



GBI Proposed American National Standard 01-2008P: *Green Building Assessment Protocol for Commercial Buildings*

FIRST PUBLIC REVIEW DRAFT

This Standard – GBI Proposed American National Standard 01-2008P—provides a method of assessing commercial building projects in relation to commonly valued environmental and efficiency outcomes. This Standard is an assessment tool and does not purport to instruct users on the appropriate design, standards, applicable laws, codes or regulations for their building project(s). The use of the Standard does not establish, expressly or implicitly, the appropriate standard of care of licensed design or other professionals nor the appropriate duties and responsibilities of design, construction, or operations personnel.

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Information on the ANSI approved procedures used to develop this standard can be found at www.thegbi.org/commercial or by calling 1-877-GBI-GBI1. To submit comments on this draft standard, please use the Comment Form and follow the Instructions provided with the draft standard.

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Note that the Foreword and Appendices are informative only and do not contain mandatory requirements necessary for conformance to this standard. As such, they may contain material that has not been subjected to public review or a consensus process.

Referenced documents cited within the standard are mandatory unless they are clearly identified as being informational references. Adherence to documents identified as informational references is not mandatory.

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FOREWORD

Note that the information contained in this Foreword is not part of this standard. It does not contain requirements necessary for conformance to the standard. It has not been processed in accordance with American National Standards Institute's (ANSI) requirements for an ANS and may contain material that has not been subjected to public review or a consensus process.

The Green Building Initiative™ (GBI) is a not-for-profit organization that in 2005 became accredited as a standards developer by ANSI. GBI owns the U.S. license for Green Globes™—the first web-based and fully interactive green building rating system to encompass both design guidance, education and environmental assessments for commercial buildings. Green Globes™ is a unique green management tool in that it offers flexibility, ease-of-use and affordability, while maintaining its effectiveness as an approach to assess green building design, construction, and delivery processes.

Green Building Rating Systems and ANSI

Comprehensive green building rating systems have been used in North America for more than a decade. By using an ANSI process to review the Green Globes™ rating system, GBI has committed the system to further development through this third-party codified, consensus-based committee process. Following ANSI approved procedures provides balanced perspectives, transparency, and public input. This was the motivation behind GBI's decision to obtain ANSI accreditation and establish the rating system within Green Globes™ as an American National Standard.

Who Should Use this Standard

Owners, design teams, developers, contractors, lenders, institutions and various levels of government can apply this Standard to a broad range of commercial building types—such as office, multi-family, health care, schools, universities, labs, industrial, and retail. It does not apply to single-family homes, which are covered in the ANSI standard developed by the National Association of Home Builders (www.nahb.com) and the International Codes Council.

Flexibility and Regionality

Flexibility is built into this Standard to allow users to consider the whole building life cycle, regional climatic issues, and local laws and ordinances. Users are encouraged to strive for the highest number of assessed points possible for the building type, in keeping with the owners' goals and objectives and while considering the potential for future uses of the building and/or deconstruction approaches.

Obtaining Third-Party Assessment

GBI recommends that users pursue a Green Globes™ third-party assessed rating. This rating of one, two, three or four Green Globes™ corresponds to the Level 1, 2, 3, 4 outlined in the standard and can only be obtained by a building project after a GBI authorized third-party assessor reviews the *construction documents* and conducts an on-site walk-through of the building. To ensure that assessors are qualified, GBI works with CSA America, Inc. to provide the industry with an independently administered personnel certification program for individuals seeking approval as green building assessors. More information on this examination can be obtained at www.thegbi.org.

User Guidance and Application Support

This standard is intended to reach the broadest possible segment of the building community. Increasing the ease of use of green building standards is a priority. Therefore, GBI uses an on-line system to break this comprehensive process down into questionnaires and automated guidance to take users through the entire design and construction process from pre-design through final delivery (Green Globes™-New Construction). The GBI's online system also includes modules addressing operations and Continual Improvement of Existing Buildings (Green Globes™-CIEB).

To obtain a free 30-day trial of the Green Globes™ system, visit www.thegbi.org/commercial.

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1. PURPOSE

This standard provides a method of assessing commercial building projects in relation to commonly valued environmental and efficiency outcomes. While actual building performance and operational issues are addressed to some extent, GBI Proposed American National Standard 01-2008P: Green Building Assessment Protocol for Commercial Buildings addresses primarily the building design and delivery process.

2. SCOPE

This Standard provides criteria, methods of measurement, and methods of interpretation. The standard also includes a point-based assessment system. This point system allows users to identify solutions that earn points for outcomes likely to achieve levels of performance commonly valued as having desirable environmental and efficiency outcomes.

The seven areas of assessment within the Standard include Project Management, Site, Energy, Water, Resources, Emissions and Storage of Hazardous Materials, and Indoor Environment.

This Standard applies to a broad range of commercial building types (e.g. offices, multi-family, health care, schools, universities, labs, industrial, retail, etc.) as well as to major renovations. For the purposes of this Standard, a major renovation has occurred when 50% of the gross area (measured to the exterior footprint) of the building has been renovated. The Standard does not apply to single-family homes.

This standard shall not be used to circumvent any health, safety, security, or environmental requirements. It is the responsibility of the user of this Standard to establish appropriate safety and health practices, follow local codes, and assess the applicability of criteria based on other possible regulatory limitations prior to use.

3. ACHIEVEMENT LEVELS, MINIMUMS, PREREQUISITES, NON-APPLICABLES AND THIRD PARTY ASSESSMENTS

3.1 Achievement Levels

Levels of Achievement 1, 2, 3, and 4 are specified in Table 1 below. Adopting entities shall specify compliance Levels according to the Levels specified in Table 1.

TABLE 1

Levels	Percentage of Applicable Points Required Out of 1000 Possible Points	Description
Level 4	85-100%	Reserved for select building design and delivery processes which serve as national or world leaders in design and delivery focused on reducing environmental impacts.
Level 3	70-84%	Demonstrates leadership in design and delivery of energy and environmentally sensitive buildings and a commitment to continual improvement.
Level 2	55-69%	Demonstrates excellent progress in reducing environmental impacts by applying best practices in energy and environmental design and delivery.
Level 1	35%-54%	Demonstrates movement beyond awareness and a commitment to good energy and environmental design and delivery practices.

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3.2 Minimum Achievement Requirements

To achieve compliance in any of the four Levels, building design and delivery processes must:

1. attain a minimum of 35% of applicable points out of the 1000 possible points available; and
2. attain a minimum percentage of points in each environmental assessment areas as denoted in Table 2.

TABLE 2

Environmental Assessment Area	Total Points Available	Minimum Percentage of Points Required For Compliance at Each of the Four Levels*
Project Management	100	50
Site	120	24 (0 for <i>major renovations</i>)
Energy	300	Performance Path A: 150 Prescriptive Path B: 100
Water**	130	26
Resources/Materials	145	29
Emissions and Storage of Hazardous Materials	45	9
Indoor Environment	160	32
Total	1000 (less non-applicable points)	320 (when Energy Path A is followed) 270 (when Energy Path B is followed)
*Where points do not sum to a whole number, round up the points to the nearest whole number. **The Water Assessment Area has a unique method for calculating final point allocations. Please refer to section 9.1 for further information.		

3.3 Non-applicable Criteria.

Each environmental assessment area contains certain criteria that a design and delivery team may deem to be “non-applicable” to the project. Selecting “non-applicable” may be appropriate in the following circumstances as denoted in Table 3:

TABLE 3

Reasons for Use of Non-applicable Criteria	
1	If a criterion does not apply to the building type (e.g. there are no cooling towers; questions related to cooling towers would be designated non-applicable).
2	If a code or regulation overrides, conflicts with, or otherwise prevents compliance with a criterion.
3	If a criterion conflicts with best practices based on regional climatic differences.

Questions without a non-applicable option should be answered as appropriate for the building project.

4. ASSESSMENT OF COMPLIANCE

Assessment of compliance with a specific Level of Achievement (Table 1) can be established through third-party review of appropriate written plans, working drawings, specifications, site plans, energy modeling, life cycle assessment results, commissioning reports, *construction documents* and/or other data or documents that demonstrate conformance.

Items from the “Suggested Documentation” list in this Standard may be requested by authorized third parties to assess compliance. An on-site post-construction walk through is a component of third-party review.

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Note: Self assessment and periodic evaluation is used throughout the project as *design and delivery teams* strive to conform to higher achievement levels.

Informational reference (s):

- GBI/CSA Personnel Certification Program, www.thegbi.org
- ISO 17024 Conformity Assessment - General Requirements for Bodies Operating Certification of Persons
- GBI's Green Globes™ for New Construction (Green Globes-NC) and Green Globes™ for Continual Improvement of Existing Buildings (Green Globes-CIEB) environmental assessment and rating system, www.thegbi.org

5. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

5.1 Definitions

Note: Italicized words found throughout this Standard indicate that a definition for the term can be found in the Definitions section. Definitions not found in this section are found in referenced Standards contained in this Standard, and the user shall adhere to the meanings as defined in those Standards. Other terms not defined in this section nor in referenced Standards contained in this Standard shall have their ordinarily accepted meanings within the context in which they are used. Ordinarily accepted meanings are based upon American standard English language usage as documented in a comprehensive dictionary.

air economizer: system commonly found on a packaged rooftop heating and cooling system, which takes advantage of favorable weather conditions to reduce mechanical cooling by introducing cooler outdoor air into a building.

basis of design: a document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

baseline emission rate (BER): The baseline building represents the average U.S. commercial building for the proposed building's location when using data from the U.S. Department of Energy's Energy Information Administration's (EIA) "Commercial Building Energy Consumption Survey (CBECS)." The BER is expressed as the mass of CO₂e emitted per year per unit area of the total useful floor area of a building – kg/m²/yr (lb/ft²/yr).

bio-based product: commercial or industrial product grown or harvested utilizing at least 50% (by weight) sustainable, biologically-generated substances, including but not limited to cellulosic materials (wood, straw, natural fibers) and products made from crops (soy-based, corn-based).

brownfield: real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. (Some legal exclusions and additions may apply.)

building envelope: the elements of a building that separate the interior spaces from the outside, such as walls, roofs, floors, doors, and fenestration.

charrette: an intensive workshop in which various stakeholders and experts are brought together to address a particular design project. It is the mechanism that starts the communication process among the project team members, building users, and project management staff. A facilitated discussion allows the team to brainstorm solutions to meeting the building user's requests and the sustainability vision for the building design.

c-factor: the amount in British Thermal Units (Btu) that flows each hour through 1 ft² of surface area of material when there is a 1° temperature difference between the inside and outside air Btu/hr-ft²-F.

