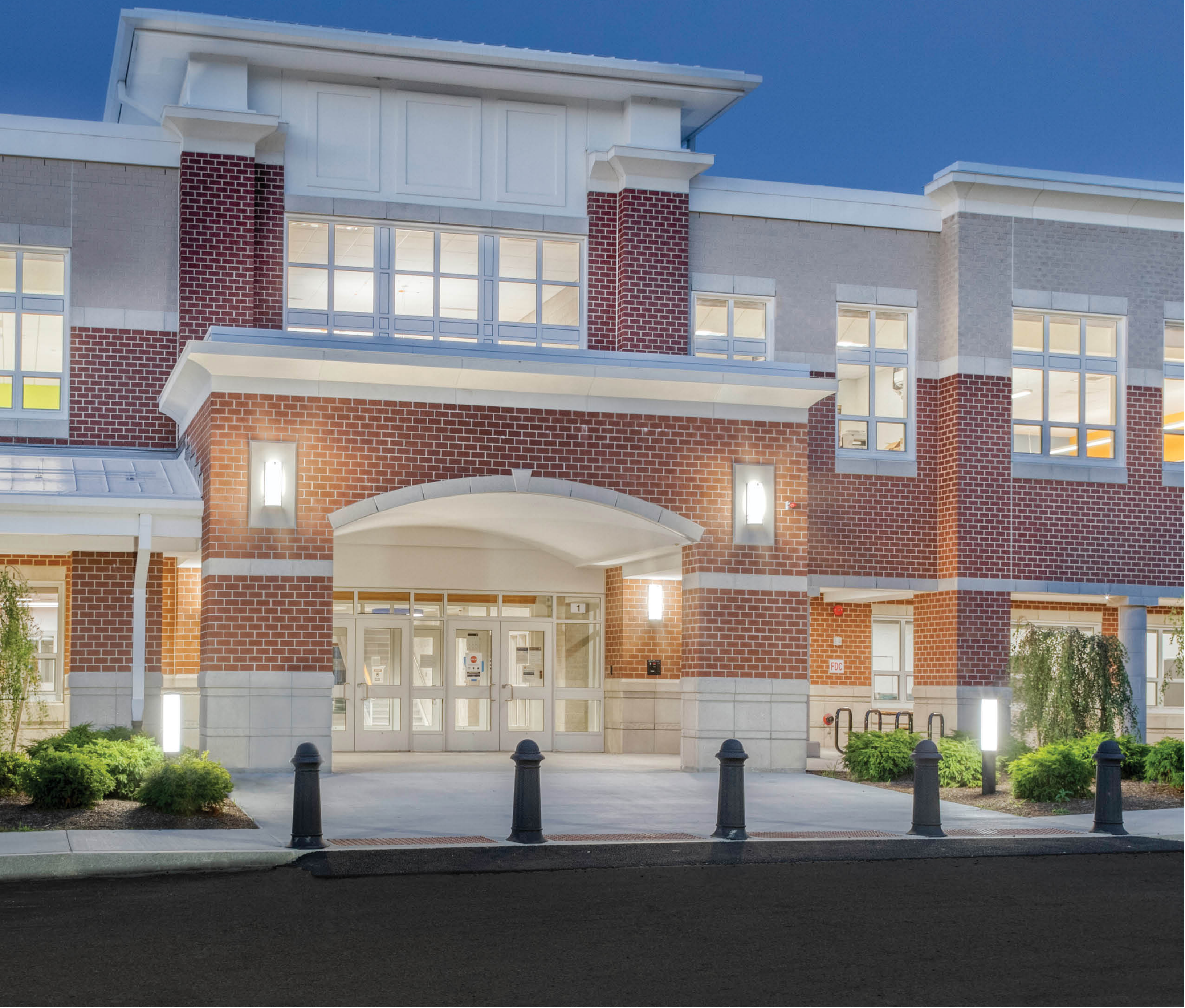
Northeast CHPS Criteria for New Construction and Renovations Version 4.0

Assessment Tool

NORTHEAST COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

Better buildings. Better students.



Northeast Collaborative for High Performance Schools Criteria (NE-CHPS) *Version 4.0*

Updated April 2021

About NEEP:

Founded in 1996, NEEP is a non-profit whose goal is to assist the Northeast and Mid-Atlantic region to reduce building sector energy consumption three percent per year and carbon emissions 40 percent by 2030 (relative to 2001). Our mission is to accelerate regional collaboration to promote advanced energy efficiency and related solutions in homes, buildings, industry, and communities. We do this by fostering collaboration and innovation, developing tools, and disseminating knowledge to drive market transformation. We envision the region's homes, buildings, and communities transformed into efficient, affordable, low-carbon, resilient places to live, work, and play. To learn more about NEEP, visit our website at http://www.neep.org.

About NE-CHPS

The Northeast Collaborative for High Performance Schools Criteria (NE-CHPS) was developed to promote operational energy savings and sustainable design features in school construction and major renovations throughout the region. NEEP's vision is that the work done today on High Performance Schools will pave the way for the development of zero net energy schools, schools that consume no more energy than they produce, on a broader scale throughout the region. NE-CHPS is based on the pioneering Collaborative for High Performance Schools' Guidelines, but has been tailored by NEEP to the climate, building codes, and educational priorities of the Northeastern United States.

About CHPS

The Collaborative for High Performance Schools believes kids learn better in schools with good lighting, clean air, and comfortable classrooms. That's why CHPS works with schools and experts to make changes to ensure that every child has the best possible learning environment with the smallest impact on the planet. CHPS helps facilitate and inspire change in our educational system. The goals of CHPS are to fundamentally change the design, construction and operation of schools to:

- Protect student and staff health, and enhance the learning environments of school children everywhere
- Conserve energy, water, and other natural resources
- Reduce waste, pollution, and environmental degradation

Cover Photo Credit: Abbot-Downing School (Concord, New Hampshire) photo provided by Ed Wonsek Art Works and HMFH Architects.

ACKNOWLEDGEMENTS

After an extended stakeholder engagement and public comment period, Northeast Energy Efficiency Partnerships (NEEP) has revised the NE-CHPS Criteria for high performance schools. This effort is intended to help accelerate the development of high performance and zero net energy (ZNE) schools in the Northeast and Mid-Atlantic states. In July 2021, NE-CHPS 4.0 was finalized and published for use. This update was led by Carolyn Sarno Goldthwaite, John Balfe, Darren Port, Kai Palmer-Dunning, Emmeline Luck, Elisabeth Krautscheid, and Andrea Ranger. Additionally, NEEP would like to recognize the following individuals for their invaluable contributions to the updated criteria:

Ariel Alves	*Massachusetts School Building Authority*
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NEEP would also like to recognize Energy & Resource Solutions (ERS) for their development of NE-CHPS Version 1.0 – 2.0.

Collaborative for High Performance Schools

The CHPS Core Criteria Version 1.0 was originally developed by an ad-hoc committee of CHPS stakeholders in 2009 as both a framework and process to establish a national definition for healthy, high performance schools while encouraging local flexibility. In addition, the Core Criteria represents a facilitated process to reduce the development time and expense of state and regional adaptations of the CHPS Criteria.

Over the intervening four years CHPS has successfully piloted the use of the Core Criteria in three states – Massachusetts (an update of the first edition of MA-CHPS), Virginia, and Hawaii. Using the Core

Criteria as a common starting point cut the development time in half. Version 2.0 of the National Core Criteria incorporates lessons learned from these pilots and other previous CHPS Criteria adaptations.

The CHPS National Core Criteria Version 2.0 was developed by the CHPS National Technical Committee under the leadership of:

- Committee Co-chairs: John Zinner and Jim Ogden
- Integration & Steering subcommittee chair: Christopher Gerber
- Indoor Environmental Quality subcommittee co-chairs: Toni Stein and Leo Cedolin
- Energy subcommittee chair: Charles Eley, vice-chair Maureen Guttman
- Water & Site subcommittee chair: Chris Duncan
- Materials & Waste Management subcommittee chair: Melanie Jacobson
- Operations & Metrics subcommittee chair: Rob Samish
- Facilitators: Kristin Parineh, Julie Duncan, Nick Semon, and Ed Wansing
- Notice and Editing: Ariel Dekovic
- Technical Editor: Bill Orr

CHPS thanks all of the members of the National Technical Committee for their time and contributions during the Core Criteria update process. See the complete membership of the CHPS National Technical Committee at: http://www.chps.net/national-technical-committee.

Table of Contents

Introduction

The Northeast CHPS Verified Program (NE-CHPS) has been designed to provide guidance and verification for new school projects, renovations, and new schools on existing campuses to achieve high performance goals. The tables below summarize the criteria and how they apply to different project types.

Points are available for all criteria. Items marked as a prerequisites must still be pursued by all projects as indicated in the criteria. By assigning points to prerequisites, it allows for a more accurate accounting of the relative importance and level of effort associated with each individual section. For example, prerequisites account for nearly a third of all points in Indoor Environmental Quality. Without assigning points to prerequisites, that section seems relatively less important than it truly is.

Version 4.0 includes updates to standards from IECC 2015 to IECC 2018 and from ASHRAE 62.1 and 90.1 2013 to 2016, certain language alignment with US-CHPS, and the inclusion of a new Zero Energy Capable pathway modeled after NEEP's Massachusetts Energy Zero Code.

New construction projects, including new buildings on existing campuses, must achieve at least 110 points total. This includes points associated with all prerequisites. Major renovations must achieve at least 85 points, although they only need to achieve the prerequisites as outlined in Table II below.

CHPS Verified Leader™ is a higher level of recognition for school projects that perform well beyond minimum eligibility requirements. CHPS Verified Leaders should be CHPS Verified™, and have inspirational designs that incorporate their high performance features into architectural expression. The school should be an image of environmental and social responsibility, and must be balanced in providing benefits to student health and student performance, resource conservation and the environment. To be eligible for recognition as a CHPS Verified Leader, a new school or building on an existing campus project must earn a minimum of 160 points. A major renovation project must earn a minimum of 135 points to be recognized as CHPS Verified Leader project.

Criteria	Title	Prerequisite	Points
Integration and Innovation			
II 1.0	Integrated Design	P	4
II 1.1	Enhanced Integrated Design		2
II 2.1	District Level Commitment		1
II 3.1	School Master Plan		1
II 4.1	High Performance Transition Plan		1
II 5.0	Educational Display	P	1
II 5.1	Demonstration Area		1
II 6.1	Educational Integration		2
II 7.1	Design for Adaptation		3
II 8.0	Safer Schools By Design	P	3
II 9.1	Innovation		4
II 10.1	Biophilic & Responsive Design		2
	I&I Subtotal		21
Operations & Metrics			
OM 1.0	Facility Staff and Occupant Training	P	4
OM 2.1	Post Occupancy Transition		2
OM 3.0	Performance Benchmarking	P	3
OM 4.0	Systems Maintenance Plan	P	1
OM 4.1	High Performance Operations		3
OM 5.0	Indoor Environmental Management Plan	P	2
OM 6.1	Green Cleaning		2
OM 7.0	Integrated Pest Management	P	1
OM 7.0	Anti-Idling Measures	P	1
OM 8.1	Green Power		2
OM 10.0	ENERGY STAR Equipment and Appliances	P	2
OM 11.1	Computerized Maintenance Management System		1
	O&M Subtotal		23
Indoor Environmental Quality			

EQ 1.0	HVAC Design - ASHRAE 62.1	P	8
EQ 1.1	Enhanced Filtration		2
EQ 1.2	Dedicated Outdoor Air System		3
EQ 2.1	Pollutant and Chemical Source Control	P	2
EQ 3.0	Outdoor Moisture Management	P	1
EQ 4.1	Ducted Returns		2
EQ 5.1	Construction Indoor Air Quality Management		5
EQ 5.2	Construction Moisture Management		1
EQ 6.1	Post Construction Indoor Air Quality		1
EQ 7.0	Low Emitting Materials	P	2
EQ 7.1	Additional Low Emitting Materials		5
EQ 8.1	Low Radon		1
EQ 9.1	Thermal Comfort - ASHRAE 55		4
EQ 10.1	Individual Controllability		1
EQ 10.2	Controllability of Systems		1
EQ 11.0	Daylighting: Glare Protection	P	4
EQ 11.1	Daylight Availability		5
EQ 12.0	Views	P	1
EQ 12.1	Additional Views		2
EQ 13.1	Electric Lighting Performance		3
EQ 13.2	Superior Electric Lighting Performance		5
EQ 14.0	Acoustical Performance	P	7
EQ 15.1	Low-EMF Wiring		1
EQ 15.2	Low-EMF Best Practices		2
EQ 16.1	High Intensity Fluorescent Fixtures		1
	IEQ Subtotal		76
Energy			
EE 1.0	Energy Performance	P	6
EE 1.1	Superior Energy Performance		40
EE 2.1	Zero Energy Capable		3
EE 3.0	Commissioning	P	4
EE 3.1	Additional Commissioning Qualifications		1

EE 3.2	Building Envelope Commissioning		1
EE 3.3	Enhanced Commissioning		1
EE 4.0	Environmentally Preferable Refrigerants	P	1
EE 5.1	Energy Management System		2
EE 5.2	Advanced Energy Management System and Submetering		2
EE 6.1	Natural Ventilation and Energy Conservation Interlocks		2
EE 7.0	Local Energy Efficiency Incentive and Assistance	P	2
EE 8.1	Variable Air Volume Systems		1
EE 9.1	Renewable Energy Performance Monitoring		1
EE 10.1	Electric Vehicle Charging		1
	Energy Subtotal		68
Water			
WE 1.0	Minimum Reduction in Indoor Potable Water Use	P	5
WE 2.1	Reduce Potable Water Use for Sewage Conveyance		4
WE 3.0	Irrigation and Exterior Water Budget - Use Reduction	P	4
WE 4.1	Reduce Potable Water Use for Non-Recreational Landscaping		2
WE 5.1	Reduce Potable Water Use for Recreational Landscaping		1
WE 6.0	Irrigation Systems Commissioning	P	1
WE 7.1	Rainwater Collection and Storage		2
WE 8.1	Water Management System		2
	Water Subtotal		21
Sites			
SS 1.0	Site Selection	P	2
SS 2.1	Environmentally Sensitive Land		3
SS 3.1	Minimize Site Disturbance		1
SS 4.1	Construction Site Runoff Control and Sedimentation		1
SS 5.1	Poste Construction Stormwater Management		1
SS 6.1	Central location		2
SS 7.1	Located Near Public Transportation		1
SS 8.1	Joint-Use of Facilities		1
SS 9.1	Human-Powered Transportation		2

SS 10.1	Reduce Heat Islands - Landscaping and Sites		1
SS 11.1	Reduce Heat Islands - Cool Roofs and Green Walls		1
SS 12.1	Avoid Light Pollution and Unnecessary Lighting		2
SS 13.1	School Gardens		1
SS 14.1	Use Locally Native Plants for Landscape		1
SS 15.0	Site and Building Best Practices	P	2
	Sites Subtotal		22
Materials and Waste Management			
MW 1.0	Storage and Collection of Recyclables	P	2
MW 2.0	Minimum Construction Site Waste Management	P	2
MW 2.1	Construction Site Waste Management		2
MW 3.1	Single Attribute - Recycled Content		2
MW 4.1	Single Attribute - Rapidly Renewable Materials		1
MW 5.1	Single Attribute - Certified Wood		1
MW 6.1	Single Attribute - Materials Reuse		1
MW 7.1	Multi-Attribute Materials Selection		2
MW 8.1	Building Reuse - Exterior		2
MW 9.1	Building Reuse - Interior		1
MW 10.1	Health Product Related Information Reporting		1
MW 11.1	Locally Produced Materials		2
	M&W Subtotal		19
		Total Points	**250**

Table II: Renovation Requirements

Prerequisite	Renovation / Requirements					Commentary
	HVAC	Lighting	Envelope	Interior	Site	Prerequisites are limited to the scope of work of the project unless noted otherwise.
Integration						
II 1.0 Integrated Design	x	x	x	x	x	Flexibility in timing of meetings allowed.
Operations and Maintenance						
OM 1.0 Facility Staff & Occupant Training						Prerequisite applies only for systems that are within scope of work and for teacher and administrative staff, if affected.
Facility Staff	x	x	x	x	x	
Teacher and Administrative Staff	x	x		x		
OM 3.0 Performance Benchmarking						Prerequisite applies when more than 50% of school is within pertinent scope of work.
Adopt Policy	x	x	x			
Deferrals: **For Phased Renovation projects**						Schools can be incrementally recognized if in conjunction with a High Performance Transition Plan (HPTP). See II4.1.
Indoor Environmental Quality						
EQ 1.0 HVAC Design – ASHRAE 62.1	x					Required in entirety when HVAC system is substantially improved, i.e., equipment and ductwork; otherwise required within scope of work.
Minimum Filtration (MERV 11)	x					Required when new HVAC system is installed.
EQ.7.0 Low-Emitting Materials						
Paints and Coatings			x	x		
Flooring Systems				x		
Composite Wood			x	x		
EQ.11.0 Daylighting: Glare Protection			x			Required only when the envelope is substantially improved; at least 70% of classrooms, libraries & administration
		x	x	x		Exceptions: structural constraints, physical constraints, i.e., HVAC or electrical conduit systems, rooms without exterior access or site obstructions but never less than 50% of spaces is allowed to meet prerequisite.

EQ.14.0 Acoustical Performance*						
Reverberation				x		Required only in classrooms where any interior changes are made to walls.
HVAC Background noise	x		x			Required when HVAC equipment & ductwork and any envelope improvement is within scope. Only impacted classrooms need to comply.
Exterior Source noise			x	x		Required only in classrooms where exterior windows or exterior walls are within the scope of work.
			x	x		*Alternatively use the HPTP to request a mitigation plan compliance pathway.
Energy						
EE.1.0 Energy Performance	x	x	x			Components of ASHRAE 62.1 are triggered by specific scope.
EE.3.0 Commissioning	x	x				
Water						
All prerequisites triggered by scope.						
Site						
SS.1.0 Site Selection					x	US EPA Facility Assessment in School Siting Guidelines.
Materials and Waste Management						
MW 1.0 Storage and Collection of Recyclables			x	x		

INTEGRATION

Integrated Design

Intent *Integrate high performance goals into district planning in early programming and in on-going decision-making to maximize system integration, and the associated efficiencies and cost benefits of high performance schools, as well as identify other sustainable opportunities.*
II 1.0 – Integrated Design
II 1.1 – Enhanced Integrated Design

Integrated design is the consideration and design of all building systems and components together. It brings together the various disciplines involved in designing a building to develop and review their recommendations as a whole. It recognizes that each discipline's recommendations have an impact on other aspects of the building. For example, the HVAC system selection and design should take into consideration the building envelope and other building systems such as lighting and daylighting. A lack of teamwork can result in oversized systems or systems that are optimized for non-typical conditions. Integrated design allows professionals working in various disciplines to take advantage of efficiencies that are not apparent when they work in isolation. The earlier the integration is introduced into the design process the greater the benefit for both new construction and renovation projects.

II 1.0 – Integrated Design		**Prerequisite**	
		4 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	II 1.0.1	Conduct a minimum of two integrated design team workshops that identify the project's high performance goals, ensure the incorporation of all CHPS prerequisites, and target the appropriate CHPS credits and best practices as an ongoing part of programming and design decision making. The outcome shall be a plan of how each prerequisite and credit will be implemented, the person responsible, and a timeline of key deliverables or implementation procedures. The first workshop must take place prior to the end of the schematic design phase. For renovations, the first workshop must take place during the planning phase. The second workshop must occur prior to the beginning of the construction documentation phase. For each workshop, attendees must include representatives of project team members under contract that have responsibility for a CHPS prerequisite or credit, such as: • Owner Representatives Group – Owner's Project Manager, Facilities Maintenance Representative, District or School Capital Project Staff, Utility Representative, and Commissioning Agent • Design Consultants Group – Architect, Interior Designers, Engineers (Mechanical, Electrical, Plumbing and Civil), Food Service, Acoustic and Energy Consultants, Lighting Designer, and Landscape Architect. • Construction Representatives Group – Construction Manager, General Contractor, and Major Subcontractors. • School Occupants Representatives Group – Principal, Teachers, Special Education Representatives, Students, Parents, Operations Staff, and Community Members. • Commissioning Agent – Optional but strongly encouraged participant.
Prerequisite	II 1.0.2	Engage the project's construction team, such as the General Contractor, key mechanical and electrical subcontractors, and/or Prime Contractors depending on the project delivery method, during the design phase, prior to beginning the construction documents. The Contractor shall provide sustainability, constructability, and document coordination reviews. The Contractor may present value engineering options, and schedule and cost data as needed for the Owner and the design team to make fully-informed decisions in the best interest of the project.

II 1.1 – Enhanced Integrated Design		**Credit**	
		2 point	
Applicability	**Verification**		
All projects	Design Review	Construction Review	Performance Review

Requirement

2 points	II 1.1.1	Hold an integrated design workshop late in the design phase (construction documents) to 'quality check' the documents for sustainable features and continued achievability of the earlier identified prerequisites and credits with an emphasis on maintenance and operational aspects of the buildings systems. School staff in charge of HVAC controls, and maintenance, lighting, cleaning, landscaping, recycling, trash collection, lighting, and consumables purchasing are required to attend. Hold an integrated design workshop during the early part of construction, which also includes the general contractor and major subcontractors to convey the integrated design intent, discuss implementation issues and the continued achievability and action items related to earlier identified prerequisites and credits.
OR 2 points	II 1.1.2	Utilize Building Information Modeling (BIM) to create a model of the project including architectural and structural elements, above ceiling coordination, and at least two of the following: plumbing, mechanical and/or electrical design.

Implementation

II 1.0-1.1

Assign a facilitator to oversee the integrated design workshops. The most likely candidates are school project manager or the project's sustainability consultant. While the design architect can be the facilitator, it is recommended that the facilitator not be the lead design architect to minimize him/her acting within dual roles and maximize their open participation as a key member of the project team.

Submit the agenda, attendee list and workshop minutes, for each integrated design workshop. Invitation to the workshops of additional relevant stakeholders is encouraged. These stakeholders may positively contribute to the discussion by providing a unique perspective. This is especially true of those who will be impacted by or responsible for the selected green building strategies long-term. The workshop minutes shall include high performance project goals, implementation procedures, topics needing further investigation or research, and team members responsible for each prerequisite and targeted credit.

Planning documents (e.g. Education Specifications and Owner Project Requirements) and procurement documents (e.g. Requests for Proposals and contracts) should reference project team member participation in these workshops where possible to ensure associated costs are covered for participation and ensure attendance of appropriate consultants is complied with. Participation via telephone or videoconference can assist with minimizing consultant travel expenses.

The CHPS Verified Application Templates and/or Scorecard are efficient tools to record the results. In addition, if time and resources allow, software programs are becoming available that can be used during the workshops to provide immediate feedback on the feasibility of the strategies being considered.

Keep in mind that although a high performance integrated workshop is an important first step in achieving the benefits of high performance schools, a collaborative team process should be carried out through continual interdisciplinary dialogue all the way through the completion of construction and into post-occupancy. In addition, although only two integrated design workshops are required, depending on the district's and team's level of high performance schools knowledge and experience, and/or the complexity of the project, more workshops may be beneficial to ensure optimum results.

It is encouraged, but not required, that additional integrated design and construction workshops are held after construction and post-occupancy, to discuss lessons learned for future projects, and to highlight any pertinent maintenance and operations issues. If in project is located in a seasonal climate, it is suggested that a workshop session be scheduled during both the heating and cooling season.

II 1.1.2

Building Information Modeling (BIM) is the process of using three-dimensional modeling software to generate and mange building design, construction and operations management. The process produces a model that encompasses building geometry, spatial relationships, systems analysis, orientation, geographic information, and quantities and properties of building components. BIM can be used to demonstrate the entire building life cycle, including the processes of construction and facility operation. It is recommended, but not required, that the contractor input as built conditions into the model for facilities operation management.

The following software programs are acceptable to meet this criterion, or a CHPS approved equivalent: Autodesk Revit, Bentley BIM, and Tekla Structures.

Documentation Requirements

Plan Sheet Approach

Design Review Requirements

II 1.0.1 – Construction drawings must incorporate the CHPS Scorecard provided through the CHPS Verified Program. Agenda, attendee list and workshop minutes for each integrated design workshop.

II 1.0.2 – Provide specifications that indicate the required scope of work for all parties. Submit meeting agendas and attendee lists with identifying roles for all four required workshops.

II 1.1.3 –Provide a brief written narrative identifying which model was used and how it impacted the outcome of the design.

Construction Review Requirements

II 1.1.1 – Provide proof of the General Contractors involvement through contract or letter, including commitment and work completed. Submit meeting agendas and attendee lists with identifying roles for all four required workshops.

Submit meeting minutes that outline high performance goals, implementation procedures, topics needing further investigation or research, and a CHPS scorecard with attempted prerequisites and credits with team members responsible for each prerequisite and targeted credit

Resources

- American Institute of Architects (AIA) Center for Practice: https://www.aia.org/resources/192431-center-for-practice
- ANSI/MTS 1.0 Whole Systems Integrated Process Guide (WSIP)-2007 for Sustainable Buildings & Communities©
- The National Institute of Building Science's Whole Building Design Guide (WBDG): www.wbdg.org/
- US Department of Energy Office of Renewable Energy and Energy Efficiency. Integrated Building Design: www.eere.energy.gov/buildings/info/design/integratedbuilding/
- US Department of Energy: Office of Renewable Energy and Energy Efficiency and Renewable Energy High-Performance Buildings Initiative & the National Renewable Energy Laboratory: www.nrel.gov/docs/fy09osti/44051.pdf

District Level Commitment

Intent

Integrate high performance goals into district planning.

II 2.1 – District Level Commitment

School and district leaders who institutionalize high performance programs are not just building better schools; they are protecting student and staff health, improving student performance, and lowering the district's operating expenses. Institutionalizing high performance schools allows districts to leverage suppliers and vendors for products and services that comply with high performance school standards; standardize specifications and building strategies to minimize time and expenses; and maximize the benefits of high performance schools on a district-wide basis.

II 2.1 – District Level Commitment		**Credit**	
		1 point	
Applicability	**Verification**		
All projects	Design Review	Construction Review	Performance Review

Requirement

1 point	II 2.1.1	The District, School Board, Board of Trustees, or other appropriate school leadership must maintain an active, free CHPS Membership and must pass a board or trustee-level resolution that mandates compliance with CHPS and CHPS best practices for the corresponding project type as follows to further formalize district-wide commitment to high performance schools. Meet or exceed the CHPS qualifying threshold using the CHPS Criteria for: • New Schools • Major Renovation projects • Phased Renovation projects in accordance with a High Performance Transition Plan (II 4.1) • New Buildings on an Existing Campus • Additions to an Existing Building • Prefabricated Classrooms
OR 1 point	II 2.1.2	The District, School Board, Board of Trustees, or other appropriate school leadership must pass a board or trustee-level resolution that mandates annual monitoring and benchmarking of building performance district-wide.

Implementation

The district must be a CHPS Member and maintain membership by submitting an annual report to CHPS in a format to be provided. Upon passing a high performance resolution, the board or trustee level resolution (or other appropriate governing authority) must be submitted and approved by CHPS. The submitted authority's governing relationship to the project in question should be demonstrated and explained as part of the submittal documentation.

CHPS School Members receive membership benefits from CHPS for free and agree to annual reporting requirements on how they are meeting their commitment. The CHPS website has additional membership information, a sample board or trustee level resolutions, and other resources.

Where applicable, state or jurisdiction (county, city or district in the case of the District of Columbia) green / high performance building legislation requiring CHPS compliance (or CHPS as an equivalent rating system to LEED where specifically legislated) for all school facility projects may accompany local board or trustee-level resolutions as additional evidence of formalized commitment.

Benchmarking and monitoring over time are excellent ways to assess the performance of school buildings and to guide the continuous high performance of the buildings. The resolution should state a commitment to conduct benchmarking using any of the tools identified in NE-CHPS OM 3.0 on an annual basis. For non-public schools, a letter of commitment from the administration or a policy adopted by the governing board are acceptable. An equivalent form of commitment is acceptable.

Documentation Requirements

Design Review Requirements

Provide a PDF of approved Governing Board-Level Resolution(s). (Provide only if the resolution is not already on file with CHPS. Resolutions on file with CHPS are listed at https://chps.net/school-district-resolutions.

Provide a PDF of Board-Level Resolution. (Provide only if the resolution is not already on file with CHPS. Resolutions on file with CHPS are listed at www.chps.net)

Resources

- CHPS sample resolutions: https://chps.net/school-district-resolutions
- CHPS School Membership Program: https://chps.net/join-us
- CHPS PreFAB Program for pre-approval of prefabricated, modular and relocatable classroom models: https://chps.net/chps-prefab
- CHPS High Performance Product Database, which includes a category of CHPS PreFAB pre-approved classroom models: www.chps.net/products

School Master Plan

Intent
Ensure high performance school priorities are carried out throughout the life of the school.
II 3.1 – School Master Plan

While a school is being designed or renovated it is important to consider the needs the school may have in the future, and how those needs may be met while keeping high performance principles in mind. It is also important to have a master plan in place to ensure that the intent of the design or renovation is carried out when the school is renovated and maintained in its future.

II 3.1 – School Master Plan		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	II 3.1.1	Develop a School Master Plan for the site and facilities of an individual school in collaboration with school board members and community stakeholders that: • Supports the continued compliance with high performance strategies followed in these Criteria. • Assess and plan for future transportation impacts on the school and flexibility for addition of alternative forms of transportation. • Assess and plan for the possibility of increased and decreased student enrollment. • Assess using the school for emergency preparedness such as a shelter. • Assess and plan for future high performance upgrades and renovations by documenting the life expectancy of major systems and materials, and documenting opportunities for high performance replacement such as reuse or recycle. • Identifies current and future opportunities for pedestrian and bike connections to surrounding neighborhoods, community services and bike paths.

Implementation

The School Master Plan should cover 10 to 15 years from the school opening or a major renovation being completed. Some school districts may already have a master plan, so a new plan may not be needed. The existing plan can be reviewed for compliance with the above requirements.

This point for a School Master Plan applies to new schools, new buildings on an existing campus, and major renovation projects if the School Master Plan is developed for the entire school site, not just the portion of the school being renovated or built.

Documentation Requirements

Design Review Requirements

Submit School Master Plan

Resources

- A4LE, *Creating Connections: The CEFPI Guide for Educational Facility Planning*, available for purchase: http://creatingconnections.a4le.org/

High Performance Transition Plan

Intent

Ensure that existing schools that are modernized incrementally and often face special circumstances have the opportunity to achieve high performance over time and be recognized by CHPS.

II.4.1 – High Performance Transition Plan

When an existing school is being modernized / renovated in whole or in part it is important to consider the needs the school may have in the future, and how those needs may be met while keeping high performance principles in mind. A High Perfromance Transition Plan may be used, as an abbreviated way, to address phased renovations and its possible effect on the overall campus. These are projects that incrementatlly renovate schools over time with the final result achieving CHPS recognition.

II.4.1 – High Performance Transition Plan		**Credit**	
		1 point	
Applicability	**Verification**		
Renovation projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	II.4.1	For Phased Renovation projects that are unable in the first phase of work to achieve all the prerequisites but will meet CHPS criteria in an incremental fashion, develop a High Performance Transition Plan (HPTP) See appropriate state addendum for additional reporting requirements.

Implementation

The High Performance Transition Plan (HPTP) is intended for existing schools and can be used in addition to a School Master Plan. It could be used multiple times on a school campus for specific projects. With the understanding that renovation projects will range from relatively minor, phased projects to large-scale improvements that transform a campus, the possibility for a specific project to address all aspects of the CHPS Criteria will often be limited. The term ‘phased renovation’ reflects discrete projects of limited scope which occur over a longer period of time but which are still considered to be on the ‘Pathway to CHPS’. These Phased Renovations are in contrast to large scale Major Renovations that are completed as a singular project within a discrete period of time which are transformational for the school and typically can meet CHPS requirements.

As a result of these project type differences, the CHPS provides this path for incremental improvements to be recognized.

The High Performance Transition Plan serves as a preliminary assessment of existing conditions undergoing renovation and will identify the opportunities for achieving specific points within the CHPS scorecard over a projected period of time. The High Performance Transition Plan would identify ‘deferred’ credits that cannot be completed within a particular “phased” project due to the prioritization or sequencing of the work. In addition, the High Performance Transition Plan would identify those prerequisites that can never be met due to the existing conditions of the school. For such constraints, an alternative improvement or mitigation must be identified which can serve to offset the pre-requisite(s) that cannot be achieved.

With consideration of financial constraints, the preparation of the High Performance Transition Plan is intended as an exercise that can be achieved without significant burden to the program budget. The High Performance Transition Plan will serve as a cohesive guide from which subsequent projects will be defined. As a phase of work is completed, notify CHPS of the credits achieved for proper record keeping and acknowledgement.

The High Performance Transition Plan should include the following components:

- Evaluate existing campus building stock related to this project to identify elements with sustainable opportunities (‘good bones’) and those that are problematic.
- Establish the priorities and goals for each prerequisite and credit to be pursued in the CHPS Criteria.
- Develop a sequencing schedule for the credits to be pursued for the project. Specific calendar milestones are not required.
- Develop a rough order of magnitude budget model.
- Establish the existing baseline performance and energy benchmarking of the project area prior to the renovation. This baseline may be established by conducting the appropriate sections of the Operations Report Card (also see OM 3.0 and OM 4.1).
- Outline a plan to address how deferred prerequisites will be met in subsequent phases of work. Establish a time limit, e.g. 3-5 years.

Prepare a summary report which includes a written narrative of the high performance goals for the campus, a completed CHPS scorecard, a site plan annotating the improvements to be addressed with the baseline conditions noted, a schedule for implementation and a rough order of magnitude budget model.

See also the appropriate state addendum for additional reporting requirements. Not all states may have additional requirements.

Documentation Requirements

Design Review Requirements

Submit a copy of the High Performance Transition Plan and a copy of a CHPS scorecard indicating which prerequisites and credits have been previously met and which are to be targeted in the scope of the current phased project.

The summary report shall include a written narrative of the high performance goals for the campus, a completed CHPS Criteria scorecard, a site plan annotating the improvements to be addressed with the baseline conditions noted, a schedule for implementation and a rough order of magnitude budget model.

Resources

- A4LE, *Creating Connections: The CEFPI Guide for Educational Facility Planning*, available for purchase: http://creatingconnections.a4le.org/

Educational Display

Intent *Raise the community's knowledge about the basics and benefits of high performance schools.*
II 5.0 – Educational Display
II 5.1 – Demonstration Area

Using the school as a learning tool, students, staff, and the community can benefit by having an educational display to illustrate the healthy, efficient, environmentally sustainable features of the school.

The educational display may have further connections in II 6.1 – Educational Integration.

II 5.0 – Educational Display		**Prerequisite**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	II 5.0	Provide a permanent display on the school site that describes the high performance features that are part of the school's design.

II 5.1 – Demonstration Area		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	II 5.1	Create demonstration areas for three of the five major high performance categories of the Criteria: Indoor Environmental Quality, Energy, Water, Site, and Materials and Waste Management. Within these demonstration sites at least one feature of a high performance category must be showcased. Each demonstration area must explain how the high performance features work, its environmental and economic benefits, and how it exemplifies a holistic and integrated approach to sustainable design.

Implementation

II 5.0

Provide a labeled plan showing the location of the display. The permanent educational display must be located in a prominent location at the school, such as in the main entry lobby. The display shall include a list of all CHPS high performance features with a statement of the intent and an explanation of each feature. Visual aids or drawings can be used to illustrate features as needed. Include a map of the school and grounds pointing to location(s) where demonstration areas of the sustainable features can be seen.

The display may be electronic and interactive, but must be physically present at the school site and dedicated for this purpose. It may not be a virtual display only accessible via computer, unless that computer is permanently located as described above. It is recommended that it is designed so that it can be updated periodically.

Schools are encouraged, but not required, to use the Educational Display in conjunction with plans made for credit II 6.1 – Educational Integration.

II5.1

Create demonstration areas for three out of the five major high performance categories in CHPS Criteria. A comprehensive, interactive kiosk in the lobby is a great resource, but it may serve as only one of the three required demonstration areas. Each demonstration area will showcase a minimum of one feature included in a high performance category. This feature will have been utilized in the design of the new school, new building, or renovation project. The design of the demonstration areas may include, but are not limited to, signage, kiosks, cut-always, meters, graphic illustrations, artistic murals, videos, real-time displays, or other design elements. For example, a demonstration area could be a meter of resource flows/usage, or a visual display of electrical generation provided by the photovoltaic. The display may be electronic and interactive, but must be physically present at the school site and dedicated for this function. It may not be a virtual display only accessible via computer, unless that computer is permanently located as described above.

When choosing materials or media to portray a high performance feature, ensure that they align with the other intents of a high performance school. For example, a kiosk made out of on-site recycled materials, or an electronic display labeled by ENERGY STAR®.

Documentation Requirements

II 5.0 Design Review Requirements

Construction drawings must include the location and details of display, describing all main high performance features, as well as materials specifications of any permanent display.

II 5.0 Construction Review Requirements

Submit at least two, and up to six photos of the installed educational display. At least one photo must show the context/location of the display, and at least one photo must show readable details of the content of the display.

II 5.1 Design Review Requirements

Submit construction documents that include the prominent location of and details of each of the three demonstration areas, and actual content of any signage, describing how the high performance features work, the environmental and economic benefits, and how it exemplifies a holistic and integrated approach to sustainable design, as well as materials specifications of each of the demonstration areas/displays.

II 5.1 Construction Review Requirements

Submit two or three photos of each of the installed demonstration areas with a brief description of each. One of the two required minimum photos must show the Demonstration Area in context, and the other required photo must be a close-up and /or show readable detail of any signage. Thus a total of 6 minimum, and up to 9 photos should be submitted. Explain any changes from the Design Review submittals of this credit.

Resources

- Minnesota Department of Natural Resources, Environmental Education Events: https://www.dnr.state.mn.us/events/environmental-education-events.html
- North American Association For Environmental Education, Guidelines for Excellence: Best Practice in Environmental Education:https://naaee.org/our-work/programs/guidelines-excellence

Educational Integration

Intent
Use the school as a learning tool by connecting the concepts of high performance design with a hands-on curriculum.
II 6.1 – Educational Integration

Using the school as a learning tool, students gain knowledge in concepts of high performance design including indoor environmental quality, energy efficiency, water conservation, materials and waste management, sustainable sites, and operational policies through hands-on science, technology, engineering and math (STEM) curriculum.

II 6.1 – Educational Integration		**Credit**	
		2 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	II 6.1.1	Present an educational plan and letter of commitment from the District, School Board, Board of Trustees, or other appropriate school leadership stating that the sustainability education will occur on yearly basis. The educational program should consist of 2 primary components: • Science, technology, engineering, or math (STEM) hands-on learning (at least 15 students engaged in minimum of 10 classroom hours of curriculum) that explores high performance design features. This core group of learners, or CHPS Champions, will be responsible for educational outreach within their school community. • Educational outreach efforts to share the CHPS high performance design with the school community.
	II 6.1.2	Identify the CHPS Champions (at least 15 students) and support staff (at least 2). CHPS champions will engage in at least 10 classroom hours of curriculum to explore the high performance design features. At least one of four high performance areas must be covered.
	II 6.1.3	Educate entire student community (100% of student population) on high performance design. Each student should be exposed to at least one design feature, exposing them to level appropriate learning-outcome relevant information.
	II 6.1.4	Educational integration should incorporate the educational display and/or demonstration areas.

Implementation

Educational integration considers people, curriculum, educational outreach, and documentation.

Personnel

- Identify the CHPS Champions group. The group size can range from whole school population to a small cluster, with a minimum number of 15 students. It could be a classroom, grade level, after school club or student government or even the entire school. If the group is more than 4 classrooms, the project may claim one innovation point via II 9.1.
- Create a support team on the side of educators and staff (minimal of 2 people). The support staff should have at least one educator. It is preferred, but not required that facilities staff is involved in technical support of the curriculum.
- Together, the CHPS Champions and the support staff will be responsible for the educating the entire school community (100% of student population).

Curriculum

- Review mission of CHPS and all features of high performance design. It is encouraged that demonstration areas are incorporated in the overview (See Demonstration Areas criterion).

- Select or design age-appropriate standards-based curriculum covering at least one of four high performance design topics (See resources). Ensure students engage for a minimum of 10 classroom hours, which can include classroom instruction, educational event, homework or a site visit.

Educational Outreach

- Each student at a school site will learn about high performance design schools and how it benefits the school community from the social, economic and performance perspectives. At least one academic hour should be spent on this. The CHPS Champions can creatively come up with the educational strategy that can range from an educational assembly to publication of educational materials that includes a discussion. (See resources).

Documentation Requirements

Construction Review

Present an educational plan and letter of commitment, or Board Resolution if appropriate, from the Governing Board stating that the sustainability education will occur on a yearly basis.

Submit any curriculum outlines, preliminary lesson plans, or project-based learning activities to be utilized in conjunction with high performance school features. Include a narrative of the District or School's intent to implement this educational integration with a proposed typical timeline and identification of the CHPS Champion and any educators or staff involved.

Performance Review

Provide 4-6 photographs of educational display and demonstration areas showing CHPS Champion and/or teacher engaging with students.

Resources

- Minnesota Department of Natural Resources, Environmental Education Events: https://www.dnr.state.mn.us/events/environmental-education-events.html

North American Association For Environmental Education, Guidelines for Excellence: Best Practice in Environmental Education:https://naaee.org/our-work/programs/guidelines-excellence

Design for Adaptation

Intent

Encourage building design practices that assess climate change vulnerability and that plan for changing climatic conditions over the building lifespan, in order to avoid excessive energy costs, repair costs, carbon emissions, and liability risks; while preserving access to safe water, sanitation, life safety, and minimizing health and student performance impacts. This approach of planning now for **future** changing conditions and disruptive events, particularly when combined with related CHPS Criteria, can allow schools to serve as sustainable centers of community resilience.

II7.1 – Design for Adaptation & Resilience

A well maintained building designed today should last 60-100 years, at least in terms of its building shell and foundation. High performance school facilities may perform well on paper, but the design is often based on outdated climate data that does not reflect changes in weather data, let alone future changes in climate. Changing climate is already contributing to increased overheating and other weather-related hazards at schools, and is expected to worsen through this century and beyond. Due diligence should be taken to assess and mitigate the vulnerability of school facilities to climate change.

Building designers around the world have been designing buildings in recent years to perform well under future climate conditions and during power outages. This life cycle approach will increase the long-term durability and performance of buildings, and help avoid unnecessary and perhaps catastrophic impacts on facilities and their occupants. It will also help state-level adaptation, mitigation and resilience planning in meeting goals for energy efficiency, emergency disaster planning, and GHG reductions in their schools, despite a changing climate.

II 7.1 – Design for Adaptation		**Credit**	
		3 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	II 7.1.1	Climate Vulnerability Assessment If no recent climate risk assessment exists for the site, conduct an assessment of the location's vulnerability to significant weather events. Assume at least 60-100 years of service life for the building shell, foundation, and other major structural components. Use the most recent and most localized (local, regional, and/or state, and/or national) climate change vulnerability assessments, maps, and/or adaptation plans to assess the magnitude and likelihood of climate change hazards at the school site and district wide, if applicable. Consider potential hazards such as power outages, winter storms, sea level rise, extreme heat events/overheating, episodic flooding or storm surge, extreme drought/water shortage, air pollution, extreme wind, wildfires, and tornadoes, State and federal (USGCRP, EPA, NOAA, or DOE) online resources, databases, or tools may be utilized, if no local climate risk assessments have been done recently. Identify the top one to two hazards from the vulnerability assessment above based on the likelihood and potential magnitude of impacts on human health and safety and on economic impacts. For the top hazard(s), identify potential actions, design strategies, and opportunities to adapt the school building project, site, and district design standards (if applicable), operational policies, and school site activities and address future emergency events and climate conditions. Outreach and partnering with the local community, state, and regional agencies is highly recommended.
1 point	II 7.1.2	Design for Climate Adaptation For the top hazards identified above, incorporate all feasible adaptation measures in the project design. Assess the feasibility, scheduling, and cost-effectiveness of the measures. Evaluate the potential benefits in terms of energy, water, and cost savings, disruption of service and other cost avoidance, improved staff and student performance, health, and safety, and reduced liability. Seek to identify and leverage other community benefits, both short and long term. If integration of climate adaptation measures is not feasible under the current project budget or other constraints, provide the school administration with a recommendation for how to assess and implement the measures in the future, such as by designing and preparing construction alternates. Phasing the measures in over time is allowed if necessary, but plan for any necessary infrastructure or preparations in the initial construction phase, e.g., brackets for external shades, substructure for green roofs, and electrical transformer/panel/wiring for more electrification, PV panels, internet of things, EV charging, and microgrids. These recommendations can be used in the plan in II C3.1 School Master Plan.

1 point	II 7.1.3	Passive Habitability/Survivability If/when the school/district establishes readiness for emergencies by working with the Red Cross or other local lead agency, then comply with the criteria below. It is not required that the school achieve formal designation as an emergency shelter. ○ Using dynamic thermal modeling such as EnergyPlus or Passive House certification, design and construct the facility, first maximizing energy efficiency and passive strategies, with 100% renewable energy systems including energy storage that can safely support the maximum occupancy for a 4-day power outage, at minimum. ○ Meet the energy storage/backup power criterion in 7.1.3 to cover critical services such as access to sanitation facilities, potable water, refrigeration of medicines and food, cooking, charging of cell phones and other essential communication and electronic devices, shade/cooling and fresh air/exhaust fans, and perhaps portable air cleaners, as well as others identified in the vulnerability assessment above. ○ Take additional measures as needed if the quality of potable water may also be affected, such as having backup filtration or a backup source. Coordinate with lead public agencies and plan with local community around other needs such as food supplies. ○ Include details on all passive features in the O&M Manual in OM P1.0 and in the Systems Maintenance Plan in OM C4.1. Provide a brief User's Guide to designated emergency personnel on the operation of the features.

Implementation

For additions and major modernizations/renovations, the credit is based on the whole building. While portions of buildings can meaningfully pursue energy resiliency, the intent of this criterion is to achieve resiliency for the whole building.

For Vulnerability Assessment II 7.1.1

Research and/or contact regional, state, or federal programs and green building programs for the latest climate change modeling results, future weather files, local or regional climate vulnerability assessments or online resources (see CHPS Resources below) with data that may already be analyzed and applicable to your project as well as examples and case studies of future climate adaptation. A growing number of state and regional agencies have researched and published useful reports, online tools, or guidance on vulnerabilities, climate assessments, and adaptation and mitigation resources. Please refer to latest versions of these documents pertinent to your project locale first.

Method for Conducting Overheating Analysis:

Estimate mid- and late-century climate conditions for the site(s). Use the High Emission Scenarios in the climate models (e.g., RCP 8.5 or A2 scenarios) and 90th percentile or higher estimates of impacts. Climate projections should use 20- year averages if possible. Use the most spatially resolved climate predictions available for the project site.

For modeling energy and thermal comfort performance, two alternate approaches are available:

1) Use TMY weather files from a city with a current climate similar to that predicted for future conditions at the site (the "climate analog city" approach"), as characterized by Cooling and Heating Degree Days, Max and Min temperatures, and humidity. If local or regional climate model results are not available for the site, use the Climate Central website to identify a "climate analog city". Current weather files for major cities in the U.S. are available at the Energy Plus website.

2) Use future weather files with hourly data that are adjusted ("morphed") to reflect projected climate changes. These files are available commercially, e.g.: http://www.weather-shift.com/. They can also be created at no cost using the online CC WorldWeatherGen tool. In addition, consider the incremental effects of urban heat islands (UHI); consult local and regional groups for mapping and estimates of UHI impacts.

For prioritizing the hazards and identifying potential adaptation measures, consider the most recent federal, state, and local plans for climate adaptation and resilience or climate change modeling results. Some of these sources may be outdated or limited in analysis, but they are good starting points.

For Design for Adaptation II 7.1.2

Give preference to measures that have been tested or modeled for their effectiveness in the type of climate and region for the project. Consider case studies as well.

Facility Planning

Identify future building and modernization projects where adaptation and resilience measures could be incorporated and provide these recommendations to the school administration. This step can be used toward credit in II C3.1 School Master Plan.

For Passive House/Survivability II 7.1.3

Utilizing the approach for identifying and designing for primary and secondary systems in 11.1.3 Energy Resiliency, identify a facility or portion thereof, that can provide emergency shelter for a large number of students and adults. Model the thermal comfort performance of the designated space at full occupancy during a 4-day power outage. Use the worst recorded weather episodes for heat waves and cold waves; for heat waves, also select those that have the highest nighttime temperature. Estimate the time until the facility goes outside the Standard Effective Temperature (SET) target range of 54 - 86°F, and the number and percent of total hours it would be outside the target ranges.

Create a brief classroom User's Guide for teachers and administrative staff. This guide shall explain policies and procedures for ensuring human safety during heat waves, cold spells, power outages, and other weather related hazards. Guidance should include warning and actions levels, and when and how to evacuate the building or move to a "cool room" or other shelter in place. Incorporate the use of the OSHA-NIOSH Heat Safety Tool app (https://www.cdc.gov/niosh/topics/heatstress/heatapp.html) for obtaining real-time, hourly forecasts of the local outdoor Heat Index.

Coordinate with school community/parents, local health and safety officials on the location and capacity of cool rooms and/or emergency shelters in the district, FEMA, the Red Cross, and other relevant agencies.

Documentation Requirements

Design Review

For II.7.1.1:

Provide a short narrative that cites the outside assessment used, if any, or describes the approach taken and includes top hazards and the rationale for selecting them.

For II.7.1.2:

Provide a short narrative of all feasible adaption measures that will be included in the project design and construction. The zero energy requirement will be fulfilled under EE 2.1.

Or, if the adaptation will occur in the future, provide a copy of the recommendations to the administration and a description of features included in the current design.

For II.7.1.3:

Identify the shelter space(s) on the CDs. Provide a description of the features that provide habitability.

Construction Review

For II 7.1.2—3: Provide a signed letter of confirmation from the primary architect, engineer, or commissioning agent that systems and any passive features have been installed as designed.

Documentation for OM 1.0 and EQ 5.1 will cover the training and manuals.

Resources

- Clean Air – Cool Planet Campus Carbon Calculator: https://cleanenergysolutions.org/es/resources/clean-air-cool-planet-ca-cp-campus-carbon-calculator
- The Climate Action Registry: www.theclimateregistry.org/
- ARCC Network (Adaptation and Resilience to Climate Change Network). Extremes and other Project types. U.K. Climate Impacts Programme. Tools; demonstration and research projects http://www.arcc-network.org.uk/extremes/overheating/. See Overheating and Flooding topics.
- Houghton et al., 2017. Design Strategies and Community Resilience to Urban Flooding: A Systematic Review of the Evidence. Int J Environ Res Public Health. 2017 Dec; 14(12): 1519. DOI: 10.3390/ijerph14121519.

- ICLEI, 2012. ICLEI's Adaptation Work: Local and Global Resources. http://resilient-cities.iclei.org/resilient-cities-hub-site/resilience-resource-point/resilience-library/methodologies-and-tools/
- Imhoff et al., 2010. Remote sensing of the urban heat island effect across biomes in the continental USA. Remote Sensing of Environment, Volume 114, Issue 3, Pages 504-513. https://www.sciencedirect.com/science/article/pii/S0034425709003174.
- New York City, April 2017. Preliminary Climate Resiliency Design Guidelines. OneNYC Initiative, Mayor's Office of Recovery and Resiliency, New York, NY. http://www1.nyc.gov/office-of-the-mayor/news/271-17/mayor-new-resiliency-guidelines-prepare-city-s-infrastructure-buildings-for.

Safer Schools By Design

Intent

Ensure school grounds, buildings, and interiors incorporate proven design strategies that foster a sense of safety, community, and connectedness to improve the quality of the life for students.

II 8.0 – Safer schools By Design

The design of learning environments can dramatically affect behavior, feelings, and attitudes towards one another. While schools in the United States remain relatively safe,it is imperative to increase feelings of safety and reduce opportunities for violence. Crime Prevention Through Environmental Design (CPTED) principles focus on reducing crime opportunities and on promoting positive social behavior. The International CPTED Association created this standard to reduce crime opportunities through thoughtful design. The CPTED Principles are:

- Natural surveillance – Integrate themes of openness and transparency for all to see and be seen.
- Natural access control – Direct the flow of people towards entrances that are most visible.
- Territorial reinforcement – Create a sense of place and ownership to deter crime.
- Maintenance and management – Well-maintained spaces feel safer and are proven to deter crime.

There are strong overlaps and synergies among the four CPTED principles. In practice, it may be useful to recognize that the principles can meet other design goals as well, like Responsive design (US-CHPS II 10.1 Biophilic and Responsive Design). The implementation of should create a warm and welcoming environment, foster a sense of physical and social order, increase a sense of place, and provide more opportunities for natural surveillance.

To incorporate CPTED Principles effectively, schools must involve those responsible for design, use, and maintenance. Key stakeholders include school officials, teachers, designers, and local emergency response agencies. The most effective CPTED strategies are those that improve the quality of the learning environment and that bring communities closer. This is in contrast to implementing visually affronting security or target hardening measures such as armed security patrols or razor wire fences. Some effective CPTED strategies include:

- Increasing visibility between interior rooms and circulation spaces
- Adequate site lighting at drop-off/pick-up areas, trash enclosure, and along pedestrian paths
- Directing the flow of people toward proper and visible entrances

- Eliminating unnecessary doors or gates such as at restrooms
- Promote land use mix to encourage activities during critical time periods
- Create a sense of ownership through design, maintenance, and management

II 8.0 – Safer Schools By Design		**Prerequisite**	
		3 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	II 8.0.1	Conduct a CPTED workshop with key project stakeholders and a CPTED professional at the beginning of, or before, schematic design to identify site, building and interior issues, and define strategies aligned with CPTED principles for addressing them in a CPTED Plan. Key project stakeholders must include representatives of the designers, users, students, community members, and emergency responders.
	II 8.0.2	The CPTED Plan must articulate strategies categorized by CPTED Principle.
	II 8.0.3	The design team must incorporate these strategies in the project design. The CPTED professional shall review the design prior to construction and provide comments as necessary to align the design with CPTED Principles.

Implementation

The CPTED Plan will be provided to the CHPS review team, along with the review comments that align the originally proposed strategies with the actual design response.

CPTED professionals may be certified by a national or regional authority. Local law enforcement personnel also qualify as CPTED professionals for the intent of this criteria.

Documentation Requirements

Design Review

Submit a copy of the CPTED Plan to the CHPS review team, along with the review comments that align the originally proposed strategies with the actual design response. Reference construction documents that indicate the incorporation of the CPTED principles. Include the agenda, minutes, and list of attendees from the CPTED workshop. Also include credentials of the CPTED professional who participated in the workshop.

Construction Review

Provide a letter from the CPTED professional indicating that the project as built complies with the CPTED plan. Any deviations from the original plan shall be justified.

Resources

- A4LE Safe Schools Planning Guide: https://www.a4le.org/pdf/knowledgecenter/SchoolSafetyGuide.pdf?hkey=8cc99e62-7d45-4db6-9cce-f6e1f5015a6f
- Department of Health and Human Services, Centers for Disease Control and Prevention, Youth Risk Behavioral Surveillance, 2007: www.cdc.gov/mmwr/PDF/SS/SS5505.pdf
- Sandy Hook Elementary School was rebuilt after the shooting – and it hides high security in beautiful design: https://www.businessinsider.com/new-sandy-hook-elementary-design-2016-8
- International CPTED Association: www.cpted.net/
- National Crime Prevention Council of Singapore, Crime Prevention Through Environmental Design Guidebook, 2003: www.ncpc.gov.sg/pdf/CPTED%20Guidebook.pdf

Innovation

Intent
Test, understand and implement innovative approaches to improving the health of school occupants and the performance of school facilities.
II 9.1– Innovation

The purpose of this criterion is to encourage school project teams to be creative and to take advantage of and/or test new technologies or strategies for improving the health and performance of students, schools and the environment. The innovation may take an existing CHPS criterion to a new height, or take a direction not offered by the CHPS Criteria.

