basic principles is indicated, or if the stakeholder group is fairly large, more time should be set aside for this event. If time and resources allow, software programs are becoming available that can be used during the eco-charette to provide immediate feedback on the feasibility of strategies being considered.

Stakeholders should include owner representatives, design consultants, and end users. Examples of attendees in these categories include:

- Owner Representatives – Capital projects staff, facilities staff, and representative school board member.
- Design Consultants – Architect and subconsultants (civil, structural, electrical, mechanical, acoustic, landscape, etc.) contractor, value engineer.
- End Users – Teachers, principal, operations staff, students, and representative parent.

Eco-Charettes or High Performance Workshops are workshops where open dialogue is encouraged and expected and operate with a few fundamental ground rules:

- A neutral, non-confrontational environment, in which there are no “bad” ideas.
- Life cycle value needs to be considered along with imperatives of first cost.

- Reservations are noted with the expectation that strategy proponents will provide additional investigation to further refine and justify that particular strategy.

Deliverables from the Eco-Charette or High Performance Workshop will guide the collaborative process for the remainder of the project, and include:

- Sustainable building mission statement.
- Set of high-level sustainable building goals that relates to the specific project's priorities.
- Summary of sustainable strategies to be incorporated or further investigated.
- Identification of project team member(s) responsible for specific sustainable strategy development, including a timeline for reporting back to the team.
- Preliminary Protocol Scorecard indicating credits easy to achieve, credits of moderate difficulty that require further investigation, and credits unlikely to be achieved (easy, moderate, difficult OR yes, maybe, no).

## Resources

See WSSP Workbook, for Workplan and Scorecard worksheets.

Energy Scheming Software, developed to assist in building design for energy efficiency. Article at Better Bricks

<http://www.betterbricks.com/default.aspx?pid=article&articleid=586&typeid=8&topicname=integrateddesign&indextype>

Another overview and ordering info at Oikos - <http://oikos.com/esb/37/scheming.html>

Green Building Studio, <http://www.greenbuildingstudio.com/About.aspx>

## Operations

**Purpose:** To encourage the use of grid-source renewable energy, as well as to optimize optimum building operations through post-occupancy evaluation and training.

### EX2.1: Green Power Contract

1 point

Provide at least 50% of the building's electricity (regulated power) from renewable sources by engaging in a minimum two-year contract to purchase green power as defined by the local utility or a recognized green power provider.

Using renewable energy reduces environmental impacts associated with production and consumption of conventional fuels, including air and water pollution, and natural resource destruction. Perhaps more directly relevant to school districts, these environmental impacts have associated economic and human health impacts for our general population, and when located near schools, for our students.

In Washington, where there are growing pressures to use fossil fuels, such as coal, this is an appropriate issue for schools to address.

An alternative to producing renewable energy on-site (see WSSP Credit E3.1) and still support the use of renewable energy in Washington State, is to purchase it through a utility green pricing program, or as renewable energy certificates available through certificate marketers listed by the U.S. Department of Energy's Green Power Network (See Resources).

### Resources

Green Power Network, U.S. Department of Energy, Energy Efficiency and Renewable Energy  
[www.eere.energy.gov/greenpower/buying/buying\\_power.shtml?state=WA](http://www.eere.energy.gov/greenpower/buying/buying_power.shtml?state=WA)

Green Power Options for Washington Customers, Washington Utilities and Transportation Commission  
[www.wutc.wa.gov](http://www.wutc.wa.gov)

### EX2.2: Post Occupancy Evaluation

1 point

Conduct a Post-Occupancy Evaluation (POE) approximately one year after the building is occupied. The evaluation shall include at a minimum, an analysis of resource use (energy and water) as well as surveys of end users regarding comfort, including thermal comfort, air quality, and acoustical comfort. A written plan and/or contract for a POE should be in place at the time of substantial completion.

A POE is a formal process which measures building performance. The process has been used for over forty years to evaluate buildings, including educational institutions. It is an important means of building a body of knowledge about the impact of sustainable building strategies employed in a particular building. Ideally, the information gained through POEs is captured in lessons-learned programs and used in the planning, programming, and design processes for new facilities to build on successes and avoid repeating mistakes. This knowledge will be useful for school districts in planning future capital projects, as well as the State, as it implements green building requirements. In fact a certain amount of monitoring and documentation of savings is required by SB 5509, and the POE should be coordinated with meeting this requirement for the first year of operation.

At a minimum the POE required for earning this credit includes occupant surveys regarding comfort, including thermal comfort, air quality, and acoustical comfort, as well as an analysis of resource use (energy and water). Additional evaluation activities could include air quality monitoring and thermal and light level testing. The results of POE activities should be included in a written report.