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construction documents: all of the written and graphic documents prepared or assembled by the architect/engineer for communicating the design and administering the project. The term “Construction Documents” also includes the Project Manual that contains the bidding forms and instructions, contract forms and conditions, and specifications, as well as documentation of all modifications made after the construction agreements are signed.

construction documents phase: the last stage of the design process. The Consultant Group is focused on finalizing the drawings and specifications for all components and systems of the building producing the Contract Documents. A complete set of Contract Documents provides a comprehensive, fully coordinated set of construction documents and specifications that the Contractor uses to determine a Guaranteed Maximum Price or lump sum price, obtain necessary permits and construct the project.

daylighting: the use of natural light to minimize the need for artificial lighting during the day using strategies such as effective *orientation* and placement of windows, use of light wells, light shafts or tubes, skylights, clerestory windows, light shelves, reflective surfaces, and shading, and the use of interior glazing to allow light into adjacent spaces.

dead legs: any area in a piping system where water can become stagnant and where water is not exchanged during flushing, allowing bacteria to contaminate the piping system. The modern piping design “six diameter rule” limits the length of any dead-end pipe to 6 times the pipe’s diameter or less.

demand-controlled ventilation: automatic ventilation control based on occupant demand.

design development phase: refines the scope of work previously approved in the schematic design phase. In this phase the project is developed to a level of detail necessary to work out a clear, coordinated description of all aspects of the project. Major elements including equipment, fire protection, mechanical, electrical, structural, telecommunications and plumbing systems are designed and coordinated through enlarged scale drawings, detailed elevations and plans, and design mock-ups as required.

direct daylighting: portion of daylight arriving at a specified location directly from the sun, without diffusion.

direct lighting: lighting provided from a source without reflection from other surfaces, which allows light to travel on a straight path from the sky (or the sun) to the point of interest, such as a ceiling-mounted or suspended luminaires with mostly downward light distribution characteristics.

district heating: the distribution of heat from one or more sources to multiple buildings.

disturbed area: area where natural vegetation and soils have been removed or disrupted.

drift eliminator: structure to control water lost from cooling towers as liquid droplets are entrained in the exhaust air, independent of the water lost by evaporation.

drought-tolerant plants: plants that can withstand long periods with little or no water and/or that have relatively low water requirements.

existing buildings: a building or portion thereof that was previously occupied or approved for occupancy by the authority having jurisdiction.

exterior vegetated space: the area exterior to the enclosure of the building that is covered by vascular and non-vascular plants at the peak of the growing season.

fenestration: building components that transmit light including windows, translucent panels, clerestory windows, skylights, glazed portions of doors, and glass block walls.

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f-factor: is the heat loss of a slab-on-grade that is proportional to the perimeter length of the slab. Btu/hr-ft-F.

global warming potential (GWP): an index, describing the radiative characteristics of well mixed greenhouse gases, that represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. This index approximates the time-integrated warming effect of a unit mass of a given greenhouse gas in today's atmosphere, relative to that of carbon dioxide.

greenfield: undeveloped lands such as fields or forests.

green design and delivery coordination process (GDDC Process): a process in which the project team is led by an individual and/or a team of individuals in the setting and ranking of measurable sustainable design and project delivery goals through an integrated process, and which facilitates reporting mechanisms to report to the team and owner on the progress made toward each goal, along with documentation of the process.

green design and delivery coordinator (GDDC Coordinator): the individual with primary responsibility for coordinating, facilitating, documenting and reporting on the green design and delivery coordination process.

green design and delivery coordination team (GDDC Team): the group of individuals selected or appointed to represent the various disciplines relevant to the project throughout the green design and delivery coordination process.

greywater: wastewater generated from showers, tubs, clothes washers, laundry sinks, and bathroom lavatory sinks.

grid displaced electricity: grid displaced electricity comprises all electricity generated in or on the building site by, for example PV panels, wind-power, combined heat and power systems (CHP), etc. The associated CO₂e emissions are subtracted from the total CO₂e emissions for the building before determining the PER. CO₂e emissions arising from fuels used by the building's power generation system (e.g., to power the CHP plant) must be included in the building's CO₂e emission calculations.

hazardous material: any element, compound, or combination thereof, which is flammable, corrosive, detonable, toxic, radioactive, an oxidizer, an etiologic agent, or highly reactive, and which, because of handling, storing, processing, or packaging, may have detrimental effects upon operating and emergency personnel, the public, equipment and/or the environment.

horizontal assemblies: applies to parking garages, and plaza deck-type applications over habitable spaces or on elevated structures, but not intended for use on building roofing systems.

impervious area: a hard surface area (e.g., parking lot) that prevents or retards the entry of water into the soil, thus causing water to run off the surface in greater quantities and at an increased rate of flow.

independent commissioning agent: a third party agent, not a member of the design team, typically under contract to the building owner to ensure objectivity.

indoor environmental quality: encompasses indoor air quality (IAQ), which focuses on airborne contaminants, humidity, as well as other health, safety, and comfort issues such as aesthetics, *potable water* surveillance, ergonomics, acoustics, lighting, and electromagnetic frequency levels.

integrated pest management: the use of different techniques used singly or in combination, such as selection of pest-resistant plant varieties, regular monitoring for pests, use of natural predators of the pest, to control pests, with an emphasis on methods that are least injurious to the environment and most specific to the particular pest.

interior zone: spaces located further than 4.57 m (15 ft) from the façade, which can be either high-occupancy (accommodating a number of work spaces) or low-occupancy (circulation or general meeting areas for example).

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Spaces within this zone are not directly affected by loads generated by the building envelope, such as solar heat gain or heat loss.

light pollution: any adverse effect of artificial light including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste.

low slope roofing: a roofing assembly applied to a roof deck having a slope less than or equal to 7.62 cm/m (3 in/ft)

low-VOC product: products with a low level of volatile organic compounds that have been positively correlated with better indoor air quality.

luminaire: a complete lighting unit, consisting of a lamp or lamps together with the components required to distribute the light, position the lamps, and connect the lamps to a power supply (often referred to as a “fixture”).

moisture resistant: the property of a building material or building system component that resists the uptake or passage of moisture from the air.

moisture sensors: devices that are designed to be fitted to automatic watering systems to prevent them from operating when it is raining (in the case of a rain sensor) or when the soil is wet (in the case of a soil moisture sensor).

net building area: the square footage area of all interior spaces as measured to the predominant interior surface of the outside wall and excluding mechanical, elevator and utility shafts but ignoring protrusions called by structural elements.

non-potable water: water that is not treated to drinking water standards and is not meant for ingestion. Non-potable water applications may include toilet and urinal flushing, irrigation or other applications deemed to be acceptable by manufacturers of related equipment and systems and authorities having jurisdiction.

off-site renewable electricity: green power or Renewable Energy Certificate’s (RECs) purchased from a third-party source such as an electrical utility. There is no physical renewable energy system either on site or specifically connected to the building.

on-site renewable electricity: a renewable energy system specifically connected to the building. Generally this is physically on the site, but it is conceivable that it could be physically located off the site as well e.g. adjacent property.

orientation: the relation of a building and its associated fenestration and interior surfaces to compass direction and, therefore, to the location of the sun, usually given in terms of angular degrees away from south, (e.g. a wall facing due Southeast has an orientation of 45 degrees east of south).

overhang: any horizontal projection that serves as a shading element for a window or wall.

perimeter zone: zone immediately adjacent to, and within 4.57 m (15 ft) of, the external façade. Perimeter spaces require special consideration in terms of their heating and cooling loads, which are significantly different to those of internal/core zone areas due to the influence of factors such as solar gain and fabric heat loss through the building envelope.

post-consumer recycled content: proportion of recycled material in a product generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose. This includes returns of material from the distribution chain. (See recycled material.)

potable water: water that is suitable for drinking.

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pre-consumer recycled content: proportion of recycled material in a product diverted from the waste stream during the manufacturing process. Content not considered to be pre-consumer recycled includes the re-utilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it (see recycled material).

predominantly wet climate zone: climate areas where the 12 month calculated soil moisture exceeds 600mm per year, as determined by the NOAA, where usage of an irrigation system is not necessary.

previously-developed area: land which is or was occupied by a permanent structure (excluding agricultural or forestry buildings), and associated fixed surface infrastructure.

projection factor: ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the farthest point of the external shading projection, in consistent units.

proposed emission rate (PER): PER is expressed as the mass of CO₂e emitted per year per unit area of the total useful floor area of the proposed building – kg/m²/yr (lb/ft²/yr).

recovered material: material that would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and recovered as a material input, in lieu of new primary material, for a recycling or a manufacturing process.

recycled content: proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer recycled materials are considered to be recycled content (see recycled material).

recycled material: material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product (see recovered material).

relative humidity: an indication of how moist air is, defined as the ratio of the water vapor density (mass per unit volume) to the saturation water vapor density, usually expressed as a percentage.

remediation: cleanup or other methods used to remove or contain a toxic spill, contamination or hazardous material.

renewable energy: energy that is continuously replenished on the earth such as wind and solar power, geothermal, hydropower, and various forms of biomass.

reuse: object or material that is used again, either for its original purpose or for a similar purpose, without significantly altering the physical form of the object or material.

room criteria (RC): a single-number simplification that describes background noise level that is a representation of the sound spectrum (RC). In addition to noise criterion (NC), it is often used as design targets for sound-sensitive spaces where the higher the number is, the louder the background noise levels. An example is RC-35 is a typical classroom design, RC-25 is a typical church design, and RC-15 is a typical concert hall or recording studio design.

schematic design phase: a critical phase where expectations are set, budget and schedule are established, and the project is submitted for approval (where applicable). Schematic Design determines the general scope, preliminary design, scale and relationships among the components of the project. The primary objective is to develop a clearly defined design with a comprehensive scope, budget and schedule.

service life: the expected lifetime of a product.

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sidelit daylit area: in a side daylit zone the depth of the window daylit zone extends perpendicular from the glazing into the space a distance of 4.6 m (15 ft), or the perpendicular distance from the glazing to the nearest 1.5 m (60 in) or higher permanent partition, whichever is less. The width of the window daylit zone is the smaller of the width of the window plus 0.6 m (2 ft) on each side, the width of the window plus the distance to a permanent partition and the width of the window plus one half the distance to the closest skylight or vertical glazing. For sidelit conditions, the effective daylit area can be calculated by multiplying the depth by the width of the daylit zone.

specialized activities: activities that generate pollutants, that may include but is not limited to, printing rooms, smoking areas, and areas that contain equipment such as photo process machines, clothing dryers, and grinding machines.

steep slope roofing: a roofing assembly applied to a roof deck having a slope greater than or equal to 7.62 cm/m (3 in/ft).

structural system: the load-resisting sub-system of a structure. The structural system transfers loads to the foundation or supporting structure through interconnected structural components or members.

sub-metering: fragmenting the utility metering of a building to determine the proportionate energy use of specific building systems and appliances.

Superfund site: a site that is on the U.S. Environmental Protection Agency's (USEPA) National Priority List (NPL) based on a scoring process that rates its current or potential health impact.

task lighting: light that is directed to a specific surface or area to provide illumination for visual tasks.

thermal efficiency: measure of the efficiency of converting a fuel to energy and useful work. Useful work and energy output is divided by the higher heating value of input fuel times 100 (for percent).

toplit daylit area: in a toplit daylit zone the daylit area is measured from the actual perimeter of the toplit glazing unit or skylight opening to a point expanding outward from each side a distance of 70% of the ceiling height. Areas of overlap with the daylit zone of a skylit or the daylit zone of vertical glazing can only be applied to one daylit zone. Light obstructed by a permanent partition that is 1.5 m (5 feet) high or taller is not considered as part of the daylit area.

u-factor: is the overall coefficient of heat transfer (conductivity) for all the elements of construction, as well as the environmental factors. Btu/hr-ft²-F.

vapor retarder: a membrane that restricts the migration of moisture by diffusion from an area of high humidity.

variable air volume (VAV) system: a system which maintains air flow at a constant temperature, by supplying varying quantities of conditioned air in different parts of the building according to the heating and cooling needs.

variable occupancy: a variance of 30% from design occupancy for a minimum of 30% of normally occupied hours.

waste heat: waste heat from industrial processes and power stations rated at more than 10MWe and with a power efficiency of greater than 35%.

wetland: 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.