II 9.1 – Innovation		**Credit**	
		4 points	
Applicability	**Verification**		
All CHPS Verified projects.	Design Review	Construction Review	Performance Review

Requirement

4 points	II 9.1	Implement new technologies or strategies that does at least one of the following not currently offered in the CHPS rating program: • Improves the health and performance of students and staff. • Improves the performance and efficiency of school facilities, or operation of those facilities. • Improves the natural environment. **OR** The innovation points can reward exceptional performance in an existing criterion area through submission of a narrative explaining how the intent was exceeded by a significant amount.

Implementation

The point value of the criterion will be determined during the CHPS Verified review process by the CHPS Verified review team. A maximum of 2 points will be awarded per strategy, technology, or for exceptional performance beyond an existing threshold. Points will be awarded based on the technology or strategy's ability to:

- Improve the health and performance of students and staff.
- Improve the performance and efficiency of school facilities, or operation of those facilities.
- Improve the natural environment.

The CHPS Criteria are designed to be a comprehensive guide to high performance design, but as new technologies and creative designs evolve, there is a responsibility to support and encourage them. These points are also offered for communities that go beyond what is required by the Criteria and push to achieve exceptional performance, health, educational and environmental benefits, place-based novel solutions, and excellent policies.

As innovation points are achieved by projects, they will be made publicly available on the CHPS website.

Ideas for innovation points are listed below:

- Producing a surplus of energy on a net annualized basis, which exceeds Zero Net Energy School per EE 2.1
- Implementing a recycling program where there is no existing infrastructure per MW 1.0
- Divert construction and demolition waste per MW 2.1 at a 90% rate for 1 point and 95% rate for 2 points.
- During the construction phase, pledge to apply dust suppression controls, restrict idling, and reduce exhaust emissions according to the Green During Construction Indoor Air Quality Pledge, available at: http://www.coshnetwork.org/node/223
- Provide a published Health Product Declaration (HPD) with a disclosure level of 1,000 ppm for at least 40 permanently installed products from at least five manufacturers in accordance with MW 10.1 for 1 point.
- Establish an alternative fuel demonstration project involving at least one bus and public outreach for one point, or utilize alternative fuel vehicles for 20% of the bus fleet or 50% of the maintenance fleet for two points. Alternative fuels include compressed natural gas, biodiesel, or hybrid electric-diesel.
- Install water bottle filling stations in accordance with the following: (1) At least one bottle filling station per 100 students; (2) At least one bottle filling station on each floor, wing or other building section of a school building; and (3) One bottle filling station in all school food service areas. See https://www.yourethecure.org/water-access/ for more information.
- Create a more expansive education initiative per II 6.1 for 1 point.

For each new credit attempted: 1) define the credit and its purpose; 2) describe the proposed criteria for compliance including any applicable standards; 3) identify documentation requirements that verify compliance with the proposed credit; 4) submit a narrative describing how the credit reflects environmental health, sustainability, and safety practices, and 5) submit documentation identified in 3).

OR

If the Innovation point is for exceptional performance in an existing criterion area, then submit a narrative of the design approach, including an explanation of how the original intent was exceeded by a significant amount.

Documentation Requirements

Design Review

For each new credit attempted: 1) define the credit and its purpose; 2) describe the proposed criteria for compliance including any applicable standards; 3) identify documentation requirements that verify compliance with the proposed credit; 4) submit a narrative describing how the credit reflects sustainable or environmental health and safety practices, and 5) submit documentation identified in 3).

For claiming credit for exceptional performance in an existing credit area, submit a narrative of the design approach, including an explanation of how the original credit was exceeded by a significant amount.

Construction Review

Varies depending on innovations.

Resources

- CHPS Innovation Library: www.chps.net

Biophilic & Responsive Design

Intent
To contribute to occupant health and wellness by providing an experience that is grounded in place, connected to nature, and promotes a sense of calmness and well-being.
II 10.1 – Biophilic & Responsive Design

As we spend increasing amounts of time inside, we create a disconnect between our day to day experiences and the natural world. Biophilic design aims to recreate that connection to nature by activating the senses with natural elements or mimics of natural systems, such as daylight, natural patterns, fresh air, moving water, and plant life.

Biophilic design principles are organized into three categories: nature in the space, nature of the space, and natural analogues. Nature in the space is the direct presence of nature. Nature of the space is about mimicking or replicating the feelings that natural spaces give us. Natural analogues use indirect methods to reflect nature, such as the use of patterns, shapes, textures, and numerical arrangements found in nature. The key to biophilic design principles is to integrate these forms in a way that feels natural.

Responsive design is the term we use to encompass design features that create safe and calming spaces, contribute to a sense of community, and allow for students of all abilities, backgrounds, and perspectives to learn together. Responsive design features support equitable education by making all children feel safe, welcome, and engaged.

Contact with nature and feeling connected is essential to the human experience. Schools should be designed and planned in ways that connect us with nature and with each other, something that we know produces numerous benefits including improved focus, awareness, social interactions, sense of wellbeing, and reduced absenteeism.

II 10.1 – Biophilic & Responsive Design		**Credit**	
		3 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	II 10.1.1	Biophilic Design Incorporate a minimum of six biophilic features, with at least two elements in each of the three categories: Nature in the Space (physically experiencing nature), Nature of the Space (spatial configurations), Natural Analogues (nature-inspired elements).
1 point	II 10.1.2	Responsive Design Provide a minimum of two interior or exterior features that create safe and calming spaces, provide sensory input, or contribute to a sense of community. Features may include the sites' cultural, spiritual, archeological, or architectural history.
1 point	II 10.1.3	Educational Materials Provide educational materials for students and teachers that document the successful biophilic and responsive design strategies in II 10.1 or II 10.1.1. These could include but not be limited to signage indicating the benefits of a biophilic element, or a user guide highlighting the biophilic patterns included in the building, or a curriculum that further explores a responsive feature.

Implementation

Conduct an integrated biophilic and responsive design charrette with key stakeholders early in the design process. Identify opportunities to incorporate features into the project that respond to Biophilic and Responsive Design principles. Teams may target either Biophilic or Responsive Design, or both.

Biophilic features bring nature into the space, replicate the feelings that natural spaces give us, and use materials, elements and symmetries that reflect and remind us of nature.

Responsive features may be targeted to classrooms or grade levels and may vary throughout the building.

Employ targeted engagement tools such as:

- Develop narratives describing strategies available for incorporation.
- Engage the greater community in the responsiveness conversation.
- Document building user group ideas.
- Draft building and site drawings highlighting spaces available and installation locations.
- Solicit ideas for curriculum integration and grade appropriate project-based learning assignments.

- Consider signage around the building that discusses the biophilic or responsive elements and why they are important. This tool can be counted towards one of the Demonstration Areas in II 5.1 Demonstration Area.

Successfully implement biophilic design strategies from the charrette and upload the project data to the ILFI Biophilic Design Initiative Design Map.

For 1 additional point:

Provide educational materials for students and teachers that document the successful biophilic design strategies, such as:

- Signage indicating the benefits of a biophilic element
- User guide highlighting the biophilic patterns included in the building
- Curriculum that further explores a responsive feature.

Documentation Requirements

Design Review Requirements

II 10.1 Submit a written narrative describing the biophilic design strategies employed, educational materials created, and a site drawing with key areas highlighted, as described above.

II 10.1.1 Biophilic Design

Provide the list of proposed and selected strategies generated from the integrated design charette. Identify within the project specifications or the construction drawings the six features that have been incorporated into the project.

II 10.1.2 Responsive Design

Provide a written explanation of the features that have been included in the design and how these features serve as calming spaces, provide sensory input, or create a sense of community.

II 10.1.3 Educational Curriculum Integration

Provide a written statement from the district or school administration reflecting their commitment to incorporate the concepts of biophilic and responsive design into the educational curriculum, including how that will be achieved

Resources

- International Living Future Initiative, Biophilic Design Initiative: https://living-future.org/biophilic-design/
- Biophilic Design: The Theory, Science and Practice of Brining Buildings to Life: https://www.wiley.com/en-us/Biophilic+Design%3A+The+Theory%2C+Science+and+Practice+of+Bringing+Buildings+to+Life-p-9780470163344
- 14 Patterns of Biophilic Design, Improving Health & Well-Being in the Built Environment: https://www.terrapinbrightgreen.com/report/14-patterns/
- AIA-funded study led by Craig Gaulden Davis Architects: https://cgdarch.com/wp-content/uploads/2019/12/The-Impact-of-Biophilic-Learning-Spaces-on-Student-Success.pdf

Facility Staff & Occupant Training

Intent

Training is the foundation of effective maintenance programs and is an essential tool to maintain and receive the high performance benefits such as protecting indoor air quality, thermal and visual comfort and maintaining superior energy performance.

OM 1.0 – Facility Staff & Occupant Training

The design and construction of the school may incorporate all the latest high performance features, yet problems can occur simply because important information is not transferred from the design and construction teams to the school facilities and maintenance staff, or to the building occupants. Training the facilities and maintenance staff is essential to the performance of the building, but is often not performed or is hastily completed.

Provide students, teachers and staff with more in-depth knowledge for each aspect of high performance design on their school site, including how they interact with the facilities' systems and features to maintain and effectively receive the high performance benefits. Training the teachers and administration staff in how they can control their room environments provides them with an understanding that will also help the facilities staff keep the building performing optimally.

For example, maintaining energy savings and thermal comfort by correctly operating HVAC systems; achieving continued energy savings from lighting systems and the continued reduction of plug loads; maintain visual comfort from effective daylight and especially proper control of shading devices; maintaining air quality by populating spaces with low emitting furniture, using green cleaning products or employing natural ventilation, etc.

OM 1.0 – Facility Staff & Occupant Training		**Prerequisite**	
		4 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	OM 1.0	Facility Staff Training Facility staff must receive training and operation & maintenance (O&M) documentation on all building systems included in the commissioning scope of work under the EE 3.0 Commissioning Prerequisite as well as systems related to high performance – lighting and shading controls, maintenance of finishes, etc. depending on the scope of the project. Teacher and Administrative Staff Training Teachers, administrators, and support staff must be provided with training on operations of lighting, heating, and cooling systems in classrooms, offices, gymnasiums, auditoriums etc. When the school opens, or the renovation is completed, provide training and a brief and easy to understand manual or display for school occupants on the high performance aspects of the school. The intent is to allow the Occupants to learn how they can assist in assuring the operation of the school enhances the high performance school goals. A User's Guide, explaining basic systems operations, shall be developed and available either electronically for download or in a central school location. The school must also commit to annual training for teachers and staff to review classroom controls and other high-performance design features, such as light shelves. The commissioning agent shall be responsible for reviewing all training documentation. Training in future years shall be done at the direction of the LEA in conjunction with the facilities manager. The trainer may be the facilities manager or an appointee of the facilities manager.

Implementation

Facility Staff Training.

Provide Operations & Maintenance training for facilities and maintenance staff on all major building systems from bulleted list in the EE 3.0 Commissioning Prerequisite. It is typical to specify training requirements in the construction contract and subsequently, the general contractor arranges for equipment vendors, controls contractors etc. to teach building operators how to use and maintain their new equipment. The training may be overseen by the commissioning agent to ensure that the facilities staff receives the materials and hours of training stipulated in the construction contract. It is vital that facility and maintenance staff attend these training sessions.

Compile an Operations & Maintenance Manual. The manual should provide detailed O&M information for all equipment and products installed. It should be specifically written for maintenance and facility staff. The construction contractor typically furnishes the O&M manuals and the commissioning agent reviews the completed O&M Manual for completeness and clarity.

Teachers and Administrative Staff Training

Create a brief and concise classroom “User’s Guide” for teachers and administrative staff explaining how to operate their room lighting and HVAC systems. A User’s Guide shall be posted in every regularly occupied room of the school.

Conduct Operations & Maintenance training for staff. Provide a short introduction for all school staff, including teachers, explaining how classroom systems work, such as lighting and temperature controls. This training shall include, at a minimum, how to use the following systems if they are installed in the school:

- The commissioning agent shall be responsible for reviewing all training documentation.
- Temperature controls
- Set-points for HVAC systems
- Fan controls
- Electric lighting controls
- Daylight controls, including blinds, shades, and light shelves
- Occupancy sensors
- Operable windows

Training shall take place within 30 days of occupancy, and it shall be conducted by the facilities director, commissioning agent, or other similarly expert personnel. Training shall be conducted with the installed building systems. PowerPoint presentations alone are not sufficient, but they may be used in conjunction with demonstrations of the actual equipment. Training shall take place at a mandatory staff meeting, and attendance shall be documented.

The principal of the school or the district superintendent must also submit a signed letter indicating that annual training will take place to educate teachers and staff about the high performance features and controls in their classrooms. The training shall be fundamentally similar to the initial training after construction is complete. The intent is to be sure that new and existing staff are using the classrooms are designed on an ongoing basis.

Training in future years shall be done at the direction of the LEA in conjunction with the facilities manager. The trainer may be the facilities manager or an appointee of the facilities manager.

Documentation Requirements

Design Review Requirements

Submit specifications indicating that the commissioning agent will have the appropriate scope of work for reviewing training materials. Also submit specifications indicating who shall have responsibility for creating all training materials.

Construction Review Requirements

Provide the training manual for facilities staff or a link if offered through the school's website. Provide a copy of training materials, training date, and attendee list for initial facilities staff training session(s).

Also provide training materials for teachers and administrative staff. Provide a copy of training date and attendee list for initial teacher and administrator training session. Also include a signed letter from the principal or superintendent committing to annual training as outlined in the prerequisite

Resources

- ASHRAE Guideline 16: The HVAC Commissioning Process
- ASHRAE Guideline 4-2008 (RA 2013): Preparation of Operations & Maintenance Documentation for Building Systems
  https://www.techstreet.com/ashrae/standards/guideline-4-2008-ra-2013-preparation-of-operating-and-maintenance-documentation-for-building-systems?gateway_code=ashrae&product_id=1852923

Post-Occupancy Transition

Intent

To ensure that facilities actually perform to design expectations and meets the Owner's operations requirements by both obtaining user feedback and transferring design knowledge during the critical handoff phase after construction.

OM 2.1 – Post-Occupancy Transition

Numerous post occupancy studies over the past decade highlight that one of the most common and significant causes of underperforming buildings is the lack of communication and understanding of effective operations and user behavior. A Post-Occupancy Transition requirements aims to address these weaknesses by both capturing feedback from the users and operators to enable the design team and facilities staff to adjust systems and to refine the transfer the knowledge of the design intent and operation from the design team to the users and facilities operators in a three part process:

Reach Out – with a brief Post Occupancy Survey to obtain feedback.

Engage – in an integrated post-occupancy transition meeting 3 months after substantial completion with the essential engagement of all parties for success ensures that the occupants understand how to control and best use their buildings, are comfortable, can work effectively, and have realistic expectations. It ensures that operators are efficiently running systems and meeting the needs of the users and that the entire group balances saving energy and staying comfortable, noise versus ventilation, daylight and shading devices versus the impact on energy use and technology systems, plug loads and energy conservation.

Enhance - the feedback gained through this interaction helps the design team, school, and district facilities staff better understand the users needs and experience of the building to actually fine tune, de-bug, and correct systems and record lessons learned. This is an opportunity to create a virtuous circle to encourage the development of a body of knowledge and a process that helps the users into the future maintain high performance environment and institutional knowledge in spite of the usual obstacles of change of personnel, change of programs and the like.

OM 2.1 – Post-Occupancy Transition		**Credit**	
		2 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 2.1.1	Post-Occupancy Survey Conduct a brief Post Occupancy survey for the project after the prerequisite (Facility Staff and Occupant Training) process is complete. Prepare the results for distribution at the Post Occupancy Transition meeting.
	OM 2.1.2	Post Occupancy Transition Meeting Conduct an integrated design and operations meeting within six months after occupancy. At least one seasonal change must have occurred before the meeting takes place. Ensure the required representatives attend. Distribute the results of the POE for discussion; determine action items for adjustment and education.
	OM 2.1.3	Meeting Action Items Perform the action items to fine tune, de-bug and correct systems.

Implementation

OM 2.1.1 - The post occupancy evaluation survey may be accomplished by using the CHPS occupancy survey template or a tool like the Center for the built Environment's IEQ online surveys. The survey may also be developed in-house to conform to the needs of the project. The survey should be distributed to all staff and faculty.

The integrated design and operations meeting attendees include design team, maintenance and operations staff representatives, user representatives – teachers and school staff representatives, school administration representatives, school custodian, and preferably student representatives.

Reference the Useable Buildings Trust website for talking points regarding effective approaches to post occupancy surveys, user behavior, and transition from design and construction to operations.

Documentation Requirements

Design Review Requirements

None.

Construction Review Requirements

Include a signed letter from the principal or superintendent indicating intent to comply with each requirement in the credit. Include a timeline with specific dates for completion of each element of the credit, and be specific about who will be responsible for completion.

If the post occupant survey has been completed at the time of submission of this application, include a summary report of the results.

Performance Review Requirements

Submit agenda and meeting minutes, including a list of attendees, for the post occupancy transition meeting. Include an action plan for addressing any identified action items.

Resources

- CHPS Sample Occupancy Survey: available upon request
- Harvard University, Research on Indoor Air Quality: https://www.ehs.harvard.edu/programs/indoor-air-quality-iaq
- Usable Buildings Trust has guidance on occupancy surveys and using the feedback. A password is required for free downloads: https://usablebuildings.co.uk/
- Energy Savings Plus Health Guide: https://www.epa.gov/iaq-schools/protecting-iaq-during-school-energy-efficiency-retrofit-projects-energy-savings-plus

Performance Benchmarking

Intent *Track energy use over time to help ensure continued high performance and maximize savings.*
OM 3.0 – Performance Benchmarking

Benchmarking school energy use can be one of the most straightforward and simple methods available to help keep a school operating efficiently. Energy benchmarking typically shows how a school is operating compared to its peers or to itself — with multiple years of utility data — and shows how well a school operates from year to year. Good benchmarking systems account for yearly changes in weather and track energy use per square foot per year.

OM 3.0 – Performance Benchmarking		**Prerequisite**	
		3 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	OM 3.0	The school must adopt a policy of benchmarking to track its energy use performance over time in order to perform the following: Conduct a post-occupancy analysis of the school's indoor environmental quality and energy performance after 2 years or perform recommissioning after 2-5 years.

Implementation

There are 3 options for benchmarking:

OPTION 1: Use US EPA's Portfolio Manager. Portfolio Manager generates an ENERGY STAR score from 1-100 using data on energy usage, space attributes, and operating hours. A school must achieve at least a 75 to reach the ENERGY STAR level. Schools using Portfolio Manager will need to go to the website, create an account, and follow the instructions for inputting data and generating reports. Portfolio Manager also tracks water and waste usage as well as GHG emissions. These elements are not required for this prerequisite but can be used towards the credit in US-CHPS OM C4.1.

Note: If a design project was saved in Portfolio Manager, the same project record can be used to add metered energy data. The tool will show a comparison of design and operating energy data for the school.

Schools using Portfolio Manager should submit a copy of the initial facility report, showing the score.

OR

OPTION 2: Use the school's own energy model created at design of the building. If a model was done according to the guidelines contained in Energy Prerequisite EE 1.0 and contains information on plug load and operating hours, it will provide the most suitable benchmark for the school. Utility data, including kWh, therms, and costs, must be tracked annually by the school, normalized using heating degree days, and organized in a way that allows them to be analyzed against the model, i.e. total costs over time must be calculated.

OR

OPTION 3: If the schools utility, a state agency, municipality, or other local entity offers a benchmarking tool or service, use it in accordance with its provisions. Other third party tools are also allowed as long as they offer the ability to run comparisons over time and normalize data by space and heating degree days.

Post-Occupancy Study and Recommissioning

Committing to perform a post-occupancy analysis or to recommission the school two years after it is designed and built to the CHPS Criteria helps to ensure the high performance features of the school continue to provide benefits over the life of the school.

Recommissioning involves having a commissioning agent re-check the systems after a couple years of operation. Recommissioning can be done by the original commissioning agent or by a different one, but should be performed by someone meeting the same qualifications described in EE.3.0. The scope of recommissioning should follow the original commissioning scope for testing and balancing and any other aspects that might be appropriate.

A post-occupancy analysis of resource use essentially combines recommissioning and benchmarking to evaluate the building's performance. Systems are typically checked to see how they are working and utility bills are recorded and evaluated against a baseline. The post-occupancy analysis must include, at a minimum, an evaluation of energy and water use and may include occupant or end-user surveys regarding thermal comfort, air quality, and acoustical comfort. The post-occupancy study should cover at least one full heating and one full cooling season.

Documentation Requirements

Design Review Requirements

Provide a PDF of the policy or resolution committing to one of the energy benchmarking options listed in the credit implementation section, along with a summary of how the policy will be implemented. Also include a PDF of the policy or resolution committing to either the post-occupancy analysis or recommissioning, along with a summary of how the policy will be implemented.

Schools benchmarking to their own energy model must submit a letter of commitment to do so, signed by the chair of the school committee or the superintendent, that contains a description of the tool that will be used to organize data (e.g. Excel) and identifying the person who will be responsible.

Schools using Portfolio Manager shall submit a copy of the initial facility report, showing the score.

Construction Review Requirements

None

Performance Review Requirements

Complete the Benchmarking Option chosen to comply with the prerequisite. If using Portfolio Manager, submit a copy of the ENERGY STAR score. If using an in-house benchmarking solution, submit copies of all records kept to date and any reports generated.

Resources

- The US Environmental Protection Agency (US EPA's) portfolio manager is available at www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager
- US EPA Portfolio Manager: https://www.energystar.gov/benchmark
- Circling Back After the Plaque: Post-Occupancy Study of Energy Efficiency, The Green Engineer: https://www.greenengineer.com/mixed-greens/2021/1/27/the-green-engineer-releases-1st-edition-of-occupant-engagement-report

Systems Maintenance Plan & High Performance Operations

Intent
Ensure that the school project meets its design intent in providing a healthy, efficient, and environmentally responsive place to learn and work and keep key buildings systems properly maintained over time to ensure ongoing performance and system life.
OM 4.0 – Systems Maintenance Plan
OM 4.1 – High Performance Operations

The Systems Maintenance Plan is one of the most important features of a high performance school since it establishes the practices that will continue to ensure the school is operated according to its high performance intent. The Systems Maintenance Plan is a key part of commissioning and has a strong connection to other energy efficiency performance items such as energy benchmarking.

One of the prime methods to maintain, enhance or promote high performance operation is to monitor and benchmark the ongoing performance of existing schools once occupied. There are eight key metrics to track: energy efficiency, thermal comfort, visual comfort, indoor air quality, acoustics, waste reduction, water conservation, and greenhouse gas emissions.

Other highly effective techniques to sustain high performance is by designation of key positions in a school system: A district wide manager to oversee energy and water usage, performance targets and coordinate efficiency policies and foster behavioral change and, at the school site level, the designation of an advocate to promote these policies.

OM 4.0 – Systems Maintenance Plan		**Prerequisite**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 4.0.1	The administration must create a school Systems Maintenance plan that includes an inventory of all equipment in the new or renovated school with a schedule of all preventative and routine maintenance needed. The plan should clearly define who is responsible for performing the task, as well as the overall management of maintenance activities. The inventory and plan should cover the following systems:
		• Electrical Systems
		  • Lighting fixtures and controls (daylight, occupancy, timing switches, etc.)
		  • On-site renewable solar electric or wind systems
		  • Telecommunication systems
		  • Electrical distribution systems
		  • Life and safety systems
		• HVAC Systems
		  • HVAC systems (such as hot water systems, chilled water systems, central air systems, ventilation systems including kitchen and laboratory fume hoods)
		  • Domestic hot water systems
		  • Energy Management system
		  • Renewable energy heating systems (if applicable)
		• Plumbing Systems
		  • Flow control devices
		  • Pumping systems
		  • Special hazardous waste treatment systems (e.g. for lab wastes)
		  • Domestic hot water systems
		  • Graywater systems (if applicable)
		• Building Envelope and Roofing Systems (particularly acid management)
		• Significant Plug Loads
		• Other High Performance systems as applicable

Requirement

OM 4.1 – High Performance Operations		**Credit**	
		3 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 4.1.1	Monitoring & Benchmarking Commit to monitor at least three metrics beyond energy efficiency and GHG for a minimum of 3 years post-occupancy. See Implementation for guidance.
1 point	OM 4.1.2	Designate Resource Manager The school district (or private or charter school) must designate a permanent energy and water manager(s) to set performance targets, monitor usage, and coordinate and support school level advocates.
1 point	OM 4.1.3	Designate Advocate Designate a school based advocate to provide education and awareness on energy and water reduction programs and targets to promote behavioral change.

Implementation

OM 4.1.1 Benchmarking

The benchmarking metrics to target are: thermal comfort, indoor air quality, acoustics, visual quality (lighting), waste generation, and water usage. The following tools may be used:

A number of alternative tools may be acceptable and can be proposed to CHPS in advance. Thermal Comfort: Some manufacturers of ventilation systems and energy services companies are offering their own a) Manufacturer-provided building monitoring products, which sometimes come free of charge with installation of the system; b) Occupant survey; c) Manual or automated data collection and analysis.

Indoor Air Quality (IAQ): a) EPA also has an IAQ mobile monitoring app: https://www.epa.gov/iaq-schools/school-iaq-assessment-mobile-app and a walk-through checklist; b) Occupant survey; c) Manufacturer-provided monitoring product, often offered by ventilation systems manufacturers; d) Manual data collection and analysis.

Acoustics: a) Manual data collection and analysis; b) Occupant survey.

Visual Quality (Lighting): a) Lighting companies may also offer products or services; b) Manual measurement and analysis; c) Occupant survey. Note that alternative tools will not provide all the functionality of the ORC and may require additional work by school staff to create a complete package.

Waste Generation: a) Portfolio Manager; b) Manual waste audit.

Water Efficiency: a) Portfolio Manager; b) Manual fixture audit.

OM 4.1.2-4.1.3 Designated Individuals

Designated individuals who can focus on monitoring performance and assist others with implementing behavioral or operational changes are important for high performance maintenance of the school. Programs do not need to be created from scratch; EPA and others have tools and programs that schools can use. See Resources.

OM 4.1.4 Systems Maintenance Plan

Like conventional schools, all high performance schools and their systems require preventive and routine maintenance. The Systems Maintenance Plan encourages districts to plan for preventive and routine maintenance tasks and invest adequate funds in the maintenance of their school facilities. Preventive and routine maintenance tasks include cleanings, calibrations, component replacements, and general inspections. Operations and maintenance manuals and commissioning reports developed during the commissioning process should be used as references for developing the maintenance plan. The plan must clearly define who is responsible for performing the task, its frequency, as well as the overall management of maintenance activities.

The plan can be in the form of a spreadsheet, manual, calendar or any other printed or electronic document that is conducive to a list of equipment and maintenance tasks with dates.

Documentation Requirements

Construction and Performance Review Requirements

Provide a copy of a resolution, written policy, or similar commitment for OM 4.1.1.

For OM 4.1.2 and/or OM 4.1.3, provide signed confirmation from the administration that a designated, permanent energy and water manager(s) has been hired and a school-based advocate has been hired or volunteered. The confirmation should include the name(s) but does not need to include contact information.

Submit program outline or plan for your behavior-based energy and/or water conservation program as applies to this project, baseline, and any interim results or energy savings reporting.

OR

Submit a copy of the district MOU with Alliance to Save Energy for the PowerSave Schools Program, or equivalent documentation for a similar established program.

Provide a copy of the Systems Maintenance Plan that includes an inventory of building system components and all regularly scheduled preventative and routine maintenance tasks and their frequency over the lifetime of the building systems or equipment for OM 4.1.4.

Resources

- CHPS sample occupant survey available upon request via email info@chps.net

- PowerSave Schools, Alliance to Save Energy: www.ase.org/projects/powersave-schools
- Alliance for Climate Education: www.acespace.org
- Center for Green Schools, Powering Down: www.centerforgreenschools.org/Libraries/Resources_Documents/Behavior-based_Efficiency.sflb.ashx
- EPA's Indoor Air Quality Tools for Schools: https://www.epa.gov/iaq-schools/indoor-air-quality-tools-schools-action-kit
- EPA's Energy Savings Plus Health: Indoor Air Quality Guidelines for School Building Upgrades: https://www.epa.gov/iaq-schools/protecting-iaq-during-school-energy-efficiency-retrofit-projects-energy-savings-plus, and Interactive Air Quality Planner: https://www.epa.gov/iaq-schools/technical-resources-energy-savings-plus-health
- Northeast Energy Efficiency Partnerships (NEEP): http://www.neep.org/initiatives/energy-efficient-buildings/high-performance-schools
- Useful information on O&M planning for schools, NE-CHPS Operations & Maintenance Guide: https://neep.org/sites/default/files/resources/omg%20update_dec%202018%20final.pdf

Indoor Environmental Management Plan

Intent *Promote ongoing efforts to prevent, monitor, and correct indoor air quality problems.*
OM 5.0 – Indoor Environmental Management Plan

According to the US Environmental Protection Agency (US EPA), the indoor environment may contain levels of air pollutants that are 2-5 times higher, and occasionally 100 times higher, than outdoor levels. Poor indoor air quality (IAQ) can cause headaches, fatigue, asthma attacks, and ultimately absenteeism. Asthma can be a leading cause of school absenteeism due to chronic illness (US EPA).

OM 5.0 – Indoor Environmental Management Plan		**Prerequisite**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	OM 5.0	Promote a healthy indoor environment in a new school or renovation utilizing the US EPA's Tools for Schools Program or an equivalent indoor health & safety program at the school district level.

Implementation

Develop an indoor environmental management plan using the US EPA's Tools for School Program or equivalent indoor health & safety program at the school district level. Documentation must show that there is staff allocated for the program and significant action will be taken within a two-year period, such as staff training, policy implementation, development of personnel infrastructure for problem solving and reporting issues, or IAQ assessment activities such as school walk-throughs, data collection, mapping, and/or action plans.

Documentation Requirements

Design Review Requirements

None

Construction Review Requirements

Provide the resolution signed by the school district (or school board or governing body for private and charter schools) requiring participation in U.S. EPA's Tools for Schools (or an equivalent program) for its schools.

Also supply additional documentation indicating that there is staff allocated for the program and significant action will be taken within a two-year period, such as staff training, policy implementation, development of personnel infrastructure for problem solving and reporting issues, or IAQ assessment activities such as school walk-throughs, data collection, mapping, and/or action plans.

Resources

- US EPA Tools for Schools www.epa.gov/iaq/schools/
- Region 1 U.S. Environmental Protection Agency New England office in Boston, Massachusetts—ph: (888) 372-7341 and at: https://www.epa.gov/indoor-air-quality-iaq/region-1-new-england-indoor-air-quality
- Massachusetts Facility Administrators Association www.massfacilities.com
- Massachusetts Coalition for Occupational Safety and Health www.masscosh.org
- Massachusetts Healthy Schools Checklist: https://www.mass.gov/service-details/the-massachusetts-school-checklist-indoor-air-quality
- Massachusetts School-Based Health Alliance provides information for school administrators, teachers, and others: https://www.masbha.org/

The Asthma Regional Council of New England provides information on a variety of indoor air quality topics: https://www.asthmacommunitynetwork.org/node/16337

Green Cleaning

Intent *Protect student and staff health and the environment from exposure to hazardous cleaning products.*
OM 6.1 – Green Cleaning

The use of green cleaning products and practices supports the goal of maintaining a healthy, safe, and clean environment for students, faculty, and staff.

OM 6.1 – Green Cleaning		**Credit**	
		2 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 6.1.1	At the school district level, or the school governing body for private and charter schools, establish a resolution or policy including the following green cleaning and maintenance requirements: • Only environmentally preferable and safer cleaning products that are certified by U.S. EPA Design for the Environment (DfE), Green Seal or EcoLogo programs shall be purchased. • Prohibition of aerosol and plug-in air fresheners. • Periodic audits of the project for cleanliness according to Association of Physical Plant Administrators (APPA) Guidelines. **AND**
	OM 6.1.2	Create a space inventory and conduct an audit between 12-18 months from occupancy (coordinated with the timing of OM 4.1 High Performance Operations) to measure cleaning program effectiveness according to APPA Leadership in Educational Facilities Custodial Staffing Guidelines and achieve Cleaning Level 2. Remediate as required to achieve Cleaning Level 2.

Implementation

Adopt and submit the green cleaning policy or resolution covering the required areas and submit

the space inventory and completed audit.

Environmentally preferable and safer cleaners are those that are currently certified to any of the following standards:

U.S. EPA Design for the Environment, DFE Standard for Safer Products, 2012. Product must be certified to display the EPA/DfE mark.

Green Seal, GS-37 Cleaning Products for Industrial and Institutional Use, 2020, or other related Green Seal product standard. Product must be certified to display the Green Seal mark.

EcoLogo, UL Global Network, Janitorial & Janitorial Products standards (relevant product category standard). Product must be certified to display the EcoLogo mark.

Documentation Requirements

Design Review Requirements

None.

Construction Review Requirements

Submit the green cleaning policy or resolution covering the required areas.

Performance Review Requirements

Submit the space inventory and completed audit.

Resources

- Association of Physical Plant Administrators Association of Physical Plant
- Administrators: https://www.appa.org/
- U.S. EPA: https://www.epa.gov/saferchoice Green Seal: www.greenseal.org
- Green Seal GS-37 Cleaning Products for Industrial Use https://greenseal.org/green-seal-standards/gs-37/
- EcoLogo: https://www.ul.com/resources/ecologo-certification-program
- The Healthy Schools Initiative of the Massachusetts Coalition for Occupational Safety & Health (MassCOSH): www.masscosh.org
- The policy from Boston Public Schools: www.masscosh.org/files/BPS_Cleaner_Policy.pdf

Integrated Pest Management

Intent
Reduce pesticide risk and exposure to students and staff.
OM 7.0 – Integrated Pest Management

Integrated pest management focuses on pest prevention using effective, least-toxic methods is proving practical to apply and cost-effective to operate.

OM 7.0 – Integrated Pest Management			**Prerequisite**
			1 point
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 7.0.1	Develop and support an Integrated Pest Management (IPM) Plan that emphasizes a least-toxic approach to IPM.
	OM 7.0.2	Design the projects exterior walls, foundation, attics, roofs, interior partitions and ceilings in food storage areas, food preparation and disposal areas, utility chases and penetrations, for integrated pest management by making it difficult for pests to enter the building including: • Blocking openings in the enclosure larger than 1/4” by 3/8”. • Use mesh or screens on openings required for airflow. • Caulk all cracks larger than 1/16”. • Any landscape planting must be located at least two feet from buildings. • Facades should be designed to discourage birds from roosting. • Select dumpsters that seal tightly and are easy for people to open and close, and enclosure designed to discourage pest infestation in buildings. • Make all kitchen surfaces easy to degrease.

Implementation

Submit the Integrated Pest Management Plan. Construction drawings must include notes identifying features included to improve pest management.

An appropriate IPM plan, specified to be a least-toxic approach, reduces the need to apply chemical sprays or deploy bait traps in order to control pest populations. A successful plan eliminates food, water, and shelter for pests, thereby decreasing the likelihood that pests will enter school facilities. The control of food and its restriction to appropriate locations in the facility decreases pest problems, and increases Indoor air quality through the elimination of pest contaminants and chemical control agents.

Consider also designing school fencing and turf/landscape bed margins to prevent weed encroachment and the need for herbicides, including:

- Installing weed barrier mow strips under fencing that is ½ inch beneath final mow height of adjacent turf, that extends at least four inches from the widest part of the fence on both sides, and that will support the deck of a mechanical mower. Consider searching for non-plastic alternatives for weed barrier mow strips.
- Installing curbing between turf and other porous landscape features (landscape beds, gardens, mulch or sand play boxes, mulched paths, etc.) that extends vertically a minimum of six inches below grade and extends four inches horizontally at the turf margin.

Documentation Requirements

Design Review Requirements

Complete the CHPS Verified Plan Sheet Construction to indicate which drawings include notes identifying features included to improve pest management.

Construction Review Requirements

Submit the Integrated Pest Management (IPM) plan.

Resources

- US EPA IPM in Schools: www.epa.gov/ipm/
- Beyond Pesticides: www.beyondpesticides.org

Anti-Idling Measure

Intent

Reduce the health and environmental effects of vehicle exhaust and decrease use of fuel by preventing unnecessary vehicle idling.

OM 8.0 – Anti-Idling Measures

According to the US Environmental Protection Agency (US EPA), exposure to diesel exhaust, even at low levels, is a serious health hazard and can cause respiratory problems such as asthma and bronchitis. Diesel emissions are well-documented asthma triggers and may increase the severity of asthma attacks.

OM 8.0 – Anti-Idling Measures		**Prerequisite**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 8.0	Adopt a no idling policy that applies to all school buses operating in the school district and all vehicles operating in the school grounds. The policy must include the following provisions: • School bus drivers will shut off bus engines upon reaching destination, and buses will not idle for more than three minutes while waiting for passengers. This rule applies to all bus use including daily route travel, field trips, and transportation to and from athletic events. School buses should not be restarted until they are ready to depart and there is a clear path to exit the pick-up area. • Post signage expressly prohibiting the idling of all vehicles for more than five minutes in the school zone. • Transportation operations staff will evaluate and shorten bus routes whenever possible, particularly for older buses with the least effective emissions control. • All school district bus drivers will complete a “no idling” training session at least once. All bus drivers will receive a copy of the school district’s No Idling Policy at the beginning of every school year.

Implementation

The term "school grounds" shall mean in, on or within 100 feet of the school, including any athletic field or facility and any playground used for school purposes or functions which are owned by a municipality or school district, regardless of proximity to a school building, as well as any parking lot appurtenant to such school, athletic field, facility or playground.

Establish the length of time an operator on school grounds may idle an engine before such idling becomes prolonged, and the limited circumstances under which the prolonged idling of an engine shall be permitted, including periods necessary to operate defrosting, heating or cooling equipment to ensure the health or safety of a driver or passengers or to operate auxiliary equipment and to undergo inspection or during maintenance.

Prohibit an operator of a school bus from idling a school bus engine while waiting for children to board or exit a bus on school grounds and from starting a school bus engine for any unnecessary period of time in advance of leaving the school grounds, unless the registrar determines that a school bus engine must be fully engaged in order to operate safety devices or that such idling prohibition would otherwise compromise the safety of children boarding or exiting a bus. Such regulations shall further prescribe templates for "no idling" signage to be posted by schools.

Documentation Requirements

Design Review Requirements

Reference specifications for anti-idling signage.

Construction Review Requirements

Provide a copy of the adopted anti-idling policy. Provide picture(s) of the installed anti-idling signage.

Resources

- US Environmental Protection Agency: Diesel Exhaust and Your Health https://www.epa.gov/dera/learn-about-impacts-diesel-exhaust-and-diesel-emissions-reduction-act-dera#:~:text=Human%20Health%20%2D%20Exposure%20to%20diesel,in%20children%20and%20the%20elderly. Massachusetts Department of Public Health Outdoor Air Pollution Asthma Toolkit for Healthy Schools: https://www.maasthma.org/toolkit/outdoorairpollution
- US EPA's Idle-Free Schools Toolkit: https://www.epa.gov/schools/idle-free-schools-toolkit-healthy-school-environment
- The Massachusetts Department of Environmental Protection offers training to help school bus drivers and municipal employees eliminate unnecessary idling. See the following link for more information: https://www.eesi.org/files/idle_reduction_guide.pdf MA DEP also has a variety of

tools for school districts, including fact sheets, sample language for signage, sample newsletters, policy statements, and information on bus routing software

Green Power

Intent *Reduce the use of fossil fuel energy sources.*
OM 9.1 – Green Power

School districts and municipalities have the opportunity to purchase green power in the form of Renewable Energy Certificates (RECs) or through Power Purchase Agreements (PPAs). These two mechanisms allow schools to use green power without constructing an on-site renewable power system.

OM 9.1 – Green Power			**Credit**
			1-2 points
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	OM 9.1.1	Commit to purchasing Renewable Energy Certificates (RECs) OR renewable power purchased through a PPA OR on-site renewable power systems equivalent to at least 15% of the school's projected annual electricity needs as modeled under EE.P1 and EE.C1 for at least two years of occupancy. If green power is purchased at the district level it must allocated to the project.
1 points	OM 9.1.2	Comply with OM10.1.1, and purchase all RECs from a local generator within 200 miles of the project.

Implementation

RECs

For each megawatt-hour of power generated and supplied to the electric grid through renewable electricity generation (solar, wind, ocean thermal, wave, tidal, landfill gas and "low emission" bio-energy sources), a REC is issued for trade on the open market. Both new and old RECs can be purchased by retail electricity suppliers or renewable electricity suppliers for resale to customers. Consumers can purchase RECs through programs or companies across the country. When a consumer purchases RECs, the RECs are effectively retired and taken out of circulation, which contributes to the increased demand for generation and sale of additional renewable electricity.

An interesting characteristic of renewable energy certificates is that they can be purchased from any location in the country, however, purchasing RECs from local generation sources means that the environmental benefits are experienced locally.

PPAs

Power Purchase Agreements are a contractual means for a site-owner and a renewable energy installer to work together to provide green power on-site when the site-owner does not wish to outright own the system. In a PPA, the system is owned and maintained by the installer (ownership may also be by a 3rd party investor), and the site-owner purchases the power generated by the system for the contracted price. Typically, PPAs are structured so that the site-owner eventually has the right to own the system. The benefits of a PPA to a site-owner are that the upfront capital costs of installation and the ongoing maintenance costs are borne by the installer. Theoretically, a PPA allows the installer to build a larger system at the site than might otherwise be possible (site conditions are still the primary determinants of system size), therefore offsetting a larger portion of the site's fossil fuel use.

To achieve this point, purchase a block of megawatt-hours (MWh) of renewable electricity from a REC supplier or wholesaler or through a PPA. The block of megawatt-hours purchased should equal 15% of the anticipated total electricity load of the school for two years of occupancy.

Purchasing clean energy can be documented as indicated below.

If the project developed an energy model for Energy EE.1, then cite the electricity load (in kWh) from the energy modeling report. Otherwise, an energy model must be developed to determine the school's total electricity loads.

Supply a receipt or copy of a renewable energy certificate to document proof of purchase.

Documentation Requirements

Design Review Requirements

Provide a receipt or copy of a renewable energy certificate to document proof of purchase or provide the Power Purchase Agreement.

If pursuing OM 9.1.2, also submit a map indicating the distance between the project site and the generation site.

Construction Review Requirements

None

Resources

- US Environmental Protection Agency: What is a Renewable Energy Credit? https://www.epa.gov/greenpower/renewable-energy-certificates-recs#:~:text=A%20renewable%20energy%20certificate%2C%20or,attributes%20of%20renewable%20electricity%20generation.&text=RECs%20include%20several%20data%20attributes,Certificate%20type

- Community Energy: www.newwindenergy.com
- Sterling Planet: www.sterlingplanet.com
- Massachusetts Energy Consumers Alliance: www.massenergy.com/
- U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, see: www.eere.energy.gov/greenpower/buying/buying_power.shtml?state=MA
- For more information on PPAs, contact the Renewable Energy Trust at the Massachusetts Clean Energy Center: www.masscec.com

ENERGY STAR® Equipment and Appliances

Intent *Install equipment and appliances that meet ENERGY STAR requirements for energy efficiency.*
OM 10.0 – ENERGY STAR Equipment and Appliances

Building systems, such as HVAC and lighting, are not the only consumers of electricity in a school. Supplementary equipment associated with school operations, or plug loads, are a growing portion of operating budgets because of the growing prevalence of computer systems and other electrical equipment. Choosing efficient equipment that is designed to meet ENERGY STAR requirements minimizes energy consumption and lowers operating costs.

OM 10.0 – ENERGY STAR Equipment and Appliances		**Prerequisite**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	OM 10.0	Establish a written policy that all newly purchased equipment and appliances to be used in the school shall be ENERGY STAR compliant in all product categories covered by ENERGY STAR. The policy must also prohibit the purchase of low-efficiency products, including incandescent lights, halogen torchieres, and portable electrical resistance heaters.

Implementation

Building systems, such as HVAC and lighting, are not the only consumers of electricity in a school. Supplementary equipment associated with school operations, or plug loads, are a growing portion of operating budgets because of the growing prevalence of computer systems and other electrical equipment. Choosing efficient equipment that is designed to meet ENERGY STAR requirements minimizes energy consumption and lowers operating costs.

The ENERGY STAR program was established to provide accuracy and consistency in energy usage ratings and to encourage the purchase of efficient equipment. The program maintains a database of compliant manufacturers and products including computers, monitors, copy machines, water coolers, printers, scanners, refrigerators, ceiling fans, and washing machines. In many cases, equipment that exceeds ENERGY STAR's efficiency requirements is available and should be considered. When ENERGY STAR compliant equipment is not available, the project owner should submit a notice of exception to the relevant high performance school administrators.

Documentation Requirements

Design Review

Submit a signed copy of the resolution passed by the school board.

Construction Review

None

Resources

ENERGY STAR: www.energystar.gov/

Computerized Maintenance Management System (CMMS)

Intent *Use a computerized maintenance management system to track work orders and maintenance.*
OM 11.1 – Computerized Maintenance Management System

Computerized maintenance management systems offer the opportunity to enhance maintenance practices through the automatic scheduling and tracking of maintenance procedures. Web-based services and stand-alone products are available.

<table>
<tr><td colspan="2">OM 11.1 – Computerized Maintenance Management System</td><td colspan="2">Credit
1 points</td></tr>
<tr><td>Applicability</td><td colspan="3">Verification Required</td></tr>
<tr><td>All projects.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

Prerequisite	OM 11.1	The school district shall purchase and use a computerized maintenance management system (CMMS) in the new or renovated school. If the district already uses a CMMS, the system must be expanded to incorporate automated maintenance scheduling for the new or renovated school.

Implementation

A Best Management Practice for preventive maintenance is a maintenance management system (MMS). Options exist for developing an MMS or implementing a computerized MMS with stand-alone software or web-based services. MMS systems may be integrated with other software programs used to maintain the school, such as the Energy Management System.

Documentation Requirements

Design Review

None

Construction Review

Submit a copy of a signed contract or the receipt for purchase of a CMMS system. If using an existing CMMS, provide a letter signed by the mechanical engineer as verification that it has been modified as required by NE-CHPS.

Resources

INDOOR ENVIRONMENTAL QUALITY

HVAC Design – ASHRAE 62.1

Intent *Establish a minimum level of indoor air quality to protect student and staff health and improve performance and attendance.*
EQ 1.0 – HVAC Design – ASHRAE 62.1
EQ 1.1 – Enhanced Filtration
EQ 1.2 – Dedicated Outdoor Air Systems

Establishing a minimum level of indoor air quality positively impacts student and teacher performance, can reduce absenteeism, and avoid the potential for long and short-term health problems. All of the criteria in this category can be used to achieve excellent indoor air quality which starts during construction with proper drainage of the site, careful siting of air intakes, protecting building materials from moisture, and protecting HVAC systems from dust and debris. Implementing all the criteria in this section will provide a foundation for providing clean, breathable air in your school.

EQ 1.0 – HVAC Design – ASHRAE 62.1		**Prerequisite**	
		8 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	EQ 1.0	*Minimum outdoor air ventilation requirement* Design and construct the HVAC system to provide continuous outdoor air (OA) ventilation to each space during occupied hours including all full- and part-load conditions. The Project Engineer shall provide a signed letter that the Project complies with all of the following: 1. The school ventilation system shall be designed to operate in continuous mode during occupied hours and not readily defeated. 2. Ventilation rates during occupied hours including all full-and part-load conditions in all school areas shall be no less than required by the outdoor ventilation rate calculated according to the outdoor air ventilation rate procedure in ASHRAE 62.1 § 6.2 or § 6.4 if natural ventilation is used. 3. The ASHRAE 62.1 Mechanical Ventilation Calculation Worksheet shall be completed in full and include it in the project drawings and design documentation. And the table shall list for each room: the HVAC system ID number and HVAC type, and the minimum outdoor air flow rate, the rooms' air classification and all exhaust fans. 4. HVAC systems and equipment shall meet the requirements of ASHRAE Standard 62.1-2016 , §5 5. The design of condensate pans (§5.11) shall meet all requirements in ASHRAE Standard 62.1-2016, §5 6. The outdoor air intakes shall meet all requirements in ASHRAE Standard 62.1-2016, (§5.5) In addition, all intakes must be 6 feet above landscaped grade including soil, lawn, shrubs, or any plant life within 1.5 ft. horizontally of intake. 7. The particulate matter filters or air cleaners shall meet all requirements in ASHRAE Standard 62.1-2016, (§5.8, §6.2.1.1 and §6.2.1.2). In addition, filtration media shall have a Minimum Efficiency Reporting Value (MERV) of **11** or higher, for all new HVAC systems excluding unit ventilators, which can have MERV 7. Replace all HVAC filtration media immediately prior to occupancy. 8. The mold resistance of air stream surfaces shall meet all requirements in ASHRAE Standard 62.1-2016. (§5.4). 9. All in-room plug in Air Cleaning Devices used in the school classrooms shall be models that are Certified and Labeled in accordance with California Air Cleaning Device regulation Section 94804 (see resources https://ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices). ***10.*** The school shall be in compliance with ASHRAE 62.1-2016 section 6.2.1.3. The design shall ensure that the ventilation system operates in continuous mode during occupied hours and is not readily defeated. Ventilation rates shall be no less than required by the outdoor ventilation rate calculated according to the outdoor air ventilation rate procedure in ASHRAE 62.1-2016 § 6.2 using the ASHRAE 62.1-2016 Spreadsheet for

		calculations; the OA rate that is greatest shall be applied to each space, or follow a local code or ordinance, whichever is more stringent. For multiple spaces served by variable air volume (VAV) systems, this means that the minimum supply setting of each VAV box should be no less than the design outdoor ventilation rate calculated for each space. The box must be controlled so that the minimum required airflow is maintained at all times when the space is occupied, even when the fan has modulated to its minimum capacity. Additionally, if the following rooms have significant pollutant sources, art classrooms, darkrooms, kitchens and kitchenettes, locker rooms, copy printing rooms, science lab classrooms, woodwork shops and/or other classrooms, the pollutants shall be exhausted directly to the outside and not re-circulated. Local contaminate exhaust in rooms such as fume hoods may meet this requirement. The exhaust airflow rates shall be no less than required in ASHRAE 62.1 § 6.5. HVAC systems and equipment shall meet the requirements of ASHRAE Standard 62.1-2016 §5, which addresses among other things the design of drain pans (§5.10), outdoor air intakes (§5.5), and air stream surfaces (§5.4). To avoid particulate accumulation and/or mold in the ductwork, duct liners must meet the American Society for Testing and Materials (ASTM) standards C 1071 or UL 181 for surface erosion resistance and ASTM standards C 1104 or C 209 (at <0.5% absorption by volume) for water vapor sorption.

EQ 1.1 – Enhanced Filtration		Credit 2 point	
Applicability	**Verification Required**		
All projects, except those with unit ventilators.	Design Review	Construction Review	Performance Review

Requirement

2 points	EQ 1.1	Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 or higher.

Implementation

The construction documents (drawings and specifications included in Construction Specifications Institute (CSI) Section 01350 or CSI MasterFormat™ (2016) 01 35 43.16 Environmental Procedures for Toxic Materials, shall include design details and control sequences presented in a manner allowing that compliance with the prerequisite may be verified. In addition to information on the contract documents, calculations used to determine the most stringent outdoor air ventilation rate shall be signed by the project engineer. ASHRAE 62.1-2016 Mechanical Ventilation Calculation Worksheet shall be completed by the project engineer documenting that each space meets the minimum outdoor air quantities according to ASHRAE 62.1-2016 calculations. The spreadsheet shall show that the outdoor air quantity in each room served by an HVAC system meets the minimum outdoor air quantity for the space. For multiple spaces the spreadsheet shall show that the minimum outdoor air quantities are met in each space including during times when all VAV boxes are turned down to their minimum flow positions. A completed table shall be compiled by the project engineer and included in the project drawings and design documentation. The table shall list for each room: the HVAC system ID number and HVAC type, and the minimum outdoor air flow rate, the room's air classification and all exhaust fans. These drawings and documents including the table and electronic spreadsheet shall be submitted for verification. Minimum outdoor air quantities for all spaces shall be verified during HVAC system Testing and Balancing and included in minimum Commissioning requirements when all when all VAV boxes are turned down to their minimum flow positions.

Throughout this criterion, ventilation air means the designed outdoor air flow rate for maximum occupancy.

Controls shall be specified that operate the HVAC fans to provide outdoor air ventilation continuously during occupied hours, whether or not there is a need for heating or cooling. Thermostats with an "automatic" setting do not meet this requirement, since in this mode, the fans cycle on and off according to demands for heating or cooling.

The HVAC shall be operated continuously during working hours except during scheduled maintenance and emergency repairs or during periods for which the district can demonstrate that the quantity of outdoor air supplied by non-mechanical means meets the outdoor air supply rate required by ASHRAE Standard 62.1-2016, §6.2 (climate is suitable and an acceptable means for natural ventilation is provided).

Natural ventilation systems must be engineered to demonstrate sufficient outdoor air ventilation and thermal comfort and shall adhere to natural ventilation guidelines including:

- Maximize wind-induced ventilation by siting the ridge of a building perpendicular to the summer winds.
- Generally, naturally ventilated buildings should be narrow.
- Generally, each room should have two separate supply and exhaust openings. Locate exhaust high above inlet to maximize stack effect. Orient windows across the room and offset from each other to maximize mixing within the room while minimizing the obstructions to airflow within the room.
- Provide ridge vents.
- Consider the use of clerestories or vented skylights.

- Provide attic ventilation.
- Consider the use of fan-assisted cooling strategies.
- Consider open staircases that provide stack effect ventilation, but observe all fire and smoke precautions for enclosed stairways.
- Doors are not acceptable natural ventilation openings.

ASHRAE Standard 62.1-2016 §5 has a number of requirements to improve the effectiveness of outdoor air ventilation systems. Some of these requirements apply to the design of equipment and manufacturers. The design engineer shall check with manufacturers to verify that the equipment that is specified, complies with the requirements of §5. Some manufacturers identify product lines or equipment as complying with Standard 62.1.

Specify that the HVAC system provides a slope in condensate pans so that water does not stand, provides access for cleaning coils and other components, and makes sure that air stream surfaces are not porous including the requirement that insulation is not placed on internal air stream surfaces except for sound attenuation insulation that may be placed selectively on the inside of HVAC ducts if it is certified to meet ASTM C 1071 and ASTM C 1104 for surface erosion resistance and water vapor sorption.

Some jurisdictions may also be required to submit to the county.

Locating air intakes away from sources of potential air pollution will ensure that indoor air quality is not compromised by diesel fumes or exhaust air from ventilation, cooling towers, kitchen, or HVAC systems. Be particularly careful to locate air intakes away from areas where school buses and other vehicles may be idling.

Design Review Requirements: Certification by the Mechanical Engineer that the mechanical system design meets these requirements. Provide drawings showing all air intake openings. Clearly identify hazardous and noxious contaminant sources on the drawings and bubble each air intake with a 10 ft radius circle on the drawings. Additionally, provide drawings showing ducted returns. Indicate the horizontal and vertical distances from the contaminant source. Locating air intakes away from sources of potential air pollution will ensure that indoor air quality is not compromised by diesel fumes or exhaust air from ventilation, cooling towers, kitchen, or HVAC systems. Be particularly careful to locate air intakes away from areas where school buses and other vehicles may be idling. Where intake openings front on a street or public way, measure the horizontal distance from the centerline of the street or public way to the air intake. Indicate the horizontal and vertical distances from the contaminant source in the drawings. Outdoor air intakes shall meet all requirements in ASHRAE Standard 62.1-2016 §5.5. All intakes must be 6 feet above landscaped grade including soil, lawn, shrubs, or any plant life within 1.5 ft. horizontally of intake. Intakes near Class 2 exhaust sources shall be a minimum of 2 feet below the exhaust and 10 feet horizontally from the nearest edge of the intake to the nearest edge of the Class 2 exhaust.

Air filtration improves indoor air quality especially for schools located near outdoor particulate sources such as highways. Filtration also protects the HVAC equipment. Filters remove airborne particulate material based on their size, shape and density. Filters are rated by different standards (e.g. arrestance and dust spot, MERV) that measure different aspects of performance. As a filter becomes loaded with captured particles, static pressure will increase across the filter bank, which requires more fan power. It is important to select a filter that is specifically designed for the specific application and to make sure that the HVAC filter enclosures are designed to perform with the filter in place without leakage around filter.