To meet SB 5509 the District must report on savings experienced by buildings constructed under the law on an annual basis for a minimum of five years. Savings enjoyed in the first year of operation can be included in the POE as well.

A POE can be simple or complex. Examples of POE occupant surveys are available (see Resources). In 2005-6 Cascadia Region Green Building Council sponsored a small research study including several POEs of green buildings in Washington and Oregon.

## Resources

Center for the Built Environment, University of California, Berkeley, at <http://www.cbe.berkeley.edu/>

Learning from Our Buildings: A State-of-the-Practice Summary of Post-Occupancy Evaluation, Federal Facilities Council, Board on Infrastructure and the Constructed Environment, National Research Council, <http://books.nap.edu/catalog/10288.html>

Cascadia Region Green Building Council, [www.cascadiagbc.org](http://www.cascadiagbc.org)

New Buildings Institute, [www.newbuildings.org](http://www.newbuildings.org)

Healthy School Environments Assessment Tool (HealthySEAT v.1.0) free at [www.epa.gov/schools/healthyseat/](http://www.epa.gov/schools/healthyseat/)

## EX2.3: Life Cycle Cost Analysis

1 point

As part of the design process, perform a life cycle cost analysis showing net present value over 30 years of the major building systems considered for the project that are anticipated to consume significant amounts of energy, water, or other natural resource.

Typically, first cost is the primary economic factor when analyzing whether to proceed with a specific strategy, sustainable or not. However, it is in the long period of operation that the employed strategy will prove economically advantageous or not. According to the Sustainable Building Technical Manual, a publication of the Public Technologies Institute, when viewed over a 30 year period, initial building costs account for approximately just 2% of the total, while operations and maintenance costs equal 6%, and personnel costs equal 92%.

A Life Cycle Cost Analysis (LCCA) will provide a much more accurate context for decision making. Ideally, this analysis compares alternatives that are relevant and viable options of interest to the owner and project participants.

There are a variety of methods to use to conduct an LCCA, varying in complexity. The National Institute of Building Sciences describes LCCA in its Whole Building Design Guide. The discussion includes a description of "Present Value" Analysis required to earn this credit. This method converts cash flows to present values by discounting them to a common point in time.

The spreadsheet available through the Washington State ELCCA program is available electronically and can be modified to address alternatives other than energy. As an alternative to ELCCA, the Pacific Northwest National Laboratory has developed Facility Energy Decision System – FEDS 5.0 which analyzes energy efficiency in single or multiple buildings. In addition, FEDS can determine the impact of energy efficiency retrofits on emissions of CO, CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, hydrocarbons, and particulates.

## Resources

Energy Life Cycle Cost Analysis Spreadsheet, Washington State General Administration, available at <http://www.ga.wa.gov/EAS/elcca/sheets.html>

FEDS Software, Pacific Northwest National Laboratory, [www.pnl.gov/FEDs](http://www.pnl.gov/FEDs)

Whole Building Design Guide, National Institute of Building Sciences, [www.wbdg.org/design/lcc](http://www.wbdg.org/design/lcc)

Building Life-Cycle Cost (BLCC) Programs, U.S. Department of Energy, Energy Efficiency and Renewable Energy, Federal Energy Management Program, [www.eere.energy.gov/femp/information](http://www.eere.energy.gov/femp/information)

Energy-10, National Renewable Energy Lab, [www.nrel.gov/buildings/energy10/](http://www.nrel.gov/buildings/energy10/)

## Education

**Purpose:** To engage students and teachers in learning about the benefits of green building, using their own building as a learning tool.

### EX3.1: Green Building Learning Opportunities

1 point

Develop student learning opportunities highlighting the environmentally sensitive aspects of the building structure and site, through exposed systems, lesson plans, teaching aids and signage.

For existing schools, students can be involved in analyzing baseline energy conditions as well as planning and implementing outdoor classroom resources (e.g., gardens, native plants). For new schools, outdoor classrooms and learning environments should be planned into the site design for use or further development by students. Students can create signs, displays, newsletter articles or brochures to educate each other and visitors about the environmental design features that are included. Exposed building systems can be utilized as learning opportunities. When advanced technology and design in new schools are made visible, buildings can become teaching tools and important features of science, math, and environmental curriculum. To earn this credit, the project must, in addition to providing the opportunity and learning elements, have a plan for providing teachers and staff with training and background information.