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whole building commissioning or total building commissioning: a quality-focused process for enhancing the delivery of a project. The process focuses upon assessing and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

zone area: also known as a control zone for an HVAC system, a zone is defined as a space or group of spaces in a building having similar heating and cooling requirements throughout its occupied area so that comfort conditions may be controlled by a single thermostat.

5.3 Abbreviations and Acronyms

AAMA: American Architectural Manufacturers Association

AGC: Associated General Contractors of America

ARMA: Asphalt Roofing Manufacturers Association

ASTM: ASTM International

ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers

ATFS: American Tree Farm System.

CBECS: Commercial Building Energy Consumption Survey. Developed by the U.S. Department of Energy's Energy Information Administration (EIA)

EVO: Efficiency Valuation Organization

FYN: Florida Yards and Neighborhoods Program/University of Florida –IFAS Extension

GDDC: See Green Design and Delivery Coordination

HVAC&R: heating, ventilating, air-conditioning, and refrigerating.

ICC: International Code Council®.

IESNA: The Illuminating Engineering Society of North America.

ISO: International Organization for Standardization.

LCA: life cycle assessment

MERV: Minimum Efficiency Reporting Value

NEMA: National Electrical Manufacturers Association.

NIBS: National Institute of Building Sciences.

NIST: National Institute of Standards and Technology.

NO_x: oxides of nitrogen, produced by the burning of fossil fuels.

NREL: National Renewable Energy Laboratory.

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PCI: Pre-Cast/Prestressed Concrete Institute.

PEFC: Programme for Endorsement of Forest Certification.

SCAQMD: South Coast Air Quality Management District.

SMACNA: Sheet Metal and Air Conditioning Contractor's National Association.

SPRI: Single Ply Roofing Industry.

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ENVIRONMENTAL ASSESSMENT AREAS

6. PROJECT MANAGEMENT FOR GREEN DESIGN AND DELIVERY COORDINATION (GDDC)

6.1 Coordination and Benchmarking (28 points)

6.1.1 GDDC Pre-Design Green Design Meetings	
<p>6.1.1.1 Individuals that represent the disciplines listed below that are involved in the Work attended a planning session (which was in the form of a meeting, <i>charrette</i>, or workshop, and was conducted during pre-design of the project).</p> <ul style="list-style-type: none"> • Owner’s representative • <i>Green Design and Delivery Coordinator</i> • Architect • Contractor • Civil Engineer • Electrical Engineer • Energy Engineer • Lighting Designer/Illuminating Engineer • Mechanical Engineer - HVAC • Structural Engineer • Mechanical Engineer - Plumbing • Landscape Engineer • Facilities Manager • User Group Representative • Commissioning Agent • Interior Designer • Community Representative(s) 	4 points
6.1.2 GDDC Performance Goals	
<p>6.1.2.1 Performance goals were established at pre-design for the following:</p> <ul style="list-style-type: none"> • Green Design and Delivery Process (e.g. <i>milestones</i>, <i>timelines</i>, <i>community collaboration</i>, <i>third party ratings</i> etc...) • Building Envelope • Emissions and Storage of Hazardous Materials • Energy Efficiency • Environmentally Responsible Construction Activities • Environmentally Preferable Products • Indoor Environmental Quality • Materials Efficiency • Operations and Maintenance Manuals • Site Issues • Water Efficiency 	10 points
6.1.3 GDDC Progress Meetings for Design	

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<p>6.1.3.1 <i>GDDC</i> progress meetings were conducted with members of the <i>GDDC Team</i> prior to the completion of the following project development phases:</p> <ul style="list-style-type: none"> • <i>Schematic Design phase</i> • <i>Design Development phase</i> • <i>Construction documents phase</i> <p>Informational Reference (s) :</p> <ul style="list-style-type: none"> • Appendix A 	<p>Maximum = 6 points</p> <p>For each meeting, 2 points will be assigned to a maximum of 6 points.</p>
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6.1.4 <i>GDDC</i> Progress Meetings for Construction	
<p>6.1.4.1 <i>GDDC</i> progress meetings were conducted with members of the <i>GDDC Team</i> prior to the completion of the following project development phases:</p> <ul style="list-style-type: none"> • Pre-Construction Conference • 25% Completion of budget or schedule • 50% Completion of budget or schedule • Substantial Completion <p>Informational Reference (s) :</p> <ul style="list-style-type: none"> • Appendix B 	<p>Maximum = 8 points</p> <p>For each meeting, 2 points will be assigned to a maximum of 8 points.</p>

6.1.5 Suggested Documentation	
<ul style="list-style-type: none"> • List of written <i>GDDC</i> performance goals; • <i>GDDC</i> Progress Meeting agendas and meeting minutes. 	

6.2 Environmental Management During Construction (16 points)

6.2.1 Environmental Management Systems (EMS)	
<p>6.2.1.1 An Environmental Management System (EMS) to be used by the general contractor included, but was not limited to, the following topics as per the AGC’s “Constructing an Environmental Management System: Guidelines and Templates for Contractors:”</p> <ul style="list-style-type: none"> • Action Plan • Training and Awareness • Communication • Emergency Preparedness and Response 	<p>5 points</p>

6.2.2 Building Materials and Building Envelope	
<p>6.2.2.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • Building materials made of organic matter (such as wood or plasterboard) or those that collect organic matter (such as leaves or insects) were protected at the construction site and in transit. • The <i>building envelope</i> was weather-tight and permitted to dry before installation of interior walls, wood floors or ceilings or HVAC systems. 	<p>Maximum = 2 points</p> <p>For each criteria met, 1 point will be assigned to a maximum of 2 points.</p>

6.2.3. Indoor Air Quality	
<p>6.2.3.1 The following following measures were implemented:</p> <ul style="list-style-type: none"> • Ventilation system components, insulation, and vapor retarders were clean, dry 	<p>Maximum = 3 points</p> <p>For each criteria met, 1 point</p>

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<p>and under cover until installed.</p> <ul style="list-style-type: none"> • HVAC was not used for heating, cooling or humidity control during construction, noting that portable heaters, fans or cooling units may be used. • Air-tight covers were installed over diffusers, registers, grilles, and open ducts during construction and after installation and not removed until major construction was completed. 	will be assigned to a maximum of 3 points.
<p>6.2.3.2 The following measures were implemented:</p> <ul style="list-style-type: none"> • The building was flushed with 100% outdoor air for 14 consecutive calendar days immediately prior to occupancy. Air filters were changed before the building was occupied. <p>OR</p> <ul style="list-style-type: none"> • A Baseline Indoor Air Quality test was conducted after construction showing acceptable air quality. 	4 points
<p>6.2.3.3 For renovations and additions, the following measure was implemented:</p> <ul style="list-style-type: none"> • Air and dust contaminants (including odors or irritants generated during renovations) were controlled by one or more of the following five basic strategies outlined in SMACNA'S "IAQ Guidelines for Occupied Buildings Under Construction": <ul style="list-style-type: none"> - HVAC protection - Source control - Pathway interruption - Housekeeping - Scheduling 	2 points
6.2.3.4 Suggested Documentation	
<ul style="list-style-type: none"> • EMS plan to be used by the General Contractor; • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets and performance documentation; • Photographs of protected building materials; • Baseline Indoor Air Quality test; 	

6.3 Whole Building Commissioning (42 points)

6.3.1 Pre-Commissioning	
<p>6.3.1.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • The owner's project requirements for building systems were documented in accordance with ASHRAE Guideline 0-05: ANNEXES I and J. • The building's <i>basis of design</i> for building systems was documented in accordance with ASHRAE Guideline 0-05: ANNEX K. • An Independent Commissioning Authority reported directly to the owner. 	3 points

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6.3.2 Whole Building Commissioning	
6.3.2.1 The <i>Building envelope</i> (roofing assemblies, waterproofing assemblies, fenestrations and doors and cladding/skin) was commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	5 points
6.3.2.2 The HVAC&R Systems were commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	5 points
6.3.2.3 The <i>Structural System</i> was commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	4 points
6.3.2.4 The Fire Protection System was commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	4 points
6.3.2.5 The Plumbing System was commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	3 points
6.3.2.6 The Electrical Systems was commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	3 points
6.3.2.7 The Lighting System was commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7.	3 points
6.3.2.8 The following building systems were commissioned in the pre-design, design and construction phase in accordance with ASHRAE/NIBS Guideline 0-05: Article 5, 6 and 7. <ul style="list-style-type: none"> • Interior Systems • Elevating and Conveying Systems • Communication Systems 	Maximum = 6 points For each building system commissioned, 2 points will be assigned to a maximum of 6 points.
6.3.2.9 Building system specifications were commissioned in accordance with ASHRAE Guideline 0-05: ANNEX L.	3 points
6.3.2.10 Training on commissioned systems took place in accordance with ASHRAE Guideline 0-05: Article 7.2.14.	3 points
6.3.2.11 Suggested Documentation	
<ul style="list-style-type: none"> • Commissioning reports; • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets and performance documentation. 	

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6.4 Environmental Management – Post Construction (14 points)

<p>6.4.1 Operations and Maintenance Manuals</p> <p>6.4.1.1 An Operations and Maintenance Manual was written that included the following plans, protocols, contracts and strategies:</p> <ul style="list-style-type: none"> • Calibration Strategy for Outdoor and Exhaust Air Dampers • Carbon Dioxide Monitoring Protocol • Carbon Monoxide Monitoring Protocol • Chemical Management and Minimization Policy • Cooling Tower Operating Agreement • Energy Metering Reporting Plan • Food and Material Waste Reduction Plan • Frost Mitigation Strategy for Ventilation Heat Recovery • Low-Impact Site and Green Building Exterior Management Plan • Operating Schedule for all EPA WaterSense/Smart Water Application Technology (SWAT) smart controllers (ET or soil moisture sensors) and automatic rain shut off devices. • Pest Reduction Plan • Site Maintenance Contract • Waste Minimization Plan • Water Efficiency Measurement and Verification Plan <p>Informational Reference (s) :</p> <ul style="list-style-type: none"> • Green Guide for HealthCare: Version 2.2; • GreenScapes for Large-scale Landscapes, U.S. EPA. • Appendix C to L 	<p>Maximum = 14 points</p> <p>For each plan, protocol, contract and/or strategy, 1 point will be assigned, to a maximum of 14 points.</p>
<p>6.4.2 Suggested Documentation</p> <ul style="list-style-type: none"> • Operations and Maintenance Manual (including all plans, protocols, strategies and contracts). 	