A minimum level of filtration is necessary to reduce the health risks associated air contaminants A minimum level of filtration is necessary to reduce the health risks associated air contaminants from outdoors. Filters rated at MERV 11will ensure very good quality ventilation air by blocking minute particles and allergens. MERV 11 filters remove 65-80% of particles 1.0-3.0 microns or larger in size, which includes various fumes, Legionella, some vehicle emissions, mold spores, pollen, and humidifier dust than lower MERV filters. This rating is conducted by ASHRAE standard 52.2. MERV scale range from 1 to 16.

For new construction or renovations that replace HVAC equipment, specify systems that accept the required filter efficiency without a loss of operating efficiency.

Note that MERV 11filters do not fit into unit ventilators. Therefore, schools with unit ventilator systems are required to utilize MERV 7 filters. The pressure drop may be greater with MERV 11filters versus filters with lower MERV ratings, and therefore, more energy may be required to draw air through these filters. There is often a tradeoff between incremental indoor air quality improvements and energy efficiency that design teams should bear in mind. This criterion may be especially desirable in environments where outdoor air quality is a serious concern, for example near schools in close proximity to heavy traffic.

Reference specification sections for MERV 11 filters in all HVAC air handling systems. Designate the CSI number, section, and page number that highlight compliance with this requirement.

Reference specification sections for replacement of filters with MERV 11higher in all new HVAC equipment. Labels on filter entry doors of all HVAC Systems shall list the date that the filter was last changed on and the date for scheduled replacement. The systems maintenance plan (OM 4.0 and/or OM 5.0) should include a filter schedule that includes all air handling units, roof top units, unit ventilators, etc. and the rating of filters used for each piece of equipment.

EQ 1.1

For many years we have known that outdoor air pollution, especially particulate matter (PM), can be harmful to health. Recent studies have shown that children living or going to school very near busy roadways or in areas with high PM experience much higher rates of asthma and other respiratory disease. Recent action by the International

Agency for Research on Cancer (IARC) has identified additional health impacts that may result from elevated exposures to outdoor pollution and PM. In October 2013, the IARC classified both outdoor air pollution and particulate matter as carcinogenic to humans (Group 1 carcinogens) alongside other known serious carcinogens including asbestos, plutonium, silica dust, ultraviolet radiation and tobacco smoke. The IARC in its evaluation found sufficient evidence that exposure to outdoor air pollution and particles causes lung cancer (Group 1) and also noted a positive association with an increased risk of bladder cancer. The IARC Director, Dr. Christopher Wild, stated, “There are effective ways to reduce air pollution and, given the scale of the exposure affecting people worldwide, this report should send a strong signal to the international community to take action without further delay.”

Filters rated at MERV 13 and higher will help ensure very good quality ventilation air by blocking some fine particles and most allergens. A MERV 13 filter has the ability to filter 90% of particles 1.0 to 3.0 microns particles in size, which includes lead dust, humidifier dust, mold spores, sand dust, fabric fibers, pollen, and dust mites, and filters some particles (less than 75%) that are 0.3 to 1.0 microns in size, etc. which includes viruses, carbon dust, and fine combustion smoke. Filters with a MERV 14 to 16 rating remove increasing amounts (about 80% up to more than 95%) of particles in the 0.3 to 1.0 micron size range, and thus help reduce exposure to truck and bus emissions from nearby roadways. HEPA filters (roughly equivalent to a MERV 17-20 rating) remove 99.97% to 100% of the smallest sized particles.

At a minimum these high efficiency filters (rated MERV 13 or higher) should be used in areas with elevated outdoor PM during one or more seasons of the year, and for schools near busy roadways.

Reference specification sections for MERV 13 filters in all HVAC air handling systems. Designate the CSI number, section, and page number that highlight compliance with this criterion.

EQ 1.2 – Dedicated Outdoor Air System		**Credit**	
		3 points	
Applicability	**Verification Required**		
All Projects.	Design Review	Construction Review	Performance Review

Ventilation systems have very significant implications on both overall facility energy and air quality. Advanced ventilation systems include fundamentally efficient strategies that are designed to minimize energy waste on ventilation, heating or cooling through elimination of inefficiencies in the way system elements work together. This is one of the major capabilities that separate “classical” and “transitional” HVAC systems from true “high performance” HVAC systems.

Dedicated outdoor air system are typically constructed around variable flow, energy recovery and evaporative processes. These reduce parasitic losses for fan and pumping energy. They also minimize the reliance on mechanical refrigeration for cooling but do not eliminate the need for it to efficiently process ventilation. DOAS systems can take multiple forms but must be able to independently deliver heating, cooling, and ventilation where, and only when it is needed. There are several potential configurations for fundamentally efficient designs. They can be affordably constructed from readily available components.

The practice of recirculation in traditional HVAC systems does not save energy, it compromises ventilation. A dedicated outdoor air system consistently delivers the required amount of outside ventilation air to each space.

Shut-off variable-air-volume delivery systems can be used with DOAS systems to control, measure and monitor ventilation in real time, permitting these systems to actively manage ventilation by delivers the precise amount of fresh outdoor air directly to each space without recirculating contaminants or pathogens generated in other spaces. Furthermore, VAV air terminal unit controls can be integrated with occupancy sensing devices to not only assure that appropriate levels of ventilation are provided when spaces are occupied, but also turn off ventilation to those spaces when they are not occupied.

For dedicated outdoor air systems to comply with the energy efficiency requirements or ASHRAE 90.1 they must utilize energy recovery to reduce the energy used to condition outdoor air a minimum of 50%, measured as enthalpy, at designconditions. Dedicated outdoor air systems that effectively employ two-stage air-to-air heat exchangers maximize the performance characteristics of energy recovery and energy avoidance equipment like heat wheels and indirect evaporative coolers. These configurations have demonstrated the ability to reduce annual ventilation cooling energy as much as 85% and heating energy requirements as much as 97%.

For more information on DOAS systems, visit http://www.doas-radiant.psu.edu/

Requirement

3 points	EQ 1.2	Provide a dedicated outdoor air ventilation system with the ability to efficiently process and manage ventilation down to the individual room level.

Implementation

Individual classrooms will vary in thermal loads depending on their orientation and other building conditions, as well as occupant preferences. If individual or integrated controls systems are to permit teachers to regulate the temperature of their classrooms. Local air temperature control range of +/- 5 º F is required for this criterion. The minimum occupied rate of outdoor air ventilation to be provided should equal the minimum rate of ventilation required to satisfy ANSI/ASHRAE Standard 62.1-2016 for the applicable category of space computed using the Ventilation Rate Procedure. IAQ procedure demand control methods employing contaminant sensing may not be employed. The maximum amount of outdoor air to be provided

Project engineers shall provide engineering documentation on the drawings in tabular format demonstrating compliance with ANSI/ASHRAE Standard 62.1-2016 using the Ventilation Rate Method. Show and describe how the dedicated outdoor air HVAC system designs seeking credit: 1) Delivers 100% fresh outdoor air directly into each space without first mixing it with any recirculated building air (i.e. variable volume, displacement ventilation dual duct, etc.) and 2) Integrates an adequate energy recovery strategy to meet ANSI/ASHRAE/IESNA Standard 90.1-2016 air-to-air energy recovery requirements.

Cross-Category and Other Considerations

This criterion is related to Energy Performance, EE 1.0 Energy Performance.

Documentation Requirements

Design Review Requirements

EQ 1.0: Complete the CHPS Verified Worksheet. Construction drawings must include diagrams and calculations showing that the design meets the natural ventilation requirements. Include tables showing floor and window ratios of each room or if an engineered system, include outputs of CFD (Computational Fluid Dynamics) analysis. They should also specify compliant air filters. Construction drawings must include a table with seasonal temperatures and humidity design criteria, and metabolic rates for each space. Provide supporting documentation with PMV/PPD calculations, and/or ASHRAE Comfort Tool results that standards have been met.

EQ 1.1: Construction drawings must specify compliant air filters.

EQ 1.2: Construction drawings must include the required components of the DOAS system. Include ASHRAE 61 MZ Calc spreadsheet or equivalent. Show that the system provides 100% fresh air without mixing with recirculated air; show integrated energy recovery strategy.

Construction Review Requirements

Submit approved submittal for compliant air filters.

Resources

- ANSI/ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality.
- ANSI/ASHRAE Standard 62.1 User's Manual.
- ANSI/ASHRAE Standard 62.1 Mechanical Ventilation Calculation Worksheet
- CSI MasterFormat™ 2016: https://www.edmca.com/media/35207/masterformat-2016.pdf

Pollutant & Chemical Source Control

Intent
Achieve good indoor air quality to protect student and staff health and improve performance and attendance.
EQ 2.0 – Pollutant & Chemical Source Control

Good indoor air quality includes proper ventilation, filtration, moisture and humidity management, and contaminate source control. This section includes an array of best practices to prevent or eliminate pollutants and chemicals releases.

EQ 2.0 – Pollutant & Chemical Source Control			**Prerequisite**
			2 points
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	EQ 2.0	For achieving the strategies below, claim two points.
	EQ 2.0.1	*Off-Gassing* Where chemical use occurs, including housekeeping areas, chemical mixing areas, copying/print rooms, photolabs, and vocational spaces, use deck-to-deck partitions with dedicated mechanical exhaust to the outdoors (no air recirculation, and negative pressure) at a rate of at least 0.50 cubic feet per minute per square foot, and adequate make up air. These spaces must have negative air pressure when the doors are closed, Negative air pressure is defined as mechanical exhaust to the outdoors at a rate of at least 0.50 cubic feet per minute per square foot. The spaces must maintain a negative pressure of at least 5 Pa (0.02 inches of water gauge) to a minimum of 1 Pa (0.004 inches of water) compared to their immediate environment and when their doors are closed. In photolabs, specify table vents to draw chemical vapors away from the breathing zone of dark room users. Doors to areas where hazardous materials are stored and used must be secured with self-locking and closing mechanisms.
	EQ 2.0.2	*Walk Off Mats* Provide a walk off mat system at every major outside common entryway to school buildings. Mat systems must be appropriate to the region. The mat system must consist of one of the following: Non-permanent mats: The district must have at least a two (2) year signed contract for non-permanent mats to be cleaned as seasonally appropriate. It is expected that maintenance staff will provide periodic maintenance in between. System must be at least 16 feet in overall length. OR *Permanent Mats* Shall consist of an exterior grate or grill 3-5 feet long that scrapes and provides water drainage, and an interior mat 6-9 feet long that traps and hides dirt and water (including possibly a finisher mat to clean and dry any residual dirt and moisture). Mats must be permanently installed. Any recessed grates, grills or slotted materials must be designed to be able to lift for cleaning. Specify periodic maintenance of walk off mat systems.
	EQ 2.0.3	Control surface dust by providing hard-surfaced paving not less than eight feet by eight feet at all outside entrances or doorways to any school room (concrete or equivalent), together with covered walkways or entry canopies to keep rain from the walkway surface.
	EQ 2.0.4	*Electric Ignitions for Gas-Fired Equipment* Specify electric ignitions for the following gas-fired equipment: water heaters, boilers, air-handling units, and cooking stoves.

	EQ 2.0.5	*No Mobile Fossil-Fuel Powered Equipment Indoors.* Prohibit all fossil-fuel-powered machinery that is mobile and whose specific function is for use inside the building. This is to prevent accumulation of exhaust inside the building from equipment such as polishers and burnishers. This criterion does not include stationary equipment such as gas stoves, chemistry equipment, and vocational equipment.
	EQ 2.0.6	Install a carbon monoxide monitor in occupied spaces served by gas fired appliances, and/or adjacent to parking areas where cars may idle to prevent unhealthful exposures to carbon monoxide and other combustion gasses. These sensors are intended for life safety purposes. Sensors capable of detecting very low concentrations of CO are not required.
	EQ 2.0.7	All school electronic devices including computers, imaging devices, and TV/AV systems shall meet the requirements of the EPEAT rating system, Silver or Gold level. All exposed cables and cords shall not contain any of the three phthalate esters of concern given in CPSIA, Section 108 (a) above 0.1% by weight. The phthalate esters of concern are di-(2-ethylhexyl) phthalate (DEPH), CAS 117-81-7; di-n-butyl phthalate (DBP), CAS 84-74-2; and butyl benzyl phthalate (BBP), CAS 85-68-7. Testing and analysis shall be conducted following CPSC-CH-C1001-09.3, 2010 and US EPA Method 8270D

Implementation

EQ 2.0.1

Design to physically isolate activities associated with chemical contaminants from other locations in the building, and provide dedicated exhaust systems to contain and remove chemical pollutants from source emitters at 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 copier or print rooms with structural deck-to-deck partitions and dedicated outside exhaust systems.

Provide a letter signed by a professional engineer explaining how the spaces stated in the prerequisite are ventilated to maintain a minimum 1–5 Pa negative pressure, compared to their immediate environment, and are exhausted at a rate of 0.50 cfm/ft^2.

EQ 2.0.2

Particles tracked into the school on shoes are one of the chief sources of contamination of floors and carpets. Research shows that pesticides, heavy metals, and soil are tracked in on students' shoes. The best way to keep the school free of dust, dirt, and contaminants is to prevent these unwanted items from entering the building in the first place. It is especially important to protect young school children since they are more likely to sit and play on classroom floors and be more directly exposed to contaminants.

EQ 2.0.3

Control surface dust by providing hard-surfaced paving not less than eight feet by eight feet at all outside entrances or doorways to any school room (concrete or equivalent), together with covered walkways or entry canopies to keep rain from the walkway surface.

EQ 2.0.4

The purpose of this criterion is to prohibit standing pilot lights in gas-fired equipment. Under certain conditions, the accumulation of carbon monoxide from standing pilot lights can cause dangerous air quality conditions for staff and students. Therefore, electric ignitions are required for the equipment listed in this prerequisite.

Reference specification sections for gas-fired equipment that uses electric ignitions to light gas burners.

EQ 2.0.5

Provide a resolution from the district indicating compliance.

EQ 2.0.6

Provide plans with locations of CO sensors highlighted. Include specifications for CO sensors.

EQ 2.0.7

Provide a resolution from the district indicating compliance.

Documentation Requirements

Design Review Requirements

EQ 2.0.1: Certify in the CHPS Worksheet that the spaces stated in the prerequisite are ventilated to maintain a 1-3 Pa negative pressure, compared to their immediate environment, and are exhausted at a rate of 0.50 cfm/ft2.

EQ 2.0.2: Use the CHPS Worksheet to reference sheet numbers identifying walk-off mats or equivalent track-off mitigation measures where required.

EQ 2.0.3: Use the CHPS Worksheet to reference sheet numbers identifying paved areas outside entrances or doorways.

EQ 2.0.4: Use the CHPS Worksheet to reference specifications for gas-fired equipment that uses electric ignitions to light gas burners.

EQ 2.0.5: Provide a letter signed by the school superintendent stating that no indoor mobile fossil fuel burning equipment will be used in the new or renovated facility.

EQ 2.0.6: Use the CHPS Worksheet to reference CD sheet numbers identifying required carbon monoxide monitors

EQ 2.0.7: Provide a copy of District purchasing policy or letter from District regarding purchasing of equipment that complies with the referenced requirements.

Construction Review Requirement

For credits EQ2.0.1-4 and EQ 2.0.6: Provide photographs of installed measures.

Resources

- National Floor Safety Institute: www.nfsi.org/

Outdoor Moisture Management

Intent
Achieve good indoor air quality to protect student and staff health and improve performance and attendance.
EQ 3.0– Outdoor Moisture Management

Due to health risks associated mold and microbial growth and the damage caused to buildings by water infiltration, all surface grades, drainage systems, and HVAC condensate must be designed to move water away from buildings and their foundations.

EQ 3.0 – Outdoor Moisture Management		**Prerequisite**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 3.0	Drainage - Design surface grades to slope away from the building and the building foundation to drain away rainwater, snowmelt, and HVAC condensate and to prevent ponding, pooling or otherwise saturating the building envelope or foundation. Rain leaders, or downspouts, must be directed to infiltration structures, on site storage, rain gardens, or daylight - provided that surface drainage moves water well away from the building and does not result in unintended ponding or pooling. HVAC systems that use evaporation drip pans for condensate removal are prohibited. Lawn irrigation systems shall be designed to prevent spray on building walls.

Implementation

EQ 3.0

Condensate removal systems that rely on gravity drainage are strongly preferred to systems that use pumps due to the reduced maintenance associated with gravity systems.

The following should be submitted to adequately show compliance:

- Site plan showing grading plan
- Diagram of condensate system. A signed statement indicating that it is an integral part of the HVAC system if such a diagram is not available.
- Typical detail of condensate drains showing drain trap and gravity drainage system
- Project team sign off that the drain trap and gravity drainage systems have been tested to show that water flows out and is neither blocked nor flows into the building.

Permanent irrigation systems that spray on buildings can cause structural damage and mold growth. Do not install irrigation systems in locations where they may spray directly onto buildings. Note: This requirement only applies to schools with permanent irrigation systems. Submit a plan of irrigation system showing that sprinkler ranges do not intersect with buildings.

Documentation Requirements

Design Review Requirements

Use CHPS Verified Plan Sheet to reference site plan showing required drainage, diagrams and details of condensate systems showing drain tap and gravity drainage system and irrigation plans showing that sprinkler ranges do not intersect with buildings.

Construction Review Requirements

Letter signed by a member of the project team stating that the drain trap and gravity drainage systems have been tested to show that water flows out and is neither blocked nor flows into the building. Submit pictures(s) of installed measures, minimum of one picture for each measure.

Resources

Ducted Returns

Intent
Prevent dust and microbial growth issues associated with plenum returns.
EQ 4.1 – Ducted Returns

Plenum returns are easily contaminated with dust, dirt and microbial and fungi growth. Ducted returns, though more expensive upfront, will help prevent such after installation problems and reduce maintenance and repairs.

EQ 4.1 – Ducted Returns		**Credit**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	EQ 4.1	Regularly occupied spaces in the school must be served by a ducted HVAC return to minimize dust and microbial growth.

Implementation

Ceiling plenum returns are easily contaminated with dust and microbial growth. Ducted returns help prevent such problems and reduce maintenance and repairs.

Examples of non-regularly occupied spaces include storage, mechanical or laundry rooms with low occupancy.

As a best practice, projects pursuing this credit are encouraged to provide appropriate access doors to adequately clean and maintain ducts.

Documentation Requirements

Design Review Requirements

Use CHPS Verified Plan Sheet to reference plan sheets that show ducted returns.

Construction Review Requirements

None.

Resources

None

Construction Indoor Air Quality Management

Intent
Achieve good indoor air quality to protect student and staff health and improve performance and attendance.
EQ 5.1 – Construction Indoor Air Quality Management
EQ 5.2 – Moisture Management

A high level of indoor air quality starts during design, is implemented during construction, and maintained during operation.

EQ 5.1 – Construction Indoor Air Quality Management		**Credit**	
		5 points	
Applicability	**Verification Required**		
All projects. EQ 5.1.1 and 5.1.3 apply to both renovation projects and new schools. EQ 5.1.2 applies only to projects with new HVAC systems.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 5.1.1	During construction, meet the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) *IAQ Guideline for Occupied Buildings Under Construction*, 2007, Chapter 3. Include the erosion and sedimentation control measures to minimize site dust during occupied renovations.
2 points, for new HVAC systems only	EQ 5.1.2	If installing a new duct system, follow the SMACNA guidelines for “Duct Cleanliness for New Construction Guidelines” according to advanced levels of cleanliness. Of specific importance are the following: • Specify that ductwork be sealed when transported to the construction site. • Store ductwork in clean, dry conditions and keep sealed while it is stored.

		- Wipe down internal surfaces of ductwork immediately prior to installation to remove dust. - Seal open ends on completed ductwork and overnight work-in-progress. - During installation, protect ductwork waiting to be installed with surface wrapping, etc. - During construction, seal HVAC supply and return openings to protect them from construction dust infiltration (e.g., from drywall installation or wood floor sanding).
2 points	EQ 5.1.3	*Building Flush Out.* The project team shall develop a plan, and include it in the specifications to flush out the building with outdoor air (no return air) based on the requirements and recommendations in the specifications to remove indoor pollutants prior to occupancy. The information should also be detailed in the projects TAB and control sequence of the specifications or project manual. The specifications at minimum must state that the maximum amount of outdoor air (the design outdoor air flow rate for maximum occupancy) must be provided during and after installation of VOC emitting materials for the maximum amount of time feasible, but not less than continuously (i.e. 24 hrs.) for seven days. It should be noted that the maximum amount of ventilation provided by an HVAC system may be limited not only by the system's capacity but also by the temperature and humidity of the outdoor air. After construction ends, prior to occupancy, and with all interior finishes installed, flush out the building. Do this by supplying the ventilation rates over the specified time period per the plan developed in detail by the design engineer and provided in the specifications. After flush out, replace air filters with new filters and provide two sets of additional replacement filters prior to occupancy. For the case where a project has fallen behind schedule, the school may alternatively conduct the flush-out while the building is occupied provided all of the following measures to protect building occupants are taken prior to their use of the space. The square root of the total number of all classrooms must be tested for compliance with the following criteria. Any non-compliant rooms must be remedied and re-tested until they are compliant. Two additional classrooms per non-compliant classroom must also be tested in all items below in the event of non-compliance. Conduct IAQ testing using protocols consistent with the methods listed in Table 1. Use current versions of ASTM standard methods, EPA compendium methods, or ISO methods, as indicated. Laboratories that conduct the tests for chemical analysis of formaldehyde and volatile organic compounds must be accredited under ISO/IEC 17025 for the test methods they use. Demonstrate that contaminants do not exceed the concentration levels listed in Table 1.

Table 1. Maximum concentration levels, by contaminant and testing method

Contaminant	Maximum concentration	ASTM and U.S. EPA methods	ISO method
Formaldehyde	27 ppb	ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6	ISO 16000-3
Particulates (PM10 & PM2.5)	PM10: 20 micrograms per cubic meter PM2.5: 12 micrograms per cubic meter	EPA Compendium Method IP-10	ISO 7708
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter	EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Target chemicals listed in CDPH Standard Method v1.2, Table 4-1, except formaldehyde	CDPH Standard Method v1.2–2017, Allowable Concentrations, Table 4-1	ASTM D5197; EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-3 ISO 16000-6
Carbon monoxide (CO)	9 ppm; no more than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224

ppb = parts per billion; ppm = parts per million; µg/cm = micrograms per cubic meter

Conduct the flush out for 24 hours a day continuous ventilation the total number of days necessary with all supply fans at their maximum rate and position. Thermal comfort is maintained during occupied hours, per the criteria in ASHRAE Standard 55. Internal temperatures are maintained at the most energy efficient level above 60°F; relative humidity is maintained no higher than 60% during non-occupancy hours. Under conditions where the heating can't be met (60°F) at that fan speed, then adjust the fan to achieve 60°F.

All air handling unit dampers are at their maximum outdoor air position during the 14-day flush out. If the 60% relative humidity level cannot be achieved with maximum outdoor air position, reduce fan speed and/or outdoor air position as needed, but extend flush-out period beyond 14 days to accomplish roughly the same amount of total air throughput that would have occurred at maximum outdoor air position.

	Classrooms shall not be “baked out”. The temperature in the building space shall not be increased to attempt to bake out and of the built environment. (If continuous ventilation is not possible, flush out must total the equivalent of 14 days of maximum outdoor air.) *Post-occupancy ventilation* When the contractor is required to perform touch-up (including furniture after occupancy) work involving products with chemical emissions, provide temporary construction ventilation during application and extend the building flush out by a minimum of 4 days after touch-up application, with 100% tempered outdoor air for 24 hours each day.

Implementation

EQ 5.1.1

For new schools constructed next to occupied schools, the construction process (and demolition process if the existing school is later torn down) will create dust, fumes, and exhaust from activities such as site grading, pouring of the foundation, framing, enclosing the walls and roof, landscaping, installation of stormwater and utility systems, and paving. The construction team must have a communications plan in place to alert school occupants to potential exposures. Additionally, there must be an occupant complaint system in place when construction activities are creating nuisance dust, fumes, and exhaust. Furthermore, if warranted, the construction team should consider protecting the occupied school’s outdoor air intakes to prevent entrainment of pollutants.

Reference specifications for a communication plan between the construction team and building occupants regarding complaints, concerns, and predicted changes to IAQ. The plan must consider communications from occupants as well as to occupants. And the plan must consider whether protection of outdoor air intakes is necessary for the project Designate the CSI number, section, and page number that highlight compliance with this requirement.

For occupied renovations, applicants must implement containment procedures for dusts, gases, fumes, and other pollutants created as part of any planned construction, addition to, or renovation of a school building. Containment procedures must follow the SMACNA *IAQ Guidelines for Occupied Buildings Under Construction.* All bids received for school construction or renovations must include the cost of planning and execution of containment of construction pollutants consistent with the SMACNA guidelines. The plan must include a plan for communicating information about procedures, protective measures, and construction schedules from the construction team to the building occupants. Additionally, there must be an occupant complaint systems in place when construction activities are creating nuisance dust, fumes, and exhaust.

EQ 5.1.2

This construction practice 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.

Duct insulation should be located on the outside of ductwork, unless it is being installed for the purpose of attenuating sound, and there is no other means of attenuation sound. Duct liners have been known to deteriorate over time and absorb moisture, leading to the release of particles in the ducts that can be blown into classrooms and offices. Ensure that the duct liners used for sound attenuation meet the ASTM standards for surface erosion resistance and water vapor sorption.

Resources

- ASHRAE Standard 62.1Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 2008.
- National Council for Occupational Health and Safety. Green During the Construction Phase: Air Quality Pledge. http://www.coshnetwork.org/node/223
- Sheet Metal and Air Conditioning Contractors' National Association, Inc., (SMACNA) Duct Cleanliness for New Construction Guidelines; ©SMACNA 2000 https://www.smacna.org/docs/default-source/technical-resources/duct-cleanliness-for-new-construction-guidelines.pdf?sfvrsn=c921fda5_2

EQ 5.2 – Construction Moisture Management		**Credit**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 5.2	Mold Prevention - Building materials, especially gypsum wallboard, wood, porous insulation, paper, and fabric, should be kept dry to prevent the growth of mold and bacteria. Cover these materials to prevent rain damage, and if resting on the ground, use spacers to allow air to circulate between the ground and the materials. Water damaged materials shall be dried within 24 hours. Due to the possibility of mold and bacterial growth, materials susceptible to moisture that are damp or wet for more than 24 hours must be discarded. Immediately remove materials showing signs of mold and mildew, including any with moisture stains, from the site and properly dispose of them. Replace moldy materials with new, undamaged materials.

Implementation

Construction activities can affect indoor air quality long after the building is occupied. Being careful to protect building materials from moisture and removing water-damaged materials are important practices in the prevention of mold growth in new buildings.

Reference specification sections for protection of building materials from water damage, and designate the CSI number, section, and page number that highlight compliance with this requirement.

Provide photographs taken at various times during construction, with a narrative for each photo describing techniques for protecting building materials from mold and moisture damage.

Documentation Requirements

Design Review Requirements

EQ 5.1.1 & 5.1.2 – Use CHPS Verified Plan Sheet to reference plan sheets which include Indoor Air Quality management features.

EQ 5.1.3 – Use the CHPS Verified Plan Sheet to reference specifications for the building flush out.

EQ 5.2:

Reference specifications for an Indoor Air Quality Management Plan that addresses SMACNA control measures for maintaining good indoor air quality on the job site and for duct protection including specific references to SMACNA Duct Cleanliness Guidelines Advanced Levels. The specifications should indicate who is responsible for implementing the IAQ management plan, and the plan should address depressurizing work areas, ongoing housekeeping, scheduling of construction activity to lower impacts of IAQ problems on workers and building occupants, and the method of communication between construction team and building occupants regarding complaints, concerns, and predicted changes to IAQ. Designate the CSI number, section, and page number that highlight compliance with this requirement.

Designate the CSI number, section, and page number that highlight the requirements for ASTM standards C 1071 or UL 181 for surface erosion resistance and ASTM standards C 1104 or C 209 (at <0.5% absorption by volume for ASTM C 209) for water vapor sorption.

Construction Review Requirements

EQ 5.1.1 & 5.1.2 – Submit pictures, taken at various times during construction, with a narrative for each photo describing compliance with the various requirements.

EQ 5.1.3 – Submit a narrative describing implementation of the flush out option chosen, pictures and sign-off from the Contractor that it took place.

EQ 5.2 – Submit pictures taken at various times during construction, with a narrative for each photo describing techniques for protecting building materials from mold and moisture damage.

For occupied renovations, provide photographs (at least six), taken at various times during construction, with a narrative for each photo describing compliance with SMACNA guidelines as follows:

- Construction areas that was isolated from adjacent non-construction areas using temporary walls, plastic sheeting, or other vapor retarding barriers.
- Construction areas that were maintained at a negative air pressure compared to surrounding non-construction areas.
- Recirculating air ducts that were temporarily capped and sealed (appropriate filters may be used if nuisance particulates are the only contaminant of concern).
- Supply air systems that were operated with filters in place.

Resources

- ANSI/ASHRAE Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality:
- ANSI/ASHRAE Standard 62.1-2016 User's Manual: https://www.ashrae.org/resources--publications/bookstore/62-1-users-manual
- ANSI/ASHRAE Standard 62.1-2016 Mechanical Ventilation Calculation Worksheet
- California Certified Air Cleaning Devices: https://ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices

Post Construction Indoor Air Quality

Intent

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.

EQ 6.1 – Post Construction Indoor Air Quality

Carpet and other soft surfaces and ventilation systems are especially susceptible to the accumulation of construction dust. Effective vacuuming will reduce the accumulation and distribution of particulates.

EQ 6.1 – Post Construction Indoor Air Quality		Credit 1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 6.1	Vacuum carpeted and soft surfaces with a certified vacuum or high-efficiency particulate air (HEPA) filter vacuum that meets or exceeds the CRI Seal of Approval/Green Label Vacuum Cleaner Program after construction is complete and prior to occupancy. For phased, occupied renovations, HEPA vacuum the carpet daily in occupied areas, and in areas adjacent to those affected by construction activities.

Implementation

Reference specifications for vacuuming of carpeted floors prior to full building occupancy using a certified vacuum or high efficiency particulate air (HEPA) filter vacuum that meets or exceeds the CRI Seal of Approval/Green Label Vacuum Cleaner Program. For phased, occupied renovations, or adjacent areas that may be affected by construction activities, submit a signed letter from the Superintendent stating that:

- Carpeting in occupied areas of the school shall be vacuumed on a daily basis

- Only certified Carpet & Rug Institutes Seal of Approval (CRI SOA) Program vacuums with manufacture model identification numbers listed on the Carpet & Rug Institutes Seal of Approval (CRI SOA) Program website List will be permitted to be used for daily vacuuming of carpet in the school.
- All maintenance and cleaning staff shall keep a written log reviewed by the schools Facility Manager annually verifying that each vacuum used in the school operated at all times with the proper filter defined for the specific vacuum in the Carpet & Rug Institutes Seal of Approval (CRI SOA) Program.
- Tracking labels shall be included and used documenting date of all past and next filter replacements.

Documentation Requirements

Plan Sheet Approach

Design Review Requirements

Use CHPS Verified Plan Sheet to reference specifications for vacuuming of carpeted floors prior to full building occupancy using a certified vacuum or high efficiency particulate air (HEPA) filter vacuum that meets or exceeds the CRI Seal of Approval/Green Label Vacuum Cleaner Program. For phased, occupied renovations, or adjacent areas that may be affected by construction activities.

Construction Review Requirements

Submit a signed letter from the Superintendent, or designee, stating that:

- Carpeting in occupied areas of the school shall be vacuumed on a daily basis
- Only certified Carpet & Rug Institutes Seal of Approval (CRI SOA) Program vacuums with manufacture model identification numbers listed on the Carpet & Rug Institutes Seal of Approval (CRI SOA) Program website List will be permitted by the Facilities Manager to be used for daily vacuuming of carpet in the school.
- All maintenance and cleaning staff shall keep a written log reviewed by the schools Facility Manager annually verifying that each vacuum used in the school operated at all times with the proper filter defined for the specific vacuum in the Carpet & Rug Institutes Seal of Approval (CRI SOA) Program.
- Tracking labels shall be included and used documenting date of all past and next filter replacements.

Resources

- The Carpet and Rug Institute (CRI) Green Label Vacuum Seal of Approval Program: www.carpet-rug.org/commercial-customers/cleaning-and-maintenance/seal-of-approval-products/vacuums.cfm

Low Emitting Materials

Intent *Provide classrooms with acceptably low indoor air concentrations of harmful volatile organic chemicals that derive from building products and building materials used indoors.*
EQ 7.0 – Low Emitting Materials
EQ 7.1 – Additional Low Emitting Materials

Many common building products and building materials used indoors in the construction of educational facilities and other buildings are sources of volatile organic chemicals (VOCs). When emitted to indoor air, these pollutants are inhaled by occupants. Such inhalation exposures can result in adverse health effects. These effects include sensory and upper respiratory irritation, pulmonary irritation, asthma, damage to organ systems and neurological and reproductive systems, and increased risk of cancer. Exposure to airborne VOCs is an especially important issue for schools as children may be more susceptible than adults. In order to reduce the potential for adverse effects due to inhalation exposures to VOCs, it is important to specify and utilize products and materials in the construction of the interiors of classrooms and other educational buildings that have low emissions of VOCs that are known to be harmful.

<table>
<tr><td colspan="2" rowspan="2">EQ 7.0 – Low Emitting Materials</td><td colspan="2">Prerequisite</td></tr>
<tr><td colspan="2">2 points</td></tr>
<tr><td>Applicability</td><td colspan="3">Verification Required</td></tr>
<tr><td>All projects. This criterion applies to new schools, a new building on an existing campus, additions and major renovation projects.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

Prerequisite	EQ 7.0	*Paints & Coatings* This prerequisite addresses all paints and coatings that are applied onsite in the project's interior. The affected products include but are not limited to sealers, stains, clear wood finishes, floor sealers and coatings, waterproofing sealers, primers, flat paints and coatings, non-flat paints and coatings, and rust preventative coatings. 90%, or more, of the total volumes of such products shall meet the applicable VOC content requirements of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011. Compliance shall be documented by product data sheets, or equivalent. Use definitions and table values in the selected VOC content standard and clearly identify the standard selected for each product. *Flooring Systems* This prerequisite addresses all resilient flooring and carpet systems installed in the project's interior. 75%, or more, of the installed area of such products shall be shall be tested for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Method V1.2, 2017 and shall be compliant with the Standard Method when modeled to the school classroom scenario described therein. *Composite Wood* This prerequisite addresses all composite wood panels and building products with composite wood cores that are installed onsite in the project's interior. Composite wood is defined in the California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products (California Code of Regulations, Title 17, Sections 93120-93120.12). The affected materials are composite core and veneer core hardwood plywood (HWPW, particleboard (PB), medium density fiberboard (MDF), and thin MDF. 90 percent, or more, of the total area of composite wood panels and the composite wood cores of finished building products (e.g., engineered wood floors, doors, trim/molding, cabinetry, and counter tops) shall meet the applicable ATCM Phase 2 formaldehyde emission standards. Compliance shall be documented by product labels and data sheets, chain-of-custody documentation, or equivalent.

EQ 7.1 – Additional Low Emitting Materials		Credit	
		5 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

5 points	EQ 7.1	Projects may select from among the six available options below, with a maximum of 5 points available.
	EQ 7.1.1	*Adhesives & Sealants* Products in this category include but are not limited to carpet, resilient and wood flooring adhesives; base cove adhesives; ceramic tile adhesives; drywall and panel adhesives; aerosol adhesives; adhesive primers; acoustical sealants; fire stop sealants; HVAC duct sealants, sealant primers; and caulks. Note that structural adhesives are excluded, and sealers including concrete floor sealers and other waterproofing sealers are treated under Option 2 for Paints & Coatings. All adhesives and sealants used on the project in quantities of 2.5 gal (10 liters) or more and totaling 90% or more of the total volumes of such products applied onsite in the project's interior shall meet the VOC content requirements in the applicable category of South Coast Air Quality Management District (SCAQMD) Rule 1168, Adhesive and Sealant Applications, amended January 2005. Compliance shall be documented by product data sheets, or equivalent. Further, 90%, or more, by volume of the flooring, wall covering and wall base adhesives and sealants covered under this criterion shall be tested for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH/EHLB Standard Method V1.2, 2017. The test results shall be compliant with the Standard Method when modeled to the school classroom scenario as follows. Flooring adhesives and sealants shall be modeled using the manufacturer's specified coverage and the classroom flooring area. Wall applied adhesives and sealants shall be modeled using the manufacturer's specified coverage and the classroom wall paint and wall coverings area. Wall base adhesives shall be modeled similarly using the wall base area.
	EQ 7.1.2	*Flooring Systems* Flooring systems include but are not limited to: carpet with or without an integral cushion, carpet with an integral adhesive system, and separate cushion; resilient flooring; wood flooring; ceramic tile flooring; other mineral-based flooring (either natural or manmade) without any organic component, and concrete flooring. For the purposes of this option, it is assumed that ceramic tile, organic-free mineral-based flooring, and concrete flooring are negligible sources of VOCs and are available for credit without any testing requirements. Site applied flooring adhesives are treated under Option 1 for Adhesives & Sealants, and site applied flooring stains, sealers and coatings are treated under Option 2 for Paints & Coatings. All flooring systems installed in the project's interior totaling 90% or more of the total floor area shall be tested for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Method V1.2, 2017 (CDPH Standard Method). The test results shall be compliant with the Standard Method when modeled to the school classroom scenario using the classroom flooring area. For systems consisting of more than one distinct layer (e.g., carpet with separate cushion), all layers shall individually meet the requirements of the CDPH Standard Method.

	EQ 7.1.3	*Composite Wood and Agrifiber Products* Composite wood is defined in the California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products (California Code of Regulations, Title 17, Sections 93120-93120.12). The affected materials are composite core and veneer core hardwood plywood (HWPW, particleboard (PB), medium density fiberboard (MDF), and thin MDF. Agrifiber products are composite boards produced from agricultural/biobased materials and a chemical binder system. At least 90%, by area, of the composite wood and the composite wood cores of finished building products (e.g., engineered wood floors, doors, trim/molding, cabinetry, and counter tops) installed onsite in the project's interior shall either 1) be manufactured with no-added formaldehyde (NAF) based resins, or 2) be manufactured with ultra-low emitting formaldehyde (ULEF) resins and shall meet the appropriate emission requirements established by the ATCM for NAF and ULEF products. Additionally, at least 90%, by area, of all agrifiber products installed onsite in the project's interior shall be manufactured with NAF based resins. Compliance of NAF and ULEF materials shall be demonstrated by product labels and data sheets, chain-of-custody documentation, or equivalent. Structural plywood, structural panels, oriented strand board, structural lumber, glue laminated timber, prefabricated wood joists, and finger jointed lumber, are excluded from this option and these requirements.

EQ 7.1.4 Furniture & Furnishings

This option is only available if 75% or more of the total number of individual stations (defined as a chair and associated work surface, i.e., either a desk or a desk/chair combination) are new and/or newly remanufactured/refurbished. All such furniture totaling 90% or more of new individual stations (e.g., combined classroom and administrative stations) shall meet this requirement.

The furniture, both classroom and administrative, shall be tested for VOC emissions following the procedures in ANSI/BIFMA M7.1-2011. Workstations and seating, both classroom and administrative, shall be tested individually except a pupil desk/chair combination is treated as a single unit. Administrative area and teacher workstations and seating shall be evaluated for VOC emissions using the parameters for an open plan workstation and seating as defined in M7.1. Pupil classroom workstations and seating shall be evaluated for emissions using parameters defined for the classroom in CDPH Standard Method V1.2, 2017. The furniture modeling parameters are listed in Table 1, below. The furniture shall meet the VOC emissions guidelines defined in ANSI/BIFMA X7.1-2011 (reaffirmed 2016) and ANSI/BIFMA e3-2014, the furniture sustainability standard, as specified in Table 1.

Table 1: Modeling parameters and VOC emission guideline requirements for administrative area and teacher workstations and seating and classroom pupil workstations and seating.

	Admin Area & Teacher		Classroom Pupil	
Modeling Parameters	Workstation	Seating	Workstation	Seating
Number of units	1	1	27[a]	27[a]
Air Flow rate, m^3/h	15.01[b]	24.84[b]	191[c]	191[c]
Total workstation area, m^2	21.75[d]	n/a[e]	n/a[e]	n/a[e]
VOC Emission Guidelines				
Meet ANSI/BIFMA X7.1-2011	Yes	Yes	n/a	n/a
Meet ANSI/BIFMA e3-2014, Section 7.6.1[f]	Same as X7.1	Same as X7.1	Yes	Yes
Meet ANSI/BIFMA e3-2014, Section 7.6.2[f,g]	Yes	Yes	Yes	Yes
Meet ANSI/BIFMA e3-2014, Section 7.6.3[h]	Not required	Not required	Yes	Yes

a. CDPH Standard Method specifies 27 occupants per classroom.
b. Air flow rates specified in M7.1 for open plan workstations and seating.
c. Classroom air flow rate from CDPH Standard Method.
d. Total open plan workstation area (work surface + storage + panel) as defined in M7.1.

		e. Not applicable. Modeling of seating is performed on a per unit basis, not area. f. Administrative workstations shall meet the requirements using either the concentration or the emission factor approach defined in M7.1. For the latter, use the open-plan workstation emission factor requirements. Classroom furniture (either workstations, seating, or combined desk seating units) shall meet the concentration limits for a workstation system as specified in the e3 standard. g. Workstation individual VOC concentration limits and open-plan workstation emission factor limits are defined in the e3 standard, Annex C. h. The formaldehyde concentration limit is 9 μg/m^3.
	EQ 7.1.5	*Paints & Coatings* See EQ 7.0 for the description of the paints and coatings covered under this criterion. 90%, or more, by volume of all interior paints and coatings normally applied to walls, ceilings, floors or trim shall be tested for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Method V1.2, 2017. The test results shall be compliant with the Standard Method when modeled to the school classroom scenario as follows. Flooring sealers and paints shall be modeled using the manufacturer's specified coverage and the classroom flooring area. Wall applied paints and coatings shall be modeled using the manufacturer's specified coverage and the classroom wall paint and wall coverings area. Ceiling applied paints and coatings shall be modeled similarly using the ceiling area. Wood stains and finishes and trim applied paint shall be modeled similarly using the area of the classroom door plus the area of the wall base (i.e., 11.6 m^2).
	EQ 7.1.6	*Ceiling & Wall Systems* Ceiling and wall systems include but are not limited to ceiling insulation installed within the structural envelope, wall insulation, acoustical ceiling panels, gypsum board wall panels, tackable wall panels, and wall coverings. Ceramic tile and other organic-free, metal-, or mineral-based wall coverings are available for credit without any testing requirements. Site applied adhesives and sealants are treated under Option 1, Adhesives & Sealants, and site applied paints and coatings associated with ceiling and wall systems are treated under Option 2, Paints & Coatings. All ceiling and wall systems installed in the project's interior totaling 90% or more of the total areas of such products shall be tested for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Method V1.2, 2017 (CDPH Standard Method). The test results shall be compliant with the Standard Method when modeled to the school classroom scenario using the classroom ceiling area and/or wall area as appropriate. For systems consisting of more than one distinct layer (e.g., walls comprised of insulation, wall panel and wall covering), all layers shall individually meet the requirements of the CDPH Standard Method.

Implementation

For the purposes of these requirements, indoor products and materials are defined as materials installed or applied on site inside of a building. The building interior is defined as everything within the waterproofing membrane. The building exterior is defined as everything outside and inclusive of the primary and secondary weatherproofing system, such as waterproofing membranes and air- and water-resistive barrier materials. Low emitting materials within a selected option shall be used throughout the project including all classroom areas, teaching laboratories, administrative and staff areas, indoor circulation areas, restrooms, and multipurpose areas such as gymnasiums. Shops or other areas requiring specialty finishes may be excluded. Ninety percent (90%) or more of the combined surface area or quantity measure of an entire system (e.g., floor, ceiling, furniture) or the individual components of a system (e.g., wall assembly consisting of three components – insulation, wall panel, and wall covering) shall be comprised of low emitting materials in order to receive credit for an option. Unless otherwise specified below, low emitting materials shall meet the testing and VOC emission requirements of the California Department of Public Health's (CDPH) *Standard Method for the Testing and Evaluation of Volatile Organic Emissions from Indoor Sources Using Environmental Chambers, Version 1.2* (2017). The school classroom shall be used as the exposure modeling scenario for evaluating the acceptability of VOC emissions as described in the Standard Method, Tables 4-2 and 4-3. For wet applied products, additional content criteria are specified.

Construction documents shall specify the low emitting products to be used on the project and that these meet the requirements defined herein. Products requiring testing for VOC emissions may be selected from the CHPS High Performance Product Database www.chps.net/products or acceptable labeling or certification programs acknowledged on the CHPS web site. Additionally, products not currently listed may be tested by an independent laboratory as prescribed by CHPS. Provided the results of the tests are accepted by CHPS, credit may be obtained assuming all other requirements have been met.

Documentation Requirements

Design Review Requirements

Use CHPS Verified Plan Sheet to reference specification sections for low-emitting products with the maximum allowed VOC concentration levels per product and certifications as required.

Construction Review Requirements

Submit the Schedule of Values for the project, formatted to group together all products within any category claimed for Low Emitting credit or prerequisite. Include subtotals of the value for compliant products and all products by category.

Complete the CHPS Verified Plan Sheet to confirm compliance with requirements.

Resources

- State of California Department of Public Health, Standard Method for the Testing and Evaluation of Volatile Organic Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, CDPH/EHLB/Standard Method, V1.2 (2017): http://cal-iaq.org/
- CHPS High Performance Products Database: www.chps.net/products
- California Air Resources Board: Suggested Control Measures: www.arb.ca.gov/coatings/arch/docs.htm
- South Coast Air Quality Management District: Rule 1113. Architectural Coatings: http://www.aqmd.gov/home/rules-compliance/compliance/vocs/architectural-coatings#:~:text=Rule%201113%20was%20adopted%20in,in%20the%20South%20Coast%20AQMD

Low Radon

Intent
Build with radon-reducing features and test for radon to determine whether mitigation is necessary to reduce health effects.
EQ 8.1 – Low Radon

This credit encourages schools to assess their radon levels and ensure that the levels are low. Radon in schools presents a significant health risk, and thousands of schools are affected. Approximately 20% of schools have high radon and, and 41% of those schools are located in known high radon areas. Radon is a human lung carcinogen and is the largest source of radiation exposure and risk to the public. Radon is the second leading cause of lung cancer; even small exposures to radon can lead to lung cancer. And according to the US EPA the only way to know if elevated radon levels are present is to test. Mitigation measures should be pursued during both the design and construction phases.

EQ 8.1 – Low Radon		**Credit**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 8.1	For new construction, institute radon reduction measures specifically, but not limited to: soil gas barrier, gas permeable layer, and vent pipes for fan-activated radon removal systems (should testing warrant system activation). Designs and strategies depend on the types of building foundations and other factors. See CC-1000 Soil Gas Control Systems in New Construction of Buildings by ANSI/AARST for radon reduction measures that work best for different construction types and scopes Radon reduction measures are not deemed effective until testing verifies radon levels below 4 pCi/L. Test for radon according to MALB Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings. For renovations/modernizations, perform post-renovation radon testing and make necessary mitigations should radon levels meet or exceed 4 pCi/L. Test for radon after HVAC systems are commissioned and performing as intended prior to occupancy. If mitigation is warranted, such as HVAC manipulations or sub-slab depressurization, procedures must follow RMS-LB Radon Mitigation Standards for Schools and Large Buildings as soon as possible. If radon levels are near 100 pCi/L or greater, school officials should call their State Radon Contact and consider relocating from affected rooms until the levels can be reduced. All radon testing must follow the MALB Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings.

Implementation

New school buildings have a unique opportunity to prevent radon gas from entering the interior of a school at the USEPA action level of greater than or equal to 4 pCi/L. Design and construction methods for radon reduction should follow CC-1000 Soil Gas Control Systems in New Construction of Buildings. Additionally, the USEPA regional office or state radon program and professionals certified in radon testing and mitigation should be consulted. If hiring measurement and mitigation consultants, ensure that they are certified through the National Radon Proficiency Program (NRPP) or National Radon Safety Board (NRSB). Also ensure that projects comply with applicable codes, regulations and certification rules within the project jurisdiction.

Once measures have been incorporated into the construction of the school and HVAC systems have been commissioned and are operating as intended, then test that levels of radon are less than 4 pCi/L. Post-construction radon testing best practices are found in MALB Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings. Where radon testing indicates high radon (4 pCi/L or greater), the radon system can be activated with a fan and/or HVAC can be modified to reduce radon in accordance with CC-1000 Soil Gas Control Systems in New Construction of Buildings.

Renovations/modernizations also have opportunities to successfully mitigate radon levels in school projects. Depressurization systems which pull air from below the slab or crawl spaces or changes to ventilation are examples of proven measures that reduce radon. These changes should be made once HVAC systems have been commissioned and are operating as intended.

At that point, testing can be conducted to determine presence of radon and whether airflow adjustments are needed. Projects must consult RMS-LB Radon Mitigation Standards for Schools and Large Buildings and MALB Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings for guidance on mitigation and testing measures and, as above, USEPA regional office or state radon program and professionals certified in radon testing and mitigation should be consulted.

To maintain low radon environments, a school should be tested at least every five years unless the school previously tested with high levels. In such schools, those rooms or buildings should be mitigated and then retested every two years. Retesting is done to ensure that the mitigation system remains effective and that common building changes are not causing a change in radon levels from previously known levels. The need for retesting is triggered by the following types of events:

- Renovation work that includes energy upgrades
- HVAC equipment that is added, removed, replaced, operated incorrectly or differently, or improperly maintained
- New additions/significant renovations

Documentation Requirements

Design Review Requirements

The Project Team must provide a statement to CHPS stating that radon prevention and active mitigation systems (if needed) have been designed according to the following standards, and include descriptions of any deviations from best practices:

- For new construction: CC-1000 Soil Gas Control Systems in New Construction of Buildings, ANSI/AARST.
- For renovation/modernizations: RMS-LB Radon Mitigation Standards for Schools and Large Buildings, ANSI/AARST.

Provide specifications and construction documents delineating radon prevention measures and active mitigation systems in order to support the statement above. Construction Review Requirements

Submit a statement from the Project Team that summarizes the following: whether radon testing was completed, when it was completed, test duration, and the radon levels detected. Indicate whether further mitigation was needed.

Statement must indicate that testing was performed in accordance with MALB Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings, ANSI/AARST

Resources

- CC-1000 Soil Gas Control Systems in New Construction of Buildings, ANSI/AARST

- RMS-LB Radon Mitigation Standards for Schools and Large Buildings, ANSI/AARST
- MALB Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings, ANSI/AARST
- EPA Radon in Schools Webinar: https://www.epa.gov/iaq-schools/forms/webinar-radon-schools-what-you-need-know-properly-manage-radon-your-school
- American Association of Radon Scientists and Technologists (AARST) Mitigation and Certification Courses: http://aarst-nrpp.com/wp/entry-level-courses/
- Schools and Daycares testing: https://www.certi.us/cms/component/virtuemart/courses/continuing-education/c-16-108-addressing-radon-in-daycare-facilities,-schools-and-large-buildings-certi-323-detail?Itemid=0
- Eastern Regional Radon Training Center courses: http://www.cpe.rutgers.edu/programs/radon_indoor_air_quality.htmlNational Radon Proficiency Program (NRPP) http://aarst-nrpp.com/wp/certification/
- National Radon Safety Board (NRSB) http://www.nrsb.org/
- 2011 Federal Radon Action Plan: https://www.epa.gov/radon/federal-radon-action-plan-frap Environmental Law Institutes Radon Law Database for the US (use database and search for schools): www.afhh.org/hps/radondocs/eli_database_radon_state_laws.pdf
- Managing Radon in Schools, The Indoor Air Quality Tools for Schools Approach:
- Key Drivers and Strategies for Success: https://www.epa.gov/iaq-schools/managing-radon-schools Radon Prevention in Design and Construction of Schools and Other Large Buildings (EPA 625R-92-016): https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NRMRL&dirEntryID=126984#:~:text=We%20recommend%20the%20following%20three,and%20(3)%20seal%20major%20radon
- Guidance on planning, implementing, and evaluating a radon testing program for a school: https://nepis.epa.gov/Exe/ZyNET.exe/910188F5.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000028%5C910188F5.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL US EPA's IAQ Design Tools for Schools document: https://www.epa.gov/iaq-schools/indoor-air-quality-design-tools-schools
- IAQ Reference Guide Appendix G - Radon
- State radon office for state-specific recommendations: https://www.epa.gov/radon/find-information-about-local-radon-zones-and-state-contact-information#radonmap

Thermal Comfort – ASHRAE 55

Intent
To provide a high level of thermal comfort to support optimum health, productivity, and comfort.
EQ 9.1 – Thermal Comfort – ASHRAE 55

Thermal comfort is controlled by six factors: air temperature, relative humidity, radiant temperature, air movement, occupant activity and clothing. Design the building envelope and mechanical systems to provide optimal comfort and energy efficiency.

<table>
<tr><td colspan="2" rowspan="2">EQ 9.1 – Thermal Comfort – ASHRAE 55</td><td colspan="2">Credit</td></tr>
<tr><td colspan="2">4 points</td></tr>
<tr><td>Applicability</td><td colspan="3">Verification Required</td></tr>
<tr><td>All projects.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

4 points	EQ 9.1	Comply with the current ASHRAE *Standard 55* for thermal comfort standards.

Implementation

Indoor design temperature and humidity for general comfort applications shall be determined in accordance with the American National Standards Institute (ANSI)/ASHRAE 55. The standard specifies conditions in which a specified fraction of the occupants will find the environment thermally acceptable. Comfort conditions for naturally ventilated buildings are included in the standard. Provide a summary that identifies each thermally controlled zone and the temperature and humidity control ranges and method of control used for each zone.

The design should also consider other important factors such as minimizing temperature differences between exterior surfaces and interior walls, decreasing the temperature variation between floors and ceilings, and decreasing the velocity of air flow such as drafts.

Supply a letter signed by the project engineer certifying that ASHRAE *Standard 55* guidelines will be achieved and how they will be achieved.

Documentation Requirements

Design Review Requirements

Use CHPS Verified Plan Sheet to reference sheet or specification section that includes a table with seasonal temperatures and humidity design criteria, and metabolic rates for each type of space. The project Engineer shall certify that the project is designed to meet the ASHRAE *Standard 55* guidelines.

Drawings must identify thermal zones, temperature and humidity control ranges, and their method of control.

Construction Review Requirements

None.

Resources

- ANSI/ASHRAE Standard 55-2020

Controllability of Systems

Intent
Enable teachers to have reasonable control of the thermal environment within their classrooms.
EQ 10.1– Individual Controllability
EQ 10.2 – Controllability of Systems

Temperature and Ventilation Controls: A high performance school is a comfortable place to learn. Temperature and humidity are important factors in maintaining occupant comfort. A comfortable and healthy indoor environment increases productivity and learning and reduces absenteeism.

Operable windows are important for personal comfort and have been shown to improve student performance.

EQ 10.1 – Individual Controllability		**Credit**	
		1 point	
Applicability	**Verification Required**		
All projects in which New HVAC system is being installed.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 10.1	Provide an individual temperature control for each classroom with an independent temperature sensor.

EQ 10.2 – Controllability of Systems		**Credit**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 10.2	Ninety percent (90%) for new schools and new school buildings, and seventy five percent (75%) for major renovations, of all classrooms shall have a minimum of one operable window per classroom that is reasonably accessible to the occupants. This precludes the use of ladders to adjust the window opening.

Implementation

EQ 10.1

Temperature Controls

Individual classrooms will vary in temperature depending on their orientation, glazing apertures, occupancy, and the effectiveness of the heating or cooling systems. Provide individual systems to allow teachers to regulate the temperature of their classrooms.