## Resources

Alliance to Save Energy, Washington, DC. [www.ase.org/section/\\_audience/consumers/kids](http://www.ase.org/section/_audience/consumers/kids) and [www.ase.org/section/program/greenschl/gazette](http://www.ase.org/section/program/greenschl/gazette)

Green Schools Energy Project: Step by Step Manual (HS), Youth for Environmental Sanity, [www.yesworld.org](http://www.yesworld.org)

SolarQuest, Solar on Schools Program Management, EcoSage, Inc., Chelsea, VT [www.solarschools.com](http://www.solarschools.com)

## Project and District Level Innovations

**Purpose:** To recognize design teams for including innovative high performance features in their school building(s) as well as efforts to expand the impact of the project to other schools in the district by integrating high performance practices into policy or planning at the district level.

### EX4.1: Innovation

1-3 points

Receive one point for each additional innovation either at the project or the district level. Write a description of the purpose or intent of the proposed innovation, any relevant reference standards, and strategies used to meet the credit, resources, and any relevant evidence of performance achieved.

The definition of a “High Performance School” is continuously evolving. New developments are constantly being introduced to improve the efficiency and effectiveness of schools.

An innovation credit is a vehicle by which Washington Sustainable Schools can recognize efforts that exceed and/or significantly enhance or are different from existing credits. Awarding innovation credits encourages districts to continually develop their skills and experiences with high performance buildings.

#### **Examples of Project Level Innovations that qualify include:**

Variance Achieved. Project achieved a variance in district, local, or state regulations in order to implement a high performance or green strategy.

Lab Environmental Quality. Lab facilities are designed to address unique concerns related to special wastes, IEQ, and energy and water use.

Food Related Waste Prevention and Management. Project design addressed special handling options for food prep and related wastes (e.g., on-site/off-site composting, worm bins, on-site vegetable/herb gardens, etc.).

Transportation Options Program. Project team developed/implemented a Transportation Options Program, with input from the local community and other stakeholders, to improve the school's connection to the community by offering students and staff more transportation choices – such as public buses, rail, biking and walking.

Professional Education. Project team developed and have a plan for distributing a case study of the environmentally sensitive aspects of the project for use by school facility designers and district planners.

#### **Examples of District Level Innovations that qualify include:**

Maintenance Plan. The district created a school maintenance plan that includes an inventory of all equipment in the school and their preventative maintenance needs. Regular maintenance is critically important to the operation and performance of schools.

District Level Transportation. Provided bus service for students using alternative fuel, with at least 20% of the district-owned buses and maintenance vehicles serving the school use alternative fuels. If district bus service is provided under contract from a third party, then 20% of the buses used to service the school use alternative fuels.

ENERGYSTAR®-compliant Equipment Purchasing Resolution. Pass a district wide resolution to purchase high efficiency equipment and appliances and prohibit the purchase of low efficiency products such as halogen torchieres and portable electric resistance heaters.

IAQ Management Plan. Implement the EPA's Tools for Schools Program or an alternative, equivalent in scope and effectiveness. Include the plan in the Facility Maintenance and Commissioning Plans.

Integrated Pest Management (IPM) Program. Develop and implement a formal IPM Program that follows the model IPM program for schools in Washington State developed by Urban Pesticide Education Strategy Team (UPEST).

Green Cleaning Purchasing Program. Develop and implement a formal green cleaning purchasing program for the district that meets or exceeds the environmental criteria listed in the State of Washington's Environmentally Responsible Cleaning Products Contract #11399, Attachment VI, or such that vendors are required to submit either Green Seal certification or specific test results to document that they meet the environmental criteria required in the Massachusetts RFR #GR016 for Cleaning Products, Environmentally Preferable.

Low Environmental Impact Disposable Product Purchasing Program. Develop and maintain a formal, district-level policy of low environmental impact disposable product purchasing program which includes:

Use of disposable paper products using 100% recycled content, with a minimum of 30% post consumer recycled content and manufactured without the additional use of elemental chlorine or chlorine compounds;

**AND** use plastic liners for trashcans and other receptacles with a minimum of 30% post consumer recycled content.

## Resources

Massachusetts RFR #GR016 for Cleaning Products, Environmentally Preferable, <http://www.newdream.org/procure/products/MassRFP.pdf>

Environmentally Preferable Purchasing, U.S. Environmental Protection Agency, <http://yosemite1.epa.gov/oppt/eppstand2.nsf/Pages/Homepage.html?Open>

EPA's Tools for Schools, [www.epa.gov/iaq/schooldesign/](http://www.epa.gov/iaq/schooldesign/)

EPA's Energy Star Program, [www.energystar.gov](http://www.energystar.gov)

Urban Pesticide Education Strategy Team (UPEST), a consortium of DOH, ECY, GA, WSU Extension, EPA and others, [www.ecy.wa.gov/programs/swfa/upest/](http://www.ecy.wa.gov/programs/swfa/upest/)

IPM Information, WSU Cooperative Extension service, <http://ipm.wsu.edu/>