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7. SITE

7.1 Site Development Area (35 points)

7.1.1 Urban Infill, Urban Sprawl and Public Transportation	
7.1.1.1 The building was constructed within a commercial zone or within 0.805 km (0.5 mi) of a commercial zone.	5 points
7.1.1.2 The site was located within 0.402 km (0.25 mi) of a public transportation facility such as a bus stop or commuter train-stop.	5 points
7.1.1.3 The following measures were implemented: <ul style="list-style-type: none"> • The site was located within 0.402 km (0.25 mi) of a public bicycle path. • A bicycle rack was provided for at least 5% of the maximum number of potential building occupants. • The site has sidewalk access. 	Maximum = 3 points For each measure implemented, 1 point will be assigned to a maximum of 3 points.
7.1.1.4 The building was constructed on a <i>previously developed</i> site that was served by existing utilities (electric power, water, and sewer) for a full year before construction began.	2 points

7.1.1.5 Suggested Documentation
<ul style="list-style-type: none"> • Site civil plans and existing site civil plans; • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets and performance documentation; • Landscaping plans.

7.1.2 Greenfields, Brownfields and Floodplains	
7.1.2.1 The building was constructed on a remediated <i>brownfield</i> or remediated <i>Superfund site</i> .	15 points
7.1.2.2 The undeveloped site was not farmland, a public park, a wooded area, prairie, or recreational area for at least 3 years before construction began.	3 points or n/a
7.1.2.3 The bottom of the lowest habitable space was located higher than the 100-year flood plain.	2 points

7.1.2.4 Suggested Documentation
<ul style="list-style-type: none"> • Site civil plans and existing site civil plans; • EPA documentation of Superfund and Brownfield site; • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets and performance documentation; • Floodplain map.

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7.2 Ecological Impacts (23 points)

7.2.1 Site Disturbance and Erosion	
<p>7.2.1.1 The following set of strategies were used during construction:</p> <ul style="list-style-type: none"> • Silt fences were installed or fiber socks were filled with compost/wood chips around the construction site and were maintained throughout construction. • Gravel pads were placed at all site entries and were cleaned throughout construction. • Riprap was placed around all storm sewer outlets and silt and debris were removed after each 24-hour rainfall of 5.08 mm (0.2 in) or more. • Disturbed soil was corrected using erosion control mats, or was mulched and seeded within 90 days of being disturbed. • During dry days dust was controlled by wetting the soil each day for 15 to 30 minutes before construction activities began, and again after construction activities were done for the day. <p>OR</p> <ul style="list-style-type: none"> • The civil engineer provided an erosion and sedimentation control plan that met or exceeded all requirements outlined by the U.S EPA’s “Sediment and Erosion Control: An Inventory of Current Practices, National Pollutant Discharge Elimination System (NPDES) Permit Program” and was fully implemented by the general contractor. 	<p>Maximum = 5 points or n/a</p> <p>For each strategy implemented, 1 point will be assigned to a maximum of 5 points.</p>
<p>7.2.1.2 Construction fences were installed around trees and shrubs that were to be retained on the site, and extended at least 1.5 times the radius of the drip line to protect plant roots.</p> <p>OR</p> <ul style="list-style-type: none"> • A certified arborist provided a tree preservation plan that was fully implemented by the general contractor. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • National Park Service/US Department of the Interior: WeedUS Database. 	<p>2 points or n/a</p>
<p>7.2.1.3 Construction activities did not go beyond 12.2 m (40 ft) of the building footprint and remained within 1.5 m (5 ft) of parking lots, roadways, sidewalks and utility right-of-ways except where the intent of the construction activities was one or more of the following:</p> <ul style="list-style-type: none"> • To remove invasive plant species. • To replace parking lots, driveways, or sidewalks with vegetated spaces. • To restore prairie or <i>wetlands</i>. • To increase on-site water retention by building rain gardens, swales, retention ponds, or berms. 	<p>2 points</p>
7.2.1.4 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Photo-documentation; • Manufacturer’s specifications, cut sheets, and performance documentation; • Site civil plans; • Landscape plans. 	

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7.2.2 Heat Island Effect	
7.2.2.1 Vegetated space was increased by 10% (expressed as a percent of the total site area) and did not contain invasive species.	2 points or n/a
7.2.2.2 The following measures were implemented: <ul style="list-style-type: none"> • 40% or more of the <i>low slope roof</i> cover was installed with a vegetated roof and/or roofing surface/material having a Solar Reflectance Index (SRI) of 70 or higher. OR • 40% or more of the <i>steep slope roof</i> cover was installed with a vegetated roof or a roofing surface/material having an SRI of 25 or higher. 	Maximum = 6 points 40% - 55% = 2 points 56% - 70% = 4 points >71% = 6 points
7.2.2.3 For sites with more than 30% paved surfaces (including parking lots, sidewalks and driveways), a minimum of 50% of the paved surfaces had an SRI of 25 or higher.	3 points or n/a
7.2.2.4 For sites with more than 30% paved surfaces (including parking lots, sidewalks and driveways), a minimum of 50% of all surfaces were shaded by trees.	3 points or n/a
7.2.2.5 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Landscape plans; • Civil site plans; • Roofing plans. 	

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7.3 Watershed Features (27 points)

7.3.1 Storm Water Runoff	
<p>7.3.1.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • At least 70% of the storm water runoff from the roof, parking lots, and sidewalks was diverted to a rain garden or swale, retention basin or permeable pavement before it reached the storm sewer. <ul style="list-style-type: none"> - For sites with silt and/or sandy soils (as determined by a 24-hour, 15.2 cm (6 in) percolation test) rain gardens, swales or permeable pavement covered by no more than 20% of the site area. - For sites where the average monthly rainfall during the wet season does not exceed 15.2 cm (6 in), the retention basin or permeable pavement was sized to accommodate at least 3.8 cm (1.5 in) of rain water released on site in a 24-hour period. - For sites with higher average monthly rainfall during the wet season, the retention basin or permeable pavement was sized to accommodate at least 6.4 cm (2.5 in) of rain water released on site in a 24-hour period. <p>OR</p> <ul style="list-style-type: none"> • The civil engineer provided calculations to demonstrate the site, once plantings have been established for five years, can hold a 24-hour rain event as defined by the International Plumbing Code without releasing any discharge to storm sewer or to adjacent properties and the water quality will be improved over pre-construction runoff. 	10 points
<p>7.3.1.2 Site boundaries were not located within 30.5 m (100 ft) of a body of water, unless where retention ponds, restored <i>wetlands</i>, man-made water features received all storm water run-off or where site boundaries had permanent continuous earth or concrete berms that rose at least 40.6 cm (16 in) higher than surrounding grade to prevent runoff.</p>	8 points
<p>7.3.1.3 A vegetated roof was installed on at least 35% of the roof area.</p>	<p>Maximum = 9 points</p> <p>35% -50% = 6 points 51% – 60% = 7 points 61% – 75% = 8 points >75% = 9 points</p>
7.3.1.4 Suggested Documentation	
<ul style="list-style-type: none"> • Roofing plans; • Percolation test results; • Site plans; • Area rainfall charts; • Storm water discharge plan. 	

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7.4 Site Ecology (28 points)

7.4.1 Landscape and Irrigation

For section 7.4.1, complete the most applicable of the following six paths.

PATH 1	
7.4.1.1 Site has impervious surfaces outside the building footprint, and therefore no potential to landscape or irrigate.	0 points If 7.4.1.1 is applicable, proceed to 7.5.1
Path 2	
7.4.1.2 100% of the <i>exterior vegetated space</i> was left in its natural state and was not irrigated. Exterior space means outside the building footprint and paved areas	28 points If 7.4.1.2 is applicable, proceed to 7.5.1
Path 3	
7.4.1.3 75% of the <i>exterior vegetated space</i> was left in its natural state and was not irrigated.	21 points If 7.4.1.3 is applicable, proceed to 7.4.1.3.1.
7.4.1.3.1 Complete 7.4.1.7 to 7.4.1.18 for additional points.	Maximum points = points obtained from 7.4.1.7 to 7.4.1.8.5) *0.25
Path 4	
7.4.1.4 50% of the <i>exterior vegetated space</i> was left in its natural state and was not irrigated.	14 points If 7.4.1.4 is applicable, proceed to 7.4.1.4.1.
7.4.1.4.1 Complete 7.4.1.7 to 7.4.1.18 for additional points.	Maximum points = points obtained from 7.4.1.7 to 7.4.1.8.5)*0.50
Path 5	
7.4.1.5 25% of the <i>exterior vegetated space</i> was left in its natural state and was not irrigated.	7 points If 7.4.1.5 is applicable, proceed to 7.4.1.5.1.
7.4.1.5.1 Complete 7.4.1.7 to 7.4.1.18 for additional points.	Maximum points = points obtained from 7.4.1.7 to 7.4.1.8.5)*0.75
Path 6	
7.4.1.6 All <i>exterior vegetated spaces</i> were landscaped and/or irrigated.	0 points If applicable, proceed to 7.4.1.7.
7.4.1.7 Landscaping	

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<p>7.4.1.7.1 A Landscape and Irrigation Plan was developed by a landscape architect or certified horticulturalist.</p> <p>Informational Reference (s):</p> <ul style="list-style-type: none"> Florida Yards and Neighborhood’s Program: “A Guide to Florida Friendly Landscaping: Florida yards and Neighborhoods Handbook.” 	2 points
<p>7.4.1.7.2 The plant palette included the following measures:</p> <ul style="list-style-type: none"> Site characteristics (e.g. soil type, drainage). Structural limitations (e.g. utilities, <i>overhangs</i>, lights). Plants were from a local or regional plant list such as from a university, water agency or nursery growers association. Moderate to high drought tolerant plants were used. Salvaged plants were identified as non-invasive. New planting were native and/or non-invasive (as defined by the National Parks Service/Department of the Interior’s WEEDUS Database). Turf grass was limited to within 6.1 m (20 ft) of buildings and does not extend beyond 1.5 m (5 ft) from parking lots, driveways, walkways, rain gardens, swales, and retention ponds. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> Florida Yards and Neighborhood’s Program: “A Guide to Florida Friendly Landscaping: Florida yards and Neighborhoods Handbook.” 	8 points
<p>7.4.1.7.3 Landscaped areas were installed with at least 15.2 cm (6 in) of soil and were aerated, tilled and/or broken up.</p>	1 point
<p>7.4.1.7.4 Landscaped areas, not including preserved or natural areas, were mulched with locally approved environmentally-preferable organic mulch. Mulch was applied 7.6 cm to 10.2 cm (3 to 4 in) deep around plants and trees, with 5.1 cm (2 in) clear around each plant.</p> <p>Informational Reference (s):</p> <ul style="list-style-type: none"> State or local university college landscape reference guide; State or local agency landscaping landscape reference guide; Florida Yards and Neighborhood’s Program: “A Guide to Florida Friendly Landscaping: Florida Yards and Neighborhoods Handbook.” 	1 point
<p>7.4.1.7.5 Plants with similar water requirements were grouped. The plants were grouped and spaced to allow for maturation at a 5-year growth rate.</p>	2 points
<p>7.4.1.7.6 Retained trees, clusters of trees and undergrowth were integrated into the landscape plan.</p>	3 points
<p>7.4.1.7.7 15% of planned impervious walkways, patios and driveways were installed with porous materials such as bricks, gravel, turf-block, mulch, or pervious concrete.</p>	1 point