EQ 10.2

Operable Windows

Provide at least one operable window in each classroom. Train teachers on how to properly use the HVAC controls in their rooms and on how opening doors and windows affects the HVAC system and the acoustical environment in a classroom. Operable windows are important for both personal comfort and operation if for example, power loss occurs and mechanical ventilation cannot be provided,

Reference specifications for operable windows. Designate the CSI number, section, and page number that highlight compliance with this requirement. For the purposes of this part of this criterion, classrooms are:

- General classrooms
- Art rooms
- Music rooms
- Science rooms
- Computer rooms
- Special needs, remedial, and collaborative space
- Industrial technology spaces
- Work and family studies spaces

Cross-Category and Other Considerations

This criterion is related to EE 1, Energy Performance; EE 3 Commissioning; and II 9.1, Innovation. Temperature control systems should not give teachers free range to adjust the temperature to whatever they desire. It is possible to install systems that allow teachers to adjust the temperature in a room to within 1-2 degrees Fahrenheit of the standard setting for the season (e.g. 70°F in winter) that will improve their comfort while not having a significant adverse impact on the building's energy efficiency. Establishing a standard temperature setting for the entire building is an important corollary action.

Documentation Requirements

Design Review Requirements

EQ 10.1: Use CHPS Verified Plan Sheet to reference sheet or specification section which shows adjustable temperature control devices in each of the classroom types required.

EQ 10.2: Use CHPS Verified Plan Sheet to reference the specification section for operable windows. Also reference plan sheets and window schedules which show locations of operable windows in each classroom.

Construction Review Requirements

Submit photographs of installed temperature control devices and/or operable windows.

Resources

None

Daylighting

Intent *Provide high quality daylighting in classrooms to enhance student performance, to improve student productivity through quality daylighting designs that minimize glare and direct sunlight penetration, and ensure energy savings.*
EQ 11.0 – Daylighting: Glare Protection
EQ 11.1 – Daylight Availability

Daylighting is fundamentally important to high performance design, and should be the primary source of light in classrooms. Daylighting has a number of advantages, including improved occupant productivity, improved connection to the outdoors, improved health, energy savings, and quality of light.

EQ.11.0 – Daylighting: Glare Protection			**Prerequisite** **4 points**
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	EQ 11.0	Design spaces to optimize daylight while preventing glare by controlling direct sunlight ingress with blinds, shades, overhangs, lightshelves, translucent material, or other effective means. Use any of the following three metrics to document achievement of this criterion, and refer to the implementation section for documentation requirements: • No direct sunlight can strike the teaching surfaces or a work plane located 4 ft. or more inside the exterior walls at 9:00AM, 12:00PM and 3:00PM on the winter and summer solstice and the equinox. **OR** • The maximum illuminance to average illuminance ratio measured in the workplane cannot exceed 15 at 9:00AM, 12:00PM and 3:00PM on the winter and summer solstice and the equinox. **OR** • The maximum Daylight Autonomy (DA_{max}) for the daylit spaces must be below 5% for all daylit spaces. AND • Skylights and roof monitors shall meet the requirements of no direct sun penetration as described above, unless they have diffusing devices such as a haze factor 99%+ or direct transmittance <1%.

EQ 11.1 – Daylight Availability			**Credit**
			5 points
Applicability	**Verification Required**		
This criterion applies to all projects. To earn these points for major renovations, it may be necessary to add skylights or modify the size and location of windows.	Design Review	Construction Review	Performance Review

Requirement

1-3 points — EQ 11.1.1

For all **classroom** spaces:

Daylight Responsive Lighting Controls

To achieve any of the available points for daylighting classrooms a daylight responsive electric lighting system or plan must be implemented for the daylit spaces.

- For photosensor based systems; documentation showing location of sensors, lighting zones, and setpoint and commissioning information for the system.

For strategic switching and occupant education approaches; drawings showing the switching and zones a brief manual to be provided to the building occupants describing the daylighting intent of the space and the recommended function of all daylighting, lighting and shading devices.

AND ONE OF THE FOLLOWING

Multiple Point in Time Approach

1 Point	Achieve >20fc annual average illuminance for >75% of classroom area
2 Points	Achieve >35fc annual average illuminance for >75% of classroom area
3 Points	Achieve >50fc annual average illuminance for >75% of classroom area

OR

Spatial Daylight Saturation (sDS) Approach

1 Point	Achieve >50% sDS$_{300/50\%}$
2 Points	Achieve >75% sDS$_{300/75\%}$
3 Points	Achieve >90% sDA$_{300/90\%}$

1-2 points — EQ 11.1.2

For **support** spaces, choose one of the following two options:

Multiple Point in Time Approach

1 point	Achieve >30fc average Illuminance for >50% of administration office area
1 point	Achieve >40fc average Illuminance for >50% of library, cafeteria, auditorium and multi-purpose/commons area

OR

Spatial Daylight Saturation Approach

1 Point	Achieve >60% $sDS_{300/50\%}$ for administration office area
2 Points	Achieve >60% $sDS_{400/50\%}$ for library, cafeteria, auditorium and multi-purpose/commons area

AND

Daylight Responsive Lighting Controls

To achieve any of the available points for daylighting support spaces a daylight responsive electric lighting system or plan must be implemented for the daylit spaces.

- For photosensor based systems; documentation showing location of sensors and lighting zones, and set-point and commissioning information for the system.
- For strategic switching and occupant education approaches; drawings showing the switching and zones a brief manual to be provided to the building occupants describing the daylighting intent of the space and the recommended function of all daylighting, lighting and shading devices.

*Any spaces where daylight would have an adverse impact on the use of the space are excluded. Provide documentation illustrating impact

Implementation

Direct Sunlight Penetration

Requirement EQ 11.0 (direct sunlight penetration) shall be verified by one of the following methods:

- A physical model should be placed on a heliodon or otherwise positioned so that the sun angles represent the dates and times specified in EQ 11.0. Verify by photograph that the 9 conditions do not have any direct sunlight on the workplane or teaching wall. Indicate if automatic or manual blinds or shades are used meet the requirement.
- A model may be set up in a computer based tool that can calculate sunlight on interior surfaces. Verify be rendering images or task plane illuminance calculations that the 9 conditions do not have any direct sunlight on the workplane or teaching wall. Indicate if automatic or manual blinds or shades are used meet the requirement.

- Manually calculate the sun profile angles and show that the criteria are satisfied for the dates and times specified in EQ 11.0 Illustrate the shading strategies provide complete direct sunlight control for the 9 conditions specified.
- Perform an incremental maximum Daylight Autonomy calculation using 300fc or other recommended target illuminance x 10. The DA_{max} should be 5% or less for no more than 5% of the workplane points. Use the Blinds/Shades Operation protocol described in section 2.2.6 of IES LM-83-12, or describe the blinds/shades operation used to achieve the requirement.
- For any manually controlled shading devices included in the above calculations (i.e. Blinds, roller-shades), provide a brief manual that can be given to users, informing of optimal use of shading devices, namely ensuring they are not left down when there is plentiful daylight.

Computer rooms and other spaces where daylight would have an adverse impact on the use of the space are excluded. For renovation projects that do not modify lighting systems, the project need not provide daylighting controls for the electric lighting system

Multiple Point in Time Approach

Option calculations for the requirements may be made with a qualified computer simulation tool.

- Computer Simulation Tool: Any daylighting simulation tool that can perform accurate daylight illuminance calculations for a grid of points under standard CIE skies for the times specified. Commercially available simulation tools include AGI32, Radiance, SPOT, 3DS Max Design, DAYSIM, DIALux
- A minimum analysis grid of 3 ft. by 3 ft. shall be used. The grid shall be positioned so that no analysis points are located closer than 2 ft. and further than 3ft from a wall.
- The annual average illumination should be determined by first calculating the workplane average illuminance for 10 design sky conditions: 9AM, 12PM, and 3PM for winter and summer solstice and equinox under a CIE clear sky and 12PM on the equinox under a cloudy sky condition Use information from the National Oceanic and Atmospheric Association's (NOAA) National Climatic Data Center, or from a TMY weather file to determine the percentage of cloudy and sunny days. The annual average illuminance is calculated with this formula:

$$E_{avg} = [(W9 + W12 \times 2 + W3) + (E9 + E12 \times 2 + E3) \times 2 + (S9 + S12 \times 2 + S3) \times 0.5)/14] \times Sunny\% + EC12 \times Cloudy\%$$

Where:

E_{avg} = estimated annual average illuminance

WX = Sunny winter solstice condition at 9AM, 12PM, and 3PM

EX = Sunny equinox condition at 9AM, 12PM and 3PM

SX = Sunny summer condition at 9AM, 12PM, and 3PM

EX12 = Cloudy equinox condition at 12PM

Sunny % - percent of year with opaque cloud cover <50%

Cloudy % - percent of year with opaque cloud cover >50%

Spatial Daylight Saturation Approach

Option calculations for the requirements must be made with a computer simulation tool.

The Spatial Daylight Autonomy calculations must meet the following criteria:

- Computer Simulation Tool: Any daylighting simulation tool that can perform accurate daylight illuminance calculations for a grid of points under standard CIE skies for the times specified. Commercially available simulation tools include AGI32, Radiance, SPOT, 3DS Max Design, DAYSIM, DIALux.
- A minimum analysis grid of 3 ft. by 3 ft. shall be used. The grid shall be positioned so that no analysis points are located closer than 2ft and further than 3 ft. to a wall.
- A design illuminance of 30fc should be used unless a different illuminance target is recommended – for example 15fc for a computer room or 50fc for a gymnasium. A design illuminance of 40fc (400 lux) is required for library, cafeteria, auditorium and multi-purpose/commons areas.
- Daylight Saturation (DS) aka “Continuous” Daylight Autonomy calculation method to be used. This method gives credit for hours that receive partial daylight contribution. For example, when 20fc of daylight is provided and the design illuminance is 30fc this counts for 20/30 or 0.66 for that time as opposed to 0 given a Daylight Autonomy approach.
- Daylight Autonomy, or an “Incremental” calculation method, to be used for DA_{max} calculations. This method only counts hours that completely meet or exceed this max illuminance with daylight.
- The school occupancy schedule and a representative weather file should be used for the annual DA and DA_{max} calculations. 7AM to 3PM should be used as a standard school schedule. Schools with schedules that vary from this standard should provide documentation of their operation hours.

General Note: Computer rooms and other spaces where daylight would have an adverse impact on the use of the space are excluded.

Documentation Requirements

Design Review Requirements

EQ 11.0 – Use CHPS Verified Plan Sheet to reference plan sheets or specification sections which show required photocontrols, sensors, lighting zones and set-points. Provide PDF results of a daylight simulation model, a computer based simulation model, a physical model, or manually calculated sunlight penetration in the classrooms to avoid direct sunlight on teaching surfaces and work planes.

EQ 11.1 – Use the CHPS Verified Plan Sheet to identify spaces that qualify as daylit, and the percentage of daylit classrooms. Fulfill this requirement by completing the CHPS Verified Plan Sheet provided at the point of registration with the CHPS Verified program. Plans and sections will be used for verification. For each classroom group identified on the CHPS Verified Plan Sheet, provide the required computer based simulation results including point-by-point lighting predictions as appropriate.

Construction Review Requirements

Submit photographs of installed light controls.

Resources

- Approved Method: IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure: https://www.usgbc.org/resources/ies-lighting-measurements-lm-83-12-approved-method-ies-spatial-daylight-autonomy-sda-and-a
- Advanced Lighting Guidelines: 2003 Edition: https://www.lightingassociates.org/i/u/2127806/f/tech_sheets/Advanced_Lighting_Guidelines_2003.pdf
- IES TM-83-13 "IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure (ASE)"
- "Daylighting Pattern Guide" at http://patternguide.advancedbuildings.net
- AGI32 Lighting Design Software: www.agi32.com/
- DAYSIM Daylighting Analysis Software: https://github.com/MITSustainableDesignLab/Daysim
- DOE-2 Building Energy Use and Cost Analysis Software: http://doe2.com/
- DOE-2 Equest: www.doe2.com/equest
- Ecotect: http://usa.autodesk.com/ecotect-analysis/
- EnergyPlus Building Energy Simulation Program: https://energyplus.net/
- SPOT: www.daylightinginnovations.com
- 3DS Max Design: https://www.autodesk.com/
- Radiance: https://floyd.lbl.gov/radiance/
- SkyCalc: https://www.eso.org/observing/etc/bin/gen/form?INS.MODE=swspectr+INS.NAME=SKYCALC
- Climate Studio: https://www.solemma.com/diva
- Open Studio: https://www.energy.gov/eere/buildings/downloads/openstudio-0

Views

Intent
Provide a connection between indoor spaces and the outdoor environment through the introduction of sunlight and views into the occupied areas of the building.
EQ 12.0 – Views
EQ 12.1 – Additional Views

View windows are essential to areas where students and staff will be working for extended periods of time. Ample and interesting views have consistently been found to increase student performance. Distant views enable the occupants of the room to relax their eyes, which is especially beneficial to computer users and younger children who are still developing their visual capabilities.

EQ 12.0 – Views Prerequisite		**Prerequisite**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review
EQ 12.1 – Additional Views		**Credit**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

This criterion applies to all new classrooms, libraries and administration areas.

Requirement

1 point	EQ 12.0	Provide direct line of sight to view glazing from 70% of the combined floor area of classrooms, library reading rooms, and administration areas. To qualify, a space shall have view glazing area equal to or greater than 7% of the floor area. View glazing shall be transparent, but not translucent, and only include window area above 2.5 ft. and below 7.5 ft. from the floor. The total width of view windows shall be greater than 1% of the floor area. Exception: School buildings that share at least two sides with other buildings, the shared walls are exempted from this requirement. Every effort shall be made to meet the view glazing requirement on walls not shared with other buildings.
2 points	EQ 12.1	Provide direct line of sight to view glazing from at least 80% of the combined floor area of core classrooms and administration areas. Access to Views, 80% = 1 point Access to Views, 90% = 2 points To qualify, a space shall have view glazing equal to or greater than 7% of the floor area. View glazing shall be clear and only include window area above 2.5 ft. and below 7.5 ft. from the floor. The total width of view glazing shall be greater than 1% of the floor area.

This criterion applies to all classrooms and administration areas. Renovation projects that involve window replacement can earn this criterion by modifying existing window configurations that do not conform to the requirements to configurations that do meet the requirements for this criterion.

Implementation

Determine the total floor area of spaces for which this requirement applies by creating a table listing the classrooms, library reading rooms and administrative areas. Like spaces may be listed just once. A like space is one with the same physical configuration, including windows.

For each space in the list determine how much of the floor area qualifies for the view criterion. Two considerations come into play: the view window area and the total width of the view windows. Each of these limit how much of the area qualifies, as explained below:

- To determine the maximum qualifying area based on the view window area, divide the view window area by 7%.
- To determine the maximum qualifying area based on the width of the view windows, divide the total width of view windows by 1%.

For each space the qualifying floor area is the lesser of the total floor area, the maximum floor area based on view window area, or the maximum floor area based on view window width. Sum the qualifying area and compare to the total area. If it is greater than 70%, then the school project qualifies, otherwise it does not.

Example Calculation

Question: A new school has 30 like classrooms each with a floor area of 960 ft². Each classroom has view windows with an total area of 60 ft² and a total width of 9 ft. The school also has six larger 1,040 ft² classrooms with 70 ft² view windows with a total width of 10.5 ft. The 2,600 ft² library reading area has 200 ft² of view windows with a total width of 25 ft. The 2,000 ft² administration area has 150 ft² of view windows with a total width of 18 ft. Does this school qualify for the view windows criterion and how much of the floor area qualifies as having view windows?

Answer: The total floor area of classrooms, administration areas and library reading rooms is 39,640 ft² (see column D in Figure 1). To meet the criterion, at least 70% of the floor area of these spaces shall have view windows, or a total of 35,676 ft². The qualifying floor area must be determined for each space based on the total view window area and the total width of the view windows. For the smaller classrooms, the maximum qualifying floor area based on view window area is 857 ft² or 60 ft² divided by 7%. The maximum qualifying floor area based on window width is 900 ft. or 9 ft. divided by 1%/ft. The qualifying area is the smaller of these numbers or 857 ft². For the larger classrooms, the qualifying area is 1,000 ft²; 2,500 ft² for the library reading area; and 1,800 ft² for the administration areas. The total qualifying area is 36,010 ft² or 91%. See Figure 1 for details of the calculation.

Figure 1: Example Calculation of View Window Criterion

				For each space					
Space	Size (ft²)	Number of spaces	Total area (ft²)	View window area (ft²)	Maximum Floor Area based on view window area (ft²)	Total width of view windows (ft.)	Maximum floor area based on view window width	Qualifying floor area per space (ft²)	Total qualifying floor area (ft²)
Classroom type 1	960	30	28,800	60	857	9	900	857	25,710
Classroom type 2	1040	6	6,240	70	1,000	10.5	1,050	1000	6,000
Library reading room	2600	1	2,600	200	2,857	25	2,500	2500	2,500
Administration	2000	1	2,000	150	2142	18	1,800	1800	1,800
Totals			39,640						36,010
Percent									91%

EQ 12.0.2

The documentation requirements are the same as EQ 12.0.1, with the exception that the threshold for this criterion is 80% access to views for 1 point and 90% access to views for 2 points. See above for information on preparing the calculations for this criterion.

Documentation Requirements

Design Review Requirements

Construction drawings must include required calculations for view windows. Fulfill this requirement by completing the CHPS Verified Plan Sheet. Plans and sections will be used for verification.

Construction Review Requirements

None

Resources

None

Electric Lighting Performance

Intent Integrate high performance electric lighting with daylighting to promote the health and well-being of the occupants while maximizing energy efficiency. Reduce hazardous substances commonly found in electric products. Provide high quality and flexible classroom lighting with teacher controls tailored to new teaching methods.
EQ 13.1 – Electric Lighting Performance
EQ 13.2 – Superior Electric Lighting Performance

The classroom is one of the focal points for preparing students for today's high tech, postindustrial world. New teaching tools such as affordable A/V systems, smart boards, tablets and web-based learning tools have turned the classroom into a dynamic place of learning. As the rate of adoption of these new technologies increases, it is important to give the teacher easy-to-use control of lighting. This will enhance learning by letting the teacher tailor high quality lighting to the type of teaching taking place.

While the use of LED-based lighting systems is not required, the selection criteria included here will help progressive schools select LED-based luminaires that will provide high quality, long-lasting and energy efficient lighting for the classroom.

EQ 13.1 – Electric Lighting Performance		**Credit**	
		3 points	
Applicability	**Verification Required**		
This criterion applies to all new classrooms and can also be earned in renovation projects when classroom lighting is included in the scope of work.	Design Review	Construction Review	Performance Review

Requirement

2 points	EQ 13.1.1	Illuminating Engineering Society (IES) TM-30-15: Method for Evaluating Light Source Color Rendition (3) All luminaires shall have light sources with a Fidelity (Rf) of 80 or greater and a Gamut Area (Rg) of between 80 and 100. AND
	EQ 13.1.2	Restriction of Hazardous Substances (RoHS) Requirements All luminaires shall be RoHS compliant following the most current European RoHS regulations, including all applicable exemptions.
1 point	EQ 13.1.3	LED Performance If an LED-based system used, all LED-based luminaires shall meet the Energy Star criteria in the latest Energy Star Luminaires Specification or be listed by the Design Lights Consortium.

EQ 13.2 – Superior Electric Lighting Performance		**Credit**	
		5 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	EQ 13.2.1	Achieve all of the following: Provide multi-scene indirect/direct lighting systems for all classrooms, with the exception for specialty classrooms where multi-scene lighting is not required.
	EQ 13.2.2	At a minimum, the lighting system shall work in at least two mode: General and Audio Visual (AV). The modes shall be recalled through a present lighting control system via dimming the fixtures to meet required light levels for each mode. Daylight sensors shall be use to dim the lighting system in response to available daylight. A 3-minute fade shall be used to slow the daylight system to prevent distracting changes in the electric lighting. The daylighting system shall not dim the electric lighting below 10% initial output.
	EQ 13.2.3	In A/V mode the average illumination levels shall be 10 to 30-foot candles, not including contribution from the teaching wall light, for any point in the room greater than 3-feet from the side walls, or 10-feet from the front wall. Limit vertical illumination on the AV screen to no more than 7-footcandles at any point on the screen.
	EQ 13.2.5 4	*Whiteboard Illumination* Provide a separately switched lighting system that provides white board vertical illumination of at least 30-footcandles average with a maximum-to-minimum illuminance ratio of 8:1 or better for all points on the whiteboard.
1 point	EQ 13.2.6	Achieve all of the following: *Enhanced Teacher Controls* Provide teacher control at the front of the classroom for: • general / AV mode. • white board control
	EQ 13.2.7	*Advanced Classroom Controls* Link the on / off occupancy signal into a school-wide management system

2 points	EQ 13.2.8	*High Performance Lighting Systems* All luminaires shall have light sources with Fidelity (Rf) of 85 or greater and a Gamut Area (Rg) of between 90 and 105. If LED-based systems are used, they must also meet the following criteria for Flicker and Performance to achieve these points: *Flicker* In all school classrooms and educational learning spaces, the measured Percent Amplitude Modulation (flicker present and frequency) from LED integrated systems (include driver, LED array, dimming controls, daylight sensor) shall be less than 30% at greater than 200Hz across the entire dimming range. *Performance* LED-based luminaires shall maintain at least 80% of their initial light output (L80) at 60,000 hours of operation.

Implementation

Many renovation projects include the installation of new lighting systems, providing an excellent opportunity to install high quality, energy efficient electric lighting that is integrated with the available daylight. Lighting technology in particular, is changing rapidly.

- TM-30-15 is an Illuminating Engineering Society (IES) technical standard that uses Fidelity (Rf) and Gamut Area (Rg) to describe how LEDs function in color space. The lighting industry is moving away from the CRI standard and using the IES TM-30-15 as the reference standard.

- Energy Star's criteria for standards from the IES TM-21 addresses all evolving aspects of the industry and is used as the main regularly updated reference for this document.

Manual override for occupancy sensors is no longer recommended due to advances in lighting technology and to the relatively higher cost. Current sensor technology can detect even minor movement now and will not shut off lights during times of classroom stillness.

Lumen maintenance is the amount of light produced from a light source or from a luminaire when it is brand new to the amount of light output at a specific time in the future.

During Audio Visual presentations, an average as low as 10-foot candles is acceptable to allow the teacher to "see" the students' faces and allow them to take notes. An average as high as 30-foot candles is acceptable to keep the contrast level of light at the desk and the screen at desired levels.

Special Consideration

Flicker – a change in lighting from modulation of intensity and frequency of lighting conditions – happens with all light sources. Flicker, both perceptible and imperceptible to the human eye, has effects on human performance and comfort and impacts different populations with varying sensitivity, particularly children, those individuals with Autism Spectrum Disorder, and those who suffer from migraines. These responses include headaches, seizures, eyestrain, and more. Addressing flicker issues can aid in classroom and school building performance and comfort. In absence of a finalized national standard for reduced flicker operation, the most applicable standard is Title 20 of the 2016 California Build Energy Efficiency Standards Code.

Documentation Requirements

Design Review Requirements

EQ 13.1 Submit specifications and subsections and/or drawings that confirm compliance.

EQ 13.2 Construction drawings, particularly the electrical plans must include point-by-point lighting calculations for each classroom type. Construction drawings, ideally the electrical schedule must include the required lighting and system features. Also reference specifications and sub-sections that confirm compliance.

Construction Review Requirements

EQ 13.1 Submit approved submittal with cover sheet and applicable materials that contain the required specifications from the manufacturer.

EQ 13.2 Submit approved submittal with cover sheet and applicable materials for the required lighting system. Submit photos of installed lighting system in typical classroom.

Resources

- Restriction of Hazardous Substances (RoHS) Guidelines: http://www.rohsguide.com/
- IES fact sheet comparing CRI and TM-30-15: https://www.energy.gov/sites/prod/files/2016/04/f30/tm-30_fact-sheet.pdf
- ANSI/IES TM-3-20 https://store.ies.org/product/tm-30-20-ies-method-for-evaluating-light-source-color-rendition/
- Energy Star Luminaires Specification Version 2.1 (published March 15, 2018): https://www.energystar.gov/products/spec/luminaires_specification_version_2_0_pdf
- IES Maximum TM-21 Testing: reference for 60,000 hours testing
- 2016 California Building Energy Efficiency Standards Code, Title 20 - Nonresidential Compliance Standard 7.2.3 Section B, #5: https://energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/72mandatorymeasures.htm
- Design Lights Consortium: https://www.designlights.org

Acoustical Performance

Intent *Provide classrooms with high quality acoustical environments.*
EQ 14.0 – Acoustical Performance

Student learning suffers in acoustically poor environments. Excessive room noise, long sound reverberation time, and intrusion of sound from adjacent spaces and the exterior negatively affect speech communication in the learning environment. This standard addresses and provides design criteria for:

- Requirements for maximum allowable interior sound levels from both interior (HVAC) equipment and exterior sound sources.
- Requirements for room sound reverberation limits.
- Requirements for sound and impact isolation ratings for interior partitions and floor/ceiling constructions.
- Identification and control of exterior sounds to interior spaces.

EQ 14.0 – Acoustical Performance		**Prerequisite**	
		7 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

New Construction:

This prerequisite applies to all newly constructed classrooms.

Renovation:

This prerequisite applies to classroom renovation projects (where reasonably practicable to incorporate, given existing building constructions). Where any of the prerequisite requirements are not reasonably practicable to incorporate given existing building construction, provide a written narrative of explanation.

Requirements:

The following lists a step by step process for compliance with the NE-CHPS EQ 14.0 Acoustical Performance requirements, in recommended order of completion of review, acoustical measurements, written submittals, etc. during the design and construction phases. All written material listed in **bold type** is required for submittal for application for the EQ 14.0 prerequisite. Where written material is required, it may be combined in one report or more reports where most practical.

<u>During the Design Review:</u>

<u>Step I (Recommended during SD phase of the project):</u>

<u>Item 1:</u> Identify all Core and Ancillary Learning Spaces: Determine and list in written form all core learning spaces and ancillary learning spaces as defined in Sections 3.1.1.1 and Section 3.1.1.2 in ANSI S12.60 2010, Part 1, and all the following spaces as described in **Section 1**:

- ICWS: Inter-Classroom Workspaces
- SER: Special Education Rooms
- CSPR: Confidential Speech Privacy Rooms
- PAS: Performing Arts Spaces
- APS: Audio/Video Production Spaces
- LAS: Large Assembly Spaces

<u>Item 2:</u> Identify Proximity to Site Exterior Noise: Determine if any school building façade is or will be located within ½-mile (800-meters) from a significant exterior noise source, such as major transit corridors, industrial/manufacturing facilities, rail lines, air traffic lanes, etc.

If all school building façades are located further than ½-mile (800-meters) from a current or known future exterior noise source (other than equipment serving the school building(s)), then no site exterior sound measurements are required. Confirm that the building exterior envelope will provide at least a composite STC 35 or higher rating with all exterior windows shut. **Provide a written report with aerial images as needed to determine school façade is further than ½-mile (800-meters) from significant exterior sound sources. The design team may proceed to Step I, Item 5**

If any of the school building façades <u>are</u> located within ½-mile (800-meters) of a significant exterior noise source, perform acoustical measurements as described in **Step I, Item 3.**

Item 3: **Provide Site Exterior Noise Measurements (if required from Step 1, Item 2):** Perform site sound measurements to determine the peak hour Leq sound levels occurring during the period of normal school operating hours. Hourly Leq sound levels should be measured continuously for no less than 7 days (168 hours). If the site is found to have peak hour Leq levels of 60 dBA or higher, it is considered a high noise site. If found to be a high noise site, proceed with the measures listed in **Step I, item 4**. **Provide a written report of site sound measurements, in accordance with the requirements in Section 2.**

Item 4: **Building Exterior Envelope Sound Isolation (if required from Step 1, Item 3):** Perform review of exterior building constructions and perform acoustical calculations to determine the composite sound isolation provided by the constructions as planned to worst case core learning spaces (those with the lowest composite exterior sound isolation). Using the measured peak hour Leq levels measured in **Step 1, Item 3**, determine the predicted interior sound level. The exterior sound transmission to the core learning space may not exceed 35 dBA. Determine exterior wall constructions (opaque wall areas, glazing areas, etc.) as required to control exterior sound based on site sound measurements in accordance with **Section 2** *"Outdoor to Indoor Attenuation",* and **provide a written report with recommendations in accordance with the requirements in Section 2**.

Item 5: **General HVAC/Mechanical Equipment Noise/Vibration Control Narrative:** Review the planned HVAC/Mechanical equipment to serve the school building(s) and provide a narrative for room target sound levels (maximum allowable levels for all occupiable spaces as listed in **Section 3**). **Provide a written report with general anticipated noise control measures for inclusion in the project contract documents, such as duct sound attenuators, acoustical duct lining, diffuser/grille noise criterion, general vibration isolation recommendations, etc.**

Step II (Recommended during the DD phase of the project):

Item 1: **Outdoor to Indoor Sound Isolation Review (if required):** Review to confirm that the exterior building envelope in core and ancillary spaces meet the sound isolation requirements determined in **Step I, Item 4** (if the project site was determined to be a high noise site). Provide a written report confirming that all exterior sound isolation detailing meets the requirements determined in **Step I, Item 4**, or if further revision is required. **If revisions are required, review during the design phase to confirm that they have been implemented and confirm in a written report**.

Item 2: **Indoor to Indoor Sound/Impact Isolation:** Review planned interior partitions, doors, and floor/ceiling constructions for all spaces listed as Core Learning Spaces (**Step I, Item 1**). Review and confirm that all interior partitions and floor/ceilings are designed to meet the required sound isolation ratings as listed in **Section 4. For any partitions which require revision, provide a written report with recommendations/requirements for revision.**

<u>**Item 3:**</u> **Room Reverberation:** For all Core Learning Spaces and Ancillary Spaces determined in **Step I, Item 1**, determine by use of either the prescriptive method or the calculation method described in **Section 5** if all spaces comply with the room acoustic reverberation limits listed in **Section 5.** Calculations must be performed using sound absorption data where available for manufactured products or estimated using published sound absorption data as available for most common building materials. For any spaces which will require additional room acoustic sound absorption treatments to meet the reverberation limits listed in **Section 5, provide a written report with recommendations/requirements to conform to the reverberation limits.**

<u>**Step III (Recommended during the CD phase of the project):**</u>

<u>**Item 1:**</u> **Indoor to Indoor Sound/Impact Isolation:** Review to confirm that any revisions to sound/impact isolation constructions were implemented in the contract documents, and **provide an updated written report noting any revisions to contract documents as required, and/or to confirm compliance with the requirements listed in Section 4.**

<u>**Item 2:**</u> **Room Reverberation:** Review to confirm that all recommendations for room sound absorption treatments as provided in **Section I, Item 1** have been included in the project contract documents. **Provide an updated written report noting any revisions to contract documents as required, and/or to confirm compliance with the requirements listed in Section 5.**

<u>**Item 3:**</u> **HVAC/Mechanical Equipment Noise/Vibration Control:** Calculate sound pressure levels in all spaces listed in **Step I, Item 1** in accordance with the *2011 HVAC Applications ASHRAE Handbook, Chapter 48, Noise and Vibration Control*, based on equipment acoustical data provided via the project mechanical engineer. Provide all noise/vibration control recommendations as needed to conform with the requirements in **Section 3** in a **written report suitable for the project MEP and project architects' use in preparation of contract documents**. **When all noise/vibration control recommendations have been in included in the project contract documents, review to determine all have been included and provide confirmation in an updated written report to confirm compliance with the requirements listed in Section 3.**

Required During the Construction Review:

1. **Pre-Installation Conference:** The Architect and Acoustical Consultant are to conduct a conference at the Project site to review the compliance required of NE-CHPS EQ 14.0 Acoustical Performance. In attendance shall be:
    - All sub-contractors whose work is part of systems that will be affected, including construction of exterior backup walls and barriers, interior partitions and ceilings, methods of making partition and floor/ceiling penetrations, application of acoustical sealants, installation of mechanical systems, and installation of acoustical room treatments.
    - The project acoustical consultant or the owner's Independent acoustical testing agent.
    - Architect's representative.
    - Owner's project manager.
    - Commissioning agent.
    - Building Envelope Commissioning Agent.
    - Project Clerk of the Works.

    Architect to provide meeting minutes in written form for record.

2. **Inspections and Testing:** The owner will engage the project acoustical consultant or a qualified independent acoustical consulting/testing firm with minimum 5 years of experience with educational projects designed to meet current acoustical design standards, and with minimum 5 years' experience in on-site acoustical testing/measurement. Inspections and/or testing of representative building areas will be performed to determine compliance of installed systems with specified requirements. **Inspections and/or testing shall take place as follows and must include any building envelope comments/recommendations in written field reports with photos as needed**.

    Acoustical Isolation – Exterior Building Envelope:

    a) (By <u>Building Envelope Commissioning Agent</u>) Provide inspection of exterior sheathing installation for the entire building envelope. Exterior sheathing should achieve the level of a smoke partition with all openings and penetrations sealed.
    b) (By <u>Building Envelope Commissioning Agent</u>) Provide inspection of the air and vapor barrier of building envelope. Air barrier and vapor barrier should meet the standard required in the 2018 IECC and be continuous with proper transition from one material to another throughout the building.
    c) (By <u>Building Envelope Commissioning Agent</u>) Provide inspection of the insulation of the exterior wall and roof. There should be no gaps at

penetrations or transition to other building elements. All gaps must be sealed/filled per contract documents.

Acoustic Isolation – Interior to Interior:

a) (By Clerk of the Works): For all spaces listed in **Step I, Item 1**, provide inspection of the installation of GWB at all interior walls. All layers of GWB/CMU must be continuous from floor slab to underside of the structure/deck with proper sealants at the top and bottom per contract documents. Each layer of GWB/CMU should meet the standard of a smoke partition with all openings and penetrations sealed. For walls with multiple layers of GWB/CMU, inspection of each layer would be required prior to installation of the next layer of GWB.
b) (By Clerk of the Works): Provide inspection to confirm installation of sealant where GWB transitions to another material. All openings and gaps to be fully sealed.
c) (By Clerk of the Works): At double or staggered framed wall designs, inspection should take place prior to installation of GWB to ensure there is no bridging of the framing.
d) (By Manufacturers' Representative(s)): Inspect all operable partitions and acoustically-rated door systems rated STC-41 and higher. Provide written report of findings noting areas that require adjustment, reinstallation, etc.

Room Acoustic Treatments:

a) (By Acoustical Consultant and Architect): At the completion of construction, confirm that all sound absorption/diffusion/reflection room treatments have been installed per contract documents for all core learning spaces and ancillary learning spaces. For any acoustical room treatments in core learning spaces of 20,000 ft^3 or greater volume not installed as per contract documents, or that have lesser sound absorption values than those included in the contract documents, perform acoustical measurements. **Provide a field visit report to confirm treatments were installed as in the project documents, and if measurements were performed, provide the results of measurements.**

Background (HVAC) Sound:

a) (Project Mechanical Engineer/Architect): Provide submittals of HVAC equipment sound data to project Acoustical Consultant.
b) (By Acoustical Consultant): When construction has been substantially completed and all mechanical equipment has been adjusted/air-

balanced in accordance with the Project contract documents, perform background sound measurements in all worst-case locations of rooms from **Step I, Item 1** (if applicable). Worst-case locations are considered those located within the shortest duct path from the HVAC unit discharge or inlet air openings. The selection of rooms to be tested should be reviewed with the project design team prior to performing measurements. Testing should be conducted as described in **Item c** of this section. **A written report of findings must be provided, with narrative as to which room were selected for sound measurement.**

c) (By Acoustical Consultant) Background HVAC Measurements

a. Turn building services (HVAC equipment) and utilities on and select the loudest design setting.
b. Use a sound level meter that conforms to the requirements for either Class 1 or Class 2 performance as specified in IEC 61672-1.
c. In each room to be tested, select at least three (3) measurement locations which are representative of typical student/teacher activities (i.e. near the teacher's desk, front of the room, student desk, etc.).
d. Measurements (Leq) at each location in a room shall be no less than 30 seconds in length.
e. Measured sound levels within 2 dB of the background criteria shall be reported as conforming to the limits in **Section 3.**
f. Provide a written report with equipment sound measurements, noting room numbers, and resulting room sound levels.

The following are Sections referred to in the "Design Review" and "Construction Review" requirements above:

Section 1:

Definitions

For the purpose of this criterion, general terms and definitions are the same as those found in Section 3 of ANSI/ASA Standard S12.60-2010/Part1, with introduction of the following amendments and additional core and ancillary learning space categories:

1. Amendments:

   a. The Core Learning Spaces category does not include special education rooms, libraries, music instruction and practice rooms. For the purpose of this criterion, these spaces are re-categorized as shown below.

   b. The Ancillary Learning Spaces category does not include corridors. CHPS exempts corridors from acoustical requirements.

2. Additional categories:

   a. Inter-Classroom Workspaces (ICWS) include: small spaces in between two or more classrooms where student groups from any of the classrooms can gather for separate activities. For the purposes of the present criteria, Inter-Classroom Workspaces shall not be treated as regular classrooms, except where the district designates the ICWS as a core learning space.

   b. Special Education Rooms (SER) include classrooms for special-needs students.

   c. Confidential Speech Privacy Rooms (CSPR) are rooms for which confidential speech privacy is required for conversations held at normal voice levels, such as educational council offices and therapy rooms.

   d. Performance Arts Spaces (PAS) include: music and choir classrooms, ensemble rooms, practice rooms, dance classrooms, drama classrooms, auditoria and theaters.

   e. Audio/Video Production Spaces (APS) include: audio/video recording or production studios and control rooms, and audio/video editing suites.

   f. Large Assembly Spaces (LAS) include: multipurpose rooms, libraries, gymnasia (when the school program requirements include the use of any of these rooms as group instruction rooms or assembly spaces where good understanding of speech (amplified or unamplified) is important).

- The ANSI/ASA Standard S12.60-2010/Part1 is available for free download (http://acousticalsociety.org/classroom-acoustics/)

- Design guidelines for controlling sound reverberation are available in Annex C of ANSI/ASA Standard S12.60-2010/Part1.

- Design guidelines for controlling background noise and vibration are available in the 2007 (or most recent version) HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control.

Section 2:

Criteria for Outdoor-to-Indoor Attenuation of Airborne Sound

CHPS adopts no prescriptive requirements for the minimum STC or OITC rating of exterior walls and windows (except for the requirements in Step 1 Item II). However, the project shall provide full documentation that the exterior noise environment has been appropriately quantified and that the design will achieve the performance criteria outlined in the "Background Noise Criteria" section below.

Site Exterior Measurements

- Perform site sound measurements to determine the peak hour Leq sound levels occurring during the period of normal school operating hours.
- A qualified independent acoustical consultant or acoustical consulting firm shall determine appropriate locations for site sound measurements based on review of the school façades in proximity to nearby noise sources.
- Hourly Leq sound levels should be measured continuously for no less than 7 days (168 hours).

Playgrounds

- When there is a playground within 50 ft of the exterior wall of a core learning space, special attention should be taken by the Project Acoustical Consultant to ensure proper sound isolation. It is recommended that playgrounds and other potential noise sources (from student activities) be located no closer than 30 ft from a core learning classroom façade, unless the playground or other exterior facility primarily serves the adjacent core learning space(s).

Section 3:

Criteria for Background Sound

In Core Learning Spaces and in spaces designated as ICWS, SER, and CSPR the total background noise from interior noise sources (building HVAC systems) shall not exceed 35 dBA, and exterior-to-interior noise shall not exceed 35 dBA.

In Ancillary Learning Spaces and in spaces designated as LAS, the total background noise from interior noise sources (building HVAC systems) shall not exceed 40 dBA, and exterior-to-interior noise shall not exceed 40 dBA.

In spaces designated as PAS and APS, the ideal background noise levels depend on the specific program for each space, though in no case shall the noise level be greater than 35 dBA. The design team shall submit a narrative stating the Basis of Design for background noise levels for each of these spaces and calculations showing achievement of such Basis of Design.

Interior Noise

- The metric for interior (HVAC systems) noise shall be the Equivalent Sound Level (Leq).
- For interior noise, the Leq when the HVAC system is in operation continuously shall be used. Acoustical calculation or measurement shall be conducted to determine the interior sound levels from HVAC.
- Measured sound levels within 2 dB of the background criteria shall be reported as conforming to the limits in this section.

Section 4:

Indoor-to-indoor attenuation of air-borne sound:

a. Wall and floor-ceiling assemblies shall be designed to achieve the minimum STC ratings specified in Table 1.
b. The STC rating requirements of Table 1 also shall apply to the design of temporary full-height partitions that subdivide a learning space into smaller enclosed areas. The ratings in Table 1 apply to wall and floor/ceiling constructions.
c. Design according to Section 5.4.2.2 of ANSI/ASA Standard S12.60-2010/Part1.
d. Interior glazing in walls with STC ratings of 45 or higher shall have the same minimum STC requirement as the wall. In no case shall interior glazing be rated less than STC 30. Specific adjacencies should be reviewed by the project acoustical consultant to provide specific STC requirements.
e. Doors shall be selected to achieve the minimum requirements specified in Table 2.
f. Interior glazing up to 10 ft^2 immediately adjacent to a door shall have the same minimum STC requirement as the door.

Table 2 - Minimum STC Ratings for Wall and Floor-Ceiling Assemblies

Space	Adjacent Space	Minimum STC Rating
Core Learning Space, Ancillary Learning Space, ICWS, SER, LAS	Core Learning Space, Ancillary Learning Space, ICWS, SER	48 (i)
	Public Restrooms	53 (ii, iii)
	Corridor	43 (i)
	Staircase	45 (iv)
	Mechanical Equipment Room	60 (v)
	Cafeteria/Kitchen	60
	Gymnasia	60
	Administration Office	45
	Conference Room	50
	PAS, APS	60 (vi)
	LAS	60 (vi)
	CSPR	50
PAS, APS (with pass door)	Corridor	50
PAS, APS (without pass door)	Corridor	60

i. Operable partitions shall have same minimum STC rating as the wall they replace.

ii. Table 1 requirements do not apply to toilets opening only into the receiving space and used only by occupants of the receiving space.

iii. In any wall between a Core Learning Space, Ancillary Learning Space, ICWS, SER and a public restroom, no plumbing shall be rigidly attached to the classroom wall framing. The wall assembly shall not contain large penetrations such as for restroom supply dispensers or disposals and shall not support rigidly attached electric hand dryer devices.

iv. For staircases that are active during Core Learning Space, Ancillary Learning Space, ICWS, SER use, the minimum STC rating shall be increased to 50.

v. The isolation between mechanical equipment rooms and Core Learning Spaces, Ancillary Learning Spaces, ICWs or SERs shall have a STC rating of 60 or greater unless it is shown that the sound level in the mechanical equipment room combined with a lower STC rating can achieve the required background noise level from building services in the core learning space. In no case shall the design STC between such spaces be less than 45.

vi. Due to the specialized nature of these spaces, horizontal and vertical adjacencies will require review by the project acoustical consultant to provide specific STC requirements.

Table 3 - Minimum STC Ratings for Doors

Space	Adjacent Space	Minimum STC Rating
Core Learning Space, Ancillary Learning Space, SER	Core Learning Space, Ancillary Learning Space, SER	40 (i)
	ICWS	35 (i)
	Corridor	See Note (ii)
Core Learning Space, Ancillary Learning Space, ICWS, SER	Conference Room	45 (iii)
	CSPR	45 (iii)
CSPR	Any other space	35 (i)
PAS, APS	Corridor	45 (iii)

i. It is the intent of this standard that doors rated up to STC 40 (non-sound-rated door assemblies) are to be solid core slabs with the STC rating as called out in Table 2, with full perimeter gasketing, astragal seal where applicable, and a drop seal.

ii. A minimum sound rating is not required for doors between classrooms and corridors. The absence of such requirement assumes that noise generated by corridor traffic can be controlled administratively by school staff.

iii. Sound-rated door assembly required. Vestibules functioning as a sound lock may be provided as an alternate to sound-rated door assemblies.

Section 5:

Criteria for Sound Reverberation

Comply with one of the two options ("performance" or "prescriptive") listed below. The prescriptive and performance methods may be used interchangeably within a single project. While each room shall comply with one method, compliance with both methods is not required for any one space.

Performance Method – (Compliance with this section may be either by calculations or site sound measurements) The maximum reverberation times in each of the one-octave frequency bands centered at 500 Hz, 1,000 Hz and 2,000 Hz shall be:

- Core learning spaces with volume less than 10,000 ft^3: **0.6 s**

- Core learning spaces with volume between 10,000 ft^3 and 20,000 ft^3: **0.7 s**
- Core learning spaces with volume greater than 20,000 ft^3 and Ancillary Learning Spaces: **1.0 s** (for the purposes of Section 5, gymnasia are not considered ancillary learning spaces, see bulleted item below).
- In spaces designated as ICWS, and SER, the ideal reverberation times depend on the specific program for each space. The design team shall submit a narrative stating the Basis of Design for reverberation times for each of these spaces and calculations showing achievement of such Basis of Design.
- In Ancillary Learning Spaces and spaces designated PAS, LAS, APS, or gymnasium spaces the ideal reverberation times depend on the specific program for each space. The design team shall submit a narrative stating the Basis of Design for reverberation times for each of these spaces and calculations showing achievement of such Basis of Design.

Prescriptive Method – prove the following minimum finishes:

- Core learning spaces with volume less than 10,000 ft^3 and ceiling heights 12 ft or less: Ceiling or wall finish with a minimum NRC of 0.70, covering minimum area equivalent to or greater than the total room volume X a multiplier of 0.09.
- Core learning spaces with volume between 10,000 ft^3 and 20,000 ft^3 and ceiling heights 12 ft or less: Ceiling or wall finish with a minimum NRC of 0.70, covering minimum area equivalent to or greater than the total room volume X a multiplier of 0.08.
- For core learning spaces with areas greater than 20,000 ft^3, with ceiling height 12 ft or greater, and/or spaces designated as ICWS and SER, follow the performance method.

Classroom audio distribution systems

Design according to Section 5.5 of ANSI/ASA Standard S12.60-2010/Part1.

Resources

- National Clearinghouse for Educational Facilities: http://ww12.edfacilities.org/
  Acoustical Society of America: https://acousticalsociety.org/
- American National Standards Institute: www.ansi.org/
- American Speech-Language-Hearing Association: www.asha.org

Low-EMF Best Practices

Intent
Minimize exposure to extremely low frequency (ELF) magnetic fields.
EQ 15.1 – Low-EMF Wiring
EQ 15.2 – Low-EMF Best Practices

The US National Electrical Code (NEC) has been published since 1897 to promote safe electrical installations and to prevent fire hazards and electric shock. Wiring errors not only violate electrical code rules but may also cause unnecessary ELF magnetic field exposures. Wiring errors may occur in new construction or renovation projects, and inspections conducted by local code enforcement authorities may not detect the great majority of these problems.

In 2000, the expert panel of the California EMF Project (scientists of the California Department of Health Services on behalf of the California Public Utilities Commission) concluded based on the then available scientific evidence that "*EMFs can cause some degree of increased risk of childhood leukemia, adult brain cancer, Lou Gehrig's Disease, and miscarriage.*"

In 2002, the International Agency for Research on Cancer classified **extremely low frequency magnetic fields** (ELF MF) as possibly carcinogenic (monograph volume 80).

In 2006, the IEQ Indoor Environmental Quality Project committee of the **US National Institute of Building Sciences** recommended to keep magnetic field exposure levels in occupied areas below 2.5 mG (250 nT), and preferably below 1 mG (100 nT).

In 2009, the **Austrian Sustainability Building Council** with support by the Federal Ministry of Transportation, Innovation and Technology released its latest version of the Total Quality Building Assessment tool. This green building rating system includes a criterion for low ELF magnetic field exposure levels: less than 1 mG (100 nT) "excellent", 1-2 mG (100-200 nT) "very good".

In addition, many education technology tools such as desktop computers, laptops, tablets, and other electronic devices are sources of electromagnetic fields. When used within close range of the human body, a student's exposure to electromagnetic fields (EMF) such as ELF magnetic and electric as well as radio-frequency electromagnetic fields may increase considerably. ELF magnetic fields were classified as possibly carcinogenic by the World Health Organization (WHO) International Agency for Research on Cancer (IARC) in 2002, and radio-frequency (RF) electromagnetic fields (including mobile phones) were classified as possibly carcinogenic by the WHO/IARC in 2011. In order to reduce the potential for adverse effects due to these exposures, it is important in school environments with children to apply the precautionary principle "as low as reasonably achievable (ALARA)" by providing low-EMF classrooms, specifying low-EMF IT equipment and wired Internet access network technology, and establishing low-EMF user practices.

EQ 15.1 – Low-EMF Wiring		Credit	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 15.1	*No net current magnetic fields – Correct school wiring* The wiring in all school rooms shall be compliant with the currently adopted US National Electrical Code (NEC) in the local jurisdiction, and applicable state electrical code 1. All school rooms shall be free of the following common wiring errors: a. Improperly wired subpanels (neutral-to-ground bond); b. Incorrect three-way switch wiring; c. Incorrect wiring of switched outlet circuits; d. Neutrals from separate branch circuits that are connected anywhere beyond the panel of origin for the circuits; e. Neutral-ground shorts (intentional or inadvertent) anywhere in the system. The correctness of the wiring shall be checked in each room and the ELF magnetic field exposure measured levels (tRMS) comply with 1 mG (100 nT) in new construction and 2 mG (200 nT) in existing school renovations, see the Austrian Sustainability Building Council (2009) – Total Quality Building Assessment Rating System as shown in Table 6 below.

EQ 15.2 – Low-EMF Best Practices		Credit	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EQ 15.2.1	*Low EMF Best Practices for Computers* The District or equivalent governing body for a private school shall pass a resolution indicating that: • Require desktop computers, laptops, notebooks, and tablets to only be operated on a desk. Prohibit operation of these devices on an occupant's lap or body. Additionally, install computer workstation equipment greater than 2 feet from occupants. • Desktop computers, laptops, notebooks, and tablets shall be TCO-certified or laboratory tested to meet TCO Criteria "Mandate A.4.2" for EMF emissions. Install only laptops or notebooks that have an Ethernet port and a physical switch to conveniently disable all wireless radios at once and an adaptor with a 3-pin plug. Additionally, install only tablets that support a USB Ethernet adaptor for a wired network connection. Operate tablets only in battery mode and not when plugged in.
OR 1 point	EQ 15.2.2	*Wired local area network (LAN) to reduce RF EMF* • Install a wired local area network (LAN) for Internet access throughout the school. Provide wired network connections for desktop computers, laptops, notebooks, and tablets. All wireless transmitters shall be disabled on all Wi-Fi-enabled devices. Provide wired input devices for computer workstations.
OR 1 point	EQ 15.2.3	*Wired Phones to reduce RF EMF in classroom* • Install easily accessible hard-wired phones for teacher and student use and prohibit installation and use of standard DECT cordless phones and cordless phones operating at 2.4 GHz and 5.8 GHz unless they have been laboratory tested to demonstrate that the cordless phone base station and handsets (whether placed in the charging station or not) do not emit RF EMF emissions in standby mode. • Prohibit the use of cell phones and other personal electronic devices in instructional areas / classrooms. Additionally, they shall be required to be powered off or be in airplane mode (sleep mode is not sufficient) except during fire-life-safety drills and incidents.

Implementation

EQ 15.1

ELF measurements shall be measured using a professional 3-axis gaussmeter. The international standard unit for ELF magnetic fields is microtesla (μT) or nanotesla (nT). A nanotesla is 1/1000th of a microtesla. 1 mG is equivalent to 100 nT.

Special Consideration

The World Health Organization International Agency for Research on Cancer has classified ELF magnetic fields and radio-frequency (RF) electromagnetic fields as possibly carcinogenic based on scientific evidence surrounding incidence of childhood leukemia and brain cancer.   Schools districts and design teams should:

1. Not allow cell phone towers and base stations on school buildings or school property. (See siting)
2. Not have above ground transformers within 50ft from outdoor play, exercise and recreation areas. (See siting)
3. Run conduits for the future possibility of fiber optic connections.
4. Position electrical supply rooms and building power supply adjacent to low occupancy areas among other strategies.

If using a wireless local area network (WLAN) for Internet access, choose the minimum number of access points and adjust the power output of the access points to the lowest maximum level required to meet the needs. Access points shall be placed a minimum distance of 16-32 feet (5-10 m) from where students and staff spend the majority of their time. The access points and Wi-Fi transmitters in the computer devices shall be turned off when not in use. Clearly label access points with warning signs.

Provide a Wireless-free Zone where cell phones, cordless phones, and Wi-Fi-enabled electronic devices shall not be used. Post clear signage at the door to instruct users on how to disable the wireless transmitters on their personal electronic devices (power off or airplane mode) before entering this space.

EMF Measurement Information

ELF EMF measurements are made with a professional 3-axis gaussmeter (broadband, minimum sensitivity: 0.2 mG (20 nT)). The ELF magnetic field exposure level at a given student seating area or workstation shall be as low as possible or less than 1 mG (100 nT) (tRMS – true root mean square). See Table 6. Measurements shall be taken on the floor in the foot area and across a vertical plane at half way between floor and edge of desk, at the edge of desk, and at 6 feet (180 cm). Retest ELF magnetic field exposure levels if the placement of workstations is changed or changes are made to the electrical installation

RF EMF measurements are made with a professional RF meter or spectrum analyzer (minimum sensitivity: 0.02 V/m or -50 dBm; minimum frequency range 10 MHz – 3 GHz (preferably higher)). The radio-frequency electromagnetic field exposure level at a given student seating area or workstation shall be as low as possible or less than 0.2 V/m or

100 μW/m^2 (peak). Measurements shall be taken on the floor in the foot area and across a vertical plane at half way between floor and edge of desk, at the edge of desk, and at 6 feet (180 cm). Retest RF electromagnetic field exposure levels if IT equipment, electronic devices, or networks with wireless connectivity are installed or added.

Table 6: ELF EMF Exposure Guidelines and Reference Levels

EMF Emission Standard or Guideline	Performance Measure	Reference Level Band I ELF 5 Hz-2 kHz Magnetic field
CA EMF EMF Project Survey of 89 schools- 5,403 school rooms	20% of measured areas had average magnetic fields	>1 mG (100 nT)
EMF Working Group of the Austrian Medical Association – Exposure greater than 4 hours per day	Within normal limits	≤0.2 mG (20nT)
	Slightly above normal limits	0.2-1 mG (20-100 nT)
	Above normal limits	1-4 mG
	Far above normal limits	≥4 mG
Austrian Sustainability Building Council (2009) – *Total Quality Building Assessment* Rating System	Excellent	≤1 mG (100 nT)
	Very good	1-2 mG
	Good	2-4 mG
	Satisfactory	≥4 mG
IEQ Project Committee Recommendation of the U.S. National Institute of Building Sciences (2006)	Preferably	<1 mG (100 nT
	All occupied areas	<2.5 mG (250 nT)
TCO Criteria “Mandate A.4.2”: – International sustainability standard for IT equipment (since 1992)	At 12-20“ distance from equipment	≤2 mG (200 nT)
Federal Safety Guideline of Russia for Computer Workstations, including schools (2003)	At 20“ distance from equipment	≤2.5 mG (250 nT)
International Agency for the Research on Cancer/WHO (2002)	Possibly carcinogenic Group 2B	>3-4 mG (300-400 nT) Increased childhood leukemia risk

Documentation Requirements

Design Review

15.1: Provide specifications requiring compliance with the necessary codes and best practices. Include specifications to test rooms for compliance.

15.2.1: Submit the resolution compliant with the requirements. Submit specifications for computer equipment that includes the requirements.

15.2.2: Submit wiring diagrams indicating LAN wiring to all rooms that contain computers.

15.2.3: Submit wiring diagrams indicating phone wiring to all rooms with telephones. Also include the district policy prohibiting cell phones and other personal electronic devices as required.

Construction Review

Submit receipts for purchase of all compliant products.