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7.4.1.8 Irrigation	
7.4.1.8.1 The need for irrigation or watering of <i>exterior vegetated spaces</i> was eliminated through plant selection, site design and landscaping practices that preserve the natural environment.	Maximum = 10 points or n/a n/a in <i>predominantly wet climate zones</i> where irrigation is not necessary. Only applicable for paths 3 through 6. If 7.4.1.8.1 is applicable, proceed to 7.5.1. If 7.4.1.8.1 is not applicable, Proceed to 7.4.1.8.2.
7.4.1.8.2 One or more of the following permanent irrigation systems were installed: <ul style="list-style-type: none"> • A permanent irrigation system with an onsite cistern and/or rainwater harvesting system. • A permanent irrigation system capable of using only reclaimed water from building services. • Gutter downspouts and roof runoff not directed to rainwater harvesting systems were designed to be directed into planted areas or other landscape features capable of retaining runoff. 	Maximum = 3 points or n/a n/a in <i>predominantly wet climate zones</i> where irrigation is not used. For each permanent irrigation system installed, 1 point will be assigned to a maximum of 3 points.
7.4.1.8.3 Swing joints or flex pipes were used on all in-ground irrigation heads.	1 point n/a in <i>predominantly wet climate zones</i> where irrigation is not used
7.4.1.8.4 EPA WaterSense/Smart Water Application Technology (SWAT), smart controllers (ET or soil <i>moisture sensors</i>) and automatic rain shut off devices were installed.	1 point n/a in <i>predominantly wet climate zones</i> where irrigation is not used
7.4.1.8.5 The irrigation system design and installation met the Irrigation Association’s “Turf and Landscape Irrigation Best Management Practices”: section 2, 3, and Appendix B.	5 points or n/a n/a in <i>predominantly wet climate zones</i> where irrigation is not used

7.4.1.9 Suggested Documentation	
<ul style="list-style-type: none"> • Pre-Construction documentation of site; • <i>Construction documents</i>; • Landscape architect /designer approved Landscape and irrigation plan; • Plant palette; • Manufacturer’s specifications, cut sheets, and performance documentation; • Local or regional plant list; • Site plans. 	

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7.5 Exterior Light Pollution (7 points)

7.5.1 Exterior Light Pollution	
7.5.1.1 All exterior lighting fixtures aimed at angles other than straight down had a combined output of 10,000 lumens or less, except where lights were required by codes or government officials for safety or security.	3 points
7.5.1.2 All exterior lighting fixtures with lamps having a mean output of 10,000 lumens or more were full cutoff types (as defined by IESNA) and were aimed straight down except where lights were required by codes or government officials for safety or security.	2 points
7.5.1.3 The following measures were implemented: <ul style="list-style-type: none"> • All full cutoff fixtures aimed straight down were located at a distance of at least twice their mounting height from the property line. • All output from fixtures are limited to 0.5 foot-candles on adjacent properties. OR <ul style="list-style-type: none"> • An electrical engineer provided a site lighting plan that graphically shows that reflected light on adjacent properties is limited to less than 0.5 foot-candles from all on-site fixtures. Additionally, all walls and roofs illuminated by these lights were located at a distance of at least twice their mounting height from the property line. 	2 points

7.5.2 Suggested Documentation
<ul style="list-style-type: none"> • Exterior lighting plans; • Electrical Engineer’s site lighting plan with illumination map.

8. ENERGY

Performance Design Option	Prescriptive Design Option
PATH A – 300 points available (150 minimum required points)	PATH B – 250 points available (100) minimum required points)
8.1 Building CO ₂ e Performance 8.2 Demand Reduction 8.3 Measurement & Verification	8.4-8.8 Prescriptive Design Criteria 8.9. <i>Renewable Energy</i> 8.10 Metering

Both the Performance Design Option (Path A) and the Prescriptive Design Option (Path B) requires that the proposed building design comply with ANSI/ASHRAE/IESNA Standard 90.1-07 or the local energy code, whichever is more stringent.

BEGIN PERFORMANCE PATH A.

8.1 Building CO₂e Performance - Path A (250 points)

8.1.1 Percent Reduction in Carbon Dioxide Equivalent Emissions (CO₂e)	
8.1.1.1 The building had more than a 50% reduction in carbon dioxide equivalent emissions over that for the baseline building for its geographical location. This reduction was calculated using the following formula: Percent reduction in CO ₂ e = 100 X (1 – PER/BER), where: <ul style="list-style-type: none"> • BER is the baseline building’s carbon dioxide equivalent emission rate. • PER is the proposed building’s carbon dioxide equivalent emission rate. 	Maximum = 250 points For a 50% reduction in CO ₂ e emissions, 150 points will be assigned. For every 1% reduction in CO ₂ e emissions above 50%, 2

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<ul style="list-style-type: none">• PER is less than <i>BER</i>. <p><u>Baseline Equivalent Emission Rate (BER) Calculations</u></p> <p>BER is calculated using the following formula:</p> <p>BER = (baseline EUI) X sum of [(percentage of each fuel in the annual energy fuel mix for the location) X (CO₂e Emission Factor for each fuel)], where:</p> <ul style="list-style-type: none">• The baseline building's site Energy Use Intensity (EUI) is determined using ENERGY STAR Target Finder.• The baseline building has an EUI of less than 50% of the average U.S. commercial building as determined for the proposed building location.• The annual energy fuel mix for the baseline building is determined using ENERGY STAR Target Finder. The CO₂e emission factor for each fuel in the baseline building's annual energy fuel mix can be found in Table 8.1.1- A of this document. <p><u>Proposed Equivalent Emission Rate (PER) Calculations</u></p> <p>PER is calculated using the following formula:</p> <p>PER = (proposed EUI) X sum of [(percentage of each fuel in the annual energy fuel mix for the location) X (CO₂e Emission Factor for each fuel)], where:</p> <ul style="list-style-type: none">• The proposed building's Energy Use Intensity (EUI) is calculated using a computer-based simulation program that conforms to the requirements outlined in ANSI/ASHRAE/IESNA Standard 90.1-07, Appendix G.• The annual energy fuel mix for the actual building is the same as that being used in the simulation.• The CO₂e emission factor for each fuel in the proposed building's annual energy fuel mix can be found in Table 8.1.1- A of this document.	<p>points will be assigned to a maximum of 250 points.</p>
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Table 8.1.1 - A: CO₂e Emission Factors

Fuel	CO₂e Emission Factor kg/kWh (lb/kWh)
Biomass	0.026 (0.057) ²
Coal (bituminous)	0.373 (0.822) ¹
Coal (lignite)	0.585 (1.289) ¹
Fuel oil (residual)	0.311 (0.686) ¹
Fuel oil (distillate)	0.299 (0.660) ¹
Gasoline	0.326 (0.719) ¹
Grid-delivered electricity	0.758 (1.670) ¹
<i>Grid-displaced electricity</i> ³	-0.833 (-1.835) ¹
LPG	0.274 (0.602) ¹
Natural gas	0.232 (0.510) ¹
<i>Off-site renewable electricity</i> ⁴	-0.758 (-1.670) ¹
<i>Waste heat</i> ⁵	0.019 (0.042) ²

¹ Deru, M., P. Torcellini. 2007. Source Energy and Emissions Factors for Energy Use in Buildings. NREL/TP-550-38617, June 2007. Golden, CO. National Renewable Energy Laboratory.

² L2A Conservation of Fuel and Power in New Buildings other than Dwellings. April 2006. Office of the Deputy Prime Minister, United Kingdom.

³ Grid displaced electricity comprises all electricity generated at the building site by, for example PV panels, wind-power, combined heat and power systems (CHP), etc. The associated CO₂e emissions are subtracted from the total CO₂e emissions for the building before determining the PER. CO₂e emissions arising from fuels used by the building's power generation system (e.g., to power the CHP plant) must be included in the building's CO₂e emission calculations.

⁴ The associated CO₂e emissions from off-site renewable electricity (e.g., using renewable energy certificates or "greenpower") are subtracted from the total CO₂e emissions for the building before determining the PER. Contracts must have a duration of at least three years. Only 25% of off-site renewable electricity can be credited to the proposed building's CO₂e calculation.

⁵ This includes waste heat from industrial processes and power stations rated at more than 10MWe and with a power efficiency of greater than 35%.

8.1.2 Suggested Documentation

- Energy simulation program and results;
- PER, BER, and CO₂e emission reduction calculations.

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8.2 Demand - Path A (40 points)

8.2.1 Passive Demand Response	
<p>8.2.1.1 For buildings located in Climate Zones 1 through 5, thermal mass in wall construction was used in the following ways:</p> <ul style="list-style-type: none"> A minimum of 20% of the <i>building envelope</i> gross wall area had a heat capacity of 35 W/m² °C (7 Btu/ft² °F) or greater. <p>OR</p> <ul style="list-style-type: none"> Provided that the wall had a material unit weight not greater than 1926 kg/m³ (120 lb/ft³), a minimum of 20% of the <i>building envelope</i> gross wall area had a heat capacity of 25 W/m² °C (5 Btu/ft² °F). <p>Informational Reference (s):</p> <ul style="list-style-type: none"> ANSI/ASHRAE/IESNA Standard 90.1 – 07 	4 points or n/a
<p>8.2.1.2 For buildings located in Climate Zones 1 through 5, thermal mass in wall construction was used in the following ways:</p> <ul style="list-style-type: none"> Mass walls used as interior partitions, had a surface area equal to at least 20% of the <i>building envelope</i> gross wall area. Mass walls had a heat capacity of 35 W/m² °C (7 Btu/ft² °F) or greater. Wallboard was not used as an interior finish on these walls. <p>OR</p> <ul style="list-style-type: none"> Mass walls used as interiors partition, had a surface area equal to at least 20% of the <i>building envelope</i> gross wall area. Mass walls had a heat capacity of 25 W/m² °C (5 Btu/ft² °F) and a material unit weight not greater than 1926 kg/m³ (120 lb/ft³) with the portion of the wall with the greatest heat capacity exposed to conditioned air. Wallboard was not used as an interior finish on these walls. 	4 points or n/a
<p>8.2.1.3 For buildings located in Climate Zones 1 through 5, thermal mass in floor construction was used in the following ways:</p> <ul style="list-style-type: none"> A minimum of 50% of the return air plenums were located directly in contact with a floor or wall having a heat capacity of at least 35 W/m² °C (7 Btu/ft² °F). <p>OR</p> <ul style="list-style-type: none"> A minimum of 50% of the return air plenums were located directly in contact with a floor or wall having a heat capacity of 25 W/m² °C (5 Btu/ft² °F), and the wall or floor had a material unit weight not greater than 1926 kg/m³ (120 lb/ft³). 	4 points or n/a n/a for Climate Zones 6-8
8.2.2 Thermal Energy Storage	
<p>8.2.2.1 For buildings located in Climate Zones 1 through 5, a thermal energy storage system was used that is capable of offsetting the peak cooling demand by greater than 30%.</p>	12 points or n/a >30% = 4 points >40% = 8 points >50% = 12 points n/a for Climate Zones 6-8
8.2.3 Power Demand Reduction	
<p>8.2.3.1 The building's monthly power demand factor (lowest kW demand month ÷ peak kW demand month) was determined to be greater than the average of one of the following:</p> <ul style="list-style-type: none"> 0.75 0.85 	Maximum = 8 points >0.75 = 4 points >0.85 = 8 points
8.2.4 Demand Capable Energy Management System	

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<p>8.2.4.1 One of the following measures was implemented:</p> <ul style="list-style-type: none"> • An Energy Management System was installed and programmed to reduce power demand below the non-reduced peak by 15% or 30% in the building. <p>OR</p> <ul style="list-style-type: none"> • Power demand is controlled by the electric utility and there is a 15% or 30% load shedding agreement. 	<p>Maximum = 8 points</p> <p>15% = 4 points 30% = 8 points</p>
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<p>8.2.5 Suggested Documentation</p> <ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation; • Energy simulation program results; • Power demand factor calculations.