Resources

- National Electrical Code NFPA 70: www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70
- Suggested Protocol for School Electricians for Correcting Wiring Errors Causing Net Current Magnetic Fields http://www.createhealthyhomes.com/WiringProtocol_Calif_Schools_K_Riley.pdf
- Tracing EMFs in Building Wiring and Grounding. (book),Karl Riley (2005): www.magneticsciences.com/TracingEMFsBook.html
- Tracing Magnetic Fields in Building Wiring. (DVD) www.magneticsciences.com/TracingEMFsVideo.html
- ELECTRIC AND MAGNETIC FIELD EXPOSURE ASSESSMENT OF POWERLINE AND NON-POWERLINE SOURCES FOR CALIFORNIA PUBLIC SCHOOL ENVIRONMENTS, Luciano E. Zaffanelia, H. Christopher Hooper, Prepared for the Public Health Institute, California Department of Health Services EMF Program, , January 31,2000, https://portal.ct.gov/-/media/CSC/Dockets-and-Other-Pending-Proceedings/Dockets201_300/Docket_272/Reference5CaliforniaEMFSchoolAssessmentpdf.pdf
- EU Directive 90/270/EEC (1990 May 29) on the minimum safety and health requirements for work with display screen equipment: eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31990L0270:EN:HTML
- Ministry of Health of the Russian Federation. 2003 Jun 30. [Sanitary and epidemiological norms on hygienic requirements for personal computers and work organization]. Norm No.: SanPiN 2.2.2./2.4.1340-03. (in Russian)
- Katharina Gustavs (2008): Options to Minimize Non-Ionizing Electromagnetic Radiation Exposures (EMF/RF/Static Fields) in Office Environments: https://static1.squarespace.com/static/55517edbe4b0b260d3936ec1/t/55b4622ee4b043b826859c6d/1437884974584/2008_Gustavs_Low_EMF_Office_Environment.pdf
- TCO standards for IT equipment: https://tcocertified.com/criteria-overview/
- Product Categories: Displays, Notebooks, Tablets, Smartphones, Desktops, All-in-One PCs, Projectors, Headsets, Network equipment, Data storage, Servers: https://tcocertified.com/product-categories/

- Austrian Sustainability Building Council with support by the Federal Ministry of Transportation, Innovation and Technology: Total Quality Building Assessment tool www.oegnb.net/de/zertifikat.htm?typ=wb
  Threshold levels for ELF-modulated RF radiation: <10 μW/m^2 excellent / 10-100 μW/m^2 very good / 100-1000 μW/m^2 good / 1000-3000 μW/m^2 satisfactory
- EMF Working Group of the Austrian Medical Association (2012): EMF Guideline of the Austrian Medical Association for the diagnosis and treatment of EMF-related health problems and illnesses. freiburger-appell-2012.info/media/EMF%20Guideline%20OAK-AG%20%202012%2003%2003.pdf
  Benchmarks apply to regular exposure of more than four hours per day: <1 μW/m2 within normal limits / 1-10 μW/m2 slightly above normal limits / 10-1000 μW/m2 far above normal limits / >1000 μW/m2 very far above normal limits

High Intensity Fluorescent Fixtures

Intent
Install high intensity fluorescent lighting fixtures instead of HID fixtures in the gymnasium and other high ceiling areas.
EQ 16.1 – High Intensity Fluorescent Fixtures

For many years, the standard choice for school gymnasiums, field houses, and other multi-use areas with ceilings over 16 feet high has been High Intensity Discharge (HID) lighting; typically metal halide or pulse-start metal halide. Although the technology is relatively efficient, long warm-up times mean that the lighting is typically turned on for the day. High intensity fluorescent lighting can be turned on and off as needed, or it can be controlled by occupancy sensors. Additionally, the fluorescent fixtures offer higher quality light with better color stability and less ballast noise.

EQ 16.1 – High Intensity Fluorescent Fixtures		**Credit**	
		1 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

This criterion applies to all new classrooms, libraries and administration areas.

Requirement

1 point	EQ 16.1	Install high intensity fluorescent lighting fixtures instead of HID fixtures in the gymnasium and other high ceiling areas.

This criterion applies to all gymnasiums, field houses, and other multi-use areas with ceilings over 16 feet high. In renovations, all such spaces in the school must use high intensity fluorescent fixtures.

Implementation

Install only high-intensity fluorescent fixtures in all high-ceiling areas of the school. Specify that HID fixtures shall not be used.

Documentation Requirements

Design Review

Submit plans showing the lighting layouts for the applicable areas. Also submit specifications (cut sheets) for the fixtures being installed.

Construction Review

Submit receipts for purchase of specified equipment.

ENERGY

Energy Performance

Intent *Reduce harmful environmental impacts and operational costs associated with building energy usage.*
EE 1.0 – Energy Performance
EE 1.1 – Superior Energy Performance

Energy-efficient schools can reduce their energy costs while avoiding the use of fossil fuels and reducing emissions of atmospheric pollutants and greenhouse gases.

EE 1.0 – Energy Performance		**Prerequisite**	
		6 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	EE 1.0	School design for new construction and new buildings on existing campuses shall meet the baseline established in ASHRAE Standard 90.1-2016 or the 2018 IECC. This correlates to a maximum zEPI score of 54. The design shall also receive an ENERGY STAR score through Target Finder. There is no minimum ENERGY STAR score requirement. **Prescriptive Compliance Options:** 1. The prescriptive requirements of the 2018 edition of the International Energy Conservation Code (IECC) 2. The prescriptive requirements of ASHRAE Standard 90.1-2016 3. Design the school according to the standards established by the basic requirements of **Tier 2** of *the Advanced Buildings* *New Construction Guide* from the New Buildings Institute.

	4. Meeting either the 50% or Zero Energy ASHRAE Advanced Energy Design Guide for K-12 Schools **OR** **Performance Compliance Option:** 1. Appendix G or Appendix BM of ASHRAE Standard 90.1-2016 on a source energy basis. ***Note:*** *If the project is occurring within a city or state that has adopted a more recent energy code (compared to the 2018 IECC), the project must adhere to those requirements while still achieving 10% better than the baseline outlined above (ASHRAE 90.1-2016 or 2018 IECC).*

EE 1.1 – Superior Energy Performance			Credit 40 points
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

30 points	EE 1.1	Follow the protocol in Energy EE 1.0 for quantifying reductions in total energy use. Points are awarded according to the percentage of energy saved over a baseline building. To demonstrate savings, projects may indicate percentage better than the code baseline building or optionally use the Zero Energy Performance Index (zEPI), which provides a stable benchmark that will not vary with future code updates.

Points	Percent Reduction	IECC 2018 zEPI Equivalent	ASHRAE 2016 zEPI Equivalent
Prerequisite	0%	54	50
9 Points	10%	48	45
12 points	20%	43	40
18 points	30%	38	35
22 points	40%	32	30
25 points	50%	27	25
28 points	60%	21	20
31 points	70%	16	15
34 points	80%	11	10
37 points	90%	5	5
40 points	100% (zero energy school)	0	0

Interpolation between the values in the above table is permitted.

Projects may not achieve more than 18 points unless they can demonstrate that their designed EUI is less than or equal to 40 kBtu/sq.ft.

Massachusetts projects in the MSBA Core Program must meet MSBA's Sustainable Schools Policy minimum energy efficiency requirements.

Implementation

EE 1.0

Compliance with this prerequisite may be achieved by using the performance approach of the referenced ASHRAE or IECC standards. Modelling shall be conducted using a method specified for EE.C1. Once minimum code compliance is established, the ENERGY STAR Target finder score shall be established.

Code Compliance: Local codes may be referenced if a percent savings is specified to achieve equivalent energy performance to the standards referenced in this prerequisite.

EE 1.1

There are significant opportunities to reduce energy use beyond the prerequisite level. Up to 34 additional points are offered for schools designed to exceed the prerequisite level. Providing a more energy efficient building saves money for the school district, reduces harmful environmental impacts and has a number of other long term benefits.

Renewable energy sources use the sun, air, and earth instead of non-renewable, polluting sources, such as coal, oil or natural gas. They include solar electric systems (photovoltaics), solar thermal systems (domestic water and space heating), biomass, and wind turbines.

Projects may not achieve more than 18 points unless they can demonstrate that their designed EUI (before renewables) is less than or equal to 40 kBtu/sq.ft. The intent of this limitation is to ensure that the school is well-insulated and well-designed with right-sized mechanical systems before energy production from renewable energy systems contributes to offsetting the energy use. Projects where this EUI is prohibitively difficult to achieve must use a Criteria Interpretation Request and submit documentation supporting their claim in order to pursue an exemption. The threshold for exemption will be limited to projects in the more extreme climates of the Northeast Region and renovation projects with limited scope.

Modeling Requirements

Demonstrating compliance with this criterion requires energy code compliance modeling following the procedures of the Standard 90.1-2016 Performance Rating Method (PRM) published in Appendix G of the document. Additional detail is provided by the COMNET Modeling Guidelines and Procedures (MGP).

The contribution from renewable energy systems may be accounted for in offsetting the energy use per this criterion.

Non-Regulated Energy Use

In earning points under this criterion, school districts may use the procedures documented in the COMNET MGP (90.1-2016 purpose) to take credit for reductions in plug loads and other components of energy use that are not addressed by Standard 90.1-2016 Plug load reductions are tied to a commitment by the school district to purchase ENERGY STAR equipment for a minimum period of time. The magnitude of the credit depends on the length of the commitment, per COMNET procedures.

Energy Metric

Source energy is required as the metric to combine electricity, gas and other energy sources used in a school. See Table 7 below for source energy multipliers derived from the DOE Common Definition for Zero Energy Buildings. CHPS regional partners are encouraged to use source energy or another metric such as time dependent valued (TDV) energy or energy cost. Note that the procedures in the 90.1-2016 PRM require the use of energy cost as the metric, but for CHPS purposes, source energy is preferred.

Table 7: Source Energy Multipliers

Energy Type	Source Energy Conversion Factor
Electricity (Grid & on-site)	3.15
Natural Gas	1.09
Fuel Oil	1.19
Propane & Liquid Propane	1.15
Steam	1.45
Hot Water	1.35
Chilled Water	1.04
Coal or other	1.05

The source energy conversion factors in the table above are based on those used by the DOE Common Definition for Zero Energy Buildings.

To determine source energy, multiply the energy consumed on site for each energy type by its source energy conversion factor. Then add together all of the source energy conversions.

For example, if 800,000 kBtu of natural gas is used in a month, the calculation would be:

$$800{,}000 \text{ kBtu Site } \times 1.09 = 872{,}000 \text{ kBtu Source}$$

Consider that the example school consumes 200,000 kBtu of electricity from the grid and generates 10,000 kBtu on-site per month. Its source energy calculation would use a conversion factor of 3.15:

$$(200{,}000 \text{ kBtu Consumed - } 10{,}000 \text{ kBtu Produced}) \times 3.15 = 598{,}500 \text{ kBtu Source}$$

If natural gas and electricity are the only two energy types used at the school, its total source energy would be:

$$872{,}000 \text{ kBtu} + 598{,}500 \text{ kBtu} = 1{,}470{,}500 \text{ kBtu}$$

If that same school were to produce more electricity than it consumed from the grid, it would have negative source energy value. Consider the school produces 100,000 kBtu of electricity but consumes 80,000 kBtu (Possible after incorporating Energy Efficiency and Energy Conservation Measures):

$$(80{,}000 \text{ kBtu Consumed - } 100{,}000 \text{ kBtu Produced}) \times 3.15 = -63{,}000 \text{ kBtu Source}$$

Naturally Ventilated Spaces

School districts in appropriate climates are encouraged to design classrooms and other school spaces to use natural ventilation to control overheating of the spaces. Credit for natural ventilation is offered through the COMNET modeling rules when the school has less than 300 unmet cooling load hours.

Naturally Ventilated Spaces as referenced in this section are not intended to be for control of contaminants in the spaces but referenced as heat sinks.

zEPI Option

Projects may optionally establish their zEPI rating in lieu of performance above ASHRAE 90.1. There is a direct correlation between ASHRAE 90.1-2016 performance and the zEPI scale. zEPI provides a more stable scale that will not vary with future code updates. The correlation is presented in the prerequisite text. zEPI scores must be calculated using source energy values.

More information about zEPI and the conversion process can be found in *Rethinking Percent Savings – The Problem with Percent Savings and zEPI: The New Scale for a Net Zero Energy Future* by Eley et al., referenced in the resources below.

Projects that do not pursue the zEPI option may still find the zEPI conversion chart useful for comparing future projects that use a baseline that differs from ASHRAE 90.1-2016.

Solar Thermal Systems

Solar thermal systems may also be used on site. While they do not directly generate electricity, they do offset other energy use. As such, the impact of solar thermal systems will generally be reflected in lower use of other energy sources.

For purposes of this criterion, thermal energy-generating renewables are defined as using renewable energy sources for space heating or cooling, pre-heating of ventilation air entering in the building or domestic water heating. Schools can use solar thermal collectors to provide space heating or hot water for lavatories, showers, kitchens, and pools.

Solar walls or similar systems used to pre-heat ventilation air in the winter can be a cost effective and simple way to utilize renewable energy in a school.

On-Site Renewable Electricity Generation

On-site renewable energy sources can be very effective components of school curricula, educating students on a wide variety of energy and science issues. On-site renewable energy production has the added advantage of increasing diversity in energy resources.

For purposes of this criterion, the on-site electricity-generating renewables are defined as follows:

- Photovoltaics
- Wind

School districts should check with the local electric utility serving the building for size limitations, protective apparatus requirements, inspections, fees and insurance restrictions and other special requirements for electricity generation interconnected with utility supplied power. Utility restriction may apply for systems connected on the building side of the utility meter and when the system has a generation capacity much larger than the electricity used within the building. To reduce hazardous situations for utility service technicians, most utilities require the renewable generation system inverter to automatically turn off generation during a utility grid power outage, a renewable generation system can function as a backup power supply with appropriate switching and battery storage. Connections with this and emergency generators need additional engineering expertise.

The local electric utility serving the building may offer a net metering arrangement. Power generated by the renewable electric generation system that exceeds the power being consumed within the building may be sold back to the electric utility. School districts should check with the utility serving the building for net metering opportunities, rates, and other special requirements. Large scale on-site renewable electricity generation systems may be able to use revenue generated from net-metering to offset a portion of the cost of the system.

Wherever possible, mature shade trees should *not* be removed to facilitate the installation of any energy generation systems if possible. If shade trees are removed for this purpose, include a letter from the system designer explaining why this was the best course of action.

Documentation Requirements

Design Review Requirements

To demonstrate compliance with the performance path option, provide a short narrative description of the energy efficiency goal and overall systems design and one of the following:

- Certification of Compliance or equivalent from energy modeling program; or
- EPA summary report (Statement of Energy Design Intent for new construction or equivalent for renovation).

To demonstrate compliance with the prescriptive path options please provide the following:

- Short narrative summary of path chosen and why; and
- Short narrative description of how achieving prescriptive items.
- Optional: EPA Summary Report

If needed to confirm compliance, the reviewer may request the entire energy model in its original electronic format, not as a .pdf.

If shade trees are removed for any purpose related to energy efficiency or on-site energy production, include a letter from the system designer explaining why this was the best course of action.

Resources

- ANSI/ASHRAE/IES Standard 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings, www.ashrae.org/standards-research--technology/standards--guidelines
- 2018 International Energy Conservation Code® published jointly by ICC and ASHRAE: https://codes.iccsafe.org/content/iecc2018
- ENERGY STAR: www.energystar.gov/
- The Consortium for Energy Efficiency (CEE) provides information on high performance equipment: www.cee1.org
- The ASHRAE Advanced Energy Design Guide for K-12 School Buildings: https://www.ashrae.org/technical-resources/aedgs/zero-energy-aedg-free-download
- Commercial Energy Services Network (COMNET): https://comnet.org/
- Efficiency and Renewable Energy Rebates: http://www.dsireusa.org/
- *The Problem with Percent Savings and zEPI: The New Scale for a Net Zero Energy Future* by Eley et al.: www.eley.com/sites/default/files/pdfs/ASHRAE-D-ML-11-029-20110922.pdf
- *Advanced Buildings New Construction Guide,* New Buildings Institute, 2014 http://newbuildings.org/new-construction-guide-online

Zero Energy (ZE) Capable

Intent *Further acknowledge the school to produce as much energy as it consumes on an annual basis.*
EE 2.1 – Zero Energy Capable

This criterion provides a bonus on the Superior Energy scale (EE.1) for schools that are designed to achieve zero energy or are capable of achieving zero energy.

<table>
<tr><td colspan="2" rowspan="2">EE 2.1 – Zero Energy Capable</td><td colspan="2">Credit</td></tr>
<tr><td colspan="2">3 points</td></tr>
<tr><td>Applicability</td><td colspan="3">Verification</td></tr>
<tr><td>All projects.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

2 points	EE 2.1.1	Zero Energy Capable. A complete design of a PV system that will provide 100% of the annual electric energy needs and operate an average efficiency of at least 80% of the optimal for your location as determined by the US DOE's PVWatts program. The roof-top PV arrays must cover at least 65% (unless a smaller area is needed to provide full capacity) of the total roof area (the remainder of the PV can be located on parking covers or free-standing mounting structures). Other solutions may be considered on a case by case basis. The complete PV system can be installed with: • No structural modification to the roof to accommodate 5 lbs. per sq. ft. additional weight. • No additional roof or wall penetrations are need for electrical wiring. • No physical expansion of electrical or mechanical rooms to accommodate the inverter(s) and other electrical system components. The project must have a projected annual site EUI of 40 kBtu per square foot to qualify for these credits. OR
	EE 2.1.2	Zero Energy. Show through the energy modeling required for EE 1.0 that on-site renewable energy systems produce as much energy on an annual basis as is used by sum of all the building systems. Project is eligible for two (2) innovation points from II 10.1. The project must have a projected annual site EUI of 40 kBtu per square foot to qualify for these credits. OR
	EE 2.1.3	Energy Zero Code. Comply with the energy efficiency requirements for one (1) of the following pathways: • AA104.3 Prescriptive Compliance Path. Buildings shall comply with the requirements of sections AA104.3.1 (Building Thermal Envelope) through AA104.3.6 (Lighting Power Density). • AA104.4 Performance Compliance Path. Buildings shall comply with the mandatory requirements of ASHRAE 90.1-2016 and shall comply with ASHRAE 90.1-2016 section 4.2.1.1.c "Performance Rating Method", with amendments. • AA104.5 Passive House Alternative Compliance Path. Built to Passive House Institute US (PHIUS) or Passive House Institute (PHI) certification requirements. Projects pre certified through PHIUS or PHI, with a certified Passive House Consultant or certified Passive House Designer verified "as-built" report demonstrating compliance with the PHIUS or PHI standard.

Implementation

Energy Modeling

Energy modeling using the procedures specified in EE.C1 shall be used to demonstrate this criterion.

Zero Net-Energy Capable

When demonstrating compliance with this criterion, the location of renewable systems shall be identified on the site or building and modeled using typical performance characteristics.

Energy Metric

Source energy is the required metric for determining zero net-energy. See discussion under EE 1.

Boundary for Determining Zero Net-Energy

In determining whether a school is zero net-energy or capable of zero net-energy, only renewable energy sources located on the school site shall be considered. The project is not limited to solar photovoltaic systems for EE 2.1.2. Wind and small-scale hydro generators may also help the project qualify for the credits. Biomass and liquid biofuels are not considered renewable energy sources.

Note that some renewable systems, such as solar thermal systems, may help offset the total energy use on site even though they do not directly generate electricity.

Documentation Requirements

Design Review

EE 2.1.1: Submit construction documents indicating the design of the PV system, which does not need to be installed on the project. Also submit construction documents which highlight features that would allow the complete PV system to be installed with:

- No structural modification to the roof to accommodate 5 lbs. per sq. ft. additional weight.
- No additional roof or wall penetrations are need for electrical wiring.
- No physical expansion of electrical or mechanical rooms to accommodate the inverter(s) and other electrical system components.

EE 2.1.2: Compliance shall be confirmed in EE 1.0.

EE 2.1.3 Submit documentation showing compliance with elected pathway. All compliance provisions of NE-CHPS are applicable to EZ Code compliance pathways.

Resources

- NREL 2010. Net-Zero Energy Buildings: A Classification System Based on Renewable Energy Supply Options, Shanti Pless and Paul Torcellini, NREL/TP-550-44586, June 2010: https://www.nrel.gov/docs/fy10osti/44586.pdf
- NREL 2007. Assessment of the Technical Potential for Achieving New Zero-Energy Buildings in the Commercial Sector, B. Griffith, N. Long, P. Torcellini, and R. Judkoff, NREL/TP-550-41957, December 2007: www.nrel.gov/docs/fy08osti/41957.pdf
- EZ Code https://neep.org/ez-code-ne-chps

Commissioning

Intent
Verify that building elements and systems are designed, installed, and calibrated to operate as intended, and provide for the ongoing accountability and optimization of building energy performance over time.
EE 3.0 – Commissioning
EE 3.1 – Additional Commissioning Qualifications
EE 3.2– Building Envelope Commissioning
EE 3.3 – Enhanced Commissioning

Commissioning is vitally important to the performance of the school and are the keys to achieving and maintaining energy efficiency. Commissioning involves a rigorous quality assurance program that ensures the building and its systems are built and operated as designed and that the school district receives the proper training and documentation needed to operate and maintain the building. No building can perform optimally without adequate maintenance.

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 owner's project requirements 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.

EE 3.0 – Commissioning		**Prerequisite**	
		4 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

EE 3.1 – Additional Commissioning Qualifications		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

EE 3.0

This prerequisite requires a commissioning process to be in place early in the design process and carries through to the post-occupancy 10-month warranty review and subsequent completion of a commissioning report.

Requirement

Prerequisite	EE 3.0 ALL of the fundamental best practice commissioning procedures must be implemented: Engage an independent, third-party commissioning agent (CA). The commissioning agent will be responsible for commissioning the following critical building systems: *Electrical Systems*: • Lighting systems and controls (daylight, occupancy, timing switches, etc.); • On-site renewable solar electric or wind systems *Mechanical Systems:* ▪ HVAC systems (such as hot water systems, chilled water systems, central air systems, ventilation systems); ▪ Energy management system ▪ Renewable energy heating systems ▪ Central plant systems in existing schools if they will serve new HVAC work and if they have not been commissioned or retrocommissioned within five years of submitting the project for review *Plumbing Systems:* • Flow control devices • Pumping systems • Special hazardous waste treatment systems (e.g. for lab wastes) • Domestic hot water systems • Graywater systems (if applicable) The commissioning scope of services shall include: • Review Owners Project Requirements (OPR) (formerly known as Design Intent documentation) and Basis of Design (BOD) documentation. • Conduct a focused review of the design prior to the construction documents phase. • Conduct a focused review of the construction documents when close to completion. • Include commissioning requirements in the construction documents. • Develop and utilize a commissioning plan. • Conduct a selective review of contractor submittals of commissioned equipment. • Review the Operations & Maintenance manual. • Verify installation, functional performance testing (including off-season testing), training, and operations and maintenance documentation. A minimum 20% sampling strategy for testing terminal units and repetitive units is permissible. All major systems must be tested. • Participate in training of facility staff in accordance with the training plan (OM.1). • Complete a commissioning report. • Conduct a 10-month warranty, post-occupancy review. Commissioning efforts in this prerequisite shall be coordinated with commissioning requirements in WE 6.0 – Irrigation Commissioning.

1 point	EE 3.1	The commissioning authority responsible for commissioning is a licensed architect or engineer with at least two years' experience in the state when he/she practices.

This criterion is intended to allow project managers to think beyond the typical scope of a commissioning authority, into other useful system testing.

EE 3.2 – Building Envelope Commissioning		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

This full scope of commissioning applies to a new school. For major renovations and a new building on an existing campus this commissioning scope is required based on the scope of the project. The scope of commissioning services for major renovations will depend on the whether the building envelope is being upgraded.

Requirement

1 point	EE 3.2	Commission the building(s) envelope using the National Institute of Building Sciences (NIBS) Guideline 3 or using an equivalent approach. The commissioning authority shall be a licensed architect or engineer with at least two years of building envelope commissioning experience in the state where s/he practices.

EE 3.3 – Enhanced Commissioning		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

This full scope of commissioning applies to a new school. For major renovations and a new building on an existing campus this commissioning scope is required based on the scope of the project. The scope of commissioning services for major renovations will depend on the whether the building envelope is being upgraded.

Requirement

1 point	EE 3.3	In addition to the prerequisite requirements, perform first-year optimization of the building systems and develop a systems manual.

Implementation

EE 3.0

Qualifications of Commissioning Authority

The CA should satisfy the qualifications of, and perform in accordance with, the Building Commissioning Associations' (BCA) Essential Attributes of Building Commissioning.

The CA must have experience commissioning schools in accordance with this standard.

Consider a commissioning agent recognized by a professional organization such as:

- AABC Commissioning Group (ACG) Certified Commissioning Agent ‖ www.commissioning.org/
- ASHRAE Building Commissioning Professional Certification (BCXP) https://www.ashrae.org/professional-development/ashrae-certification/certification-types/bcxp-building-commissioning-professional-certification
- Building Commissioning Association (BCA) certification www.bcxa.org/certification.html/
- Educational certification from University of Wisconsin cx.engr.wisc.edu/
- NEBB Qualified Commissioning Administrator www.nebb.org/certified/nebbs_certification_program/
- TABB Certified Commissioning Supervisor www.tabbcertified.org/

The CA may be a qualified employee of the school district.

Commissioning Scope

The following list describes each of the commissioning steps listed above in greater detail.

- *Engage a commissioning agent.* The commissioning agent (CA) directs the commissioning process and should be hired in time for the design development phase. The commissioning services must be performed by an independent third party, i.e. not part of the design or construction management of the project. The CA may be hired by the owner, the owner's project manager, or the design firm as long as the CA is not an employee of the design firm and reports to both the school district and the design firm. Review design intent and basis of design documentation. The architect and the design engineer are the most appropriate people to create this document, which should list the owner’s project requirements and design intent for each of the systems or features to be commissioned. The CA will review this document, and a copy of the review shall be provided to the owner.

- *Conduct a focused review of the design prior to the construction documents phase.* This review early in the design process should be focused on an assessment of how well the design meets the owner’s design intent. Assessment should be made as to how the design meets the functionality, utility performance, maintainability, sustainability, cost, and indoor environmental quality requirements outlined in the design intent. Evidence of the review is to be documented in the commissioning report.

- *Conduct a focused review of the construction documents when close to completion.* This review should be conducted prior to issuing the construction documents for bid and captured in the commissioning report. The review should answer these questions:
    - Does the design meet the owner’s design intent?
    - Does the design allow for proper maintenance access?
    - Do the construction documents clearly detail the construction requirements?
    - Do the construction documents clearly define the commissioning requirements?
- *Include commissioning requirements in the construction documents.* All commissioning requirements must be integrated into the construction documents to clearly specify the responsibilities and tasks to be performed. Of particular importance are the delineation of the contractors’ responsibilities regarding documentation, functional performance testing, occupant and operator training, and the creation of the operations and maintenance manuals.

- *Develop commissioning plan.* The commissioning plan includes a list of all equipment and systems to be commissioned, delineation of roles for each of the primary commissioning participants, and details on the scope, timeline, and deliverables throughout the commissioning process.

- *Conduct a selective review of contractor submittals and shop drawings related to the commissioned systems*. Contractor submittals for the systems included in the commissioning scope shall be reviewed by the CA in conjunction with the designer’s review. The review shall focus on the ability of the submitted product to meet the owner’s requirements and review comments shall be provided to the owner and the design team.

- *Review Operations & Maintenance manual.* The Contractor compiles the O&M Manuals prior to commencement of training and the CA reviews them for completeness, organization and readability. The CA shall review the O&M Manuals for the following items:

- As-built sequences of operations for all equipment as provided by the design professionals and contractors, including time-of-day schedules and schedule frequency, and detailed point listings with ranges and initial setpoints.
- Ongoing operating instructions for all energy- and water-saving features and strategies.
- Seasonal operational guidelines.
- Recommendations for recalibration frequency of sensors and actuators by type and use.
- Guidelines for continuous maintenance of the owner's project requirements (operational requirements) and basis of design (basis of operation).

- *Verify Pre-Functional Testing.* The CA shall provide the Contractor with the Pre-Functional Checklists (PFC) that include a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment. PFCs are primarily static inspections and procedures to prepare the equipment or system for initial operation. The CA shall observe, at minimum, the startup procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used). Extent of CA observation of Pre-Functional Testing will be at the discretion of the CA, though spot checking of items on the lists will be performed prior to Functional Testing. PFC's are separate and in addition to the manufacturers installation and start-up forms and shall be reviewed by the CA and included in the Commissioning Report. Contractor shall certify that installation, prestart, and startup activities have been completed prior to commencing Functional Testing. Certification shall include completed PFC's, manufacturer installation and startup checklists and the final TAB report approved by the A/E.
- *Functional Testing.* The CA shall develop the functional test procedures in a sequential written form, coordinate, oversee and document the actual testing. Functional Performance Tests (FPT) are performed after Prefunctional testing and startup are complete and test the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems shall be tested under various modes and run through all the control system's sequences of operation while components are verified to be responding as the sequences state. Checklists will be completed during the testing process, deficiencies will be added to the Commissioning Issues Log and each included in the Commissioning Report.
- *Participate in training of facility staff in accordance with the training plan.* The CA may be charged with reviewing the training plan, developed by the Construction Manager/General Contractor, for adequacy. The CA may additionally be charged with participating in the training itself.

- *Complete a commissioning report.* The report must show that the building's systems have met the design intent and specifications, have been properly installed, are performing as expected, and that proper O&M documentation and training have been provided. The report should include a compilation of all commissioning documentation described in this criterion, including complete functional testing results and forms and should note any items that have not been resolved at the time the report is issued.

- *Ten month warranty, post-occupancy review*. The commissioning contract shall contain provisions for a 10-month warranty and post-occupancy review. The review is intended to bring the design, construction, commissioning, and facility staff together to solicit the facility staff's comments, suggestions, and areas of concern regarding the systems in their first year of operation. Warranties on any commissioned systems should be reviewed and deficient equipment should be identified and a plan for resolution developed.

Testing Sampling Criteria

The contractors shall submit to the CA documentation that they have performed installation and functional performance verification in accordance with the commissioning plan for all equipment components and systems. The functional performance test may be demonstrated to the CA for a sample of systems that comply with all of the following criteria:

- Equipment or systems have similar components and configurations. For component testing, sampling may apply where there are many identical component types with similar applications.

- The systems or equipment have identical sequences of operation, which are implemented using identical control software programming or firmware settings.

- The components and systems to be included in the demonstrated samples shall be chosen by the commissioning authority at the time of demonstration.

- Building Automation System mapping of component to the operators graphic shall be demonstrated for all components.

- The trend logging portions of all functional performance test shall be completed for 100% of the systems or components

Failure Testing

The Commissioning Plan must also identify retesting protocols for components and systems that fail initial testing.

Cross-Category and Other Considerations

This prerequisite relates to all prerequisites and credits that involve operable building systems, including HVAC, windows, and room controls. Good training is critical for good operations, and good operations are critical for good building performance. The prerequisite also relates to the required Systems Maintenance Plan in OM 5.1. The operations & maintenance manual described here will be part of the plan, along with the inventory and schedule of maintenance.

It is recommended that the owner consider using the commissioning process and provider for additional services including acoustic testing and irrigation commissioning. Qualified commissioning authorities can provide quality control on a range of high performance school systems and strategies. Other major systems can include items such as pools or audio-visual systems. Contact CHPS to see if your “major system” qualifies.

EE 3.2

When commissioning the envelope, follow the NIBS Guideline 3 or an equivalent method that at minimum includes drawing review, field inspection (construction checklist) and prior to window installation perform an infrared (IR) mock up to test for thermal breaks or IR testing of the first window installation.

EE 3.3

The prerequisite commissioning scope EE 3.0 does require a 10-month warranty review, but this review may not provide much value if the commissioned systems have not been monitored during the first year of occupancy. The school’s O&M staff may not have the manpower to dedicate to such monitoring and potential issues may not be apparent until the expiration of the warranty period.

First year optimization scope shall include, at a minimum:

• Monthly collection of building energy use and benchmark against predicted energy use and average comparable school building in the Northeast

• Quarterly review and analysis of operations trend data for select commissioned systems to verify continued proper systems operation

• Quarterly review and analysis of space temperature and CO2 trend data for a sampling of building spaces to verify satisfactory indoor environments

• Quarterly meetings with school O&M staff to review findings from review and analysis of building energy use, commissioned systems and space trend data. These quarterly meetings will also be used to discuss any specific questions or concerns the O&M staff may have regarding the commissioned systems to help direct the commissioning authority’s efforts for subsequent review and analysis.

A systems manual organizes equipment information by system and incorporates information above and beyond a regular O&M manual including; BOD, TAB reports, project specific operating considerations, functional performance tests, etc. The commissioning authority is in the best position to develop the systems manual due their project involvement from design through the first year of occupancy.

Documentation Requirements

Design Review Requirements

EE 3.0 & 3.1 – Provide the project's Commissioning Plan and Owners Project Requirements (OPR).

EE 3.0 – Construction drawings must include general notes that commissioning is required, at what stages and where the Commissioning Plan may be found for more information.

EE 3.2: Compliance will be confirmed by reviewing documentation for EE 3.0 and EE 3.1. Be sure to include additional requirements in construction documents as appropriate.

EE 3.3: Compliance will be confirmed by reviewing the additional scope of work for the Commissioning agent submitted in EE 3.0 and EE 3.1.

Construction Review Requirements

EE 3.0, 3.1, 3.2 – Provide the final Commissioning Report.

EE 3.3: Submit the systems manual.

Performance Review Requirements

EE 3.3: Submit a report summarizing the first year optimization process.

Resources

- ASHRAE Guideline 1.1-2007: HVAC&R Technical Requirements for The Commissioning Process: www.techstreet.com/ashrae/cgi-bin/detail?product_id=1573306
- ASHRAE Guideline 4-2019 (RA 2013): Preparation of Operations & Maintenance Documentation for Building Systems: https://www.techstreet.com/standards/guideline-4-2019-preparation-of-operations-and-maintenance-documentation-for-hvac-r-systems?product_id=2033699
- The Building Commissioning Association, Essential Attributes of Building Commissioning: https://www.bcxa.org/about-us/essential-attributes.html
- ASHRAE Guideline 0 – 2019 The Commissioning Process: https://www.techstreet.com/ashrae/standards/guideline-0-2019-the-commissioning-process?product_id=2076120

- National Institutes of Building Sciences, NIBS Guideline 3-2012, Building Enclosure Commissioning Process BECx: https://www.wbdg.org/ffc/nibs/criteria/nibs-guideline-3
- Utility Post-Occupancy Verification Incentives
    - National Grid: https://www.nationalgridus.com/media/pdfs/bus-ways-to-save/riverificationincentive.pdf
    - Mass Save: https://www.masssave.com/en/saving/business-rebates/new-buildings-and-major-renovations
    - Energize CT: https://www.energizect.com/your-business/solutions-list/Energy-Conscious-Blueprint
-

Environmental Preferable Refrigerants

Intent *Reduce the ozone layer impact and global warming contribution of refrigerants.*
EE 4.0 – Environmental Preferable Refrigerants

Because many refrigerants in use today have been found to adversely affect the ozone layer and contribute to the accumulation of atmospheric greenhouse gasses, this criterion requires the use of environmentally preferable refrigerants in Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC&R) systems.

EE 4.0 – Environmental Preferable Refrigerants			**Prerequisite** **1 point**
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EE 4.0	Use no CFC or HCFC based refrigerants in building Heating, Ventilating, Air Conditioning, & Refrigeration (HVAC&R) systems. HFC refrigerants are allowed and preference should be given to low GWP refrigerants. Existing HVAC equipment in renovation projects are exempt from this requirement if any non-compliant equipment was installed within the last 10 years.

Implementation

Submit specifications demonstrating the use of non-CFC/HCFC-based refrigerants in all HVAC and refrigeration systems to be installed. The following table may be used as a reference in choosing refrigerants. Note that the following table is not exhaustive and is simply a reference list. Any refrigerant complying with the prerequisite may be used regardless of its presence or absence in the table below.

Table 8: Refrigerants and Environmental Performance (After LEED Reference Guide for Green Building Design and Construction)

Refrigerant	ODP	GWP	Common Building Applications
Chlorofluorocarbons (CFC) and Hydrochlorofluorocarbons (HCFC) **not permitted in new equipment**			
CFC-11	1.0	4,750	Centrifugal chillers
CFC-12	1.0	10,900	Refrigerators, chillers
R-500	0.738	8,080	Centrifugal chillers
R-502	0.334	4,660	Centrifugal chillers, humidifiers
HCFC-22	0.055	1,810	Air conditioning, chillers
HCFC-123	0.02	77	Centrifugal chillers
High-GWP Hydrofluorocarbons **permitted in new equipment**			
HFC-134a	0	1,430	Air conditioning, centrifugal chillers, refrigerators, vending machines
HFC-245fa	0	1,030	
R-404A	0	3,920	
R-407A	0	2,110	Low-temperature refrigeration
R-410A	0	2,090	
R-507A	0	3,990	
Other Low-GWP Refrigerants **permitted for use in new equipment**			
Carbon Dioxide	0	1.0	Low-temperature refrigeration, water heating, vending machines
HFC-32	0	675	Air conditioning (under R&D)
R-1233zd	0	7	Centrifugal chillers
R-1234ze	0	6	Centrifugal Chillers
R-1234ze	0	4	Centrifugal Chillers

Note that many refrigerants have been or are being phased out because they deplete the ozone layer. All CFC production has stopped. Regardless of the refrigerant school districts currently use in existing equipment or purchase for new equipment, they should implement exceptional maintenance and operation practices to assure that refrigerant is not lost from the system. This will reduce costs of replacement refrigerant, help maintain energy efficiency, and protect the reliability of the equipment.

Documentation Requirements

Design Review Requirements

Construction drawings, including the mechanical schedule, must include equipment specified with no CFC based refrigerants.

Resources

- U.S. EPA Refrigerant Guidelines and Regulations: www.epa.gov/Ozone/title6/608/index.html

Energy Management System

Intent *Provide control, accountability, and optimization of building energy performance.*
EE 5.1 – Energy Management System
EE 5.2 – Advance Energy Management System and Submetering

Energy Management Systems (EMS), lighting control and metering are important systems for controlling, monitoring and understanding patterns of energy use in schools.

The prerequisite requires a base level EMS system to be installed, whereas EE 5.2 gives points for a more advanced system.

EE 5.1 – Energy Management System		**Credit**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	EE 5.1	Install a base level energy management system (EMS) to control the operating schedule of HVAC systems throughout the building including terminal units, packaged units, air handling units, make-up air units, centralized hydronic heating and cooling systems, pumps, and fans including fume hoods. Fractional horsepower fans, fractional horsepower pumps and units providing air conditioning to spaces requiring continuous 24/7 cooling such as computer server rooms, network equipment rooms, or walk-in refrigerators and freezers are excluded. The base level EMS shall provide the following energy saving features: • Schedule unoccupied setback temperature control so that units can heat during unoccupied modes should the space temperature fall below the setback temperature. Setback temperature settings shall be no higher than 60 degrees F. • Scheduled control of all ventilation outdoor air fans, exhaust fans and outdoor air dampers so that fans are turned off and dampers are closed during unoccupied periods. • Zoning of systems so that major building areas (i.e. gymnasium, cafeteria, library, classrooms, and administrative offices) can be independently scheduled during non-school hours. • An override system to temporarily change a unit or zone from unoccupied to occupied mode locally is permitted provided that it is timed and will automatically revert back to the normal operating schedule after no more than four hours. A local override switch that is not on a timer is not permitted. Ventilation outdoor air shall be set to occupied mode if the local override is used. A centrally located scheduling interface shall be provided so that the operator can schedule the EMS operating mode for weekdays, weekends, and holidays. The scheduler shall be capable of independently scheduling each major building area or zone. If the facility management staff that sets the operating schedule is located at another site, the EMS shall have a web-based interface so that the schedule can be set remotely.

EE 5.2 – Advanced Energy Management System and Submetering		**Credit**	
		2 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	EE 5.2.1	*Automated Demand Management.* Install an advanced energy management system (EMS) capable of supporting Automated Demand Management functions. System shall be capable of: • Storing pre-programmed demand management control strategies for specific controlled equipment and/or systems that will, in a safe and controlled manner, increase or decrease electrical demand, (e. g., change cooling setpoints, turn equipment on or off, rotate loads to avoid simultaneous/stacked demand) when triggered. • Store pre-conditions for triggering and releasing discrete demand control strategies, such as approaching user defined demand thresholds, applicable electricity pricing points, etc. • Respond to external signals as triggers for implementing and releasing demand management control strategies such as a contracted demand response event. The facility shall either demonstrate compliance with Open ADR 2.0 or demonstrate similar functionality via automated triggers using other communications protocols. • Support automated notification of a demand response event scheduled, threshold met, strategies scheduled for triggering, strategies executed and strategies released to normal control. • Allow for remote access opt out or cancellation of any demand control strategy scheduled or currently in force. • Allow for remote access user triggering of any demand control strategy not currently in force as well as scheduling triggering any demand control strategy for future triggering and release. • Energy models should be used to determine appropriate setback temperatures during unoccupied hours
	EE 5.2.2	*Data Acquisition and Storage.* Install a meter data acquisition and storage system for all electrical power used within the building. The system can use the main utility meter as a data source or an owner supplied sub-meter provided that all electrical power used in the building is recorded. Data from the system shall at a minimum record and store every 1 minute and shall be available to the operator with no less than 1 hour of the time the energy was consumed. The system shall include a user interface to trend and analyze stored data. Using the EMS, a separate stand-alone system, or a system provided by the local utility company are all acceptable provided that the system meets the requirements described herein. Project is eligible for two (2) innovation points from II 9.1.

Implementation

EE 5.1

While energy management systems (EMS) are typically installed with new HVAC and heating systems, care must be taken to specify and install an appropriate system for the district and its maintenance staff. The best EMS for a district is the simplest system that still addresses the school's energy management needs. Increased complexity does not always mean increased value for the district.

Energy management systems can potentially save significant energy, but only if the staff understands how to operate them. With EMS installation, proper training of district staff is absolutely critical. The district must be prepared to budget for staff training and for training new staff when those knowledgeable about the EMS leave employment.

EE 5.2

The following are considered exempt from this criterion:

- Unit heaters, cabinet heaters, radiation and convectors located in vestibules, storage rooms, janitor closets, and other unoccupied areas.
- Natural gas and heating oil demand sensors are not required on buildings less than 50,000 ft^2.

Monitoring capabilities of the EMS should allow for comparison between various types of building loads throughout all spaces of the school. This information is valuable and can be used to manage and optimize energy use. By trending and monitoring the building operation, any deviation from the design operation can be identified and corrected before an impact on occupant comfort and energy performance of the building is created. Building performance can also be optimized by longer-term trending, observation of performance characteristics, and benchmarking performance against expected operation.

The EMS should comprise the following:

Sensors should be provided as follows:

- Sensors to trend outdoor air temperature.
- Sensors to monitor and trend equipment status for all equipment with motors greater than ½ hp.
- Indication and trending of damper and valve commanded position.
- Sensors to monitor building electrical, natural gas, and heating oil demand and consumption.
- Sensors to monitor indoor and outdoor CO_2.
- Sensors to monitor and *trend* (create trend logs) controlled variables at the operator interface. Control variables may include air and/or water flow, temperature, pressure, CO_2, and pump or fan speed. 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.

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

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).

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

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.

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.

Communications: the EMS system may automatically generate reports on a regular basis summarizing recent system functionality and energy use. Such automatic reporting can be helpful for staff to continually understand how building systems are operating.

Documentation Requirements

Design Review Requirements

EE 5.1: Construction drawings and specifications that show a compliant EMS.

EE 5.2: No additional documentation. Compliance will be reviewed with EE 5.1.

Resources

- Advanced Buildings Benchmark Version 1.1, by the New Buildings Institute, Inc. pp. 38-39

Natural Ventilation & Energy Conservation Interlocks

Intent
Provide a bonus for school designs that incorporate natural ventilation and an incentive to install interlocks on doors and windows.
EE 6.1 – Natural Ventilation & Energy Conservation Interlocks

Natural ventilation is an effective energy design strategy for schools in many climates. Natural ventilation is already credited in the Superior Energy Performance criterion (EE 1.1) and this criterion offers additional bonus points when the strategy is employed.

EE 6.1 – Natural Ventilation & Energy Conservation Interlocks			**Credit**
			2 points
Applicability	**Verification Required**		
This criterion applies to new schools, a new building on an existing campus, additions and to major renovations based on the scope of the project. While this criterion applies to renovation projects; the cost of installing interlocks on existing windows can be prohibitive. A good opportunity to install interlocks occurs when the windows are being replaced as part of the project. For new buildings and renovation projects, interlock switches may only be installed in just the new building(s) or the building(s) being renovated/modernized to earn these points.	Design Review	Construction Review	Performance Review

Requirement

2 points	EE 6.1.1	Design schools such that at least 90% of the classrooms are designed to provide comfort conditions with no mechanical cooling according to the comfort conditions defined in ASHRAE Standard 55-2020. Naturally ventilated classrooms (with no mechanical cooling) shall meet the classroom ventilation requirements of ASHRAE Standard 62.1-2016 § 5.1 or demonstrate that engineered natural ventilation systems satisfy the requirements.
	EE 6.1.2	For hybrid systems that use natural ventilation is combination with mechanical cooling, Install interlocks, or an equivalent mechanism, to prevent heating and cooling equipment from operating when exterior windows or doors are open.

Implementation

Outdoor air Ventilation

Comply with ASHRAE 62.1-2016 § 6.4 requirements for classroom natural ventilation or include an engineered natural ventilation system that meets ASHRAE requirements). The former requires a minimum operable area in comparison to the classroom size, that openings are unobstructed, and that there is means to open the required operable windows or doors are readily accessible, in addition to other requirements. Adequate amounts of ventilation must be supplied to occupied classrooms at all times.

Interlock Switches

For hybrid spaces, specify and install interlock switches on all relevant classroom and non-classroom operable windows and doors. Consider including a strategy (such as a red light/green light system) to notify staff when the air temperature outside is appropriate for opening windows and utilizing natural ventilation.

Each year, significant amounts of energy are lost when teachers or staff members open exterior doors or windows while the HVAC heating and cooling equipment dedicated to that space continues operating. Interlocks installed on windows and doors can be used to shut off this equipment when windows and doors are opened for extended periods. If the heating or cooling equipment provides conditioned air to multiple rooms, the equipment should only be shut down when all related rooms have a window or door open. Interlocks must not turn off supply air fans that are used for ventilation, only equipment that is used to condition the air such as furnaces, heat-pumps, air-conditioner compressors and coil valves. Adequate amounts of ventilation must be supplied to the classroom at all occupied times.

Controls that use some form of time delay must be included so that normal use of doors do not cause the HVAC equipment to cycle on and off unnecessarily, and teachers must be educated on how the system works and why it is needed. The energy savings for natural ventilation are included in the calculations for EE 1.0 Energy Performance and EE 1.1 Superior Energy Performance.

Documentation Requirements

Design Review Requirements

Complete the CHPS Verified Plan Sheet to verify compliance. Construction drawings, ideally the mechanical plans, must include system details.

Construction Review Requirements

Provide proof of installation or pictures for required features.

Resources

- ASHRAE Advanced Energy Design Guide for K-12 School Buildings: https://www.ashrae.org/technical-resources/aedgs/zero-energy-aedg-free-download
- ASHRAE 62.1 2016: https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-interpretations/interpretations-for-standard-62-1-2016
- ASHRAE 55-2017: https://www.ashrae.org/technical-resources/bookstore/standard-55-thermal-environmental-conditions-for-human-occupancy

Local Energy Efficiency Incentives and Assistance

Intent *Require participation in local energy efficiency incentives and technical assistance programs.*
EE 7.0 – Local Energy Efficiency Incentives and Assistance

Virtually every utility customer in the Northeast region is eligible to participate in at least one, and typically several, energy efficiency programs. The programs offer either technical assistance or incentives for efficient equipment and practices. Many programs offer both technical assistance and financial incentives for the installation of efficient equipment and the incorporation of efficient design practices

EE 7.0 – **Local Energy Efficiency Incentives and Assistance**		**Prerequisite** **2 points**	
Applicability	**Verification Required**		
This criterion applies to all projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	EE 7.0	Participate in energy efficiency incentive and technical assistance programs that are available through applicable utility and governmental programs.

Implementation

Virtually every utility customer in the Northeast region is eligible to participate in at least one, and typically several, energy efficiency programs. The programs offer either technical assistance or incentives for efficient equipment and practices. Many programs offer both technical assistance and financial incentives for the installation of efficient equipment and the incorporation of efficient design practices.

In addition to utility and state government operated programs, the Federal Government offers a tax credit program that will allow the designers of energy efficient buildings to apply for a tax credit to help offset the costs of the design and construction of efficient buildings.

Participation in these programs not only leads to possible financial incentives, but often provides valuable information regarding best practices in the local area and local expert design and consultation services. School administrators should contact their electric and gas utility companies as well as their state energy office for specific program information.

Documentation

Design Review

Submit copies of utility and/or governmental program documents that demonstrate participation in available energy efficiency programs. Requirements may vary by state. Check state addendum for possible additional reporting requirements.

Construction Review

Submit documentation to confirm participation in any programs that could not be utilized prior to construction.

Resources

Efficiency Maine, www.efficiencymaine.com/

Efficiency Vermont, www.efficiencyvermont.com/

Mass Save: https://www.masssave.com/en/saving/business-rebates/new-buildings-and-major-renovations

Energize CT: https://www.energizect.com/your-business/solutions-list/Energy-Conscious-Blueprint

NH Saves, https://nhsaves.com/programs/new-equipment-construction/

National Grid, www.nationalgridus.com/

National Grid Rhode Island: https://www.nationalgridus.com/RI-Business/Energy-Saving-Programs/New-Construction-Major-Renovations

NYSERDA, https://www.nyserda.ny.gov/All-Programs/Programs/P-12-Initiative/Programs

Eversource, https://www.eversource.com/content/nh/business

Active Demand Response Programs (non-exhaustive list)

- Eversource Connected Solutions: https://www.eversource.com/content/ema-c/business/save-money-energy/manage-energy-costs-usage/demand-response
- National Grid RI Connected Solutions: https://www.nationalgridus.com/RI-Business/Energy-Saving-Programs/ConnectedSolutions
- National Grid NY Demand Response: https://www.nationalgridus.com/Upstate-NY-Business/Energy-Saving-Programs/Demand-Response

Variable Air Volume Systems

Intent
Install a VAV system to ensure exceptional access to fresh air.
EE 8.1 – Variable Air Volume Systems

School buildings require abundant amounts of fresh air in order to maintain indoor air quality. If the air volume is not carefully controlled, energy will be wasted needlessly conditioning excess fresh air.

EE 8.1 – Variable Air Volume Systems		**Credit**	
		1 points	
Applicability	**Verification Required**		
This criterion applies to all projects.	Design Review	Construction Review	Performance Review

Requirement

1 points	EE 8.1	Install a VAV system with variable speed drives on appropriate fans and motors. Control air volume in response to indoor air quality needs.

Implementation

School buildings require abundant amounts of fresh air in order to maintain indoor air quality. If the air volume is not carefully controlled, energy will be wasted needlessly conditioning excess fresh air.

To qualify for this credit, a VAV system must be installed that responds to indoor air quality through the use of CO 2 sensors or other air quality monitoring systems. Fans 5 hp and greater associated with this system are to be controlled by variable speed drives that respond to the air quality and thermal comfort needs. Additionally, pumps associated with the HVAC system are to use variable speed drives to regulate flow.

“Displacement” ventilation systems that are responsive to indoor air quality demands may also be submitted for this credit.

Systems that simply monitor temperature are not eligible for this credit.

Documentation

Design Review

Submit HVAC design document complete with pump, fan, and controls schedules, along with a "sequence of operations" document.

Resources

Advanced Buildings Core Performance Guide, https://www.usgbc.org/resources/advanced-buildings-core-performance-guide

Renewable Energy Performance Monitoring

Intent

Monitor the performance of renewable energy systems and publicly display results online.

EE 9.1 – Renewable Energy Performance Monitoring

Renewable energy systems are significant investments for schools. Ensure that they are performing as expected by specifically monitoring their performance. Displaying the results online helps drive accountability and improve community engagement in the school.

EE 9.1 – Renewable Energy Performance Monitoring		Credit	
		1 point	
Applicability	**Verification Required**		
This credit applies to all projects that install renewable energy systems.	Design Review	Construction Review	Performance Review

Requirement

1 points	EE 9.1	Install a performance monitoring system that monitors installed on-site renewable energy systems and displays the results on a Web site accessible by the public.

Implementation

For any of the on-site renewable energy systems installed on site, install a performance monitoring system that monitors and records system performance over time. Include a protocol for uploading performance information to a Web site allowing open access to the information.

Documentation

Design Review

Provide specifications for a performance monitoring system and a protocol for the automatic or scheduled uploading of performance data to an open access project Web site.

Construction Review

Submit screenshots of the website specific to the school.

Resources

Renewable energy system manufacturers typically supply or recommend monitoring equipment.

Electric Vehicle Charging

Intent *Provide electric vehicle supply equipment to support electric vehicle charging.*
EE 10.1– Electric Vehicle Charging

Electric vehicles have rapidly gained popularity in the Northeast and throughout the country. Infrastructure to charge and support electric vehicles is still developing. This credit incentivises projects to provide charging stations at schools to further encourage the adoption of electric vehicles.

EE 10.1 – Electric Vehicle Charging		**Credit**	
		1 point	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	EE10.1	Install electrical vehicle supply equipment (EVSE) in 2% of all parking spaces used by the project. Clearly identify and reserve these spaces for the sole use by plug-in electric vehicles. Parking spaces that include EVSE must be provided separate from and in addition to preferred parking spaces for green vehicles. The EVSE must: • Provide a Level 2 charging capacity (208 – 240 volts, 3 – 19 kWh output) or greater. • Comply with the relevant regional or local standard for electrical connectors, such as SAE Surface Vehicle Recommended Practice J1772, SAE Electric Vehicle Conductive Charge Coupler or IEC 62196 of the International Electrotechnical Commission for projects outside the U.S. • Be networked or Internet addressable and be capable of participating in a demand-response program or time-of-use pricing to encourage off-peak charging.

Documentation

Design Review

Submit plans showing the location of charging stations and specifications complying with the credit requirements.

Construction review

Submit photographs of the charging stations installed on site.

WATER

Minimum Reduction in Indoor Potable Water Use

Intent
Maximize water efficiency within buildings to reduce the burden on municipal water supply, aquifers, and wastewater treatment systems.
WE 1.0 – Minimum Reduction in Indoor Potable Water Use

The growing value of potable water in the United States underscores the importance of lowering demand. Efficient water consumption naturally reduces the amount of water pumped from the ground or transported from reservoirs to cities and towns. In addition, water efficiency reduces the cost and amount of sewage needing treatment after use. Because water-efficient devices can vary in quality and performance, specify only durable, high performance fixtures.

Well designed water efficient systems may earn one or more points by reducing the overall amount of potable water used in the schools and by reducing the amount of potable water used for sewage conveyance .

WE 1.0 – Minimum Reduction in Indoor Potable Water Use		**Prerequisite**	
		5 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

5 points	WE 1.0	Provide fixtures and fittings that, in aggregate, reduce potable water use for new construction, and for major renovations to meet the performance requirements as specified in Table 9: Fixture Performance Requirements.

Implementation

WE 1.0

This credit requires that all indoor water fixtures listed in Table 9: Fixture Performance Requirements comply with the listed maximum water consumption figures. These fixture requirements are **not** averages – every fixture must comply.

Table 9: Fixture Performance Requirements*

Fixture/Fitting Type	Maximum Water Consumption	Other Requirements & Notes
Showerheads	2.0 gpm @ 80 psi	Must be listed to WaterSense
Commercial lavatory faucets	0.5 gpm @ 60 psi	
Private lavatory faucet	1.5 gpm	
Metering faucets (self-closing)	0.20 gallons/cycle	There is no maximum flow rate for metering faucets
Water closets - other than remote locations*	1.28 gallons/flush	Tank-type water closets must be listed to WaterSense
Water closets - remote locations*	1.6 gallons/flush	
Urinals	0.5 gallons/flush	Flushing urinals must be listed to WaterSense
Commercial pre-rinse spray valves	1.3 gpm @ 60 psi	Must be listed to WaterSense
Kitchen faucets	2.2 gpm	
Drinking fountains (manual)	0.7 gpm	
Drinking fountains (metered)	0.25 gallons/cycle	
*Remote location is where a water closet is located at least 30 feet upstream of the nearest drain line connections or fixtures, and is located where less than 1.5 drainage fixture units are upstream of the water closet's drain line connection.		

Documentation Requirements

Design Review Requirements

Construction drawings must include a plumbing fixture schedule that reflects the required flow rates.

Construction Review Requirements

Provide pictures of installed fixtures, and manufacturer receipts, proof of purchase, or approved submittals for the water-efficient products purchased.

Resources

- US Environmental Protection Agencies Water Sense® program for efficient fixtures and sensors: www.epa.gov/watersense/

Reduce Potable Water Use for Sewage Conveyance

Intent
Reduce wastewater generated and/or the amount of potable water used for sewage conveyance.
WE 2.1 – Reduce Potable Water Use for Sewage Conveyance

The growing value of potable water in the United States underlines the importance of lowering demand. Water efficiency naturally reduces the overall amount of water needing to be pumped from its source or distributed around the city or state, thus resulting in lower energy needs. In addition, water efficiency reduces the cost and amount of sewage needing treatment after use. Because water-efficient devices can vary in quality and performance, specify only durable, high performance fixtures.

The mantra of watershed protection organizations across the world is "keep water local." In other words, harvest, use, treat, and re-infiltrate water close to the source of its use. Every step of extracting water, treating it, transporting it, and eventually reintegrating it into the water cycle uses energy. Transporting water, in particular, uses enormous electrical and infrastructure resources.

Use water-efficient fixtures and reclaimed water (where available) to reduce the amount of potable water used for sewage conveyance. Reclaimed water (tertiary treated wastewater) and/or recycled water from municipal sources (greywater, or harvested rainwater cooling tower blowdown, foundation drain water) may be suitable for flushing toilets and urinals, which typically produce the largest amounts of wastewater in a school. However, check first with the manufacturer(s) of the toilets and urinals to determine the minimum water quality requirements for the plumbing fixtures being considered. Note that fixture warranties may be voided by the manufacturer if the water quality fails to meet minimum specifications.)

A new generation of High Efficiency Toilets (HETs) and Urinals (HEUs) that use a maximum volume of 1.28 and 0.5 gallons per flush, respectively, are now readily available. Third party testing to determine the Maximum Performance (MaP) for different toilet fixtures has been available since 2003. Performance test results are available for both tank-type toilets and flushometer valve and bowl combination type toilets. For more information and test results, refer to: www.map-testing.com.

WE 2.1 – Reduce Potable Water Use for Sewage Conveyance		**Credit**	
		4 Points	
Applicability	**Verification**		
All new schools and major renovations. New building on an existing campus and	Design Review	Construction Review	Performance Review

additions may be eligible for these points if enough toilets and urinals are provided within the building to meet the occupant load. In cases where compliance with the toilet-occupant load ratio is determined on a campus wide basis the calculations should be performed for the entire school site.			

Requirement

2 points	WE 2.1.1	Provide shut-off capabilities for water supply to all urinals and water closets to prevent water leakage when unoccupied. Reduce the use of potable water for building sewage conveyance by a minimum of 20% through the utilization of water-efficient fixtures. Use rainwater, when possible, for non-potable uses.
2 point	WE 2.1.2	Comply with the requirements in WE 2.1.1, but reduce the use of potable water for building sewage conveyance by a minimum of 40% through the utilization of water-efficient fixtures, use of rainwater catchment systems, or both.

Implementation

This criterion requires reductions in total indoor water use; therefore all significant water uses are included in the calculations. Differentiation was made between the necessary reductions for new construction and major renovation due to the difficulty of working with existing grading of pipes.

Use the CHPS Templates to calculate the total water use (excluding landscaping) for the baseline design and for the proposed efficient design (to be used for Criterion WE.4). Create a spreadsheet that lists each fixture type, the flow rate, estimated duration of use, and any automatic controls. For the baseline design calculations assume the water consumption amounts shown in Table 9 - Fixture Performance Requirements. Food service and laundry appliances and fixtures should be considered to the extent that there is an existing baseline for those items, such as food steamers, Combined ovens, clothes washers, dishwashers, and ice machines. Fixtures and appliances that are used for consumption, such as a soda machines or coffee makers, should not be included. Baseline recommendations for food service appliances and fixtures should not compromise school health regulations or codes. Then estimate the number of occupants that will use each fixture type and the number of uses per day. Use this data to calculate the water use for each fixture type and the total daily and annual water use of the school. Create a similar spreadsheet for the efficient design case (if it improves on the prerequisite) using actual flow rates of the specified fixtures and equipment. The estimated number of occupants and daily uses remains the same for both cases.

Use water-efficient fixtures and/or site-collected water to reduce the amount of potable water used for sewage conveyance. Only those sources that produce blackwater, such as toilets and urinals, are included in this calculation. Rainwater is suitable for flushing toilets and urinals, which typically produce the largest amounts of wastewater in a school.

To quantify water use reductions, use the CHPS water use spreadsheet to determine baseline and design water consumption. List each fixture that produces blackwater, the amount of daily uses, number of occupants, and total water use. A water-efficient design for a 1,000-student school is shown in Table 11. The example assumes the use of low-flow toilets and waterless urinals, with all fixtures either using no water or using non-potable water.

Example Calculation

Question: How is the total potable water consumption savings calculated beyond the baseline established by Table 10 for the school in this example?

Example: Calculate the water use of the efficient design using high-efficiency fixtures where possible and the using Table 10 as the baseline design case. Divide the efficient design annual use by the baseline design annual use and subtract this from 1. The total savings in the following example is 34.1%, which exceeds this criterion and can be applied for under WE.4. If reclaimed or recycled water, or graywater are used for irrigation in place of potable water, that volume of water is further subtracted from the efficient design.

Table 10: Baseline Design Case Total Water Consumption

Fixture Type	Flow-rate	Duration	Occupants	Daily uses	Water use (gal)
Conventional Toilet (male)	1.28 gal/flush *	1 flush	500	1	640
Conventional Urinal (male)	0.5 gal/flush *	1 flush	500	2	500
Conventional Toilet (female)	1.28 gal/flush *	1 flush	500	3	1920
Bathroom Lavatory – conventional faucet	0.5 gal/min	.25 min	500	3	190
Bathroom Lavatory equipped with metering faucet	0.2 gal/cycle	N.A.	500	3	300
Conventional Shower	2.0 gal/min *	5 min	100	1	1000
Kitchen Sink – Food Service Kitchen	2.2 gal/min *	45 min	N.A.	10	990
Clothes Washer	40 gal/load	1 load	-	2	80

5,620 gal	Total Daily Volume
180	Number of School Days
1,011,600 gal	Baseline Total Annual Volume

* Water Sense® compliant

***This is not a comprehensive list. Among other fixtures found in schools, there are food service fixtures and appliances that consume a considerable amount of water and should be included in the baseline** as outlined in the implementation section above where appropriate and established limits have been set.

Table 11: Efficient Design Case Total Indoor Water Consumption

Fixture Type	Flow-rate	Duration	Occupants	Daily uses	Water use (gal)
High- Efficiency Toilet (male)	1.1 gal/flush	1 flush	500	1	550
High-Efficiency Urinal (male)	0.13 gal/flush	1 flush	500	2	130
High- Efficiency Toilet (female)	1.1 gal/flush	1 flush	500	3	1650
Bathroom Lavatory – conventional faucet	0.5 gal/min	.20 min	500	3	150
Bathroom Lavatory equipped with metering faucet	.18 gal/cycle	N.A.	500	3	270
Low-flow Shower**	1.5 gal/min	5 min	100	1	750
Low-flow Kitchen Faucet – Food Service Kitchen	1.8 gal/min	45 min	N.A.	10	810
Efficient Clothes Washer	20 gal/load	1 load	-	2	40

4,350 gal	Total Daily Volume
180	Number of School Days
783,000 gal Total	Baseline Total Annual Volume
22.3%	Percentage Savings

** Low Flow Showers at flow rates below 2.5 gpm should not be installed without Automatic Compensating Valve certified at the same flow rate as the showerhead.

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

% Savings = 100 – [(Efficient Design Total Annual Volume / Baseline Design Total Annual Volume) x 100]

% Savings = 100 – [(800,100/1,156,140) x 100] = 100 – (.692 x 100) = 30.8%

If a rainwater collection system part of the project, then provide justification for the volume of collected, useable rainwater over the school year. If seeking SS 5.1 Post-Construction Stormwater Management, documentation used to justify rainwater storage sizing may be used for this criterion. Helpful documentation would include: a building rainwater reuse plan and a water balance analysis that includes integrated analysis of source, storage, and demand. A source analysis should take into consideration the contributing watershed, daily and/or weekly rainfall data, the variations in rainfall during the year, and rainfall abstraction.

Rainwater Collection and Water Storage

For some schools, installation of a rainwater catchment system with underground storage tanks is a cost-effective option to provide water for flushing water closets (toilets) and urinals as well as for supplemental irrigation. Catchment systems can decrease some irrigation water demand depending on the size of the fields being irrigated. However, they are unlikely to contribute much to schools with many playing fields and large irrigation demands.

A rainwater catchment system should be designed with a water storage capacity for sewage conveyance and/or irrigation in typical years under average conditions. Oversizing water storage to meet drought conditions will be costly and under sizing storage may simply result in a system that is too small to significantly offset potable water consumption. In addition, rainwater collection and storage systems should be designed to avoid stagnation that could lead to mold growth and accumulation of bacteria. It will be important to check with your plumbing inspector early in the process if you pursue a catchment system.

The underground storage tanks and cisterns could at times run dry during drought conditions. Therefore, it is acceptable for tanks and cisterns to connect to wells or municipal water supplies.

Table 12: Design Sewage Conveyance Calculation

Fixture Type	Flow-rate	Duration	Occupants	Daily Uses	Water Use (gal)
Toilets (male)	1.1 gal/flush	1 flush	500	1	550
Urinals (male)	0.13 gal/flush	1 flush	500	2	130
Toilets (female)	1.1 gal/flush	1 flush	500	3	1650
Total Daily Volume					2330
Number of School Days					180
Design Total Annual Volume					419,400
Minus Collected Rainwater					(396,000)

Total Potable Water Used for Sewage Conveyance	23,400

Calculate Daily Water Use per fixture using the following equation:

- Daily Water Use = (Flow-rate) (Duration)(Occupants)(Daily Uses)
- Sum Daily Water Volumes for each fixture to find Total Daily Volume.

Multiply the Total Daily Volume by the number of school days for Total Annual Volume.

Subtract the amount of reclaimed water used to find Total Potable Water Used for Sewage Conveyance.

For baseline indoor water consumption calculations, use a similar spreadsheet in the Application Template, but change only the type of fixture and its associated design details. For baseline calculations, assume flow rates outlined by the ASHRAE SS198.1-2011, Section 5 fixture performance requirements:

Table 13: Baseline Sewage Conveyance Calculation

Fixture Type	Flow-rate	Duration	Occupants	Daily uses	Water use (gal)
Conventional Toilet (male)	1.28 gal/flush	1 flush	500	1	640
Conventional Urinal (male)	0.5 gal/flush	1 flush	500	2	500
Conventional Toilet (female)	1.28 gal/flush	1 flush	500	3	1,920
Total Daily Volume					3,060
Number of School Days					180
Baseline Total Annual Volume					550,800

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

% Savings = 1 – (Design Total Annual Volume / Baseline Total Annual Volume) = 1 – (23,400/550,800) = 0.95 = 95%

Therefore, this design would earn one point because potable water used for sewage conveyance has been reduced by 95% through using treated rainwater water in the toilets and urinals. Note that the high-efficiency fixtures by themselves were not enough to earn this criterion.

If a rainwater collection system is part of the project, provide justification for the volume of collected, useable rainwater over the school year. If seeking Site SS.11 – Post-Construction Stormwater Management, documentation used to justify rainwater storage sizing may be used for this criterion. Helpful documentation would include: a building rainwater reuse plan and a water balance analysis that includes integrated analysis of source, storage, and demand. A source analysis should take into consideration the contributing watershed, daily and/or weekly rainfall data, the variations in rainfall during the year, and rainfall abstraction.

Documentation Requirements

Design Review Requirements

WE 2.1.1 – Construction drawings must include the required CHPS Verified Plan Sheet with indoor water calculations provided at the point of registration with the CHPS Verified program. Construction drawings must identify shut-off capabilities for restroom facilities.

WE 2.1.2 & 2.1.3 – Construction drawings must include a plumbing fixture schedule that reflects the indoor water calculations.

Construction Review Requirements

WE 2.1.2 & 2.1.3 – Provide pictures of installed fixtures, and manufacturer receipts, proof of purchase, or approved submittals for the water-efficient products purchased.

Resources

- High-efficiency fixture and fitting standards are available through the American National Standards Institute (ANSI) as published by the American Society of Mechanical Engineers (ASME): www.asme.org/kb/standards#des=A112
- Maximum Performance (MaP) tested toilet fixtures: www.map-testing.com
- US Environmental Protection Agencies Water Sense® program for efficient fixtures and sensors: www.epa.gov/watersense/

Irrigation & Exterior Water Budget / Use Reduction

Intent *Reduce and optimize potable water use for irrigating recreational areas.*
WE 3.0 – Irrigation & Exterior Water Budget / Use Reduction

A water budget is a reasonable estimate of the amount of irrigation water required for a specific landscape over a given time interval. Local governments may have a different ordinance from the state model for calculating a water budget.

WE 3.0 – Irrigation & Exterior Water Budget / Use Reduction		**Prerequisite**	
		4 points	
Applicability	**Verification Required**		
All projects that are installing irrigation systems.	Design Review	Construction Review	Performance Review

Requirement

4 points	WE 3.0.1	Develop a water budget for landscape (both non-recreational and recreational) and ornamental water use to conform to the local water efficient landscape ordinance. If no local ordinance is applicable, then use the EPA WaterSense Water Budget tool. Alternatively, install no permanent irrigation for landscaping.
	WE 3.0.2	Reduce potable water, natural surface water or groundwater consumption for irrigation of non-recreational landscape areas by 20% over landscape budget baselines with the use of water-efficient native (or adapted) climate-tolerant plantings, high-efficiency irrigation controllers, soil moisture meters/rainfall sensors, or using captured rain or reclaimed water.
	WE 3.0.3	Reduce potable water, natural surface water or groundwater consumption for irrigation of recreational areas by 25% over landscape budget baselines with the use of water-efficient native (or adapted) climate-tolerant plantings, high-efficiency irrigation technologies, soil moisture meters/rainfall sensors, or using captured rain or reclaimed water.
	WE 3.0.4	Any in-ground irrigation systems used for recreational fields must have soil moisture meters, weather stations, or equivalent technology (ET Controllers) to control and shut off operation of irrigation systems when adequate ambient moisture is available to the turf.

Implementation

Recreational areas include athletic fields, playing fields, practice fields, etc.

Develop a baseline water budget for landscape and ornamental use in accordance with the projects local ordinance. If a local ordinance is not available use the EPA WaterSense Water Budget tool. Exceed this baseline budget by the required amounts.

Alternatively, no permanent irrigation must be supplied for landscaping. Temporary irrigation may be supplied for an establishment period of up to two years.

Design in-ground irrigation systems to include moisture meters, weather stations, or other equivalent ET controllers to control and shut off the irrigation systems whenever ambient moisture is adequate for turf irrigation. All in-ground irrigation must be connected to such a control system.

Documentation Requirements

Design Review Requirements

Construction drawings must include complete landscape drawings identifying irrigation system components and soil moisture meters if required. Construction drawings must include complete landscape drawings including all outputs of the U.S. Environmental Protection Agency's WaterSense Water Budget Tool including both the Landscape Water Requirement (LWR) and Landscape Water Allowance (LWA). The outputs should reflect the landscape plans provided.

If no permanent irrigation is installed on site, provide a letter from the landscape architect confirming this fact and explaining how long any temporary irrigation will be supplied.

Construction Review Requirements

Provide proof of purchase, installation, pictures, approved submittals or other supporting documents that show compliance.

If no permanent irrigation is installed, provide a letter from the landscape architect confirming compliance with the design documents or explaining any changes that occurred during construction.

Resources

- EPA WaterSense Water Budget Tool: http://www.epa.gov/watersense/water_budget/
- For information on local evapotranspiration rates, see lists provided by the Irrigation Association: https://www.irrigation.org/IA/Resources/Tools-Calculators/ET-Resources/IA/Resources/ET-Resources.aspx?hkey=576c5d0f-fee5-415f-b325-2ea2a95083fb

Reduce Potable Water Use for Non Recreational Landscaping Areas

Intent

Reduce or eliminate potable water use for landscaping irrigation.

WE 4.1 – Reduce Potable Water Use for Non Recreational Landscaping Areas

In the United States, the patterns of precipitation vary greatly from year to year. When the demand of potable water increases, more water is drawn to accommodate that demand and lakes, rivers and aquifers can be stressed to the point of creating the water shortages. To minimize the shortage and drought problem, irrigation systems should only be provided if necessary. Permanent irrigation systems should be designed with efficiency in mind. Irrigation when necessary should be limited to early morning hours to minimize evaporation. Potable water use can also be minimized by specifying drought tolerant plants and considering the soil composition to support the plants.

WE 4.1 – Reduce Potable Water Use for Non Recreational Landscaping Areas		**Credit**	
		2 Points	
Applicability	**Verification**		
All new schools. New building on an existing campus, additions, and major renovations the calculations must be made for the entire school site, not just the area around the new building or the buildings being modernized.	Design Review	Construction Review	Performance Review

Requirement

1 point	WE 4.1.2	Reduce potable water, natural surface water or groundwater consumption for irrigation of non-recreational landscape areas by 35%.
OR 2 points	WE 4.1.3	Do not install permanent irrigation systems for watering non-recreational landscaped areas (excluding designated school gardens) AND specify drought resistant plants or grasses in these areas so that irrigation is not needed beyond plant establishment.
		OR
	WE 4.1.4	Reduce potable water, natural surface water or groundwater consumption for irrigation of non-recreational landscape areas by 50%.

Implementation

Compliance will be determined based on information submitted for WE 3.0.

Documentation Requirements

Design Review Requirements

Compliance will be determined based on information submitted for WE 3.0.

Construction Review Requirements

Compliance will be determined based on information submitted for WE 3.0.

Resources

- Local water utility staff, water efficient landscape consultants, Certified Irrigation Designers (www.irrigation.org), and Master Gardeners are good resources for helping achieve this criterion.

Reduce Potable Water Use for Recreational Landscaping Areas

Intent
Reduce or eliminate potable water use for irrigating recreational areas.
WE 5.1 – Reduce Potable Water Use for Recreational Landscaping Areas

Significant amounts of water are used to irrigate recreational fields. A typical natural turf recreation field needs up to 5,000 gallons of water/acre/day during the peak of the irrigation season and in many locations exceeds 7,000 to 8,000 gallons/acre/day.

WE 5.1 – Reduce Potable Water Use for Recreational Landscaping Areas			**Credit** **1 point**
Applicability	**Verification**		
All new schools. New building on an existing campus, additions, and major renovations the calculations must be made for the entire school site.	Design Review	Construction Review	Performance Review

Requirement

1 point	WE 5.1.2	Reduce potable water, natural surface water or groundwater consumption for irrigation of recreational areas by 50% over landscape budget baselines with the use of water-efficient native (or adapted) climate-tolerant plantings, high-efficiency irrigation technologies, soil moisture or weather based meters, or by using captured rain or reclaimed water.

Implementation

Recreational areas include athletic fields, playing fields, and practice fields.

Soil Types

The best types of soil for playing fields are 3% to 7% organic content and fall into the US Department of Agriculture soil categories:

Table 14: Watering Requirements by Soil Type

Soil Type	Watering Requirements
Loamy sand	1 in. per week
Sandy loam	1 in. per week
Loam	1 in. per week

Artificial Turf

Artificial sports turf can be installed, but no credit will be given for water savings because fields tend to require watering for maintenance and heat control.

Documentation Requirements

Design Review Requirements

Compliance will be determined based on information submitted for WE 3.0.

Construction Review Requirements

Compliance will be determined based on information submitted for WE 3.0.

Resources

- Local water utility staff, water efficient landscape consultants, Certified Irrigation Designers (www.irrigation.org/), and Master Gardeners are good resources for helping achieve this criterion.

Irrigation Systems Commissioning

Intent
Verify that the site's irrigation systems and controls are operating as intended and that effective training has been provided.
WE 6.0 – Irrigation Systems Commissioning

Irrigation system testing and training is a rigorous quality assurance program administered by a knowledgeable party that ensures the irrigation systems perform as expected. Irrigation system testing can help to ensure that water efficiency measures are working properly and design water savings are achieved.

WE 6.0 – Irrigation Systems Commissioning		**Prerequisite**	
		1 point	
Applicability	**Verification**		
All projects that include irrigation systems.	Design Review	Construction Review	Performance Review

Requirement

1 point	WE 6.0	Create an irrigation commissioning plan and complete installation review during construction, performance testing after installation, and documentation for ongoing operations and maintenance.

Implementation

Reference specifications for an irrigation commissioning plan. Designate the CSI number, section, and page number. State that irrigation commissioning plan must include:

- Identification of which entity will prepare the irrigation commissioning plan and who will perform the commissioning tasks.
- Review of irrigation system installation during construction, with record of deficiencies found and corrected.
- Performance testing and documentation of results (as compared to specified performance) at least once during the first year of installation.

- Site-specific documentation detailing maintenance requirements and frequency and operation procedures including a recommended irrigation schedule to apply appropriate weekly water amount per week to athletic fields.

Acceptance testing shall be included in the specifications and performed on the following, if applicable:

- Irrigation pipes and fittings. Under static conditions the system pressure loss shall not exceed 3 psi over a one hour time period.
- Irrigation heads and coverage. The system shall have a measured distribution uniformity (lower quarter) of no less than 65%.
- Back-flow devices.
- Automatic sensors, timers and other controls.

For equipment not listed, the design team shall provide acceptable test results, and the contractor shall certify that the tests were performed and the equipment performs as specified.

Supply a letter signed by commissioning agent verifying requirements for performance testing of irrigation equipment and actual performance have been met.

Documentation Requirements

Design Review Requirements

Provide a PDF of the Irrigation Commissioning Plan which includes items listed in the Implementation Section of the credit as well as who will be responsible for the commissioning and when it will occur.

Construction Review Requirements

Provide final commissioning report.

Resources

- Local water utility staff, water efficient landscape consultants, Certified Irrigation Designers (www.irrigation.org/), and Master Gardeners are also good resources for helping achieve this criterion. In particular, https://www.irrigation.org/ia/Resources/Audit-Guidelines.aspx provides information about testing of irrigation systems.

Rainwater Collection and Storage

Intent
Install a rainwater collection and storage system to be used to convey sewage and/or irrigate play fields.
WE 7.1 – Rainwater Collection and Storage

In order to reduce water demand for sewage conveyance and irrigation, some schools opt to use rainwater catchment systems with cisterns or underground storage tanks. These supplementary systems can significantly decrease water demand by drawing on stored water instead of municipal water supplies or drinking water wells.

WE 7.1 – Rainwater Collection and Storage		**Credit**	
		2 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 point	WE 7.1	Install a rainwater collection and storage system to be used to convey sewage and/or to irrigate the playing fields when no portable water is to be used.

Implementation

A rainwater catchment system should be designed with a water storage capacity for sewage conveyance and/or irrigation in typical years under average conditions. In other words, oversizing water storage to meet drought conditions may be costly and could increase maintenance requirements. On the other hand, undersizing storage may simply result in a system that is too small to significantly offset potable water consumption. Rainwater collection and storage systems should be designed to avoid mold growth, bacteria accumulation, and stagnation.

The underground storage tanks and cisterns could at times run dry during drought conditions. Therefore, it is acceptable for tanks and cisterns to connect to wells or municipal water supplies.

Documentation Requirements

Design Review

Submit construction documents containing specifications for the installation of a rainwater collection system that meets the above requirements. Include the CHPS Verified Plan Sheet with calculations for the sizing of the system.

Resources

- The Irrigation Association, www.irrigation.org/
- The Irrigation Best Management Practices for Agriculture in New Hampshire is a good reference for assistance in calculating a water budget. The document is available from the NH Department of Environmental Services. NHDES, http://des.nh.gov/
- Local water utility staff, water efficient landscape consultants, certified irrigation designers and Master Gardeners are also good resources for helping achieve this credit.

Water Management System

Intent

Provide ongoing accountability and optimization of the building and site water performance over time.

WE 8.1 – Water Management System

A water management system must monitor both indoor and outdoor water usage to detect leaks and improve efficiency. Water leaks can result in significant water losses and costs, and have the potential to cause structural damage and promote mold growth. Information obtained from water meters is valuable in managing and optimizing water usage. When selecting a water management system take into consideration district and maintenance staff needs, training considerations, and how the system could be integrated with an energy management system. A water management system can potentially save significant water, but only if staff understands its reports and how to operate it. Proper training of district staff is critical, and high turnover rates continue to challenge school districts to provide retraining programs and on-site manuals.

WE 8.1 – Water Management system			**Credit**
			2 point
Applicability	**Verification**		
This credit applies to all schools.	Design Review	Construction Review	Performance Review

Requirement

2 point	WE 8.1	Install a Water Management System to monitor water use of all indoor and outdoor water uses. Water meters should have a pulsed output for automatic meter readings (AMR). Separate water meters (also called sub-meters) must monitor and report on water usage for the following: • Gyms with showers • All other indoor water uses • Landscaping if irrigated • Recreational fields if irrigated • Swimming pools • Cooling towers if equipped For new buildings on existing campuses, the water management system may only monitor the new building's indoor water use. For major renovations, the water management system may only monitor indoor water use if the scope of the project does not include any outdoor systems.

Implementation

The plans and specifications should include a list of all sensors (measurements to be taken through the building and exterior) and actuators (devices to be controlled). It should also specify the protocol communication between the sensor, actuators, and the computer (controller).

The construction documents should also specify the requirements for the graphic user interface (GUI). The designers should work with the school district maintenance and operation staff to determine the desired features. School districts should consider standardizing on one type of system in order to reduce the need to learn and maintain different operating systems.

Monitoring capabilities should allow for comparison between indoor water usage, landscaping if irrigated and recreational fields if irrigated. This information is valuable and can be used to manage and optimize water use.

Documentation Requirements

Design Review

Construction Documents must clearly indicate equipment and locations for Water Management System.

Construction Review

Provide proof of purchase, installation, approved submittals, pictures or other supporting documents that show compliance.

Resources

None

SITES

Site Selection

Intent
Select sites that are a safe and healthy environment for students and staff, and that protect topsoil.
SS 1.0– Site Selection

State and federal laws and regulations for school siting and environmental impact studies were created to prevent schools from being constructed on sites containing pollutants known to be hazardous to student and staff health. A variety of factors, from hazardous materials in the soil to airborne pollutants from nearby sources are included in the site review process. At existing facilities, an assessment should be undertaken to determine the environmental and health problems with the facilities prior to renovations.

SS 1.0 – Site Selection		**Prerequisite**	
		2 points	
Applicability	**Verification Required**		
This prerequisite applies to new schools. For major renovations and a new building on an existing campus, this prerequisite is required based on the scope of the project. For renovation projects that do not encompass an entire campus, the evaluation shall be provided for each building, portion of building and/or campus area affected by the renovation. The CHPS requirement regarding siting a school within 500 feet from a freeway or traffic corridor, applies to any project involving the purchase of a school site or the construction of a new elementary or secondary school by a school district.	Design Review	Construction Review	Performance Review

Requirement

Prerequisite	SS 1.0	New Schools: Complete a Phase I Environmental Site Assessment (ESA) in accordance with ASTM E1527-13. If a Phase II ESA is necessary based on the results of Phase I, follow ASTM E1903-11. The ESA must include:: • Identification of facilities within ¼ mile that might reasonably be anticipated to emit hazardous air emissions, or handle hazardous or acutely hazardous material, substances or waste. A determination shall be made (following ASTM 1527-13) that such facilities will not adversely affect the health of students, staff or teachers. • A risk assessment and implementation of appropriate mitigation measures or the establishment of appropriate "buffer zones" to ensure that the proposed school site would not expose school occupants to significant health or safety risks from rail lines, hazardous material pipelines, high power transmission lines, toxic air emissions from stationary sources, or other sources of pollution including those identified under ASTM 1527-13. • Written findings verifying that the site is not currently or formerly a hazardous, acutely hazardous substance release, or solid waste disposal site or, if so, that the wastes have been removed in a manner that meets the referenced standard. Also, the written findings must state that the site does not contain pipelines, which carry hazardous wastes or substances other than a natural gas supply line to the school or neighborhood. If hazardous air emissions are identified, the written findings must state that the health risks do not, and will not, constitute an actual or potential danger of public health of students or staff. If corrective measures of chronic or accidental hazardous air emissions are required under an existing order by another jurisdiction, the governing board shall make a finding that the emissions have been mitigated prior to occupancy of the school. Identification of train tracks, freeways, or traffic corridors within 500 feet of the site and analyses that neither short-term nor long-term exposure to air pollutants poses significant health risks to students.

The ESA Must Also Include all of the following:

- Site the school with at least the following distances from the edge of respective power easements above ground; 100 feet for 50-133 kV lines, 150 feet for 220-230 kV lines, and 350 feet for 500-550 kV lines.
- The site shall be self-draining, including detention ponds or other engineered systems (lakes) to control and direct water, and free from depressions in which water may stand and be allowed to stagnate. The site shall be kept free from refuse, weed overgrowth, and other hazards. Livestock or poultry shall be located more than fifty (50) feet from food service areas, offices, or classrooms except those offices and classrooms associated with animal husbandry activities.
- The site shall not be located near an above-ground water or fuel storage tank or within 1500 feet of the easement of an above ground or underground pipeline that can pose a safety hazard as determined by a risk analysis study, conducted by a competent professional, which may include certification from a local public utility commission.
- If the site is located in an agricultural area, identify drift problems throughout the year from highly toxic and volatile pesticides. Pesticides under concern are listed as “Restricted Use Products” by the US EPA. If highly toxic and volatile pesticides are identified and not mitigated, the school will not meet this prerequisite.
- If the school drinking water source is an on-site private well, the well water must be tested by the local health department or authority having jurisdiction to ensure the water is free of harmful contaminants prior to occupancy. The local jurisdiction may require further testing during occupancy.

Major Renovations.

- All Major Renovations must identify facilities within ¼ mile that might reasonably be anticipated to emit hazardous air emissions or handle hazardous or acutely hazardous material, substances, or waste. A determination shall be made (following ASTM 1527-13) that such facilities will not adversely affect the health of students, staff, or teachers.
- Refer to U.S. EPA's School Siting Guidelines for additional guidance on identification of nearby facilities that may impact the school site, conducting Phase I and Phase II site assessments, evaluating potential impacts from nearby sources of air pollution and integrating public involvement into the school siting process
- Renovation projects shall complete the Environmental Review Process as they apply to existing schools, as outlined in *School Siting Guidelines* published by the US EPA, Chapters 3 through 6.

Implementation

A "Freeway or other busy traffic corridors" refers to those roadways that, on an average day, have traffic in excess of 50,000 vehicles in a rural area, and 100,000 vehicles in an urban area.

Refer to U.S. EPA's School Siting Guidelines for additional guidance on identification of nearby facilities that may impact the school site, conducting Phase I and Phase II site assessments, evaluating potential impacts from nearby sources of air pollution and integrating public involvement into the school siting process.

Documentation Requirements

Design Review Requirements

Provide Phase 1, and Phase 2 if necessary, Environmental Site Assessment in accordance with ASTM 1527-13. The Site Assessment should include all items covered in SS.P1 regardless of whether or not they are normally covered in a Phase 1 or Phase 2 Environmental Site Assessment.

A memo from the architect summarizing the results of the assessment and explaining what changes have been made as a result.

Resources

- ASTM Environmental Assessment Requirements: www.astm.org/Standards/E1527.htm
- US EPA School Siting Guidelines: https://www.epa.gov/schools/view-download-or-print-school-siting-guidelines
- US EPA Restricted Use Product List: https://www.epa.gov/pesticide-worker-safety/restricted-use-products-rup-report
- US EPA Travel and Environmental Implications of Schools Siting: https://www.epa.gov/smartgrowth/travel-and-environmental-implications-school-siting 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 lands within their jurisdiction. County offices can be located at: http://offices.sc.egov.usda.gov/locator/app

Environmentally Sensitive Land / Preserve Greenspace & Parklands

Intent *Avoid development on environmentally sensitive sites to reduce impact of the building footprint. Protect open space and channel development to previously developed sites in order to protect habitat and natural resources.*
SS 2.1 – Environmentally Sensitive Land / Preserve Greenspace & Parklands

Protect environmentally sensitive site features, such as wetlands and tree stands, and encourage landscaping and architecture that responds to and includes the school's immediate environment. A district faces many issues during site selection. Cost, student demographics, and environmental concerns all influence when sites are acquired and how the school district uses them. The site is a crucial element in determining the overall sustainability of the school. Sites are sometimes purchased years in advance, and some of these criteria may be out of the control of the districts and/or designers at the time the school is being built. 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.

Urban redevelopment reduces environmental impacts by utilizing established infrastructure and preserving the open space of undeveloped lands. If the site already contains a building, additional credit may be earned with Materials points for MW 8.1 and/or MW 9.1 on Building Reuse.

<table>
<tr><td colspan="2" rowspan="2">SS 2.1 – Environmentally Sensitive Land / Preserve Greenspace & Parklands</td><td colspan="2">Credit</td></tr>
<tr><td colspan="2">3 points</td></tr>
<tr><td>Applicability</td><td colspan="3">Verification</td></tr>
<tr><td>All new schools. A new building on an existing campus or additions to existing buildings can earn this point if the site for the new building or addition is not on environmentally sensitive land. For major renovations, this point may be earned if it can be verified that the site is not environmentally sensitive land as defined by this criterion.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

Do not develop buildings or impervious surfaces on portions of sites that meet any one of the following:

2 point	SS 2.1.1	Do not temporarily or permanently modify land, which prior to acquisition for the project was public parkland, conservation land, or land acquired for water supply protection.
		Do not build on:
	SS 2.1.2	Greenfields. For the purposes of this criterion, greenfields are defined as undeveloped lands or lands that are used for agriculture, forestry, or park purposes. Undeveloped lands are defined as lands that have not been in use for a period of 50 years or more and cannot be identified, by visual inspection, as having been developed.
	SS 2.1.3	Land specifically identified as habitat for any species on the federal or state threatened or endangered list.
	SS 2.1.4	Land that is prime farmland, unique farmland, or farmland of statewide importance as defined by the US Department of Agriculture (USDA) Natural Resources Conservation Services NRCS.
1 point		Do not develop buildings on:
	SS 2.1.5	Land whose elevation is lower than 5 feet above the elevation of the 100-year flood as defined by FEMA and as shown on the FEMA Flood Insurance Rate Map (FIRM) for the site.
	SS 2.1.6	Land that is within 100 ft. of any wetland as defined by 40 CFR (Code of Federal Regulations), Parts 230-233 and Part 22, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent.
	SS 2.1.7	Previously undeveloped land that is within 50 feet of a water body, defined as seas, lakes, rivers, streams and tributaries that support or could support aquatic life, recreation or industrial use, consistent with the terminology of the Clean Water Act.

Implementation

SS 2.1.1

A district faces many issues during site selection. Cost, student demographics, and environmental concerns all influence site acquisition. The site is a crucial element in determining the overall sustainability of the school design. Some sites are purchased years in advance, which leaves little room for input from the districts and designers. 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.

Provide a current existing site survey with the school site property boundaries marked in bold.

SS 2.1.2

During the site selection process, use previously developed sites instead of greenfields. Redevelopment reduces environmental impacts by utilizing established infrastructure and preserving the open space of undeveloped lands.

SS 2.1.3

Verify that the proposed site is not habitat to any species on the federal or state, threatened or endangered list. Provide the excerpt of document indicating that the site is not habitat to any species on the federal or state, threatened or endangered list.

SS 2.1.4

Verify that the proposed site is not prime farmland, unique farmland, or farmland of statewide importance farmland as defined by the US Department of Agriculture (USDA). The Natural Resources Conservation Services (NRCS) division of the USDA maintains the definitions and soil surveys that designate areas as "prime farmland, unique farmland, or farmland of statewide importance." Provide NRCS map indicating site location.

SS 2.1.5

Do not construct permanent buildings, or structures to support buildings within the 100-year flood plain. Both federal and state agencies have worked together over the last several decades to prevent construction of buildings in 100-year floodplains to achieve two important results: 1) a significant decrease in building damage and liability and 2) a restoration of functional floodplains to absorb flood waters and minimize impacts to downstream communities.

"Above the floodplain" means that the building footprint must be above the 100-year flood plain, but the requirement does not apply to non-building areas of the site.

Consult with FEMA to determine the 100-year floodplain for the school site. Verify that the proposed building footprint is located at an elevation five feet or higher than the 100-year floodplain. Provide the site plan indicating site is located five feet or higher than the 100-year flood plain.

SS 2.1.6

Do not build on sites, which are within 100 ft. of a wetland as defined below. Site development includes the school facilities, playing fields and parking lots and construction operations that are not related to wetlands improvement. Survey the site to determine if wetlands exist on, or near the site. Verify that all construction activity, including parking lots, playgrounds or any structures are located more than 100 feet from wetlands. Consult with federal regulations 40 CFR, Parts 230-233 and Part 22, or local, or state rule to determine if an area qualifies as a wetland. If more than one definition exists, use the one that is more stringent. 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]. Provide the site plan indicating that the site is located more than 100 feet from wetlands.

During construction, protect all wetlands with a fence or other physical barrier that cannot be easily moved (wildlife-permeable barrier, if appropriate) that protect the wetland from equipment parking and traffic, storage of materials, and other construction activities. All construction and maintenance personnel shall be educated about the locations and protective measures of the wetlands. In construction documents, outline consequences to contractor if wetland boundaries are not respected.

SS 2.1.7

Do not build on sites, which are within 50 ft. of a water body as defined below. Site development includes the school facilities, playing fields and parking lots and construction operations that are not related to water body improvement. Survey the site to determine if water bodies exist on, or near the site. Verify that all construction activity, including parking lots, playgrounds or any structures are located more than 50 feet from water body.

Water bodies include navigable waters, waters of the contiguous zone, the oceans and adjoining shorelines as well as wetlands and watersheds that feed the water bodies listed. See https://www.epa.gov/nwpr/final-rule-navigable-waters-protection-rule for further guidance.

Provide the site plan indicating that the site construction is located more than 50 feet from water bodies.

Documentation Requirements

Use the CHPS Verified Plan Sheet to provide site parcel number and physical address (or intersections if street address is unknown), as well as to confirm project meets credit requirements.

Provide a drawing (site plan) that identifies the building footprint and any wetlands within 100'. (Utilize the U.S. Fish and Wildlife Service Wetlands Mapper at: https://www.fws.gov/wetlands/data/mapper.html to identify wetland locations.) On the same drawing include the 100-yr flood plain and a line indicating a 5' in elevation above the flood line if either cross the site (use a map from the FEMA web site to identify 100-yr flood plain), or provide equivalent documentation through attaching a PDF of a part of a CEQA report, or other Mitigated Negative Declaration item.

SS 2.1.1 – Provide a current existing site survey with the school site property boundaries marked in bold.

SS 2.1.2 – Provide evidence of historical property use through submittal of aerial photographs, environmental assessment or similar verification that property is not a greenfield.

SS 2.1.3 – Provide the excerpt of document indicating that the site is not habitat to any species on the federal or state, threatened or endangered list.

SS 2.1.4 – Provide NRCS map indicating site location.

SS 2.1.5 – Provide the site plan indicating site is located five feet or higher than the 100-year flood plain.

SS 2.1.6 – Provide the site plan indicating that the site is located more than 100 feet from wetlands. In construction documents, outline consequences to contractor if wetland boundaries are not respected.

SS 2.1.7 – Provide the site plan indicating that the site construction is located more than 50 feet from water bodies.

Resources

- 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 lands within their jurisdiction. County offices can be located at: offices.sc.egov.usda.gov/locator/app. Maps are also available at websoilsurvey.nrcs.usda.gov/app/HomePage.htm
- Federal Wetlands information (40 CFR, Parts 230-233) can be found at the US EPA website: https://www.law.cornell.edu/cfr/text/40/part-232 . Many wetlands are digitally mapped and downloadable from the National Wetlands Inventory, www.fws.gov/wetlands/; or from state, county, or municipal GIS departments or Natural Resources Conservation Service offices.
- Federal Water Pollution Control Act (Clean Water Act) can be found at https://www.epa.gov/laws-regulations/summary-clean-water-act .
- Federal Emergency Management Agency (FEMA) Regions: https://www.fema.gov/about/organization/regions .
- FEMA Flood Maps: https://www.fema.gov/flood-maps

Minimize Site Disturbance

Intent *Reduce the extent of land used for development and discourage the use of automobiles for transportation to and from school.*
SS 3.1 – Minimize Site Disturbance

This criterion is intended to mitigate negative impacts on existing ecosystems. Reducing a building footprint, reducing parking, and limiting paved site development can reduce site disturbance to these systems. Multi-story schools decrease the amount of land used in construction and help preserve existing open space. Excess parking spaces encourage increased automobile use, contribute to urban heat island effects, and can increase pollution from stormwater runoff. Design parking so as not to exceed listed amounts and include clearly marked, preferred parking areas for carpools. Combined, strategies for reducing the footprint of buildings and limiting parking and paving while encouraging alternate means of transportation can minimize the effects existing ecosystems.

SS 3.1 – Minimize Site Disturbance		**Credit**	
		1 point	
Applicability	**Verification**		
All projects	Design Review	Construction Review	Performance Review

Requirement

1 point	SS 3.1.1	Increase the Floor Area Ratio (FAR) of the school to be at least 1.4 to reduce the development footprint and preserve open space. In this document, the FAR is defined as a building's gross square footage divided by the square footage of the building footprint. **AND**
	SS 3.1.2	Do not exceed minimum local parking requirements. Comply with the following, unless they result in more parking than local requirements: **New Construction and Additions:** Size parking capacity not to exceed: • High schools: 2.25 spaces per classroom plus parking for 30% of students. • Elementary and Middle schools: 2.25 spaces per classroom. If event parking is provided, it must be permeable. AND provide preferred parking spaces and signage for 5% of total parking spaces for carpools, vanpools, and low-emitting vehicles. **Major Renovations:** • Add no new parking compared to existing conditions, AND provide preferred parking spaces and signage totaling 5% of total parking spaces for carpools or vanpools and for low-emitting or fuel-efficient vehicles. **AND**
	SS 3.1.3	Limit total site development so that open space is 25% more than Zoning Open Space requirements. If no Zoning Ordinances apply to open space, provide a minimum of 50% vegetated open space. If a school is located in a densely populated area (SS 6.1: Central Location), provide a minimum of 25% vegetated open space.

Implementation

For a new building, addition or major renovation project to earn these points, the calculations must be based on the entire campus, not the individual building or building(s) being modernized. A major renovation project, a new building on an existing campus, and an addition can also claim these points if the existing campus already satisfies the requirement.

SS 3.1.1

Demonstrate that the design meets this requirement through the following equation:

$$\frac{\text{Total Floor Area of Building (ft}^2\text{)}}{\qquad} \geq 1.4$$

Total Floor Area of the Building Footprint (ft^2)

Calculate the Floor Area Ratio (FAR) by dividing the school facility's footprint by the facility's entire square footage including all stories. Said another way, achieving a floor area ratio (FAR) of 1.4 requires at least 40% of the total building square footage needs to be above the first floor. The building footprint is defined as the ground surface occupied by the structure and excludes awnings, overhangs and projections from the building.

SS 3.1.2

Excess parking spaces encourage increased automobile use, contribute to urban heat island effects, and can increase pollution from stormwater runoff. Design parking so as not to exceed listed amounts, and include clearly marked, preferred parking areas for carpools, vanpools and low-emitting, fuel-efficient vehicles. For the purposes of making calculations for this criterion, classrooms include:

- General classrooms
- Art rooms
- Music classrooms
- Computer labs
- Science labs
- Special needs collaborative, and remedial classroom space

For new construction, provide a site plan showing parking layout (indicate total number of parking spaces). Highlight preferred parking spaces. Signage schedule highlighting Preferred Parking signage. Indicate number of classrooms (as defined for this criterion) and total number of students.

Low-emitting vehicles are defined as compliant with the US EPA Low Emitting Vehicle Standard. Fuel-efficient vehicles are defined as vehicles that have achieved a minimum green score of 50 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide

For major renovation, provide an existing site plan showing existing parking conditions (indicate total number of parking spaces). Site plan of new parking layout (indicate total number of parking spaces). Highlight preferred parking spaces and provide a signage schedule or other graphic highlighting Preferred Parking signage.

If event parking is provided, it must be permeable (gravel, permeable paving or concrete grid with drainage).

SS 3.1.3

Calculate building and paving areas to determine open space remaining within the site boundary. Calculate building footprint as listed above. Only vegetated areas will be considered open space.

Where State or Local Zoning Ordinance specifies Open Space requirements, open space must measure a minimum of 25% greater than Required Open Space.

Where no State or Local Zoning Ordinances apply to open space, vegetated open space must measure a minimum of 50% of total site area.

Where project complies with SS 6.1: Central Location and no State or Local Zoning Ordinances apply to open space, open space must measure a minimum of 25% of total site area.

When reducing the floor area ratio (FAR), a careful balance must be achieved between the energy benefits and costs of the building envelope, the footprint of the building, and daylighting best practices. Tuck-under parking and sharing of off-site parking facilities can minimize site disturbance.

Documentation Requirements

Design Review Requirements

SS 3.1.1 – Complete the CHPS Verified Plan Sheet to include both the building's gross square footage and the building footprint square footage.

SS 3.1.2 – Construction drawings that indicate the number of parking spaces. Preferred parking spaces must be clearly indicated. Provide references to specifications for preferred parking signage. Complete the CHPS Verified Plan Sheet to indicate compliance.

SS 3.1.3 – Construction drawings, ideally the title page that provides the overview of the project, must include the square footage of open space.

- US EPA Low Emitting Vehicle Standard: http://www.epa.gov/otaq/lev-nlev.htm
- Fuel-efficient Vehicles: https://www.aceee.org/press/2020/01/2020-hybrids-surge-greenest-car-list. Also www.greenercars.org/. Note that vehicles must be rated 50 and above to qualify for this criterion.

Construction Site Runoff Control / Sedimentation

Intent *Reduce erosion and negative impacts on water and air quality during construction.*
SS 4.1 – Construction Site Runoff Control / Sedimentation

Erosion results when wind and precipitation carry away soil that has not been protected during site clearing and earth moving operations. This leads to degradation of property and sedimentation of local waterways. Mitigation measures to protect soil during construction reduce negative impacts to water and air quality.

The Federal Clean Water Act mandates that the discharge of pollutants to the waters of the United States from any point source is unlawful unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES stormwater permitting program is administered by most states, otherwise the NPDES is administered through the US EPA. It is the responsibility of all municipal jurisdictions including schools to apply for a permit in order to verify compliance with established state program or EPA requirements.

<table>
<tr><th colspan="2" rowspan="2">SS 4.1 – Construction Site Runoff Control / Sedimentation</th><th colspan="2">Credit</th></tr>
<tr><th colspan="2">1 point</th></tr>
<tr><td>Applicability</td><td colspan="3">Verification Required</td></tr>
<tr><td>All projects that disturb the site.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

1 point	SS 4.1	Control erosion and the transport of soil and other pollutants off the site during construction. Design and implement a site-specific plan that incorporates the use of best management practices in compliance with the US EPA's National Pollutant Discharge Elimination System (NPDES). The plan should incorporate Part 2 of the NPDES Construction General Permit: General Permit for Stormwater Discharges from Construction Activities (see link in resources below). The plan shall meet the following objectives: • Prevent soil loss by wind and water erosion, including protecting topsoil by stockpiling for reuse. • Prevent transport of sediment and particulate matter to storm sewers or receiving waters and/or to air. • Eliminate or reduce off-site discharge of construction waste. • Establish maintenance commitments on post-construction pollution control measures.

Implementation

The owner must submit and implement a site-specific Stormwater Pollution Prevention Plan (SWPPP) that includes specific controls for preventing water and air-borne soils from being carried off-site. Controls must stay in place and be maintained throughout the period of construction. Provide specification language requiring filing of a SWPPP to the agency having jurisdiction.

The property owner must submit a Notice of Intent (NOI), and develop and implement a site-specific Stormwater Pollution Prevention Plan (SWPPP) to comply.

The property owner shall verify with local agencies whether or not any additional requirements apply to the project site.

Documentation Requirements

Design Review Requirements

Construction drawings must include the site runoff control measures and Property Owner Notice of Intent.

Construction Review Requirements

Provide the SWPPP and pictures identifying measures taken throughout construction.

Resources

- US EPA NPDES Construction General Permit: www.epa.gov/npdes/pubs/cgp2012_finalpermit.pdf

- To verify if your state administers the NPDES program: https://www.epa.gov/npdes
- Stormwater Pollution Prevention Plan: https://www.epa.gov/npdes/npdes-stormwater-program
- US EPA's NPDES electronic reporting: https://www.epa.gov/npdes/electronic-reporting-epas-npdes-general-permits
- Best Management Practices (BMPs): www.bmpdatabase.org/

Post Construction Stormwater Management

Intent

Manage stormwater after construction to control erosion and runoff, recharge local aquifers, and maintain the quality of receiving waters. Encourage the use of Low Impact Development and other innovative techniques.

SS 5.1 – Post Construction Stormwater Management

Reducing runoff is the most effective way to minimize its negative impacts to water quality. Many strategies exist to limit stormwater runoff, including Nonstructural Best Management Practices, such as using green or vegetated roofs, or preserving natural areas by concentrating or clustering development on a portion of the site, and leaving remaining land in its natural condition by limiting clearing and grading, maximizing trees and other vegetation, promoting natural vegetation, and preserving riparian areas and wetland.

There are also Structural Best Management Practices. They include maximizing site stormwater infiltration by retaining pervious and vegetated areas and reducing impervious surfaces and capturing rainwater from impervious areas of the building for groundwater recharge or landscaping. Projects should minimize stormwater pollutants designated by federal, state, or local jurisdictions, by designing the project to minimize direct connection between impervious areas with stormwater drainage through BMP's such as silt fences, earth dikes, drainage swales, and sediment traps. Finally, slopes and channels can be protected by conveying runoff safely from the tops of slopes and stabilizing disturbed slopes, utilizing natural drainage systems to the maximum extent practical, stabilizing permanent channel crossings, vegetating slopes with native or drought tolerant vegetation as appropriate, and installing energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, etc.

SS 5.1 – Post Construction Stormwater Management		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	SS 5.1.1	For sites with an existing imperviousness of less than or equal to 50%, limit the post-development peak stormwater runoff discharge rate so that it does not exceed the estimated pre-development rate. For sites with an existing imperviousness of more than 50%, implement a stormwater management plan that results in a 25% reduction in the rate and quantity of stormwater runoff. **AND**
	SS 5.1.2	For all sites, design trash storage areas to provide appropriate drainage from adjoining roofs and pavement to divert stormwater runoff around the trash storage areas. The trash container areas must be screened or walled to prevent off-site transport of trash. **AND**
	SS 5.1.3	Provide post-construction treatment control Best Management Practices (BMP). Incorporate, at a minimum, either a volumetric or flow based treatment control design standard, or in combination, as identified below to mitigate (infiltrate, filter or treat) stormwater runoff: Volumetric Treatment Control BMP The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998); or The volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for “treatment” that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event. **OR** Flow Based Treatment Control BMP The flow of runoff produced from a rain event: • equal to at least two times the 85th percentile hourly rainfall intensity for the area; or • that will result in treatment of the same portion of runoff as treated using volumetric standards above; or • the intensity-duration-frequency method, with a hydrograph corresponding to a 50-year storm; or • 0.2 inches per hour.

Implementation

Applicability for Quality:

- If the new project results in an alteration of more than 50% of the impervious surface of a previously existing development, and the existing development was not subject to stormwater treatment measures, then the entire project must be included in the treatment measure design.

- If the new project results in an alteration of less than 50% of the impervious surface of a previously existing development, and the existing development was not subject to stormwater treatment measures, then only the new and replaced impervious surface must be included in the treatment system design. In order to earn a point under this criterion, the area of site altered must be greater than 25% of the site area.
- For new school on Greenfield site the entire project must be included in the treatment measure design.

This criterion applies to new construction projects on previously developed land and renovation projects. The criterion does not apply to newly constructed schools on Greenfield sites (open land).

For the purpose of verifying compliance, the peak stormwater discharge rate is assumed to be directly proportional to the imperviousness of the site. For example, a 25% reduction in imperviousness is assumed to equate to a 25% reduction in the peak stormwater runoff discharge rate.

Provide fully enclosed trash areas or garbage containers with self-closing lids. Fully enclosing trash areas prevents feral animal intrusion and contamination of stormwater.

The impervious site area is the sum of the area of each surface multiplied by its runoff coefficient, and the imperviousness of the site is the impervious site area divided by the total site area. Use the runoff coefficients for typical surfaces in the (statewide Stormwater Management Handbook or as recommended by US EPA stormwater resources). Other surfaces or systems not listed may be considered if proper documentation is shown for runoff coefficients. Use manufacturers information or a "best estimate" for surfaces not included in the table. Calculate the imperviousness of the site both before and after development using the following equations. Note that many sites have vegetated surfaces but are underlain with high clay content soils that do not perc. For these sites, Runoff coefficients for the existing site should be adjusted to reflect higher runoff rates and care should be taken to develop methods for reducing the rate of runoff and increasing infiltration, if possible.

$$\text{ImperviousSiteArea} = \sum \text{SurfaceArea} \times \text{RunoffCoefficient}$$

$$\text{Imperviousness} = \frac{\text{ImperviousSiteArea}}{\text{TotalSiteArea}}$$

This calculation should be completed for the proposed development and pre-development conditions. For sites with an existing imperviousness less than 50%, the post-development imperviousness must be equal to, or less than, the pre-development conditions. In cases where the existing imperviousness is greater than 50% the post-development imperviousness must be 25% less than the existing conditions.

Example Calculations

Question: What is the imperviousness of an approximately ½ acre site (20,787 ft²) before and after development? The site is being converted from a *gravel* parking lot (11,420 ft²) to a new school.

Answer: ***The site has an existing imperviousness of 49% as calculated in Table 15.***

After the site is developed, it is estimated to have an imperviousness of 43% as calculated in Table 16.

The post-development site has imperviousness less than the pre-development site, therefore, the peak stormwater runoff may be assumed to be lower and the criterion may be earned.

Table 15: Calculation of Existing Imperviousness

Surface Type	Runoff Coefficient	Area (ft²)	Impervious Area (ft²)
Pavement, Gravel	0.75	11,420	8,565
Vegetation, Flat	0.10	2,332	233
Vegetation, Average	0.20	7,035	1,407
Total		20,787	10,205
Imperviousness		49%	

Table 16: Calculation of Post-Development Imperviousness

Surface Type	Runoff Coefficient	Area (ft²)	Impervious Area (ft²)
Pavement, Pervious	0.60	4,128	2,477
Pavement, Brick	0.85	1,072	911
Roof, Conventional	0.95	4,020	3,819
Roof, Rain Water Collection	0.0	3,400	0
Turf, Flat	0.25	3,542	886
Vegetation, Average	0.20	4,625	925
Total		20,787	9,018
Imperviousness		43%	

Question: What is the imperviousness of an approximately ½ acre site (20,787 ft²) before and after development? The site is being converted from a *paved* parking lot (11,420 ft²) to a new school.

Answer: The site has an existing imperviousness of 60% as calculated in Table 15.

After the site is developed, it is estimated to have an imperviousness of 43% as calculated in Table 18.

60% x 25% = 15%.

60% - (60% x 25%) = 45% > 43%

The site's imperviousness is at least 25% less than it was before development.

Table 17: Calculation of Existing Imperviousness

Surface Type	Runoff Coefficient	Area (ft²)	Impervious Area (ft²)
Pavement, Gravel	0.95	11,420	10.849
Vegetation, Flat	0.10	2,332	233
Vegetation, Average	0.20	7,035	1,407
Total		20,787	12,489
Imperviousness		60%	

Table 18: Calculation of Post-Development Imperviousness

Surface Type	Runoff Coefficient	Area (ft²)	Impervious Area (ft²)
Pavement, Pervious	0.60	4,128	2,477
Pavement, Brick	0.85	1,072	911
Roof, Conventional	0.95	4,020	3,819
Roof, Rain Water Collection	0.0	3,400	0
Turf, Flat	0.25	3,542	886
Vegetation, Average	0.20	4,625	925
Total		20,787	9,018
Imperviousness		43%	

Design the project to maintain natural stormwater flows by promoting infiltration, using alternative surfaces (e.g., green roofs or permeable paving materials) and sustainable design strategies. Show BMP's on site plans, civil drawings and specifications. Include calculations to verify required levels are met. Schools should consider using organic, natural turf fertilizers during operation to improve water quality.