8.3 Measurement and Verification (10 points)

<p>8.3.1 Measurement and Verification Protocol</p>	
<p>8.3.1.1 The Energy Metering Reporting Plan in the Operations and Maintenance Manual included the following operations and anticipated energy demand and consumption characteristics:</p> <ul style="list-style-type: none"> • Lighting and lighting controls: daily demand and consumption by floor or by zones no greater than 18, 580.6 m² (20,000 ft²). • Plug loads: daily demand and consumption by floor or by zones no greater than 18, 580.6 m² (20,000 ft²). • Major electric HVAC equipment (chillers, cooling towers, AHU fans, major pumps): seasonal peak demand and monthly consumption. • Chilled water generation: seasonal peak output and monthly consumption. • On-site renewable energy power generation: monthly peak output, monthly production, and site specific weather characteristics (irradiance, wind, and temperature). • Heating water or steam generation: seasonal peak and monthly consumption. • Secondary electric HVAC equipment as appropriate (e.g. heat pumps, fan coils, fan powered boxes): operational status. • Speciality or process electrical equipment: daily demand and consumption. • Critical HVAC controls (e.g. scheduling, economizer operation, temperature resets): status monitoring and verification. <p><i>Sub-metering</i> equipment was installed for the building systems listed above.</p>	<p>8 points or n/a</p>
<p>8.3.1.2 A Measurement and Verification program was implemented in accordance with EVO’s “International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction: Option D, Calibrated Simulation (Savings Estimation Method 2).</p>	<p>2 points or n/a</p>

<p>8.3.2 Suggested Documentation</p> <ul style="list-style-type: none"> • Energy Metering Reporting Plan; • Measurement and Verification Program details; • References to specifications and drawings of sub-metering equipment; • Cut sheets for meters and meter reading equipment; • Description of the monthly monitoring and verification reports that will be sent to building management.

END OF PERFORMANCE PATH A. BEGIN PRESCRIPTIVE PATH B.

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Prescriptive Design Criteria – Path B (250 points)

8.4 Building Opaque Envelope (42 points)

8.4.1 Thermal Resistance and Transmittance	
8.4.1.1 The effective thermal resistance and effective thermal transmittance of all elements of the opaque portion of the <i>building envelope</i> met or exceeded the values specified in Tables 8.4.1-A and 8.4.1– B.	12 points The overall values are calculated based on a weighted area average of the assemblies.

Table 8.4.1- A : Insulation Minimum R-values*

Climatic Zones	1	2	3	4	5	6	7	8
Opaque Elements								
<i>Roofs</i>								
Insulation above Deck	R-15.0 ci	R-15.0 ci	R-20.0 ci	R-20.0 ci	R-20.0 ci	R-20.0 ci	R-20.0 ci	R-30.0 ci
Metal Building	R-19.0	R-13.0 + R-13.0	R-13.0 + R-13.0	R-13.0 + R-19.0	R-13.0 + R-19.0	R-13.0 + R-19.0	R-30.0 + R-10.0 ci	R-30.0 + R-10.0 ci
Attic and Other	R-30.0	R-38.0	R-38.0	R-38.0	R-38.0	R-38.0	R-60.0	R-60.0
<i>Walls Above Grade</i>								
Mass	NR	R-7.6 ci	R-9.5 ci	R-11.4 ci	R-11.4 ci	R-11.4 ci	R-15.2 ci	R-15.2 ci
Metal Building	R-16.0	R-16.0	R-6.0 + R-13.0	R-6.0 + R-13.0	R-13.0 + R-13.0	R-13.0 + R-13.0	R-13.0 + R-13.0	R-13.0 + R-16.0
Steel Framed	R-13.0	R-13.0	R-13.0 + R-3.8 ci	R-13.0 + R-7.5 ci	R-13.0 + R-7.5 ci	R-13.0 + R-7.5 ci	R-13.0 + R-7.5 ci	R-13.0 + R-21.6 ci
Wood Frame & Other	R-13.0	R-13.0	R-13.0	R-13.0 + R-3.8 ci	R-13.0 + R-3.8 ci	R-13.0 + R-3.8 ci	R-13.0 + R-7.5 ci	R-13.0 + R-10.0 ci
<i>Walls Below Grade</i>								
Below Grade Wall	NR	NR	NR	NR	R-7.5 ci	R-7.5 ci	R-7.5 ci	R-15.0 ci
<i>Floors</i>								
Mass	NR	R-6.3 ci	R-8.3 ci	R-8.3 ci	R-10.4 ci	R-10.4 ci	R-12.5 ci	R-16.7 ci
Steel Joist	R-19.0	R-19.0	R-19.0	R-30.0	R-30.0	R-30.0	R-38.0	R-38.0
Wood Frame & Other	R-19.0	R-19.0	R-30.0	R-30.0	R-30.0	R-30.0	R-30.0	R-30.0
<i>Slab-On-Grade Floors</i>								
Unheated	NR	NR	NR	NR	NR	R-10.0 for 24 in.	R-15.0 for 24 in.	R-20.0 for 24 in.
Heated	R-7.5 for 12 in.	R-7.5 for 12 in.	R-7.5 for 12 in.	R-7.5 for 24 in.	R-10.0 for 36 in.	R-10.0 for 36 in.	R-20.0 for 36 in. + R-5.0 ci below	R-20.0 for 36 in. + R-5.0 ci below
NR – No Requirement CI – Continuous Insulation *The values in this table are adapted from ANSI/ASHRAE/IESNA Standard 90.1-07 but have been modified to be more stringent.								

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Table 8.4.1 – B: Maximum Assembly *U*-factors, *C*-factors and *F*-factors*

Climatic Zones	1	2	3	4	5	6	7	8
Opaque Elements								
Roofs								
Insulation above Deck	U-0.063	U-0.063	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.032
Metal Building	U-0.065	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.028	U-0.028
Attic and Other	U-0.034	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.017	U-0.017
Walls Above Grade								
Mass	U-0.580	U-0.123	U-0.104	U-0.090	U-0.090	U-0.090	U-0.071	U-0.071
Metal Building	U-0.093	U-0.093	U-0.070	U-0.070	U-0.057	U-0.057	U-0.057	U-0.055
Steel Framed	U-0.124	U-0.124	U-0.084	U-0.064	U-0.064	U-0.064	U-0.064	U-0.040
Wood Frame & Other	U-0.089	U-0.089	U-0.089	U-0.064	U-0.064	U-0.064	U-0.051	U-0.045
Walls Below Grade								
Below Grade Wall	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119	C-0.119	C-0.063
Floors								
Mass	U-0.332	U-0.107	U-0.087	U-0.087	U-0.074	U-0.074	U-0.064	U-0.051
Steel Joist	U-0.052	U-0.052	U-0.052	U-0.038	U-0.038	U-0.038	U-0.032	U-0.032
Wood Frame & Other	U-0.051	U-0.051	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-On-Grade Floors								
Unheated	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.540	F-0.520	F-0.510
Heated	F-1.020	F-1.020	F-1.020	F-0.950	F-0.840	F-0.840	F-0.373	F-0.373
Opaque Doors								
Swinging	U-0.700	U-0.700	U-0.700	U-0.700	U-0.700	U-0.700	U-0.600	U-0.500
Non-Swinging	U-1.450	U-1.450	U-1.450	U-0.500	U-0.500	U-0.500	U-0.500	U-0.500
*The values in this table are adapted from ANSI/ASHRAE/IESNA Standard 90.1-07 but have been modified to be more stringent.								

8.4.2 Orientation	
8.4.2.1 The building was oriented such that the north/south <i>fenestration</i> ratio was greater than the east/west <i>fenestration</i> ratio by between 1.25 and 2.00.	<p>Maximum = 6 points or n/a</p> <p>1.25 = 1 point 1.40 = 2 points 1.55 = 3 points 1.70 = 4 points 1.85 = 5 points 2.00 = 6 points</p> <p>n/a where site factors do not allow or favor <i>orientation</i> adaptations.</p>

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8.4.3 Fenestration Systems	
8.4.3.1 The thermal transmittance (<i>U-factors</i>) of the building's <i>fenestration</i> system met or exceeded the values in Table 8.4.3-A.	12 points The overall values are calculated based on a weighted area average of the assemblies.
8.4.3.2 The Solar Heat Gain Coefficient (SHGC) of the building's <i>fenestration</i> system met or exceeded the values in Table 8.4.3-A.	12 points The overall values are calculated based on a weighted area average of the assemblies

Table 8.4.3 – A: Building Envelope Requirements: Fenestration*

CLIMATE ZONE	1	2	3	4 Except Marine	5 And Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
<i>U-Factor</i> Framing materials other than metal with or without metal reinforcement or cladding								
<i>U-factor</i>	1.20	0.75	0.65	0.40	0.35	0.35	0.30	0.30
Metal framing with or without thermal break								
Curtain / Storefront <i>U-Factor</i>	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance Door U	1.20	1.10	0.90	0.85	0.80	0.80	0.75	0.75
All Other U-Factor ^a	1.20	0.75	0.65	0.55	0.50	0.50	0.45	0.45
SHGC-All Frame Types								
SHGC: North ^b	0.45	0.45	0.45	0.50	0.50	0.50	0.65	NR
SHGC: E, S & W PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.50	NR
SHGC: E, S & W 0.25 ≤ PF < 0.5	0.30	0.30	0.30	0.50	0.50	0.50	NR	NR
SHGC: E, S & W PF ≥ 0.5	0.40	0.40	0.40	0.65	0.65	NR	NR	NR
Skylights (3% maximum)								
<i>U-Factor</i>	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.50
SHGC	0.20	0.20	0.30	0.40	0.40	0.50	0.60	NR
NR = No requirement. PF = Projection factor a. All other includes operable windows, fixed windows and non-entrance doors. b. North-Facing within 45 degrees of true north (Northern Hemisphere). *The values in this table are adapted from ANSI/ASHRAE/IESNA Standard 90.1-07 but have been modified to be more stringent.								

8.4.4 Suggested Documentation
<ul style="list-style-type: none"> • Site plans; • Landscaping plans; • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation.

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8.5 Daylighting (15 points)

8.5.1 Daylighting	
8.5.1.1 The effective sidelit daylit area and toplit daylit area was a minimum of 10% of the <i>net building area</i> .	<p>Maximum = 8 points or n/a</p> <p>10% -15% = 1 point 16% - 21% =2 points 22% - 27%=3 points 28% - 32%=4 points 33% - 38%=5 points 39% - 44% = 6 points 45% -50% =7 points >50% = 8 points</p> <p>n/a for buildings or areas which would be functionally compromised by daylighting</p>
8.5.1.2 Buildings located in climate zones 1, 2, 3A, 3B were determined to have, at a minimum, an <i>effective aperture</i> for vertical <i>fenestration</i> of 0.10 EA _{VF} . Buildings located in climate zones 3C, 4, 5, 6, 7, 8 were determined to have, at a minimum, an <i>effective aperture</i> for vertical <i>fenestration</i> of 0.15 EA _{VF} . Calculations were performed in accordance with ANSI/ASHRAE/IESNA Standard 90.1 – 07.	<p>4 points or n/a</p> <p>n/a if there are no windows.</p>
8.5.1.3 Between 2-3% of the roof area was installed with skylights.	<p>3 points or n/a</p>
<p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ANSI/ASHRAE/IESNA Standard 90.1 – 07 	<p>n/a if building is located in Climate Zone 7 and 8</p>
8.5.2 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets, and performance documentation; • Effective aperture calculations. 	

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8.6 HVAC Systems and Controls (84 points)

8.6.1 Cooling Equipment	
<p>8.6.1.1 The seasonal energy efficiency ratio (SEER), energy efficiency ratio (EER), integrated part-load value (IPLV), coefficient of performance (COP) or kilowatt per ton (kW/ton) of the cooling equipment exceeded ANSI/ASHRAE/IESNA Standard 90.1 - 07 by 5-15%.</p> <p>If ANSI/ASHRAE/IESNA Standard 90.1-07 requires more than one efficiency rating, the lower one was used.</p> <p>The overall values are calculated based on a weighted area average of the capacity of the equipment.</p>	<p>Maximum = 12 points or n/a</p> <p>5% - 6% = 2 points 7% - 8% = 4 points 9% - 10% = 6 points 11% -12% = 8 points 13% -14% = 10points 15% = 12 points</p> <p>n/a where there is no cooling equipment</p>
<p>8.6.1.2 Multiple compressors, variable speed compressors or other measures were installed to allow a plant capacity reduction to 30% of load with a maximum of 25% loss while in full load efficiency.</p> <p>The overall values are calculated based on a weighted area average of the capacity of the equipment.</p>	<p>3 points or n/a</p> <p>n/a if there is no part load.</p>
8.6.2 Cooling Towers	
<p>8.6.2.1 To reduce fan energy consumption, the following measures were used in cooling towers:</p> <ul style="list-style-type: none"> • Two speed fans • Variable speed fans • Other measure. 	<p>Maximum = 3 points or n/a</p> <p>3 points will be assigned for any one or combination of measures used.</p> <p>n/a if there is no cooling tower</p>
<p>8.6.2.2 A waterside economizer system was installed with a capacity to use outdoor air for cooling water in lieu of mechanical cooling.</p>	<p>3 points or n/a</p>
8.6.3 Heat Pumps	
<p>8.6.3.1 The heating efficiency for heat pump applications exceeded ANSI/ASHRAE/IESNA Standard 90.1 - 07 heating seasonal performance factor (HSPF) or coefficient of performance (COP) between 5-15%.</p> <p>Heat pumps and other heating equipment (see 8.6.4) can be combined in a building but no more than 12 points can be achieved from 8.6.3 and 8.6.4 together.</p> <p>The overall values are calculated based on a weighted area average of the equipments capacity.</p>	<p>Maximum = 12 points or n/a</p> <p>5% - 6% = 2 points 7% - 8% = 4 points 9% - 10% = 6 points 11% -12% = 8 points 13% -14%= 10 points 15% = 12 points</p> <p>n/a if there are no heat pump applications.</p>
8.6.4 Heating Equipment	

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<p>8.6.4.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • Heating equipment exceeded ANSI/ASHRAE/IESNA Standard 90.1 – 07 annual fuel utilization efficiency (AFUE), <i>thermal efficiency</i> (E_t) or combustion efficiency (E_c) by between 1-15%. • Heating control specifications indicated hydronic system temperatures conducive to the efficiency claimed. <p>Heat equipment and heat pump (see 8.6.3) can be combined in a building but no more than 12 points can be achieved from 8.6.3 and 8.6.4 together.</p> <p>The overall values are calculated based on a weighted area average of the capacity of the equipment.</p>	<p>Maximum = 12 points or n/a</p> <p>1% - 2% = 1 point 3% - 4% = 2 points 5% - 6% = 3 points 7% - 8% = 4 points 9% - 10% = 6 points 11% - 12% = 8 points 13% - 14% = 10 points >15% = 12 points</p> <p>n/a if there is no heating.</p>
<p>8.6.5 Condensate Recovery</p> <p>8.6.5.1 Steam heating systems, including district systems, were equipped to recover and return condensate (excluding trap losses).</p>	<p>Maximum = 3 points or n/a</p> <p>50% - 64% condensate return = 1 point</p> <p>65% - 79% condensate return = 2 points</p> <p>>80% condensate return = 3 points</p> <p>n/a if there are no steam heating systems</p>
<p>8.6.6 Steam Traps</p> <p>8.6.6.1 All steam trap designs were stamped by a Professional Engineer. Isolation valves were installed to allow all steam traps to be isolated for repairs.</p>	<p>2 points or n/a</p> <p>n/a if there are no steam traps</p>
<p>8.6.7 Domestic Hot Water Heaters</p> <p>8.6.7.1 All domestic hot water heaters met the efficiency requirements of ANSI/ASHRAE/IESNA Standard 90.1 – 07, and were equipped with intermittent electric igniters and <i>low NO_x</i> burners.</p>	<p>2 points or n/a</p> <p>n/a if there are no domestic hot water heaters.</p>
<p>8.6.8 Variable Speed Control of Pumps</p> <p>8.6.8.1 Variable speed control pumps of 3hp or greater were provided for 15% or more of connected hydronic pumping power.</p>	<p>Maximum = 5 points or n/a</p> <p>15% - 34% = 1 point 35% - 54% = 2 points 55% - 74% = 3 points 75% - 74% = 4 points 75% or more = 5 points</p>

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8.6.9 Minimizing Reheat and Re-cool	
8.6.9.1 The HVAC design included a system that eliminates reheat by utilizing thermal and ventilation compartmentalization, with heating, cooling, and ventilation provided independently for each zone (e.g. fan coil systems, distributed heat pumps, single zone systems).	8 points
8.6.10 Air Economizers	
8.6.10.1 <i>Air economizers</i> were installed with a mode that uses outdoor air for cooling in place of mechanical cooling.	1 point
8.6.10.2 Controls were installed to shut off outdoor and exhaust air dampers during unoccupied periods.	1 point
8.6.10.3 Low leakage dampers (dampers with leakage rates of less than 5% of design flow) were used for air handling systems using outside air at a rate of 28.32 m ³ per minute (1000 ft ³ per minute) or greater.	1 point or n/a n/a if there are no air dampers
8.6.11 Fans and Ductwork	
8.6.11.1 The duct distribution system was installed with diffusers and registers sized with a full flow pressure drop no greater than 0.025 cm (0.01 in) of water column, and noise criteria (NC) of 35 or less. The supply and return ductwork was sized with a pressure drop no greater than 0.25 cm (0.1 in) of water column per 30.5 lineal meters (100 lineal feet) of duct run.	1 point or n/a n/a where there is no ductwork
8.6.11.2 Flexible duct work was: <ul style="list-style-type: none"> • Limited to 1.5 m (5 ft) when fully stretched • Limited to connections between duct branches and diffusers, and connections between duct branches and variable air volume terminal units • Installed with durable elbow support when used as an elbow 	1 point or n/a n/a where there is no ductwork
8.6.11.3 Sealed duct joints and seams were leak-tested at the rated pressure and determined to have an overall leak rate of less than 5%.	1 point or n/a n/a where there is no ductwork
8.6.11.4 Motors for fans that were one horsepower or more met NEMA's "Energy Efficiency Motor Program."	1 point
8.6.11.5 Variable speed fans were installed to be controlled by a duct pressure set-point or an energy management control system.	2 points

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8.6.12 Demand Controlled Ventilation	
<p>8.6.12.1 In spaces predicted to experience occupancy variances of greater than 30% from design occupancy for a minimum of 30% normally occupied hours, ventilation rates were controlled using the following measures:</p> <ul style="list-style-type: none"> • Controls were installed in spaces representing at least 90% of the design ventilation volume and meeting local ventilation standards. • Occupancy and/or CO₂ sensors were installed at the space/room level and were specified as being capable of maintaining calibration within 2% for a one-year period of operation. 	<p>5 points or n/a</p> <p>n/a if spaces meeting this criterion represent less than 40% of the total design ventilation volume of the building</p>
<p>8.6.12.2 Ventilation heat recovery was used on systems not required by ANSI/ASHRAE/IESNA Standard 90.1-07 and included the following design items:</p> <ul style="list-style-type: none"> • Pressure-drop impact on fan power. • Bypass for economizer operation, if applicable. • Filtration. • All connections and leak paths were sealed with metal-backed UL181A tape. 	<p>5 points or n/a</p> <p>n/a for heating systems in climate zones 1 through 3 and cooling systems in climate zones 3c, 4c, 5b, 5c, 6b, 7 and 8.</p>

8.6.13 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Equipment specifications, control schedules and diagrams; • Results of leak-testing. 	

8.7 Lighting Systems and Controls (54 points)

8.7.1 Total Lighting Power Density	
<p>8.7.1.1 The total lighting power density of the building was determined to be at or below the allowed lighting power density (LPD) given in Table 8.7.1-A (Building Area Method) or Table 8.7.1-B (Space-by-Space Method).</p>	<p>13 points</p>

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Table 8.7.1-A: Lighting Power Density (LPD): Using the Building Area Method*

Building Type	LPD (W/m²)	LPD (W/ft²)
Automotive Facility	0.08	0.81
Convention Center	0.10	1.08
Court House	0.10	1.08
Dining: Bar Lounge/Leisure	0.11	1.17
Dining: Cafeteria/Fast Food	0.12	1.26
Dining: Family	0.13	1.44
Dormitory	0.08	0.90
Exercise Center	0.08	0.90
Gymnasium	0.09	1.00
Health Care-Clinic	0.08	0.90
Hospital	0.10	1.08
Hotel	0.08	0.90
Library	0.11	1.17
Manufacturing Facility	0.11	1.17
Motel	0.08	0.90
Motion Picture Theater	0.10	1.08
Multi-Family	0.06	0.63
Museum	0.09	1.00
Office	0.08	0.90
Parking Garage	0.03	0.27
Penitentiary	0.08	0.90
Performing Art Theater	0.13	1.44
Police/Fire Station	0.08	0.90
Post Office	0.09	1.00
Religious Building	0.11	1.17
Retail	0.13	1.35
School/University	0.10	1.08
Sports Area	0.09	1.00
Town Hall	0.09	1.00
Transportation	0.08	0.90
Warehouse	0.07	0.72
Workshop	0.12	1.26

*The values in this table are adapted from ANSI/ASHRAE/IESNA Standard 90.1-07 but have been modified to be more stringent.