Documentation Requirements

SS 5.1.1 – Complete the CHPS Plan Sheet to calculate stormwater management provided to CHPS Verified projects at the point of registration. Surfaces identified will be crosschecked with plans.

SS 5.1.2 – Construction drawings must identify trash storage areas, how water is diverted from this area, and measures taken to ensure the trash is not transported off-site (walls, screens).

SS 5.1.3 – Construction drawings must include the total volume of runoff and the total volume of runoff treated. In addition, drawings must call out where Best Management Practices (BMP's) are located and details where appropriate.

Construction Review Requirements

SS 5.1.2 – Provide picture(s) of the primary trash storage areas showing appropriate draining from adjoining roofs, pavement diverting stormwater runoff and screen or wall preventing transport of trash.

SS 5.1.3 – Provide pictures of at least one implemented BMP.

Resources

- US EPA Best Management Practice Design Guide, EPA Document No. EPA-600/R-04/121A: https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=99759
- US EPA NPDES Construction General Permit: https://www.epa.gov/npdes/2017-construction-general-permit-cgp

Central Location

Intent

To make the school more accessible to its occupants and to promote smart growth through centrally locating new schools close to dense, mixed-use areas to encourage alternatives to automobile use.

SS 6.1 – Central Location

Over the lifetime of the building, schools and parents invest significant amounts of time, energy, and money transporting students to and from school. Cars driven by parents, guardians, or the students themselves are one of the largest resource users and sources of pollution. Centrally located sites allow more students to walk or bike to school, while reducing the distance cars must travel.

Furthermore, locating new schools in areas of density and/or mixed use allows more students to walk or bike to school, while reducing the distance cars must travel. Schools located near public and private services such as libraries and community centers not only allow students to access these services after school, they put parents en route to these services if they pick their children up after school (though use of public transportation is strongly encouraged). Planning around centers of public and private activity is embodied in the concept of Smart Growth, which promotes dense development in order to preserve public parks and natural features such as open space and wildlife habitat.

Recent Federal transportation initiatives have required local jurisdictions to amend their Comprehensive Plans to accommodate pedestrian-friendly access to roads and community schools.

SS 6.1 – Central Location		**Credit**	
		2 points	
Applicability	**Verification**		
All projects	Design Review	Construction Review	Performance Review

Requirement

2 points	SS 6.1.1	Create centrally located sites in which 50% of students are located within the following distances; Elementary schools: one mile, Middle schools: two miles, and High schools: two miles. **OR**
	SS 6.1.2	Site the school within a maximum of ½ mile of at least eight (8) of basic resident services such as: 1) Supermarket; 2) Commercial Office Building; 3) Convenience Grocery with fresh food; 4) Day Care; 5) Fitness center; 6) Hardware; 7) Laundry 8) Library; 9) Medical/Dental Services; 10) Senior Care Facility 11) Public Park; 12) Pharmacy; 13) Post Office; 14) Bank; 15) Community Center (e.g., recreation center, after-school program building, or art center); 16) Place of Worship; 17) Cleaners; 18) Fire Station; 19) Beauty Salon; 20) Restaurant; 21) Theater **OR**
		If the project is in a rural school district as defined by the National Rural and Small Schools Consortium (the district inhabitants number is fewer than 150 per square mile, or if the district is located in a county where 60% or more of the population lives in communities of 5,000 or fewer), locate the school so that it relates to the historic central main street business district of the town/city by meeting at least one of the following criteria: • Locate the school within a quarter (1/4) mile of the historic central main street business district. Provide a direct pedestrian connection between the school and the business district that includes walking paths and bicycle paths; or • Locate the school on the grounds of a historic school grounds, that is, or has been the site of school buildings constructed before 1940; **OR**
	SS 6.1.3	If there are long-term energy use or transportation circumstances that lead it to be more efficient to site the school in a centralized location to serve multiple districts, or between schools, submit your own proposal showing why it is more transportation and/or energy efficient.

Implementation

This criterion applies to new schools, a new building on an existing campus, additions and to major renovations. A major renovation project and a new building on an existing campus may claim this criterion if the existing campus already satisfies the requirement, or if the site is expanded and satisfies the requirement.

For all cases, base calculations must include the total school population, not just the population of the new building, addition or the building(s) being renovated/modernized.

SS 6.1.1

To earn this criterion, calculations must be based on the estimated school population when the school opens or when a new building on an existing campus opens. Develop a site map that identifies the school site and the location of the student population that the school supports. Draw a circle centered on the school using the mile requirement by school level listed in SS.6.1 as the radius.

Schools located near busy arterials or highways are encouraged to develop Walking School Bus programs – see also SS 9.1 Human Powered Transportation.

Verify that at least 50% of the school's students are within the circle.

SS 6.1.2

Provide a map showing the ½ mile perimeter around the school and indicating the names and location of eight of the basic services listed in the criterion text box. The ½ mile radius may be drawn from EITHER the front entrance of the school, where the school driveway meets the public way, or from the front door of the school. The front door of the basic service identified on the map must fall within the ½ mile radius. Online tools such as MapQuest® or Google Maps™ may also be submitted as documentation of the ½ mile radius.

SS 6.1.3

Submit a proposal showing why a particular school siting is more transportation and/or energy efficient than other locations.

Documentation Requirements

Design Review

Use the CHPS Verified Plan Sheet to provide School Level, Distance Requirements, Student Capacity, and Student/Site distance to calculate the Percentage of Students Near School Site.

Provide a narrative that describes the assumptions made above. OR provide a district letter explaining the school selection criteria, a supporting map, demographic information or other document as an attachment that justifies the number entered in this template.

For rural schools, provide a narrative, maps and/or other proof of compliance with one of the criteria options.

SS 6.1.2 – Provide a map showing the ½ mile perimeter around the school and indicating the names and location of eight of the basic services listed in the criterion text box. The ½ mile radius may be drawn from EITHER the front entrance of the school, where the school driveway meets the public way, or from the front door of the school. The front door of the basic service identified on the map must fall within the ½ mile radius. Online tools such as MapQuest® or Google Maps™ may also be submitted as documentation of the ½ mile radius.

SS 6.1.3 – Submit a proposal showing why a particular school siting is more transportation and/or energy efficient than other locations.

Resources

- US EPA’s Smart Growth site: www.epa.gov/smartgrowth
- US Census Bureau Population Information: https://data.census.gov/cedsci/
- Radius Around Point Map: www.freemaptools.com/radius-around-point.htm

Located Near Public Transportation

Intent *Encourage the use of public transportation*
SS 7.1 – Located Near Public Transportation

Transportation is the second largest energy using sector, accounting for approximately 28 percent of total energy use in the United States. Public transportation is a more efficient method of transportation than the private automobile. Some school districts offer reduced or subsidized fares for students and staff who use public transportation. If sufficient capacity exists, schools can use public transportation to replace district provided bus service. Schools located near high traffic areas must ensure safe student access. In addition, all transportation-related pollution must be considered when investigating site air quality and the potential for natural ventilation.

SS 7.1 – Located Near Public Transportation		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	SS 7.1	Locate building within 1/4 mile of a commuter rail, light rail or subway station, or within 1/8 mile of one bus line.

Implementation

The energy use and pollution associated with transportation often dwarfs the total lifetime energy used by the school itself. Locating the site close to public transportation, encouraging use of public transportation and carpooling by minimizing parking, and creating bike facilities and safe walking/biking access all reduce the automobile-related pollution (additional criteria SS 9.1). 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.

Provide an area map locating transportation lines within the distance to school as noted. Measure from the main entrance of the school building (i.e. front door), and mark bus stops or stations for commuter rail, light rail, or subway lines.

Documentation Requirements

Design Review Requirements

Provide a map showing the required features and distance to the school.

Resources

- Center for Neighborhood Technologies: What is Locational Efficiency? http://www.cnt.org/tcd/projects/location-efficiency/

Joint-Use of Facilities

Intent
Allow for more community and neighborhood integration within the school facility and grounds.
SS 8.1 – Joint-Use of Facilities

Community common-pool resources such as school facilities and grounds, park and recreation space (for example, habitat areas, playgrounds and athletic fields), parking lots, gardens and libraries are shared with the community. Joint-use of school facilities is a growing trend. Increasingly, schools are making their facilities available to community groups during and/or outside schools hours, providing mutual benefits to both the school and the community.

The benefits of sharing community common-pool resources have been well documented (Elinor Ostrom, et al), and include social benefits such as communication, trust, cooperation, security, ecological benefits and cost sharing (resource costs such as energy and water use, capital and operating costs).

In planning for shared community common-pool resources, care must be taken to provide for programmatic and operational needs. For example, a school campus shared with joint-use programs must be able to maintain separate access and security between the main campus student areas and the after-hours community joint-access areas. Another example would be a parking lot that could well serve multiple community needs on a 24/7 basis. Similarly, a school garden could be made accessible to qualified community members.

Joint-use facilities may be owned and/or maintained by other organizations or agencies, but be available for school use. If so, the contractual agreement(s) must clearly provide for the long-term benefit to the school community.

SS 8.1 – Joint-Use of Facilities		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point		Implement any two of the following measures:
	SS 8.1.1	Provide for controlled access and amenities: With community involvement, design one or more spaces (2,500 ft^2 minimum for interior spaces) for use by community or other appropriate organizations. The plans shall designate this area as the "Joint-Use Area" and must contain toilet facilities that can be accessed without compromising the security of the non-Joint-Use portions of the facility Provide direct access to "Joint-Use Area" owned and/or operated by a non-school entity. The "Joint-Use Area" must be accessed and secured independently of the non-joint-use portions of the facility (1 point). Provide an entrance for spaces identified for Joint-Use so that non-school hours' access can be segregated the non-public parts of the school facilities and grounds. The "Joint-Use Area" must be accessed and secured independently from the non-Joint-Use portions of the site (1 point).
	SS 8.1.2	Share at least 75% of school grounds based on total square feet of availability with the community.
	SS 8.1.3	Share at least 50% of parking space required, based on total availability, with the community, and make those spaces available outside school hours.
	SS 8.1.4	Share at least 75% of garden space based on total availability, with the community, and make that space available to community members.
	SS 8.1.5	Share at least 75% of library space based on total availability, with the community as a community library.

Implementation

A new building on an existing campus can claim this criterion only if the building is designated as a "Joint-Use Area", and the above requirements are satisfied for the whole campus. A renovation project can claim this criterion if new measures are taken or if the existing campus already satisfies the requirements. Schools with special needs facilities may request a variance based on circumstances.

SS 8.1.1

The most successful schools have a high level of parent and community involvement, but there is a need to control access for security reasons. Therefore, this involvement can be enhanced if a school is designed so that neighborhood meetings, recreation activities, and other community functions can take place at the school in a safe and secure fashion.

Building or renovating a school provides an opportunity for the community to incorporate community programs and services into the building program. During the planning stages, school districts should give careful thought to the types of programs, services, and facilities they may wish to offer via the future school building (e.g., library services, recreation services, meeting space, space for special events, etc.).

Other strategies that contribute to shared use of the school building include designing separate entrances for spaces likely to be shared, adjusting building orientation and layout to separate classroom and administration areas from shared spaces, planning for shared kitchen and toilet facilities, and designing special features into the school that the community can use.

Alternately, the school can incorporate spaces owned and operated by other entities, but available for direct access from the school during school hours. These spaces must incorporate separate security and may include separate toilet facilities if school-site facilities are not directly available. Letter signed by project architect and school superintendent indicating features of the school that enhance its shared use with the community.

To earn this criterion the physical design must incorporate measures to facilitate joint-use while providing security for the school. Provide doors or security gates to close off portions of the school that are used during non-school events.

If a joint-use facility is owned by another entity, provide a copy of the formal agreement between the school district and outside entity on joint use of facilities, including any operations / maintenance provisions and provide copies of applicable insurance policies for use of the facilities by the school if the spaces are owned and maintained by others. Joint-Use facilities owned by other entities will be considered for this criterion only if use by the school occurs on a regular (at least weekly) basis. Provide a description of contractually approved use pattern by the school.

SS 8.1.2

Joint Use of school facilities and grounds is a growing trend across the country. This criterion is intended to encourage schools to share their outdoor space with the community at large or vice versa – to encourage municipalities to allow schools to use local parks, in lieu of having the school construct separate facilities. Either arrangement allows the community to optimize resources dedicated to community common pool needs.

Provide a copy of the formal Joint-Use agreement between the school district and other entity and provide copies of applicable insurance policies for use of the space. Include maintenance and operations provisions in any agreement.

Urban schools with a lack of adequate outdoor space may consider use of off-site Public Park and recreation space to comply if such space is within safe, walkable 1/8 mile route.

SS 8.1.3

Joint Use of parking facilities provides both social and ecological benefits. Socially, it provides a node for safe interaction. Ecologically it limits disruption of the landscape, reduces heat island effects and reduces stormwater runoff by minimizing construction of impervious paving.

Provide a copy of the formal Joint-Use agreement between the school district and other entity and provide copies of applicable insurance policies for use of the space. Include maintenance and operations provisions in any agreement.

Joint-Use parking facilities will only be considered if 50% of a school's parking lot capacity is used by an outside organization on a regular basis, or 50% of the school's parking requirement is satisfied by use of another organization's parking lot. Provide a calculation and a schedule of use substantiating this requirement.

SS 8.1.4

Share at least 75% of garden space based on total availability, with the community, and make that space available on a 24/7 basis to qualified community members.

Joint Use of garden space provides both social and ecological benefits. Socially, it provides a place for community social interaction, communication, and building relationships of mutual trust and cooperation. Furthermore, it provides for local food security. Ecologically it mitigates climate change by protecting soil fertility, biodiversity, water management, and so forth.

Provide a copy of the formal Joint-Use agreement between the school district and other entity and provide copies of applicable insurance policies for use of the space. Include maintenance and operations provisions in any agreement.

Joint-use garden space will only be considered if 75% of a school's garden space is shared based on total availability, with the community, and make that space available to community members. Provide a calculation and a schedule of use substantiating this requirement.

SS 8.1.5

Share at least 75% of library space based on total availability, with the community, and make that space available during normal library operating hours as a community library.

Joint Use of library space provides both social and ecological benefits. Socially, it provides a place for community social interaction, communication, and building relationships of mutual trust and cooperation. Furthermore, it provides for a node for local information resource sharing. Ecologically it mitigates climate change by reducing redundant facilities.

Provide a copy of the formal Joint-use agreement between the school district and other entity and provide copies of applicable insurance policies for use of the space. Include maintenance and operations provisions in any agreement.

Documentation Requirements

Design Review Requirements

SS 8.1.1: Construction drawings must include a site plan that identifies the "Joint-Use Area" and the bathroom facilities that can be accessed without compromising the security of the non-joint-use portions of the facility.

SS 8.1.2 – 8.1.5: Construction drawings must include a site plan that identifies the area of space available for joint-use. A calculation must be provided on the sheet that includes the total amount of space available, and the percentage of that space available for joint-use.

Provide a copy of the agreement between organization(s) and school district, school principal, or school board to provide joint-use. The agreement should be signed by both parties and state the facilities /parks to be used and for what purpose. OR provide copies of applicable insurance policies governing use of the parks or recreational space by the municipality or by the school if the spaces are municipally owned.

Resources

- US EPA SMART Growth, benefits of Smart Growth provisions: https://www.epa.gov/smartgrowth/about-smart-growth#benefits
- New Schools Better Neighborhoods offers information on the benefits of joint-use facilities, examples of join-use projects, joint-use analysis, recommendations, and policies at: http://www.nsbn.org/case/jointuse/developfacilities.php.html

Human Powered Transportation

Intent *Encourage alternative transportation methods to and from school that increase physical activity, improve healthy, and reduce dependence on fossil fuels.*
SS 9.1 – Human Powered Transportation

Walking, biking, and using scooters and skateboards, are a popular and pollution-free form of transportation. When encouraging the use of bicycles it is important to encourage the safety of pedestrians and bicyclists through providing bike lanes and sidewalks.

<table>
<tr><td colspan="2" rowspan="2">SS 9.1 – Human Powered Transportation</td><td colspan="2">Credit</td></tr>
<tr><td colspan="2">2 points</td></tr>
<tr><td>Applicability</td><td colspan="3">Verification</td></tr>
<tr><td>All projects.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

1 point	SS 9.1.1	Provide sidewalks or walkways and bike lanes that extend at least from the school entrance to the end of the school property; and **AND** Provide suitable means for securing bicycles, and scooters outside the school, skates and skateboards and helmets indoors (including lockers and/or cabinets). The storage must be safe, convenient, and at accessible locations at the following ratio: • Grades 4-12: 1.5 spaces for every 10 students planned capacity (2 spaces minimum) Other novel forms of human-powered transportation, such as skiing, also qualify for this credit in areas where such transportation is viable.
1 point	SS 9.1.2	In addition to requirements of SS 9.1.1, collaborate with local organizations and the municipality to provide safe bike lanes that extend appropriately from the school site at least one mile into neighboring communities or access ways.
OR 1 point	SS 9.1.3	Walking School Bus/ Safe Routes to School: for elementary schools that also comply with SS.6 Central Location, provide an active Safe Routs to School Program involving parents, students, school and city traffic officers and transportation planners. Program can include walking school buses, bike trains, bike and walk skills training, bike helmet promotion and other active transportation encouragement events.

Implementation

For a new building, addition or major renovation project to earn these points, the calculations must be based on the number of occupants for the entire campus, not the individual building or building(s) being modernized. A major renovation project, a new building on an existing campus, and an addition can also claim these points if the existing campus already satisfies the requirement.

Calculations must be based on the number of occupants for the entire campus.

SS 9.1.1

The purpose of this criterion is to provide safe access to the school by students and staff who choose to walk or ride their bicycles to school.

To earn these points, bike storage areas must be:

- In a prominent location that is easily viewable from a main administrative location or within 100’ of main entrance and accessible from the bicycle lane or route.
- Have sufficient electric lighting.

- Half of bike rack area must be protected from precipitation for schools in areas with more than 20 inches of annual precipitation. Projects are encouraged to employ photovoltaic panels as roof structure.

- Racks must be fixed in place and must provide for locking of wheel and frame. Additionally, projects are encouraged to provide supplemental bike racks for visitors near the main entrance.

To earn these points, safe bicycle lanes must extend from the school entrance to the ends of the school property to protect and encourage cyclists. There should be no barriers (e.g., fences) on school property line at cycling routes/access points, unless gates that can be locked open during appropriate hours are provided. Work with the local authorities to extend the bike lanes beyond the project limits and across busy roads. Illustrate how site bike lanes relate to neighborhood use patterns. Bike lanes should be designed to accommodate significant traffic (lane width established by the local jurisdiction) and be separated from pedestrian sidewalks and parking.

As a supplement to encouraging bicycle use, projects are encouraged to provide skateboard lockers, racks, or other means of separately and safely storing skateboards, scooters, roller skates, and helmets. Where individual lockers or lockable racks are provided reduce the required number of bike racks by the count of lockers or skateboard racks provided.

Projects may also provide storage for other novel forms of human-powered transportation, such as skiing, in areas where such transportation is viable. Where individual lockers or lockable racks are provided for these other novel forms of transportation, the project may reduce the required number of bike racks by:

- 50% of the count of lockers or racks provided if these alternative forms of transportation are not readily available for at least four months of the year, or

- 100% of the count of lockers or racks provided if these alternative forms of transportation are available for at least four months of the year.

For example, if racks for ski equipment are provided, the amount of bike storage that can be reduced depends on how often skiing is a viable option.

SS 9.1.2

In addition to the requirements of SS 9.1.1 provide a map showing the relationship of the school to existing or new bike lanes that extend at least one mile from the school site into neighboring communities.

SS 9.1.3

Provide a description of a Walking School Bus / Safe Routes to School program including a map indicating route(s) and a statement of participant levels and school population. Provide a map indicating routes and showing the relationship of the school to existing or new sidewalks that extend at least one mile from the school site into neighboring communities. Include organizational description listing how program will be implemented and maintained. Provide a written confirmation from the school district that they will institute at least a yearlong program.

Documentation Requirements

SS 9.1.1 – Construction drawings must identify the location and required storage. Complete the CHPS Verified Construction Drawing with required calculations.

SS9.1.2 – Construction drawings must indicate bike lanes that meet the requirements.

Construction drawings must include the required features.

Construction Review Requirements

SS 9.1.1 – Provide picture(s) of the features.

SS 9.1.3 – Provide the Safe Routes to School Plan (SRTS). Include pictures of strategies implemented to provide safe bike lanes or a network that extends appropriately from the school site at least one mile into neighboring communities or access ways.

Resources

-
- Safe Routes to Schools: www.saferoutesinfo.org/guide/index.cfm
- Walking School Bus: www.walkingschoolbus.org/

Reduce Heat Islands – Landscaping / Sites

Intent *Reduce heat islands to minimize impact on microclimate and human and wildlife habitat.*
SS 10.1 – Reduce Heat Islands – Landscaping / Sites

Heat islands raise temperatures and can impact school communities by increasing peak energy demand, air pollution levels, air conditioning costs, and heat-related illness. Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials.

SS 10.1 – Reduce Heat Islands – Landscaping / Sites		**Credit**	
		1 point	
Applicability	**Verification**		
All new schools. For a new building on an existing campus, additions, and major renovations, the requirement applies to the entire school site, not just the area around the new building or the buildings being modernized. A major renovation project, a new building on an existing campus, and an addition can also claim this point if the existing campus already satisfies the requirement.	Design Review	Construction Review	Performance Review

Requirement

1 point	SS 10.1	Provide shade (within five years) on at least 50% of non-roof, impervious surfaces on the site, including parking lots, walkways, plazas, etc. **OR** Use light-colored/ high-albedo materials (a Solar Reflectance Index* (SRI) of at least 0. 29) for 50% of the site's non-roof, impervious surfaces **OR** Use a combination of shading and high-albedo materials for 50% of the site's non-roof surfaces. *SRI or Solar Reflectance Index is calculated according to ASTM E 1980. Reflectance is calculated according to ASTM E 903, ASTM E 1918 or ASTM C 1549. Emittance is calculated according to ASTME E 408 or ASTM C 1372.

Implementation

Note that the "heat island effect" is largely an urban phenomenon. Dark surfaces, such as pavement, cladding, and roofing absorb heat and radiate it back to surrounding areas. In a city, where there are many dark, heat absorbing surfaces, infrared radiation can easily boost temperatures by 10˚F or more. The heat island effect increases the need for air conditioning (and therefore electricity consumption) and is detrimental to site plantings, local wildlife, and maintaining comfortable temperatures.

Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials. Note Solar Reflectance Index (SRI) 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. Explore elimination of blacktop and the use of new coatings and integral colorants for asphalt to achieve light colored surfaces.

Where artificial turf is provided, provide turf with light aggregate to reduce heat island effect caused by black aggregate. Artificial turf will be considered impervious for the purposes of this criterion.

A site plan or landscaping plan should show trees that contribute to shade and/or highlight light-colored, non-roof impervious surfaces.

Calculations for shading and/or high-albedo materials:

- Shading
- Identify all non-roof impervious surfaces on the project site and sum the total area.
- Identify all trees that contribute shade to non-roof impervious surfaces. Highlight these trees on the plan you submit.

- Calculate the shade coverage provided by these trees after five years of growth on the non-roof impervious surfaces on June 21 at solar noon to determine the maximum shading effect.
- Determine the total area of shade provided for non-roof impervious surfaces. To calculate the percentage of compliant hardscape surfaces, divide the non-roof impervious surface area that is shaded by the total hardscaped area.

For use of light-colored/ high-albedo materials:

- Identify all non-roof impervious surfaces on the project site and sum the total area.
- Calculate the total area of non-roof impervious surfaces designed with light-colored/high-albedo materials. Divide by total—result must be 20%.
- If light-colored/ high-albedo materials are used to achieve this criterion, provide specifications showing an SRI of 29 or better.

Note: Projects may achieve 20% coverage by adding together areas of shading and areas of light-colored/high-albedo materials to total 20%.

Documentation Requirements

Design Review Requirements

Construction drawings, including the landscaping plans, must provide the results described under the implementation section.

Resources

- Concrete and Sustainable development: http://www.columbia.edu/cu/civileng/meyer/publications/publications/2002_04_ShahPaper.pdf
- US EPA Heat Island resources and strategies: www.epa.gov/heatislands/

Reduce Heat Islands – Cool Roofs

Intent

Employ cool roofs, green roofs, or green walls to reduce the heat island effect.

SS 11.1 – Reduce Heat Islands – Cool Roofs

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. This criterion is most beneficial for schools with significant cooling loads.

SS 11.1 – Reduce Heat Islands – Cool Roofs		Credit 1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	SS 11.1.1	Cool Roofs. Use roofing materials that have a Solar Reflectance Index* (SRI) as listed below for roof type for a minimum of 75% of the roof surface.
OR 1 point	SS.C11.2	Install a green or vegetated roof equal to at least 25% of the roof surface. Develop a guide and maintenance plan for the green roof.
OR 1 point	SS 11.1.3	Green Wall/Trellis: Provide vegetated wall surface, shading from trees or other landscaping (within 5 years) or exterior shading device shading 30% or more of glazed surfaces that are not north facing, at 9:00am and 3:00pm at the equinox.

Roof Type	Slope	SRI
Low-Sloped Roof	<=2:12	78
Steep-Sloped Roof	>2:12	29

*Use the weathered SRI, also known as the 3-year aged SRI.

Implementation

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. Both the reflectivity and emissivity are important characteristics of cool roofs. A solar reflectance of 0.0 means that all the solar energy hitting the surface is absorbed and none is reflected. Emissivity is the ability of a material to shed infrared radiation.

Schools that do not have significant cooling loads (i.e. schools that do not have significant summer use) or are not located in urban areas, or are in areas dominated by winter heating (northern plains) may not wish to pursue this criterion. In these cases, a cool roof can actually result in more energy use in the heating season than it will offset in cooling loads during the summer. Energy modeling can help predict which facilities would be likely to experience an energy benefit by installing a cool roof. To find qualifying roof products, see the Cool Roof Rating Council website at www.coolroofs.org.

While some solar panel systems shade roofing surfaces and decrease heat transmission through the roof, they differ in their emissivity. Projects that wish to earn credit for roof areas covered with solar panels in lieu of cool roofing materials must show reflectance and emissivity properties to assess overall SRI of roof + solar panel assembly.

Vegetated roofs have been found to significantly reduce both the heating and cooling loads of buildings on which they are implemented. While they may significantly reduce the urban heat island effect by not using traditional building materials, they can also provide increased insulation and help reduce heating costs in the winter months, unlike cool roofs, which possibly increase a building's energy use during the winter. Green roofs greater than 3-inch soil thickness have also been found to considerably lengthen the lifespan of a roof and reduce stormwater runoff. In some cases implementing a vegetated roof has been found to more than double the lifespan of a roof.

Green walls, shading from trees or other landscaping or exterior shading device can shade glazed areas and prevent intrusion of sunlight in to spaces that experience cooling loads. Like cool roofs, care should be taken to assess cooling vs. heating loads in order to determine overall effect of planting on building energy use. Provide plans and sections to calculate the shading effect of green walls, landscape trees or vegetated trellises on glazing. Provide information about yearly duration of vegetation if deciduous and indicate expected growth within 5 years of planting.

Green roofs may be difficult to implement on existing structures due to limitations on the weight load of the existing roof. Retrofitting roofs with certain types of green roofs may not be possible because the substrate and vegetation placed on the roof will exceed permitted static loading. In addition to issues concerning weight load, waterproofing the existing roof structure can potentially be an obstacle because of the amount of water retained on the roof and the potential for roots to penetrate the waterproof membrane. For an informational database containing more information on the implementation and different kinds of green roofs that exist, see http://www.greenroofs.com/.

Documentation Requirements

Design Review Requirements

Construction drawings, including a roof plan or landscaping plan, must include the square footage of total roof surface and the total surface covered by cool roof, or the size of green wall. For cool roofs, the specifications must include the CRRC Product ID#, emissivity and reflectance. For vegetated wall, details should be provided on the construction.

Construction Review Requirements

Provide picture(s) of the installed cool roof or green wall.

Resources

- Cool Roof Rating Council (CRRC): www.coolroofs.org
- Greenroofs.com informational database for green roofs: www.greenroofs.com/
- Solar Reflectance Calculator (SRI): coolcolors.lbl.gov/assets/docs/SRI%20Calculator/SRI-calc10.xls
- US EPA ENERGY STAR® reflected roof products: www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products
- US EPA Heat Island resources and strategies: www.epa.gov/heatislands/
- Lawrence Berkeley National Laboratory (LBNL), Heat Island Group resources: https://heatisland.lbl.gov/

LBNL Winter heating penalty map: https://heatisland.lbl.gov/coolscience/cool-roofs

Avoid Light Pollution and Unnecessary Lighting

Intent   *Reduce or eliminate uses of artificial night lighting that are not needed or contribute to light pollution.*
SS 12.1 – Avoid Light Pollution and Unnecessary Lighting

Night lighting represents a significant source of energy use on campuses and can adversely affect the nighttime environment, while well-designed lighting can ensure safety, security, and beneficial use of properties. Avoidance of unnecessary lighting reduces resource use and minimizes the potential adverse environmental effects on the nighttime environment. Approaches may range from "dark campus" programs to careful controls on direction, intensity, duration, and spectrum of lighting.

SS 12.1 – Avoid Light Pollution and Unnecessary Lighting		**Credit**	
		2 points	
Applicability	**Verification**		
All new or existing schools. For a new building on an existing campus, additions, and major renovations, the calculations must be made for the entire school site, not just the area around the new building or the buildings being modernized.	Design Review	Construction Review	Performance Review

Requirement

1 point	SS 12.1.1	All ***outdoor*** non-emergency lighting will be automatically controlled to turn off after hours. Provide manual override capability for after-hours use with timed automatic shut-off (dark campus scenario).
1 point	SS 12.1.2	All outdoor lighting for general illumination and color rendition shall be fully shielded, except decorative lamps, which may be partially shielded if less 2000 fixture lumens or unshielded if less than 20 fixture lumens. Total outdoor light output per acre shall not exceed 50,000 lumens per acre, of which only 5,000 lumens may be partially shielded or unshielded in rural or park settings or 100,000 lumens per acre of which only 10,000 lumens may be partially shielded or unshielded in all other settings. Sports fields are considered separately. See below. Sports fields shall be considered Sports Class IV as defined by the illuminating Engineering Society of North America (IESNA) and lighting of them considered Class 1 (Color Rendition) lighting. Illumination of sports fields is exempt from the lumens per acre limits, but shall be designed to achieve no more than the minimum illumination levels defined for Sports Class IV by the IESNA and use only fully shielded fixtures that permit no light to be emitted above the horizontal and be extinguished within 30 minutes of the end of play. Except for areas requiring color rendition (e.g., sports fields), outdoor lighting for general illumination shall not have a color temperature exceeding 3200 K.

Implementation

Unnecessary light pollution will be moderated by the prerequisite EE 1.0 that requires controls to automatically turn off unnecessary interior and exterior lighting after hours.

SS 12.1.1 & 12.1.2 – Product Information & Plans

Provide site plan indicating all exterior lighting with different fixtures referenced. Provide exterior light fixture data indicating lumens, CRI, cutoff & color temperature, as appropriate. Provide calculation of lumens per acre.

Definitions:

Emergency Lighting

“Emergency Lighting” used here will be considered any lighting required for occupants safety in and around the building. Examples include:

1. Lighting providing the minimum required for the means of egress that must be maintained at all times any space served by the means of egress is occupied, and may not be controlled by motion sensors.

2. Lighting in areas designated as security or emergency areas. Parking lot lighting is not considered security lighting.

3. Emergency lights upon activation during loss of power.

4. Lighting in spaces where an automatic shutoff would endanger occupant safety or security.

Fully Shielded (Light Fixture)

A light fixture constructed in such a manner that all light emitted by the fixture, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the fixture, is projected below the horizontal. Any structural part of the light fixture providing this shielding must be permanently affixed, and part of the fixture, not part of any surrounding building or architectural elements.

Partially Shielded (Light Fixture)

A light fixture constructed and mounted such that most light emitted by the fixture, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the fixture, is projected below the horizontal. Light emitted at or above the horizontal direction (sideways or upwards) arises only from decorative elements or strongly colored or diffusing materials such as "honey" or colored glass or plastic. Fixtures using spot or flood lamps are considered partially shielded if the lamps are aimed no higher than 45 degrees above straight down (half-way between straight down and straight to the side).

Documentation Requirements

Design Review Requirements

Construction drawings must include:

- Interior Lighting: provide building section(s) diagramming the angle of the maximum candela value, or the lighting plans should show that all non-emergency lighting is on a programmable timer that turns lighting off during non-operable hours and that provides manual override capability for afterhours use.

- Provide a photometric site plan (that shows at least 10' beyond the property line) produced by a computer model that includes the average, maximum and minimum illuminances for each area (walkways, parking lots, building entries etc.) Horizontal illuminances at ground level on a minimum ten-foot by ten-foot grid with the property line clearly marked in bold on photometric plan and abutting residential properties, parks, or natural wildlife areas noted. The plan should indicate the location and mounting height of all site building mounted exterior fixtures clearly indicated by fixture type designations relating to the lighting fixture schedule.

- Exterior lighting fixture schedule with manufactures and model numbers, and manufacturers spec sheets, with a clear description of the specified lamps, wattage, IESNA cutoff classification and shielding accessories for each fixture.

Construction Review Requirements

Provide manufacturer receipts or proof of purchase for compliant light fixtures. Provide pictures as alternatives if appropriate.

Resources

- IDA approved lighting fixtures: https://www.darksky.org/our-work/lighting/lighting-for-industry/fsa/fsa-products/
- International Dark Sky Association, www.darksky.org/
- Illuminating Engineering Society (IES), www.iesna.org/
- Lighting Handbook, by IES, https://www.ies.org/lighting-library/

School Gardens

Intent
Promote learning about the environmental systems and healthy foods
SS 13.1 – School Gardens

School gardens can provide a diverse learning environment as well as a beautiful respite from the demands of the rest of the school day. Gardens promote learning about the environmental systems and healthy foods. Students who are not engaged by traditional learning methods often find the experience of working and learning in the garden a welcome path to understanding.

Gardens can be integrated into natural science, social sciences or humanities curriculum. Gardens should promote ecologically sustainable practices such as building soil health, alternatives to the use of chemical fertilizers, soil amendments, pesticides & herbicides. School Gardens can also be the site of school-wide composting programs.

SS 13.1 – School Gardens		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

½ point	SS 13.1.1	Provide a site on campus for one or more school gardens with a minimum of 200 sf for a student enrollment of 499 or less, and 500 sf for student enrollment greater than or equal to 500. The garden must promote learning about the environment, natural systems and/or healthy foods. It shall have a permanent source of water for irrigation that may include access to a tap and hose, an installed irrigation system, or access to a rain collection system. There must also be dedicated storage space for garden maintenance supplies and tools. Provide signage to designate the area as a school garden and to differentiate it from the surrounding grounds. Develop a long-term ecologically sustainable maintenance plan to ensure the garden is implemented and continues to thrive. For existing school sites (major renovations or new building on existing campus project) the soil must be tested to ensure there are no harmful contaminants. New school sites are covered under SS.1 site requirements.
½ point	SS 13.1.2	Provide a native plant hedgerow around the school garden. The plant materials must provide habitat for beneficial insects such as pollinators, which in turn will increase garden yield and support biodiversity. The hedgerow may also provide materials for traditional basketry, building materials, clothing or herbs.

Implementation

SS 13.1.1

To earn this point, the project shall designate an area(s) appropriate for gardening by the school community. Examples of acceptable uses of garden space include a vegetable garden, pollinator or butterfly habitat, or for animal husbandry, such as raising turtles, fowl (ducks, geese, chickens), rabbits, fish amphibians or other animals.

Indicate on the plans the location of the garden and its components. A school garden can come in many different forms. It can be fenced off, or physically separated from buildings, making it easily accessible to the school and to community members, or it can be integrated onto the school site in multiple areas or planters. Unique gardens, such as roof gardens, can also be considered for credit.

It is highly recommended that school community members, including staff and parents, be involved with the school garden and its development. When school is closed during summer months, for example, the garden will still need care, and community support is essential for this purpose.

The garden must have:

- A prominent entrance that is easily accessible and/or identified by signage.

- A long-term maintenance plan to ensure the garden is implemented and continues to thrive.

- Soil that has been tested (for existing school sites or redeveloped sites) to ensure there are no contaminants.

- Permanent irrigation or water source.

Submit plans and specifications for the garden that meet the above requirements.

Submit either a) the long-term maintenance plan or b) a letter of commitment from the school committee or the superintendent indicating that the plan will be developed and by whom.

Because the primary intent of this credit is to make the garden available as a teaching tool, schools are very strongly encouraged to incorporate it into their curriculum.

SS 13.1.2

Provide a native plant hedgerow surrounding the garden area. Hedgerows are closely planted rows of native bushes, shrubs, forbs and grasses. The hedgerow must contain at least five different species of plants native to the locale.

Documentation Requirements

Design Review Requirements

Construction drawings should identify the location and size of the garden as well as its storage space and hedgerow. Irrigation for the garden should be identified on a landscape irrigation design plan.

A letter from the landscape architect summarizing the planting schedule and confirming compliance.

Construction Review Requirements

Submit a picture(s) of the completed garden(s). Submit the long-term maintenance plan for the garden spaces. For existing schools, submit proof that the garden site soil has been tested and no harmful contaminants are present.

Resources

- Green Schoolyard Network: greenschoolyardnetwork.org/
- Hedgerows Enhance Beneficial Insects: https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=6241
- Native American Plant Hedgerow Resource Establishment: www.plant-materials.nrcs.usda.gov/pubs/capmctn7882.pdf

- Native plant hedgerow in Maryland: https://dnr.maryland.gov/wildlife/Pages/habitat/wahedgerows.aspx
- Square Foot Gardening: www.squarefootgardening.org
- The Edible Schoolyard: www.edibleschoolyard.org
- EarthWorks Boston is a non-profit that promotes environmental and health education for urban children in the Boston area through the planting and care of school orchards and gardens: http://www.earthworksboston.org

Use Locally Native Plants for Landscape

Intent

Increase use of locally native and ecologically appropriate plants to increase biodiversity and associated teaching opportunities and to reduce use of irrigation.

SS 14.1 – Use Locally Native Plants for Landscape

Native plants have multiple benefits. These include increased biodiversity, especially birds and insects, reduction in need for supplemental irrigation, and increased opportunities to teach about these topics, especially in the biological sciences. If appropriately designed, native plantings can reduce maintenance needs as well.

SS 14.1 – Use Locally Native Plants for Landscape		Credit	
		1 point	
Applicability	**Verification**		
All projects. Calculations must be made for the entire school site, not just the area around the new building or the buildings being modernized.	Design Review	Construction Review	Performance Review

Requirement

½ point	SS 14.1.1	At least 80% of the trees and shrubs planted on the site are native species. Existing non-native trees can be retained without penalty. Native trees outside of development footprint must be retained.
½ points	SS 14.1.2	At least 80% of non-turf ornamental plant species (excluding trees) installed are native species.

Implementation

Native Plant

A species of plant that was historically present in the vicinity (usually defined as local watershed) of the project site. This does not include cultivars. Historical presence can be assessed using local floras, surveys of natural areas, or herbarium records.

If, due to climate change or other shifting conditions, historically native planting are no longer appropriate in this context, similar species may be substituted that are adapted to the expected conditions. In this case, select species from nearby ecosystems that will work harmoniously with the local ecology.

Provide a site planting plan listing plant varieties indicating native and non-native species. Provide a reference designating locally native plants.

Documentation Requirements

Design Review Requirements

Construction documents must contain the planting schedule, noting which plants are native and non-native. Existing site plans and proposed development plans must indicate existing trees.

Resources

- Burghardt, K., D. Tallamy, and W. Gregory Shriver, 2009, Impact of Native Plants on Bird and Butterfly Biodiversity in Suburban Landscapes. Conservation Biology 23:219-224: https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/j.1523-1739.2008.01076.x Pacific Northwest Native Plant Habitat Garden Manual. https://www.wnps.org/files/106/Starflower-Plant-Resources/351/Habitat-Garden-Manual.pdf
- Tallamy, D. 2009, Bringing Nature Home: How You Can Sustain Wildlife with Native Plants. Timber Press: https://bookshop.org/books/bringing-nature-home-how-you-can-sustain-wildlife-with-native-plants-second-edition-revised/9780881929928

Site and Building Best Practices

Intent

Ensure a thorough and comprehensive site and building orientation analysis by implementing at least three of seven best practices.

SS 15.0 – Site and Building Best Practices

There are many other best practices for site selection and building orientation not covered elsewhere. To help ensure that a comprehensive and thorough site analysis is completed, choose at least three measures from the list of seven best practices to implement.

SS 15.0 – Site and Building Best Practices		**Prerequisite**	
		2 point	
Applicability	**Verification**		
All new building projects.	Design Review	Construction Review	Performance Review

Requirement

2 point	SS 15.0	Choose any three of the following best practices to implement: 15.0.1: Orient the building(s) to take advantage of maximum natural daylighting and plot shadow patterns from surrounding buildings and place buildings to optimize solar gain (for urban-infill sites). 15.0.2:. Consider prevailing winds when determining the site and building layout. For example, consider how the shape of the building itself can create wind-sheltered spaces and consider prevailing winds when designing parking lots and driveways to help blow exhaust fumes away from the school. 15.0.3: Take advantage of existing land formations and vegetation to provide shelter from extreme weather or to deflect unwanted noise. 15.0.4: Plant or protect existing deciduous trees to block summer sun and allow winter solar gain. Plant or protect existing coniferous trees to block winter wind. 15.0.5: Minimize importation of non-native soils and exportation of native soils. Optimize Cut & Fill (ideally 1:1) during clearing and excavation. 15.0.6: Create physical connections to existing bike paths, natural features, or adjacent buildings and neighborhoods. 15.0.7: Design parking lots and driveways to limit student proximity to bus emissions. Design bus loading and unloading areas such that

		buses need not be lined up head to tail. Do not design bus loading and unloading areas such that bus exhaust is in proximity to any of the school's air intake vents.

Implementation

Performing a thorough site analysis at the pre-design phase is critical to understanding all the opportunities and complexities of a building site. A good site analysis allows the designer to make informed design decisions to take full advantage of solar orientation, prevailing wind direction, topography, and tree species and locations. Adjacent streets and traffic patterns should be considered, functional synergies with surrounding buildings created, and special environmental elements featured.

Item #1 highlights the importance of building orientation. Energy efficiency and environmental impacts are affected by decisions made early in the planning process. For example, when the building is oriented along the east-west axis, the designer can take advantage of natural daylighting, which reduces the need for electrical lighting and resultant energy consumption.

Note: Urban infill projects do not usually have the opportunity to orient the building to the sun, due to tight site constraints. However, project designers are encouraged to think about maximum solar exposure within the limits of the surrounding buildings.

Item #2 encourages designers to consider prevailing winds to help move vehicle exhaust away from the school, minimizing exposure to students and staff.

For items #3 and #4, earth berms, forests, and other natural features can help shape the layout of the school building during early design. Likewise, manmade structures, such as storage structures for bio-mass fuel, can be sited carefully to provide protection to the site. Plantings of deciduous trees provide shade to the school during warmer months and access to sunlight at the end of autumn when the trees' leaves have fallen.

Importation or exportation of soil can be costly in terms of both dollars and environmental impact. Item #5 encourages the conservation of the environment by minimizing excavation and importation of non-native soils. By optimizing cut and fill (ideally 1:1) during clearing and excavation, use of native soils is maximized, reducing the adverse impacts on the site.

In item #6, "creating physical connections" means considering features on adjacent properties and designing the site layout such that it promotes their use.

For item #7, avoid head-to-tail lineups of school busses, which is the traditional dismissal practice experienced at many schools. Instead, require that busses ready for students park head-first towards the curb so that bus exhaust is not near the intake for other buses or the school ventilation system. When considering site placement of bus parking, also consider prevailing winter winds so that exhaust is not blown into the school air intakes.

Documentation Requirements

Design Review

For all strategies attempted, submit site analysis sketches outlining all of the site's features before the building is placed and submit the following for individual strategies for at least three of the items listed below. Site layouts and design narratives may be combined where appropriate.

1. Site layout and design narrative showing how the project responds to natural daylighting.

2. Site layout and design narrative showing how the project responds to prevailing winds.

3. Site layout and landscape design narrative showing how the existing topography and tree coverage respond to weather or deflect unwanted noise.

4. Site layout and landscape design narrative showing how the intended or existing plantings increase shade in the summer and allow solar gain in the winter.

5. Submit a cut and fill analysis report that shows a maximum of a 5% deviation to a 1:1 ratio. If avoidable, please do not submit the entire report, only the sections that identify the report and support the intent of a 1:1 ratio of excavation and infill with native soils.

6. Site layout and design narrative showing how the project responds to natural features and/or adjacent buildings.

7. Site plan showing bus loading and unloading area. Also show on this drawing, or submit a separate drawing, that shows that the building's air intake vents are not located near the loading/unloading zone.

Resources

Asthma Regional Council: https://asthmaregionalcouncil.org/our-work/state-asthma-programs/

MATERIALS & WASTE MANAGEMENT

Storage & Collection of Recyclables

Intent

Facilitate the separation and collection of materials for recycling.

MW 1.0 – Storage & Collection of Recyclables

Providing easily accessible recycling to the students, teachers and staff ensures a significant portion of solid waste can be diverted from landfills and incineration/transformation facilities. Recycling of paper, cardboard, metals, plastics and organics diminish the need to extract virgin materials.

<table>
<tr><th colspan="2" rowspan="2">MW 1.0 – Storage & Collection of Recyclables</th><th colspan="2">Prerequisite</th></tr>
<tr><th colspan="2">2 points</th></tr>
<tr><th>Applicability</th><th colspan="3">Verification Required</th></tr>
<tr><td>All projects.</td><td>Design Review</td><td>Construction Review</td><td>Performance Review</td></tr>
</table>

Requirement

Prerequisite	MW 1.0	*Condition 1:* School jurisdiction has a local recycling ordinance. The school building must meet the local ordinance for recycling space. Provide easily accessible areas serving the entire school that are dedicated to the collection and storage of materials for recycling. There must be at least one centralized collection point (e.g. loading dock), and ability for separation of recyclables where waste is disposed of for classrooms and common areas such as cafeterias, gyms or multi-purpose rooms. The team must provide a copy of the ordinance. Provide means for recycling inside of each classroom. Administration areas must have one central recycling station set up per 20 employees. **OR** *Condition 2:* School jurisdiction does not have a local recycling ordinance but local recycling services are available to the school district. Recycling must include a minimum of three of the following: paper, cardboard, glass, plastics, and metals. The school must have a written program stating the logistics of the recycling efforts. Provide easily accessible areas serving the entire school that are dedicated to the collection and storage of materials for recycling. There must be at least one centralized collection point (e.g. loading dock), and ability for separation of recyclables where waste is disposed of for classrooms and common areas such as cafeterias, gyms or multi-purpose rooms. Provide means for recycling inside of each classroom. Administration areas must have one central recycling station set up per 20 employees. **OR** *Condition 3:* School jurisdiction does not have a local recycling ordinance and no recycling services are available to the school district. If there is no recycling infrastructure within the boundaries of the school district then the project is exempt from this prerequisite. If there is no recycling infrastructure and the project establishes a recycling program, the project should consider applying for an innovation credit.

Implementation

For sizing guidelines on spaces for storage and handling of recyclable material, see the CalRecycle's *Recycling Space Allocation Guide*: https://www2.calrecycle.ca.gov/Publications/Details/832

Early in the design phase, be sure to reserve space for recycling functions and show areas dedicated to the collection of recycled materials on floor plans. Consider the question of how recyclable materials will be collected and removed from classrooms, teachers' prep rooms, and offices. When recycling bins are used, they should be able to accommodate a 75% diversion rate (from normal waste basket contents) and be easily accessible to students and staff as well as custodial staff. Consider bin designs that allow for easy cleaning to avoid health issues. Consider claiming innovation credit for establishing a composting program for landscape waste and food.

Documentation Requirements

Design Review Requirements

Construction drawings, site and classroom plans, must include the centralized collection point and recycling bins/dumpsters/areas in classrooms and common areas such as cafeterias or multi-purpose rooms.

Construction Review Requirements

Provide pictures of the centralized recycling collection point and typical classroom/common area recycling bins/dumpsters.

Resources

- US EPA School Recycling: https://archive.epa.gov/wastes/conserve/tools/localgov/web/html/school.html
- US EPA Land, Waste, and Cleanup Topics: https://www.epa.gov/environmental-topics/land-waste-and-cleanup-topics
- US EPA List of Common Recyclables: https://www.epa.gov/recycle/how-do-i-recycle-common-recyclables
- US EPA Sustainable management of Food: https://www.epa.gov/sustainable-management-food Grasscycling: http://ipm.ucanr.edu/TOOLS/TURF/MAINTAIN/grasscyc.html_l
- US EPA Toolkit for Improving a Recycling Program https://archive.epa.gov/region4/rcra/mgtoolkit/web/html/improving.html
- US EPA Reduce, Reuse, Recycle: https://www.epa.gov/recycle

Minimum Construction Site Waste Management

Intent *Divert construction and demolition was from landfills.*
MW 2.0 – Minimum Construction Site Waste Management
MW 2.1 – Construction Site Waste Management

This criterion is very feasible in many parts of the United States. Even if there are limited recycling facilities or waste management recycling companies in the project area, construction waste management can still take place through sub-contractor sorting the waste into multiple dumpsters. The cost is then associated with the dumpster costs and hauling charges. Recycling construction and demolition (C&D) materials reduces demand for virgin resources and diminishes the need for landfill space. Meet local ordinance requirements concerning C&D materials at construction sites, if applicable; and develop and implement a C&D waste management plan, quantifying material diversion by weight.

MW 2.0 – Minimum Construction Site Waste Management		**Prerequisite**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	MW 2.0.1	Recycle, reuse, and/or salvage at least 50% (by weight) of non-hazardous construction and demolition waste, not including land clearing and associated debris.

MW 2.1 – Construction Site Waste Management		**Credit**	
		2 points	
Applicability	**Verification Required**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 points	MW 2.1.1	Recycle, reuse, and/or salvage at least 75% (by weight) of non-hazardous construction and demolition waste, not including land clearing and associated debris. **OR**
2 points	MW 2.1.2	Recycle, reuse, and/or salvage at least 90% (by weight) of non-hazardous construction and demolition waste, not including land clearing and associated debris. **OR**
2 points	MW 2.1.3	Fulfill the requirements of MW.2.3, and develop a comprehensive Waste Recovery Plan such that a minimum of 50% of the building waste (by weight) is reused or salvaged by donating or selling to a reuse organization within 1000 miles.

Implementation

Successful salvage, recycling, and diversion of construction and demolition materials is usually the result of a well thought out waste management plan and on-site training for contractors and subcontractors.

Compliance calculations for this criterion 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. Note that in Massachusetts, Alternative Daily Cover is not allowed in the calculations by regulation.

Recycle Rate (%) = [Recycled Waste [Tons] / (Recycled Waste [Tons] + Garbage [Tons])] x 100

Note: DO NOT include materials classified as hazardous wastes in these calculations.

The Construction Waste Management Plan should detail the following components:

- The diversion percentage goals for C&D wastes, e.g., 75%. A 90% recycling rate may receive an Innovation point.
- Recycling/reuse strategies and processes for onsite recycling, deconstruction and salvage, e.g., scheduling of different stages of deconstruction to best remove recyclable or salvageable materials intact.
- On-site communication: the general contractor will detail communication strategies for construction workers and subcontractors about the recycling program and goals.
- Waste management documentation: The construction waste management plan will specify documents needed to show waste diversion—e.g., weight tickets for all wastes removed from the site including recycled and salvaged materials.

- Recycling summary: Recycling and waste data will be collected into a summary document for construction documentation.

For projects pursuing MW 2.1.3, include a section called “Waste Recovery Plan” in the Construction Waste Management Plan. Identify reuse organizations within 1000 miles that will purchase or accept the donation of construction waste for reuse. The identified organization must intend to reuse the waste as-is, or sell the material for the intent of re-use.

During construction, collect the receipts from the reuse organization that shows the donated or sold items and weight of the donated or sold items form construction & demolition recycling waste.

Documentation Requirements

Design Review Requirements

Construction drawings must include general notes to the Contractor to implement a Construction Waste Management Plan. The notes should specify the required diversion rate through recycling, composting or salvage, compliant and preferred facilities to receive the debris, and that they are responsible to maintain documentation (weight tickets / receipts) for all debris leaving the site to be summarized and submitted after construction as a diversion summary.

Construction Review Requirements

Provide a diversion summary and back up documentation for where debris was taken.

Resources

- Recycling Construction and Demolition Wastes: A Guide for Architects and Contractors https://archive.epa.gov/region1/healthcare/web/pdf/cdrecyclingguide.pdf

US EPA Construction and Demolition Debris: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/construction-and-demolition-debris-material

Single Attribute – Recycled Content

Intent
Specify and install recycled content products in order to reduce the environmental impacts associated with extraction and processing of virgin materials.
MW 3.1 – Single Attribute – Recycled Content

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.

MW 3.1 – Single Attribute – Recycled Content		**Credit**	
		2 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	MW 3.1	Prescriptive Approach: Specify and install at least four major materials from Table 19 for 1 point, or eight major materials from Table 19 for 2 points. **OR** Performance Approach: The weighted average recycled-content value by cost is at least 10% (post-consumer + ½ pre-consumer), or at least 20% for 2 points. Fly ash generated from municipal solid waste incinerators is not an acceptable recycled content material under this criterion, nor is fly ash generated as a coal combustion by-product where the coal plant is fired with hazardous waste, medical waste or tire-derived fuel. Mercury concentration should not be more than 5.5 ppb (0.0055 mg/L) as determined by a Toxic Characteristic Leaching Procedure (TCLP) following EPA 7470A. Most US fly ash has mercury content of 2 ppb or less. This is a level that is deemed acceptable for drinking water in the US and is safe for use in construction. Furthermore, when this mercury is bound in the matrix of construction materials, the scientific literature indicates that it does not leach out, even when subjected to more aggressive conditions than anticipated in real life. Certain combinations of coal types and power plant combustion may produce fly ash with higher mercury content, though this appears to be rare.

Implementation

Recycled content is either a post-consumer (collected from end users) or secondary material. Pre-consumer, or post-industrial, waste is collected from manufacturers and industry. The objective of this criterion is to maximize post-consumer recycled content; therefore pre-consumer recycled content is discounted 50% for the calculations.

Recycle content claims must be in accordance with the International Organization of Standards document ISO 14021-1999 – Environmental labels and declarations.

Prescriptive Approach

At least four major materials must be specified and installed in the project that meet the minimum total recycled content levels as listed in Table 19, Minimum Recycled Content Levels in the appendix. A total of two points must be achieved when at least eight major materials are specified and installed that meet the recycled content levels as listed in Table 19. 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. For example, credit would not be issued if tackable wall panels were used in only one classroom. Recycled content products with minimum recycled content levels must be used throughout the project.

For Table 19, Total Recycled Content = Post-consumer Recycled Content + ½ Pre-consumer Recycled Content

Note: If tire derived products are used indoors, they must also meet EQ.C4 standards for low-emitting materials.

Table 19: Minimum Recycled Content Levels (MW.C2: Recycled Content, Prescriptive Approach)

Category	Product	Total Recycled Content	Post-Consumer Recycled Content
Building Insulation	Fiberglass Insulation	30%*	30 %
	Cellulose Insulation (Including Cotton and Denom)	75%*	75 %
Flooring	Nylon Carpet (Total) Weight	10%*	10 %
	Polyester Carpet Fiber Face	25%*	25 %
	Plastic	50%	0 %
	Linoleum	40%	0%
	Vinyl	50%	0%
	Rubber (non-tire-derived)	40%	0%
	Tire-derived Rubber	50%*	50 %
	Glass	50%*	50 %
	Ceramic	45%	0 %
Acoustical Ceiling Tiles and Wall Panels	Glass	30%	0 %
	Recycled Newspaper, Slag Wool, Aluminum	30%	0 %
Countertops	Paper	30%*	30 %
	Glass	50%*	50 %
	Ceramic Tile	45%	0 %
Cabinetry	Medium Density Fiberboard	80%	0 %
Wall Coverings	Tackable Wall Panels	100%*	100 %
	Paint	50%*	50 %
Aggregate Base and Subbase	Recycled Aggregate	50%	0 %
Structural Concrete	Fly Ash, Rice Hull Ash, or other Pozzolanic Materials (See credit restrictions on claiming credit for fly ash.)	25%[1]	0 %
Structural Steel	Basic Oxygen Furnace (BOF) Produced Steel	16%*	16 %
	Electric Arc Furnace (EAF) Produced Steel	67%*	67 %
Shower/Restroom Partitions	Plastic	20%	0 %
	Steel	25%	0 %

Windows	Fiberglass Frame	15%	0 %
Roofing Materials	Steel	25%	0 %
	Aluminum	20%	0 %
	Fiber (Felt) or Fiber Composite	50%*	0 %
	Tire-derived Products	50%*	50 %
	Plastic or Plastic/ Rubber Composite	100%*	100 %
Playground Equipment	Plastic	90%	90 %
	BOF Steel, EAF Steel	16%, 67%	16 %, 67 %
	Aluminum	25%*	25 %
Playground Surfaces	Plastic	10%*	10 %
	Tire-derived	100%*	100%
Landscaping Products	Compost, Co-compost, and Mulch	80%*	80 %
Plastic Lumber and Timbers	Plastic	10%*	10 %
Parking Stops	Plastic	10%*	10 %
	Tire-derived Products	100%*	100 %
New product categories may be considered provided the value exceeds 5% of the total project material cost. See ME 4.1.2, which states that a default value of 35% of the Total Construction Cost can be used for Total Project Material Cost. i.e. for a $5,000,000 major renovation project take 35% of that cost, 5% of that cost and a new product category would need to be worth at least $87,500 to be considered		20%	10%
All Other Product Categories (Maximum of 2 points from this category are eligible for credit under ME4.1. To receive credit, products must also complete a Life Cycle Effects Screening (LCES) to ensure there are no environmental or health tradeoffs).		25%	0 %

*Products with asterisk must meet their minimum total recycled content level entirely with post-consumer (collected from end-users) content. For all other products, secondary recycled content (also known as post-industrial or pre-consumer) may count as half credit toward the minimum total recycled content required.

Performance Approach

Another method to verify compliance with this criterion is to use the performance approach. The weighted average of recycled-content value is calculated using the following equations:

- Recycled Content Value (RCV): Calculate the Recycled Content Value of each product by multiplying the cost of the product by the percent of postconsumer recycled content and then adding ½ of the cost of the product multiplied by the percent of pre-consumer recycled content. Material Cost is the construction cost of each individual material excluding all labor costs, project overhead, and fees.

RCV = (% postconsumer recycled content x material cost) + 0.5 x (% pre-consumer recycled content x material cost)

- Total Recycled Content Value: Total Recycled-content Value is the sum of the postconsumer and pre-consumer recycled-content value of all recycled-content products.

$\sum$RCV = RCV Product A + RCV Product B + RCV Product C, etc.

- Verify RCV of Each Recycled Product DOES NOT Exceed 25% of $\sum$RCV: If RCV of Product A is greater than 25% of $\sum$RCV, then 25% ($\sum$RCV) must be substituted for the value of Product A in the Total Recycled Content Value equation. This step must be repeated for each product to verify that no one material accounts for more than 25% of the $\sum$RCV.

RCV Product A ≤ (25%) ($\sum$RCV)

(If RCV of Product A is greater than 25% of $\sum$RCV, then 25% ($\sum$RCV) must be substituted for the value of Product A in the Total Recycled Content Value equation. Repeat equation for each product.)

Weighted Average Recycled Content Value (%): The Weighted Average Recycled Content Value is calculated by dividing the Total Recycled-Content Value ($\sum$RCV) by the Total Project Material Cost. The Total Project Material Cost is the construction cost of all materials excluding all labor costs, project overhead, and fees. A default value of 35% of the total construction costs can be used for the Total Project Material Cost.

Weighted Average Recycled Content Value [%] **=** Total Material Cost [$]/Total Recycled Content Value [$] x 100

Documentation Requirements

Design Review Requirements

Submit construction documents specifying use of anticipated recycled content products.

Construction Review Requirements

Provide the CHPS Materials Worksheet provided to CHPS Verified projects at the point of registration. Provide cut sheets for materials claimed to have the required recycled content. Proof of purchase and/or installation is only required if audited during construction review. CHPS recommends that records be kept in the event an audit is requested.

Resources

- CHPS Product Database: www.chps.net/products
- US EPA's Comprehensive Procurement Guideline (CPG) Program: www.epa.gov/cpg

- US EPA Guide for Industrial Waste Management, Chapter 2, Characterizing Waste: https://www.epa.gov/sites/production/files/2016-03/documents/industrial-waste-guide.pdf CA Department of Toxic Substance Control TCLP and WET:

https://dtsc.ca.gov/

Single Attribute – Rapidly Renewable Materials

Intent *Specify and install materials that replenish themselves faster than traditional extraction demands.*
MW 4.1 – Single Attribute – Rapidly Renewable Materials

Rapidly renewable raw materials are those materials that substantially replenish themselves faster than traditional extraction demand (e.g. planted and harvested in less than a 10 year cycle); and that are sustainably managed. Products in this category include, but are not limited to, bamboo products, wheat grass cabinetry, linoleum and bioplastics. Ensure that the products protect indoor air quality and are durable.

MW 4.1 – Single Attribute – Rapidly Renewable Materials		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	MW 4.1.1	Prescriptive Approach: Specify rapidly renewable materials, for 50%by area of one of the following major interior finish: • Flooring (ft^2) • Casework (ft^3) • Acoustical Ceiling Tile (ft^2) • Wall Covering (ft^2) A product must contain a minimum of 25% rapidly renewable raw materials based on weight to qualify for this criterion. **OR**
1 point	MW 4.1.2	For at least 50% by area of one of the same interior finishes, use certified USDA organic materials or materials utilizing environmentally sustainable agriculture harvest methods certified under the “Draft National Standard for Trial Use, Sustainable Agriculture (SCS-101) certified under a program that meets the criteria for Alliance full membership such as IFOAM organically grown materials.

Implementation

To confirm compliance with this criterion determine the total costs of all qualifying materials and the total cost of all renewable materials. Materials considered as qualifying are listed on Table 20 - Materials to be Included and Excluded from Calculations.

Table 20: Materials to be Included and Excluded from Calculations

Name	Included in the cost calculation	Not included in the cost calculation	Notes on DHS Materials Testing
General Conditions	Not Applicable	Not Applicable	Not applicable
Site Work	Site furnishings, bike racks, site paving systems (including asphalt, concrete for sidewalks and driveways as well as other paving systems), gravel, fences and gates, parking lot accessories, playground surfaces, and playground equipment.	Plant materials, earth, sand and outdoor lighting fixtures (see Division 16).	No testing required.
Concrete	All products. Include all concrete used in the construction of the building: slabs, structural concrete, basement walls and concrete toppings on steel or wood decks. Concrete used in site work is also included, but in Division 2.	Formwork and temporary scaffolding.	No testing required.
Masonry	All products. Include all masonry used in the construction of the building, both structural and otherwise. Masonry used in site work is also included, but in Division 2.	Nothing	No testing required.
Metals	Light gauge metal framing for walls, roofs or floors, wood structural connectors, metal roofing, decorative metal, guard rails and hand rails. Aluminum or steel used in the manufacturing of windows and doors is included in Division 8.	Structural steel including steel reinforcing bars or meshes used in concrete.	No testing required.

Name	Included in the cost calculation	Not included in the cost calculation	Notes on DHS Materials Testing
Wood and Plastic	All products used in the permanent construction of the building.	Formwork, temporary fences, construction barriers, scaffolding, bracing, and other elements that are not part of the finished building.	Only applies for materials that are exposed to the interior space. If people can see from inside it you have to test it. Most structural wood products would not need to be tested: framing lumber, OSB, and plywood.
Thermal and Moisture Protection	All products. All insulation used in walls, roofs, floors and slabs as well as insulation used for pipes and ducts. All air barriers and vapor barriers.	Nothing	Testing required.
Doors and Windows	All products `	Nothing	No testing required.
Finishes	All products	Nothing	Everything has to be tested.
Specialties	All products	Nothing	Testing only required for surface mounted whiteboards and tack boards.
Equipment	Nothing is included.	All products	No testing required.
Furnishings	Fixed casework and other built-items	Moveable desks, tables, chairs, cabinets and bookcases that are not in the construction contract. Generally everything that is not bolted down is excluded.	Testing required.
Special Construction	Excluded	All Products	No testing required.
Conveying Systems	Excluded	All products	No testing required.
Mechanical	Excluded	All products	No testing required.
Electrical	Excluded	All products	No testing required.

Material cost is the construction cost of a material excluding all labor costs, project overhead, and fees. Divide the cost of all renewable materials by the total qualifying material cost and multiply by 100 to determine the percentage of renewable materials in the construction.

Renewable Raw Materials [%] = Renewable material cost[$]/Total material cost[$] x100. Be sure to use the total qualifying materials cost for the project in the denominator of the calculation equation.

The prescriptive approach requires that 50% of all material by area from one of the listed groups meet the criteria. For example, a minimum of 50% of all floor coverings used in the school must contain 25% rapidly renewable raw materials based on weight. This calculation may use the formula above for the dollar value of the materials or may be calculated on the base unit:

Renewable Raw Materials [%] = Renewable Material Unit/ Total Material Unit x100

Documentation Requirements

Design Review Requirements

Submit construction documents containing specifications for products with anticipated rapidly renewable or organic content.

Construction Review Requirements

Provide the CHPS Materials Worksheet provided to CHPS Verified projects at the point of registration. Provide cut sheets for materials claimed to have the required rapidly renewable or organically grown features. Proof of purchase and/or installation is only required if audited during construction review. CHPS recommends that records be kept in the event an audit is requested.

Resources

- CHPS High Performance Products Database: www.chps.net/products
- ISEAL Member certifying organizations: www.isealalliance.org/

Single Attribute – Certified Wood

Intent
Specify and install sustainably harvested wood.
MW 5.1 – Single Attribute – Certified Wood

Wood grown and harvested in an ecological manner is a truly sustainable material that is renewable, biodegradable, energy efficient and recyclable. The Forest Stewardship Council (FSC) guidelines help to ensure wood is grown and harvested with responsible forest management practices.

MW 5.1 – Single Attribute – Certified Wood		**Credit**	
		1 point	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	MW 5.1	Use a minimum of 50% of wood-based materials, by cost, certified in accordance with one of the following programs. This includes, but is not limited to, framing, flooring, finishes and built in cabinetry. • Forest Stewardship Council (FSC) • NWFA Responsible Procurement Program (RPP) may be used instead of FSC Certification for flooring products only

Implementation

Refer to one of the wood certification programs listed above for wood building components that comply with the requirements, and incorporate them into the material selection for the project.

The National Wood Flooring Association has developed the Responsible Procurement Program that provides a management structure for wood sources to transition over time to meet the Forest Stewardship Council (FSC) standards. CHPS encourages other wood industries to develop similar improvement plans.

To perform the calculation for this criterion, determine the cost of total new wood based products and the cost of certified wood based products. Exclude all labor costs, project overhead and fees. Divide the total cost of certified wood products by the total cost of all new wood products that are incorporated into the permanent construction. Multiply this result by 100 to determine the percentage of wood products that are certified. Be sure to use the total wood products cost for the project in the denominator of the calculation equation.

Wood Material Portion [%] =
Certified Wood Products Cost [$] / Total New Wood Based Products Cost [$] x100

Documentation Requirements

Design Review Requirements

Submit construction documents containing specifications for compliant wood.

Construction Review Requirements

Provide the CHPS Materials Worksheet provided to CHPS Verified projects at the point of registration. Provide cut sheets for materials, and Certificates of Chain-of-Custody signed by manufactures certifying that the product meets the required standard. Proof of purchase and/or installation is only required if audited during construction review. CHPS recommends that records be kept in the event an audit is requested.

Resources

- CHPS High Performance Products Database: www.chps.net/products
- Forest Stewardship Council Website at: www.fscus.org
- National Wood Flooring Association – Responsible Procurement Program https://nwfa.org/manufacturing/

Single Attribute – Materials Reuse

Intent
Specify and install re-used (salvaged) materials to limit waste and the use of raw materials.
MW 6.1 – Single Attribute – Materials Reuse

Salvaged materials or products are reused from a previous use or application and then used in a new use or application with only superficial modification, finishing, or repair. Commonly salvaged building materials include wood flooring/paneling/cabinets, doors and frames, ironwork and decorative lighting fixtures, brick, masonry and heavy timbers.

MW 6.1 – Single Attribute – Materials Reuse		**Credit**	
		1 point	
Applicability	**Verification**		
All projects that obtain salvaged material from off-site. For a new building, the calculation should be performed using the total salvaged material costs and the material costs for the new building. The costs of new materials purchased for renovations should be used in the denominator of the equation for calculations in this instance.	Design Review	Construction Review	Performance Review

Requirement

1 point	MW 6.1	To receive criterion for salvaged materials, the materials may not be considered hazardous, including those containing lead based paint, asbestos, mercury, arsenic, or other harmful PBT's. Performance Approach: Specify re-used, salvaged or refurbished materials obtained off-site for 5% of building materials by cost. (1 points) **OR** Prescriptive Approach: Specify re-used, salvaged or refurbished materials for 25% of one (for one point) of the following major interior non-structural materials obtained off-site: • Flooring (ft^2) • Casework (ft^3) and Doors (ft^2) • Acoustical Ceiling Tile (ft^2) • Wall Finishes (ft^2) • Tile (ft^2)

Implementation

Re-used materials are defined as material taken from another site and used for the same purpose at the new site, e.g. removing wood flooring from another site to use as flooring in the new school. Salvaged material may also come from the same building site but must be used for a different purpose; otherwise it is considered recycled material. For example, many schools build on the same site and demolish the old school building when the new one is completed. If the project demolished concrete structures from the old school and ground the concrete as fill for the new school, the concrete fill would be considered salvaged material. Commonly salvaged building materials include wood flooring/paneling/cabinets, doors and frames, mantels, ironwork and decorative lighting fixtures, brick, masonry, and heavy timbers.

To verify compliance with this criterion first determine the total cost of all salvaged materials if purchased new, and the total cost of all qualifying materials. Materials considered as qualifying are listed on Table 20 – Materials to be Included and Excluded from Calculations under MW 4.1.

Material cost is the construction cost of a material excluding all labor costs, project overhead, and fees. If the cost of the salvaged or refurbished material is below market valued, use the replacement cost to estimate the material value; otherwise use the actual cost to the project. The next step is to divide the total cost of salvaged materials by the total cost of all qualifying materials and then multiply by 100 to determine the salvage rate as a percentage of all qualifying materials.

Re-Used Rate [%] = Salvaged Material Cost [$]/Qualifying Material Cost [$] x 100

Hazardous re-used or salvaged materials that contain lead based paint, asbestos, mercury, arsenic or other harmful PCB's must be avoided.

The prescriptive approach requires that 25% of all material from one of the listed groups be salvaged or refurbished for 1 point.

May apply for Innovation points (II 9.1): 25% of all material from two of the listed groups be salvaged or refurbished for 1 point. 50% of the material from one group will also earn 1 point. For example, using salvaged ceiling tile for 55% of all ceilings in the school will earn one points. This calculation may use the formula above for the dollar value of the materials or may be calculated on the base unit:

Re-Used / Salvage Rate [%] = Salvaged Material [Unit]/ Qualifying Material [Unit] x 100

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. Provide the specifications for the salvaged material. Designate the CSI number, section, and page number that highlight compliance with this requirement.

Documentation Requirements

Design Review Requirements

Construction drawings must include notes regarding how salvaged materials will be used in various locations.

Construction Review Requirements

Provide the CHPS Materials Worksheet provided to CHPS Verified projects at the point of registration. Proof of purchase and/or installation is only required if audited during construction review. CHPS recommends that records be kept in the event an audit is requested.

Resources

- CHPS Product Database: www.chps.net/products
- Old to New: Design Guide, Salvaged Building Materials in New Construction, 3rd Edition (2002): www.lifecyclebuilding.org/docs/Old%20to%20New%20Design%20Guide.pdf

Multi-Attribute Material Selection

Intent *Specify materials that contain a third-party Environmental Product Declaration.*
MW 7.1 – Multi-Attribute Material Selection

The intent of CHPS is to help manufactures and specifiers invest products and materials that throughout their life cycle provide minimal impact on the environment and human health.

Manufactures and specifiers that are committed to understanding their products' impact on the environment and on human health should be recognized for their efforts.

MW 7.1 – Multi-Attribute Material Selection			**Credit**
			2 points
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

2 points	MW 7.1	Select 10 products that contain a third-party certified Environmental Product Declaration conforming to the requirements of ISO 14025 on Type III environmental declarations and/or ISO 21930 on environmental declarations of building products. Environmental Product Declarations must address the requirements found in Appendix A of the ISO standards. The Declaration must justify the omission of any impact category in narrative form within the document.

Implementation

ISO 14025 Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures

ISO 14025 establishes the principles and procedures for developing Type III environmental declarations (EPD). It specifically establishes the use of the ISO 14040 series of standards on life-cycle assessment in the development of these declarations. Type III environmental declarations prepared in accordance with this standard are intended to present quantified environmental life cycle product information to enable comparisons between products fulfilling the same function.

ISO 21930 Sustainability in building construction -- Environmental declaration of building products

Building on the framework and requirements described in ISO 14025, ISO 21930 contains specifications and requirements for type III environmental declarations (EPD) of building products. The standard recommends that Type III declarations for building products account for all life cycle stages of the product. Omissions of life cycle stages must be justified.

ISO 21930 requires that environmental information covering all life cycle stages ("cradle to grave") be subdivided into at least three life cycle stages for reporting purposes:

- product stage (raw material supply, transport to production, manufacturing: "cradle to gate")
- building stage (transport to building site, building installation, use, maintenance and repair, replacement)
- end of life stage (demolition, transport, disposal / recycling)

ISO 21930 also specifies the minimum requirements for the verifiers in terms of competence (ISO 19011:2002, clause 3.14) including:

- Knowledge of relevant industry, product and product-related environmental matters
- Process and product knowledge of the product category
- Expert on LCA and methodology for LCA work
- Knowledge of the relevant standards in the field of environmental labeling and declarations, and life cycle assessment
- Knowledge of the regulatory framework in which requirements for environmental declarations have been prepared
- Knowledge of the program for Type III environmental declarations

Documentation Requirements

Design Review Requirements

Submit construction documents specifying the use of products that meet the requirements

Construction Review Requirements

Update the CHPS Plan Sheet and submit Environmental Product Declarations for each of the 10 chosen products.

Resources

- CHPS High Performance Products Database: www.chps.net/products
- ISO 14025: https://www.iso.org/standard/38131.html
- ISO 21930: https://www.iso.org/standard/40435.html
- Pharos: www.pharosproject.net/

Building Reuse – Exterior

Intent *Increase the reuse of existing building structure and shell.*
MW 8.1 – Building Reuse – Exterior

Reusing parts of the building can save significant money and resources, while greatly reducing the amount of construction waste. When materials are re-used, the environmental benefits start with resource savings and extend down through the entire life-cycle of the material: less energy is spent extracting, processing, and shipping the materials to the site. Depending on the amount of building re-used, 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.

MW 8.1 – Building Reuse – Exterior		**Credit**	
		2 points	
Applicability	**Verification**		
For major renovations this criterion would apply in reuse of the existing structure and shell of the building(s) being renovated.	Design Review	Construction Review	Performance Review

Requirement

1-2 points	MW 8.1	Reuse large portions of existing structures during renovation or redevelopment projects. Maintain at least 50% of existing building structure and shell (exterior skin and framing, excluding window assemblies). Hazardous materials that are remediated as part of the project scope AND elements requiring replacement due to unsound material condition must be excluded from the calculation of the percent maintained. Points are allocated as follows: • Maintain 50% of existing structure and shell – 1 point • Maintain 75% of existing structure and shell – 2 points

Implementation

Reusing parts of the building can save significant money and resources, while greatly reducing the amount of construction waste. When materials are re-used, 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 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 their removal addressed.

Percentage of reused structural materials (foundation, slab on grade, beams, floor and roof decks, etc.) and shell materials (roof and exterior walls) should be estimated in square feet. Average together the structural and shell reuse percentages. The average will be used to determine the overall reuse percentage for the building.

Building Reuse (%) = 100 x [Reused (floor+ roof area + ground floor/slab) + Reused (exterior wall area excluding window assemblies)] ÷ [[Total (floor+ roof area + ground floor/slab) + Total (exterior wall area excluding window assemblies)].

Note: This criterion will be subject to review if design changes are made affecting the amount of existing structure and shell that are retained.

For new schools to satisfy this criterion, the new school must be in an existing (previously non-school) facility. For new buildings on an existing campus, this criterion would apply in the instance of an existing building, for instance a maintenance shed, being converted into conditioned space for classrooms, administration, or other school functions. In addition, this criterion pertains to a case where a building next to an existing school is purchased by the school district and converted into classroom or other school space.

Documentation Requirements

Design Review Requirements

Construction drawings must include demolition plans and existing site plans that verify features to remain.

Construction Review Requirements

Provide the CHPS Materials Worksheet provided to CHPS Verified projects at the point of registration. Maintain pictures taken before and after of major or large reuse of structural or shell elements.

Resources

None

Building Reuse – Interior

Intent
Increase the reuse of interior non-shell elements.
MW 9.1 – Building Reuse – Interior

There are many materials that may be reused from within a building beyond the existing shell and structural system. Interior partitions, finishes, doors and ceilings systems are among the items that can be salvaged and reused in the refurbished building. Reuses of these materials not only reduces the amount of waste sent to landfills, but can also significantly reduce material and construction costs.

MW 9.1 – Building Reuse – Interior		**Credit**	
		1 point	
Applicability	**Verification**		
All projects. Refer to the applicability section of criterion MW.8, Building Reuse – Structure and Shell. See also criterion MW.6, Single Attribute – Material Reuse.	Design Review	Construction Review	Performance Review

Requirement

1 point	MW.9.1	Maintain 50% non-structural elements (interior walls, doors, floor coverings, and ceiling systems) in at least 50% of completed building (including additions).

Implementation

Percentage of reused, non-shell building portions will be calculated as the total area (ft2) of reused walls, floor covering, and ceiling systems, divided by the existing total area (ft2) of walls, floor covering, and ceiling systems.

Internal Building Reuse (%) = Reused Non-structural Elements [ft2] / Total Non-structural Elements [ft2] x 100

Documentation Requirements

Design Review Requirements

Construction drawings must include demolition plans and existing site plans that verify features to remain.

Construction Review Requirements

Provide the CHPS Materials Worksheet provided to CHPS Verified projects at the point of registration. Maintain pictures taken before and after of major non-structural elements to be provided if audited only.

Resources

None

Health Product Related Information Reporting for Building Products

Intent
Specify materials that have a published Health Product Declaration.
MW 10.1 – Health Product Related Information Reporting for Building Products

The Health Product Declaration Open Standard v1.0 is a streamlined methodology for reporting language to enable transparent disclosure of the content in a material and the related health information.

MW 10.1 – Health Product Related Information Reporting for Building Products			**Credit**
			1 point
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

Requirement

1 point	MW.10.1	*Performance Approach* Provide a published Health Product Declaration (HPD) with a disclosure level of 1000ppm for at least 20 permanently installed products from at least five different manufacturers in accordance with the Health Product Declaration Standard Version 1.0. Products with an HPD with full disclosure of known hazards shall count as two products for these calculations. **OR** *Prescriptive Approach* Specify that a published Health Product Declaration with a disclosure level of 1000ppm must be provided for 50% (by cost) of one of the following major interior finish or structural materials. Products with an HPD with full disclosure of known hazards may be selected and counted as double value. • Adhesives & Sealants • Paints & Coatings • Flooring Systems • Composite Wood and Agrifiber Products • Furniture & Furnishings • Ceiling & Wall Systems

Implementation

The Health Product Declaration Open Standard v1.0 is a streamlined methodology for reporting language to enable transparent disclosure of the content in a material and the related health information. The standard was developed by the Health Product Declaration Collaborative. The standard is a free resource for manufacturers to use a reporting tool.

Designers and specifiers may collect disclosure certificates from identified third party programs, from the manufacturer, or from the certificate website, if applicable. In order to meet the requirements of this credit, the documentation must be publicly available--either published by the manufacturer on the manufacturer website with other technical data and/or in a registry (ex. Pharos, GreenWizard, etc).

For each of the programs, the following requirements shall apply:

- Health Product Declarations (HPDs): the HPD shall be published and disclose, at a minimum, all hazards down to 1000ppm.
- Cradle to Cradle Product Certification Standard (C2C): the product shall be certified at the C2C v2 Silver level or above, or at the C2C v3 Bronze level or above.

- Cradle to Cradle Material Health Certificate (MHC): the product has a Cradle to Cradle Material Health Certificate at the Bronze level or above.
- Declare: the product has a Declare label at any of the 3 levels (Declared, LBC Compliant, LBC Red List Free).
- Manufacturer Inventory: the product has a published list of ingredients identified by name, percentage of ingredient found in product, and Chemical Abstracts Service Registry (CAS) number, disclosed to at least 1000 ppm. In addition, the manufacturer shall provide a GreenScreen Benchmark or GreenScreen List Translator Benchmark for each disclosed ingredient. Where IP concerns are an issue, a manufacturer may choose to not disclose the chemical name/CAS number, but shall still be required to disclose the GreenScreen Benchmark or GreenScreen List Translator Benchmark, as well as the role of the chemical. Also, manufacturers may disclose percent ranges where appropriate.
- The product has a Product Lens label.

If a project collects only third-party certified Health Product Declarations, the team should consider applying for an innovation credit.

Definitions:

"Published" means that the HPD is publicly accessible – either published by the manufacturer on the manufacturer website with other technical data and/or in a registry such as Pharos provides.

"Complete" means the HPD has been completed as required in the HPD Standard. See the "Checklist for a Complete HPD" in the Health Product Declaration Standard v1.0.
"Full Disclosure of Intentional Ingredients" means that the HPD discloses the identity of each ingredient added to the product by the manufacturer or suppliers that exists in the product as delivered for final use

"Full Disclosure of Known Hazards" means that the HPD discloses the role and hazard traits of each ingredient but may mask the identity of certain ingredients that are restricted by IP and/or trade secret policies.

"Full disclosure of intentional ingredients" means that the HPD discloses the role and hazard traits of every ingredient in the product. This is a much higher standard that is not required by this credit, but its use is encouraged where appropriate.

Documentation Requirements

Design Review Requirements
Submit construction documents specifying the use of products that meet the requirements

Construction Review Requirements

Submit Health Product Declarations for each of the 10 chosen products. Complete the CHPS Materials Worksheet.

Resources

- Health Product Declaration Standard 1.0 https://www.hpd-collaborative.org/wp-content/uploads/2017/04/hpdstandard_v1_0_121215.pdf

Health Product Declaration Standard – Guide for Manufacturers https://www.hpd-collaborative.org/manufacturers-guide-chapter-1/

Locally Produced Materials

Intent
Specify and install locally produced materials.
MW 11.1 – Locally Produced Materials

The use of locally manufactured materials not only aids the local economy, but it also reduces the environmental impacts from the transportation of goods.

MW 11.1 – Locally Produced Materials		**Credit**	
		1 or 2 points	
Applicability	**Verification**		
All projects.	Design Review	Construction Review	Performance Review

1 point OR	MW 11.1.1	Specify a minimum of 20% of building materials by cost that are extracted, harvested, recovered, or manufactured regionally within a 500-mile radius.
2 points	MW 11.1.2	Specify a minimum of 40% of building materials by cost that are extracted, harvested, recovered, or manufactured regionally within a 500-mile radius.

Implementation

The use of locally produced materials not only aids the local economy, but it also reduces the environmental impacts from the transportation of goods.

To earn this credit show that the required percentage of products, by cost, are produced within a 500-mile radius of the project. Include all product costs, except:

- Labor costs
- Mechanical and electrical materials
- Project overhead and fees

For the cost of all products, include CSI sections 3-11, only the permanent equipment/furnishings/specialty construction included in sections 12 and 13, and sections 31 – 33 (following MasterFormat 2020). Use the following formula to determine compliance:

$$\text{Local Product Percent} = \frac{\text{Cost of local products}}{\text{Cost of all products}} \times 100\%$$

Documentation Requirements

Design Review Requirements
Submit construction documents specifying use of compliant products

Construction Review Requirements
Complete the CHPS Materials Worksheet. Maintain receipts or purchase orders to confirm compliance.

Resources

Glossary

ASHRAE – A global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry.

ASTM – American Society for Testing and Materials.

B-20 –The term for a blend of 20% renewable bio-derived diesel fuel with 80% petroleum-based diesel fuel.

Biodiesel – A domestic, renewable fuel for diesel engines derived from natural oils like soybean oil, which meets the specifications of American Society for Testing and Materials D 6751. Biodiesel is not the same thing as raw vegetable oil. It is produced by a chemical process that removes the glycerin from the oil.

Biogas – Gas, rich in methane, which is produced by the fermentation of animal dung, human sewage, or crop residues in an airtight container. It is used as a fuel to heat stoves and lamps, run small machines, and generate electricity. The residues of biogas production can be used as a low-grade organic fertilizer.

Bio-oil – A liquid created from biomass (see below) found in forestry and agricultural residues. The biomass is thermo-chemically converted to bio-oil by using processes called direct liquefaction or fast pyrolysis. The high water and oxygen content of bio-oils reduces their heating value to less than half the value of petroleum. However, bio-oils are low in viscosity and have been successfully burned in boilers, kilns, turbines, and diesel engines.

Biomass –Any biological material that can be used as fuel. Biomass fuel is burned or converted in systems that produce heat, electricity, or both. In this document, biomass-fired systems refer to systems that are fueled by clean wood chips from forestry or saw mill operations.

Brownfields –Industrial or commercial property that is abandoned or underused, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

CSI – Construction Specifications Institute.

CHPS – Collaborative for High Performance Schools.

COMcheck –Software developed by the U.S. DOE to help commercial projects demonstrate compliance with all commercial energy code requirements for envelope, lighting, and mechanical systems. For more information, see http://www.energycodes.gov/comcheck/.

Commissioning – A systematic process of ensuring that all building systems perform interactively according to the contract documents, the design intent, and the schools operational needs. Commissioning involves three phases: pre-design, construction, and warranty.

Commissioning plan – A plan that includes a list of all equipment to be commissioned, delineation of roles for each of the primary commissioning participants, and details on the scope, timeline, and deliverables throughout the commissioning process.

Cool roof – A roof that reflects most of the sun's energy instead of absorbing it into the interior spaces below.

Daylighting –The practice of placing windows and reflective surfaces so that the natural light of day provides effective internal illumination. Optimize the daylighting design to minimize glare and eliminate direct-beam light in the classroom and use daylighting controls designed to dim or turn off electric lights when sufficient daylight is available.

dBA - A measure of the level of sound expressed in units of "decibels". The application of the "A-weighted filter" de-emphasizes low-frequency and very high-frequency sound in a manner similar to human hearing.

Design-build – A construction-project delivery process in which a single entity assumes the obligation of furnishing the design, supervision, and construction services required to complete a project.

DOE-2 – Software that was developed by the U.S. DOE to predict the fuel consumption (both electric and fossil fuel) of a building based on its design. Later iterations include DOE 2.2, a more advanced form of the original software.

DOE-2.1E – An updated version of DOE-2 software.

e-QUEST – (QUick Energy Simulation Tool) – Sophisticated software that allows for detailed energy analysis of a designed building. It also allows users to build 2-D and 3-D displays of the building geometry.

ENERGY STAR- A program that maintains a database of compliant manufacturers and products. Partial list of products include computers, monitors, copy machines, water coolers, printers, scanners, refrigerators, and washing machines.

Energy Use Intensity (EUI) – EUI expresses a building's energy use as a function of its size or other characteristics. It's calculated by dividing the total energy consumed by the building in one year (measured in kBtu or GJ) by the total gross floor area of the building

Electromagnetic field (EMF) - The lowest EMF frequencies (longest wave length) are referred to as Extremely Low Frequency or ELF. Higher frequencies (shorter wave length) are referred to as Radio Frequency (RF) or Microwaves.

Flicker - A relative measure of the cyclic variation in output of a light source (i.e. percent modulation). Also sometimes referred to as the "modulation index."

Gray water system – Water that has been used in showers, sinks, and laundry machines that may be reused for other purposes, especially landscape irrigation. Toilet water is not used in this system.

Greenfields- Parcels of land not previously developed beyond that of agriculture or forestry use. The opposite of brownfield.

Green Roof/Wall – A roof or wall that utilizes soil-rooted vegetation to absorb water and light that would normally reach the building itself

Heat island – An effect caused when exterior surfaces absorb the sun's energy and heat the air near the ground. On a school site, rising temperatures make the school's air conditioning work harder, increasing energy cost.

HEPA filters – High Efficiency Particulate Air filters

Integrated pest management (IPM) – A sustainable approach to managing pests that minimizes economic, health, and environmental risks.

Integrated design – The consideration and design of all building systems and components. It brings together the various disciplines involved in designing a building and reviews their recommendations as a whole. It also recognizes that each discipline's recommendation has an impact on other aspects of the building project.

Life cycle costing – A means of calculating and comparing different designs, equipment, and products to identity the best investment.

Local Educational Authority (LEA) - LEAs include county offices of education, school districts, charter schools, and state special schools.

Minimum Efficiency Reporting Value (MERV) - MERV is a rating system for HVAC system air filters. ASHRAE standards use the MERV. The higher rating indicates increased particle capture efficiency and the capture of smaller particles.

Net metering - Net energy metering (NEM), commonly referred to as net metering, is a metering and billing arrangement designed to compensate distributed energy generation system owners for any generation that is exported to the utility grid.

OSHA – Occupational Safety and Health Administration.

Operations and maintenance manual – Provides detailed operations and maintenance information for all equipment and products used in the school.

Operations and maintenance training – Provides a short introduction on operations and maintenance of equipment and products for all school staff and then features hands-on workshops for facility personnel.

Potable water – Water of sufficient quality to serve as drinking water. Northeast Collaborative for High Performance Schools Protocol energy & resource solutions 138

PowerDOE – Software that allows users to detail the predicted energy consumption of a building. Like e-QUEST, it is very graphical in its presentation of both the building description and the display of results. It includes 2-D and 3-D displays of the building geometry.

Rain water collection system – A system that supplies water year round by harvesting both potable and non-potable water.

Rapidly renewable materials – Materials that substantially replenish themselves faster than traditional extraction demand (e.g., planted and harvested in less than a 10-year cycle), do not result in significant biodiversity loss or increased erosion, positively impact air quality, and can be sustainably managed. Products in this category include, but are not limited to, bamboo products, wheat grass cabinetry, oriented strand board, and other wood products made from fast-growing pine trees.

Recycled content – Materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer).

Responsibly produced – Materials that are extracted, harvested, or manufactured in an environmentally friendly manner (includes certified wood products).

Reverberation time - The time in seconds it takes for the sound level to decrease by 60 decibels after the source of the sound has been abruptly interrupted.

Salvaged or reused – Materials that are refurbished and used for a similar purpose rather than processed or remanufactured for different use.

Source Energy: Approach for evaluating energy that represents the total amount of fuel that is required to operate a building and incorporates all transmission, delivery, and production losses, thereby enabling a complete assessment of energy efficiency in a building.

Thermal comfort – A condition of mind that expresses satisfaction with the surrounding environment. It is determined by taking into account environmental factors (such as humidity, A/C, heat) and personal factors (what an occupant is wearing).

VisualDOE – Energy modeling software that is based on DOE-2 and allows users to evaluate energy and demand impacts of design alternatives.

VOC – Volatile Organic Compounds

Wetlands –Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support vegetation adapted for life in saturated soil. Wetlands generally include swamps, marshes, bogs, and other similar areas.

zEPI: ZERO ENERGY PERFORMANCE INDEX - A scale representing the ratio of energy performance of the proposed design compared to the average energy performance of buildings relative to a benchmark year of 2000, with similar occupancy, operation schedule and climate. The ratio is multiplied times 100 such that 100 represents a building that uses the same amount of energy as the 2000 average and zero represents a zero net energy building.

Zero Energy Buildings – An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

Collaborative for High Performance Schools (CHPS)

Project Scorecard: NE-CHPS Version 3.2

School Name:

Expected Completion:	**Current Phase:**
School District:	**Website:**
School Address:	**City:** **State:** **Zip:**
School Contact:	**Phone:** **E-mail:**
Student Capacity:	**Notes:**
Approximate Square Feet:	

Verification

Is this the final CHPS Scorecard?

Registered Principal Architect (Signature) **Project Manager** (Signature)

Name, Title, Date (Please print) **Name, Title, Date** (Please print)

Use this scorecard to track expected scores. Note that prerequisites have points associated with them even though they are required. This enables project teams to talk more meaningfully about the effort being put into each section of the Criteria. Prerequisite point columns are also highlighted for reference. Mark each credit as ready for review by using the appropriate column for each phase of the review.

Key: P - Prerequisite; **PS -** CHPS Plan Sheet Required; **CD -** Construction Documents Required; **A -** Attachment Required

Criteria	Title	Prerequisite	Points Possible	Points Targeted	Points Claimed	Responsible Team Member	Design Review Requirements			Ready for Design Review	Construction Review Requirements		Ready for Construction Review	Performance Review Requirements	Ready for Performance Review	Documentation
	Total		**250**													
Integration and Innovation																
II 1.0	Integrated Design	P	4					CD				A				
II 1.1	Enhanced Integrated Design		2						A							
II 2.1	District Level Commitment		1						A							
II 3.1	School Master Plan		1						A							
II 4.1	High Performance Transition Plan		1						A			A				
II 5.0	Educational Display	P	1					CD				A				
II 5.1	Demonstration Area		1					CD				A				
II 6.1	Educational Integration		2						A			A				
II 7.1	Climate Change Action / Carbon Footprint Reporting		3						A			A				
II 8.0	Crime Prevention through Environmental Design	P	3						A			A				
II 9.1	Innovation		4				VARIES				VARIES			VARIES		
II 10.1	Biophilic Design		2						A			A				
	Subtotal															
Operations & Metrics																
OM 1.0	Facility Staff and Occupant Training	P	4					CD				A				
OM 2.1	Post Occupancy Transition		2						A			A				
OM 3.0	Performance Benchmarking	P	3						A			A		A		
OM 4.1	High Performance Operations		4						A			A		A		
OM 5.0	Systems Maintenance Plan	P	1									A				
OM 6.0	Indoor Environmental Management Plan	P	2									A				
OM 7.1	Green Cleaning		2									A		A		
OM 8.0	Integrated Pest Management	P	1				PS					A				
OM 9.0	Anti-Idling Measures	P	1					CD				A				
OM 10.1	Green Power		2						A							
OM 11.0	ENERGY STAR Equipment and Appliances	P	2						A							
OM 12.1	Computerized Maintenance Management System		1				PS					A				
	Subtotal															
Indoor Environmental Quality																
EQ 1.0	HVAC Design - ASHRAE 62.1	P	8				PS									
EQ 1.1	Enhanced Filtration		2					CD				A				
EQ 1.2	Dedicated Outdoor Air System		3					CD				A				
EQ 2.0	Polluntant and Chemical Source Control	P	2					CD	A			A				
EQ 3.0	Outdoor Moisture Management	P	1					CD				A				
EQ 4.1	Ducted Returns		2					CD								
EQ 5.1	Construction Indoor Air Quality Management		5					CD				A				
EQ 5.2	Construction Moisture Management		1					CD				A				
EQ 6.1	Post Construction Indoor Air Quality		1					CD				A				
EQ 7.0	Low Emitting Materials	P	2				PS	CD			PS	A				
EQ 7.1	Additional Low Emitting Materials		5				PS	CD			PS	A				
EQ 8.1	Low Radon		1					CD				A				
EQ 9.1	Thermal Comfort - ASHRAE 55		4				PS	CD								
EQ 10.1	Individual Controllability		1					CD				A				
EQ 10.2	Controllability of Systems		1					CD				A				
EQ 11.0	Daylighting: Glare Protection	P	4					CD	A			A				
EQ 11.1	Daylight Availability		5				PS	CD	A			A				
EQ 12.0	Views	P	3				PS	CD								
EQ 13.1	Electric Lighting Performance		3					CD	A							
EQ 13.2	Superior Electric Lighting Performance		5					CD				A				
EQ 14.0	Acoustical Performance	P	7				PS	CD	A			A		A		
EQ 15.1	Low-EMF Wiring		1					CD				A				
EQ 15.2	Low-EMF Best Practices		2					CD	A			A				
EQ 16.1	High Intensity Fluorescent Fixtures		1					CD				A				
	Subtotal															

Energy																
EE 1.0	Energy Performance	P	6					CD	A							
EE 1.1	Superior Energy Performance		40					CD	A							
EE 2.1	Zero Net Energy Capable		3					CD								
EE 3.0	Commissioning	P	4					CD	A			A				
EE 3.1	Additional Commissioning Qualifications		1					CD	A			A				
EE 3.2	Building Envelope Commissioning		1					CD	A			A				
EE 3.3	Enhanced Commissioning		1					CD	A			A		A		
EE 4.0	Enviornmentally Preferable Refrigerants	P	1					CD								
EE 5.1	Energy Management System		2					CD								
EE 5.2	Advanced Energy Management System and Submetering		2					CD								
EE 6.1	Natural Ventilation and Energy Conservation Interlocks		2				PS	CD				A				
EE 7.0	Local Energy Efficiency Incentive and Assistance	P	2						A			A				
EE 8.1	Variable Air Volume Systems		1					CD								
EE 9.1	Renewable Energy Performance Monitoring		1					CD				A				
EE 10.1	Electric Vehicle Charging		1					CD				A				
	Subtotal															
Water																
WE 1.0	Minimum Reduction in Indoor Potable Water Use	P	5				PS	CD				A				
WE 2.1	Reduce Potable Water Use for Sewage Conveyance		4				PS	CD				A				
WE 3.0	Irrigation and Exterior Water Budget - Use Reduction	P	4					CD				A				
WE 4.1	Reduce Potable Water Use for Non-Recreational Landscaping		2					CD	A			A				
WE 5.1	Recuce Potable Water Use for Recreational Landscaping		1					CD				A				
WE 6.0	Irrigation Systems Commissioning	P	1						A			A				
WE 7.1	Rainwater Collection and Storage		2				PS	CD								
WE 8.1	Water Management System		2					CD				A				
	Subtotal															
Sites																
SS 1.0	Site Selection	P	2						A							
SS 2.1	Enviornmentally Sensitive Land		3				PS	CD	A							
SS 3.1	Minimize Site Distrubance		1				PS	CD								
SS 4.1	Construction Site Runoff Control and Sedimentation		1					CD				A				
SS 5.1	Poste Construction Stormwater Management		1				PS	CD				A				
SS 6.1	Central location		2				PS		A							
SS 7.1	Located Near Public Transportation		1						A							
SS 8.1	Joint-Use of Facilities		1					CD	A							
SS 9.1	Human-Powered Transportation		2				PS	CD				A				
SS 10.1	Reduce Heat Islands - Landscaping and Sites		1					CD								
SS 11.1	Reduce Heat Islands - Cool Roofs and Green Walls		1					CD				A				
SS 12.1	Avoid Light Pollution and Unnecessary Lighting		2					CD				A				
SS 13.1	School Gardens		1					CD	A			A				
SS 14.1	Use Locally Native Plants for Landscape		1				PS	CD								
SS 15.0	Site and Building Best Practices	P	2				PS	CD	A							
	Subtotal															
Materials and Waste Management																
MW 1.0	Storage and Collection of Recyclables	P	2					CD				A				
MW 2.0	Minimum Construction Site Waste Management	P	2					CD				A				
MW 2.1	Construction Site Waste Management		2					CD				A				
MW 3.1	Single Attribute - Recycled Content		2					CD			PS	A				
MW 4.1	Single Attribute - Rapidly Renewable Materials		1					CD			PS	A				
MW 5.1	Single Attribute - Certified Wood		1					CD			PS	A				
MW 6.1	Single Attribute - Materials Reuse		1					CD			PS	A				
MW 7.1	Multi-Attribute Materials Selection		2				PS	CD			PS	A				
MW 8.1	Building Reuse - Exterior		2					CD			PS	A				
MW 9.1	Building Reuse - Interior		1					CD			PS	A				
MW 10.1	Health Product Related Information Reporting		1					CD			PS	A				
MW 11.1	Locally Produced Materials		2					CD			PS	A				
	Subtotal															
		Total	**250**													

Rhode Island Addendum

Verification in Rhode Island will follow the requirements provided in the NE-CHPS. The Rhode Island Green Buildings Act requires that all new construction projects over 5,000 gsf, and all renovation projects over 10,000 gsf, constructed by a "public agency"... be designed and constructed to the LEED Certified or equivalent high performance green building standard. These rules are clarified by implementation regulations stating that LEED Equivalent Standards include High Performance Schools Standards, as required by the Rhode Island Department of Elementary and Secondary Education, as a condition of construction reimbursement. Additionally, School Construction Regulations established by the Rhode Island Department of Education (RIDE) include a 2% - 4% incentive for approved projects that demonstrate both energy and water efficiency cost reduction beyond the minimum school construction threshold requirements as defined in NE-CHPS. The Energy and Water Efficiency Inventive stipulates:

Districts are eligible for 2% additional reimbursement funds for projects that achieve energy efficiency 30% above the RI Building Energy Code; 3% additional reimbursement for energy efficiency 40% above the RI Building Energy Code; and 4% additional reimbursement for energy efficiency 50% above the RI Building Energy Code. For purposes of Rhode Island School construction regulations, this addendum clarifies that the term "RI Building Energy Code" henceforth shall be defined as the 2009 International Energy Conservation Code.

Projects utilizing NE-CHPS should refer to the table below in order to determine their performance relative to the RI Building Energy Code. This is because school construction incentives shall be granted relative to the 2009 International Energy Conservation Code (IECC), but NE-CHPS 4.0 is based on the 2018 version.

Points	**NE-CHPS Reduction Requirement (IECC 2015)**	**zEPI Equivalent**	**Reduction from RI Code (Anchored to IECC 2009)**
Prerequisite	10% minimum reduction	49	23.5%
12 points	20% minimum reduction	43	32%
18 points	30% minimum reduction	38	40.5%
22 points	40% minimum reduction	32	49%
25 points	50% minimum reduction	27	57.5%
28 points	60% minimum reduction	22	66%
31 points	70% minimum reduction	16	74.5%
34 points	80% minimum reduction	11	83%
37 points	90% minimum reduction	5	91.5%
40 points	100% minimum reduction (zero net-energy school)	0	100%

Rhode Island's School Construction Regulations and further information can be found at: http://www.ride.ri.gov/Finance/Funding/construction/

RI High Performance Schools Scorecard Addendum

Section	Description	Comments
II 2.1- District Level Commitment	**Prerequisite**	CHPS membership is available at no cost.
II 3.1 Facilities Master Plan	**Prerequisite**	Also required for RIDE "Necessity of School Construction Application"
II 4.1 High Performance Transition Plan (HPTP)	**Prerequisite**	Local Educational Authority (LEA) should notify RIDE (emails below), not CHPS, of plan's progress
II. 6.1 Educational Integration	**Prerequisite**	Should align with Rhode Island Environmental Educator's Association's School as a Tool Protocol
OM 11.1 Computerized Maintenance Management System	**Prerequisite**	
EQ 8.0 Radon	**Prerequisite**	State Law Requires
EE 7.0 Energy Efficiency Incentives	**Additional Resource**	Link to: Rhode Island's incentive/rebate programs
EE Energy/Water Efficiency	**Demonstrate 30% energy and water reduction beyond code**	Eligible for 2% additional reimbursement funds
EE Energy/Water Efficiency	**Demonstrate 40% energy and water reduction beyond code**	Eligible for 3% additional reimbursement funds
EE Energy/Water Efficiency	**Demonstrate 50% energy and water reduction beyond code**	Eligible for 4% additional reimbursement funds

Rhode Island School as a Tool Protocol
SCHOOL/DISTRICT Agreement

SCHOOL/DISTRICT ____

By this agreement, the SCHOOL/DISTRICT commits to implementing the School as a Tool / RI Sustainable Schools Protocol, pursuant to the RIDE School Construction Program.

The SCHOOL/DISTRICT has extensive infrastructure ideal for the School as a Tool protocol. The school itself can become a hands-on teaching tool to enable instruction about the benefits of high-performance design as well as to help prepare an environmentally literate student body. According to the RI Environmental Literacy Plan (2011), an environmentally literate student is one who has "the opportunity to become aware, inquire, investigate, and develop responsible citizenship action plans or behavior regarding local, national, or global environmental issues." In preparing environmentally literate students, RI schools and communities also "have the opportunity to concurrently improve students' proficiency" in core academic areas.

The SCHOOL/DISTRICT will develop the School as a Tool program by integrating sustainability through curriculum, campus, and community as outlined in the five (5) components below.

I. Establish a Green Team

The SCHOOL/DISTRICT will assemble a motivated and empowered group of stakeholders including, but not limited to, principals, teachers, facility managers, students, nurses, and/or parents. The Green Team will:

- adopt an environmental vision statement specific to the SCHOOL/DISTRICT.
- plan and develop an action plan to be shared with all stakeholders.
- meet on a regular basis to implement, and monitor the action plan.
- coordinate and direct School as a Tool related initiatives and activities.

Resources for establishing a green team:

- *Green Schools Initiative: http://greenschools.net/*
- *Healthy Schools Campaign: http://www.greencleanschools.org/*
- *RIC Green Initiatives: http://www.ric.edu/green/*
- *URI Green Team: http://www.uri.edu/sustainability/greenteams.php*
- *The Green Team (Massachusetts): http://www.thegreenteam.org/*
- *Eco-Schools: http://www.eco-schools.org/*

II. Conduct a School Environment Survey

Students and teachers will engage in data collection to acquire information about the SCHOOL/DISTRICT that will inform their forthcoming decisions.

- The survey might collect data on: greenhouse gas emissions; water quality and conservation; waste production and disposal; recycling; transportation methods; pest management; air quality; cleaning products and chemical management; physical fitness and outdoor time; food and nutrition; environmental education activities; and more.

Resources for conducting a school environment survey:

- *RI Green Ribbon Schools Online Application: http://www.ride.ri.gov/finance/funding/construction/schoolconstruction.aspx*
- *Green Flag Schools' The School Environment Survey: http://www.greenflagschools.org/Survey.pdf*
- *US EPA Healthy School Environment Resources: http://cfpub.epa.gov/schools/index.cfm*
- *Energy Education & Workforce Development: http://www1.eere.energy.gov/education/lessonplans/default.aspx*

III. Integrate Environmental Literacy into the Existing Curriculum

Using the school as a hands-on laboratory and integrating environmental education activities into science, math, civics and government, engineering and technology, language arts, art, and elective courses provides abundant opportunity for real world problem solving and instruction on the benefits of the SCHOOL/DISTRICT's sustainable building. The following section describes five (5) key elements in the School as a Tool program, each followed by examples of how the SCHOOL/DISTRICT may integrate them into the curriculum.

- Integrate environmental and sustainability concepts throughout the curriculum. Examples include:
  - creating environmental education units and lesson plans aligned to state and national standards (i.e. Common Core State Standards, Grade Level Expectations/Grade Span Expectations, etc.).
  - using sustainability and the environment as a context for learning science, technology, engineering and mathematics thinking skills and content knowledge.
  - establishing opportunities for interdisciplinary learning about the key relationships between environmental, energy and human systems.
  - allowing students to undertake study of environmental and sustainability themes such as energy, water, forest, pollution, and waste.
  - providing real-world contexts and relevant issues by using the facility as a teaching tool for indoor environmental quality, energy efficiency, renewable energy, and more.
  - involving the entire school in initiatives such as saving water, recycling, and saving energy.
  - using sustainability and the environment as a context for learning green technologies and career pathways.
  - offering environmental science courses.
- Integrate environmental literacy into student exhibitions, portfolios, and course assessments. Examples include:
  - incorporating environmental and sustainability concepts into classroom based and school wide assessments.
  - allowing students' civic and community engagement projects to focus on environmental and sustainability topics.
  - creating an environmental or sustainability literacy graduation requirement.
- Provide and/or promote professional development opportunities in environmental and sustainability education for all teachers.
- Promote outdoor education and time spent in nature. Examples include:
  - using the school yard, parks, and/or field trips to engage students in meaningful outdoor learning experiences at every grade level.
  - using outdoor settings to teach an array of subjects in contexts, engage the broader community, and develop civic skills.
- Increase alignment to North American Association for Environmental Education's (NAAEE) Guidelines for Learning.

Resources for integrating environmental literacy into the existing curriculum:

- *RI Environmental Literacy Plan: http://rieea.org/images/stories/RI/documents/ri_elp_plan_2011.pdf (NEEDS TO BE UPDATED)*
- *NAAEE's Guidelines for Learning: http://eelinked.naaee.net/n/guidelines/topics/Excellence-in-EE-Guidelines-for-Learning-K-12*
- *Green Ribbon Schools: http://www2.ed.gov/programs/green-ribbon-schools/index.html*
- *Green Strides Resources: http://www2.ed.gov/about/inits/ed/green-strides/resources.html*
- *PLT Green Schools! Program: http://www.plt.org/about-project-learning-tree-greenschools-program*
- *Green Education Foundation: http://www.greeneducationfoundation.org/*

IV. Inform and Involve the Community

The SCHOOL/DISTRICT will facilitate communication about the School as a Tool program within and outside of the whole school community. Such activities can include:

- partnering with external organizations to implement the School as a Tool program.
- operating an information kiosk in the community where information pertaining to the School as a Tool program is regularly updated.
- developing a website/webpage to update the community on the School as a Tool program.

- organizing a semi-annual or annual event to showcase the ways in which students are involved in the School as a Tool program.
- conducting educational workshops for school personnel, parents, students, and/or community members.

Resources for informing and involving the community:
- *RI Environmental Education Association: http://rieea.org/*
- *Sustainable Schools Network: http://www.apeiron.org/new/education/rissn.php*
- *Earth Day Network: http://edu.earthday.org/*

V. Monitor and Evaluate Progress

By gathering and analyzing information and data initiated through the School as a Tool program, the SCHOOL/DISTRICT will be able to measure progress, inform future decisions, and even promote the program when applying for recognition or funding. Such activities can include:
- conducting an annual school survey of teachers, students, parents, and other project partners.
- facilitating an annual meeting or seminar to obtain feedback from project partners.

Resources for monitoring and evaluating progress:
- *Educational Survey Templates: http://www.surveymonkey.com/mp/education-survey-templates/*
- *School Survey Templates: http://www.websurveymaster.com/1-School-Survey-templates-*

VI. Apply to the Green Ribbon Schools Program

The SCHOOL/DISTRICT will apply for a Green Ribbon Schools Award, a national program that recognizes schools that save energy, reduce costs, feature environmentally sustainable learning spaces, protect health, foster wellness, and offer environmental education to boost academic achievement and community engagement.

Resources for applying to the Green Ribbon Schools Program:
- *Online Application: http://www.ride.ri.gov/finance/funding/construction/schoolconstruction.aspx*
- *US Department of Education Green Ribbon Schools: http://www2.ed.gov/programs/green-ribbon-schools/index.html*

Timeline

By ________________________ , the SCHOOL/DISTRICT will submit an environmental vision statement, action plan, roster, and meeting schedule.

By ________________________ , the SCHOOL/DISTRICT will submit the results from the school environment survey.

By ________________________ , the SCHOOL/DISTRICT will submit a preliminary proposal for how it will integrate environmental literacy into the curriculum; inform and involve the community; and monitor and evaluate progress.

By ________________________ , the SCHOOL/DISTRICT will submit a final program description for how it will integrate environmental literacy into the curriculum; inform and involve the community; and monitor and evaluate progress.

By ________________________ , the SCHOOL/DISTRICT will implement the approved program.

By ________________________ , the SCHOOL/DISTRICT will apply to the Green Ribbons School program.

In addition, the SCHOOL/DISTRICT will welcome the opportunity to be active participants in sustainable schools opportunities in the future. These activities might include participation in sustainable schools meetings or hosting RIDE-sponsored events such as sustainable schools meetings.

____	______________________
Signature of SCHOOL/DISTRICT authorized representative	Date

____

Print name of SCHOOL/DISTRICT authorized representative

____

Title of SCHOOL/DISTRICT authorized representative

____

SCHOOL/DISTRICT