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Table 8.7.1-B: Lighting Power Density (LPD): Using the Space-by-Space Method*

Common Space Types^a	LPD (W/m²)	LPD (W/ft²)
Office Enclosed	0.09	1.00
Office-Open Plan	0.09	1.00
Conference/Meeting/Multipurpose	0.11	1.17
Classroom/Lecture/Training	0.12	1.26
For Penitentiary	0.11	1.17
Lobby	0.11	1.17
For Hotel	0.09	1.00
For Performing Arts Theater	0.28	2.97
For Motion Picture Theater	0.09	1.00
Audience/Seating Area	0.08	0.81
For Gymnasium	0.03	0.36
For Exercise Center	0.03	0.27
For Convention Center	0.06	0.63
For Penitentiary	0.06	0.63
For Religious Building	0.14	1.53
For Sports Area	0.03	0.36
For Performing Arts Theater	0.22	2.34
For Motion Picture Theater	0.10	1.08
For Transportation	0.04	0.45
Atrium – First Three Floors	0.05	0.54
Atrium – Each Additional Floor	0.02	0.18
Lounge/Recreation	0.10	1.08
For Hospital	0.07	0.72
Dining Area	0.08	0.81
For Penitentiary	0.11	1.17
For Hotel	0.11	1.17
For Motel	0.10	1.08
For Bar Lounge/Leisure Dining	0.12	1.26
For Family Dining	0.18	1.89
Food Preparation	0.10	1.08
Laboratory	0.12	1.26
Restrooms	0.08	0.81
Dressing/Locker/Fitting Room	0.05	0.54
Corridor/Transition	0.04	0.45
For Hospital	0.08	0.90
For Manufacturing Facility	0.04	0.45
Stairs – Active	0.05	0.54
Active Storage	0.07	0.72
For Hospital	0.08	0.81
Inactive Storage	0.03	0.27
For Museum	0.07	0.72
Electrical/Mechanical	0.13	1.35
Workshop		1.71

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Building Specific Space Types	LPD (W/m²)	LPD (W/ft²)
Gymnasium/Exercise Center		
Playing Area	0.12	1.26
Exercise Area	0.08	0.81
Courthouse/Police Station/Penitentiary		
Courtroom	0.16	1.71
Confinement Cells	0.08	0.81
Judges Chambers	0.11	1.17
Fire Stations		
Fire Station Engine Room	0.07	0.72
Sleeping Quarters	0.03	0.27
Post Office – Sorting Area	0.10	1.08
Convention Center – Exhibit Space	0.11	1.17
Library		
Card File and Cataloging	0.09	1.00
Stacks	0.14	1.53
Reading Area	0.10	1.08
Hospital		
Emergency	0.23	2.43
Recovery	0.07	0.72
Nurse Station	0.08	0.90
Exam/Treatment	0.13	1.35
Pharmacy	0.10	1.08
Patient Room	0.06	0.63
Operating Room	0.18	1.98
Nursery	0.05	0.54
Medical Supply	0.12	1.26
Physical Therapy	0.08	0.81
Radiology	0.03	0.36
Laundry – Washing	0.05	0.54
Automotive – Service/Repair	0.06	0.63
Manufacturing		
Low Bay (<25 ft Floor to Ceiling Height)	0.10	1.08
High Bay (>25 ft Floor to Ceiling Height)	0.14	1.53
Detailed Manufacturing	0.18	1.89
Equipment Room	0.10	1.08
Control Room	0.04	0.45
Hotel/Motel Guest Rooms	0.09	1.00
Dormitory – Living Quarters	0.09	1.00
Museum		
General Exhibition	0.08	0.90
Restoration	0.14	1.53
Bank/Office – Banking Activity Area	0.13	1.35
Religious Buildings		
Worship Pulpit, Choir	0.20	2.16
Fellowship Hall	0.08	0.81
Retail		
Sales Area	0.14	1.53
Mall Concourse	0.14	1.53
Sports Area		
Ring Sports Area	0.23	2.43
Court Sports Area	0.19	2.07
Indoor Playing Field Area	0.12	1.26
Warehouse		
Fine Material Storage	0.12	1.26
Medium/Bulky Material Storage	0.08	0.81
Parking Garage – Garage Area	0.18	
Transportation		
Airport – Concourse	0.05	0.54
Air/Train/Bus – Baggage Area	0.08	0.90

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Terminal – Ticket Counter	0.13	1.35
*The values in this table are adapted from ANSI/ASHRAE/IESNA Standard 90.1-07 but have been modified to be more stringent.		

8.7.2 Interior Automatic Light Shutoff Controls	
<p>8.7.2.1 For buildings larger than 464.52 m² (5000 ft²), one of the following measures was implemented:</p> <ul style="list-style-type: none"> • Time-scheduling devices were installed to control no more than 2322.58 m² per floor. (25,000 ft² per floor). Controls were incorporated with manual override switching devices that control no more than 464.52 m² (5000 ft²) and allow lighting to stay on for no more than two hours. <p>OR</p> <ul style="list-style-type: none"> • Occupant-sensing devices were installed to control no more than 232.26 m² (2500 ft²) in spaces smaller than 929.03 m² (10,000 ft²), and 929.03 m² (10,000 ft²) in spaces larger than 929.03 m² (10,000 ft²). In addition, occupant-sensing devices were installed to turn off all lighting in controlled areas within 30 minutes of all occupants leaving the area. 	3 points or n/a

8.7.3 Light Reduction Controls	
<p>8.7.3.1 To reduce the lighting load by at least 50%, each interior (non-daylit) area was installed with one or more of the following control(s) :</p> <ul style="list-style-type: none"> • Dual switching of alternate rows or <i>luminaires</i> • Switching of individual lamps independently of adjacent lamps within a <i>luminaire</i> • Switching of each lamp or <i>luminaire</i> • Occupancy sensors within the space 	7 points or n/a n/a for spaces that use less than 0.05 w/m ² (0.5 w/ft ²)

8.7.4 Controls for Daylit Zones	
<p>8.7.4.1 For each <i>sidelit daylit area</i> and/or <i>toplit daylit area</i> between 23.23 m² (250 ft²) and 232.26 m² (2500 ft²), one of the following control strategies was installed:</p> <ul style="list-style-type: none"> • For Manual Controls: <ul style="list-style-type: none"> - Switching of each <i>luminaire</i> - Switching of individual lamps independently of adjacent lamps within a <i>luminaire</i> <p>OR</p> <ul style="list-style-type: none"> • For Automatic Controls: <ul style="list-style-type: none"> - Stepped switching by photocell control - Stepped dimming by photocell control - Continuous dimming by photocell control <p>Allocation of points will be based on the type of control used for the majority of zones.</p> <p>For projects that contained the two-daylit area sizes described in 8.7.4.1 and 8.7.4.2, the allocation of points will be based on the type of control used for the majority of zones but no more than 6 points total can be achieved.</p>	<p>Maximum = 6 points or n/a</p> <p>For each type of manual control installed throughout the daylit area, 3 points will be assigned to a maximum of 6 points</p> <p>OR</p> <p>Stepped switching by photocell control = 2 points</p> <p>Stepped dimming by photocell control = 4 points</p> <p>Continuous dimming by photocell control = 6 points</p>

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<p>8.7.4.2 For each <i>sidelit daylit area</i> and/or <i>toplit daylit area</i> greater than 232.26 m² (2500 ft²), one of the following automatic control strategies was installed:</p> <ul style="list-style-type: none"> • Switching each <i>luminaire</i> by photocell control • Stepped switching of lamps by photocell control • Continuous dimming of lamps by photocell control <p>Allocation of points will be based on the type of control used for the majority of zones.</p> <p>For projects that contained the two daylit area sizes described in 8.7.4.1 and 8.7.4.2, the allocation of points will be based on the type of control used for the majority of zones but no more than 6 points total can be achieved..</p>	<p>Maximum = 6 points or n/a</p> <p>Switching each <i>luminaire</i> by photocell control = 2 points</p> <p>Stepped switching of lamps by photocell control = 4 points</p> <p>Continuous dimming of lamps by photocell control = 6 points</p>
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8.7.5 Exterior Lighting Controls	
<p>8.7.5.1 Controls were installed for the following exterior lighting:</p> <ul style="list-style-type: none"> • Lighting not designated for dusk-to-dawn was controlled by a time switch with 10-hour backup. <p>OR</p> <ul style="list-style-type: none"> • Lighting that was designated for dusk-to-dawn were controlled by a photo sensor or astronomical time switch with 10-hour backup. 	<p>Maximum = 3 points</p> <p>Installation of time switch = 2 points</p> <p>Installation of photo sensor or astronomical time switch = 3 points</p>

8.7.6 Exterior Luminaires	
<p>8.7.6.1 Permanent exterior <i>luminaires</i> were installed with the following features:</p> <ul style="list-style-type: none"> • Lamps with an initial system efficacy of at least 60 lumens per watt • Lamps greater than 100 watts to 250 watts were semi-cutoff, cutoff, or full cutoff • Lamps greater than 250 watts were cutoff or full cutoff 	<p>4 points</p> <p>No points if a Mercury Vapor lamp source is used</p>
<p>8.7.6.2 Pulse-start metal halide lamp sources were used for exterior lighting.</p>	<p>2 points</p>

8.7.7 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation. 	

8.8. Vertical Transport (5 points)

8.8.1 Elevators and Escalators	
<p>8.8.1.1 Regenerative braking elevators were installed.</p>	<p>3 points or n/a</p> <p>n/a where there are no elevators</p>
<p>8.8.1.2 Escalators were equipped with the capability to slow down or stop when detectors indicate no traffic.</p>	<p>2 points or n/a</p> <p>n/a where there are no escalators</p>

8.8.1.3 Suggested Documentation

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| <ul style="list-style-type: none"> • Construction documents; • Manufacturer’s specifications, cut sheets, and performance documentation; • Drawings and specifications of vertical transport equipment. |
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8.9 Renewable Energy (50 points)

8.9.1 Off-Site Renewable Energy	
<p>8.9.1.1 The building owner signed a contract with a minimum three-year commitment to purchase either certified “green” power or certified renewable energy certificates (RECs) for between 1-100% of total off-site consumption.</p> <p>Offsite and onsite renewable energy (see 8.9.2.1) can be combined in a building but no more than 50 points can be achieved from 8.9.1.1 and 8.9.2.1 together.</p> <p>Brenda’s recommendation</p>	<p>Maximum = 50 points</p> <p>For every 2% of the total energy consumption supplied by off-site renewables, 1 point will be assigned.</p>

8.9.2 On-Site Renewable Energy	
<p>8.9.2.1 On-site renewable energy technology was installed and supplies between 1-25% of the total energy consumption for the building.</p> <p>On-site and off-site renewable energy (see 8.9.1.1) can be combined in a building but no more than 50 points can be achieved from 8.9.1.1 and 8.9.2.1 together.</p>	<p>Maximum = 50 points</p> <p>For every 1% of the total energy consumption supplied by <i>on-site renewables</i>, 2 points will be assigned.</p>

8.9.3 Suggested Documentation
<ul style="list-style-type: none"> • Construction documents; • Manufacturer’s specifications, cut sheets, and performance documentation; • On-site renewable energy generation documentation; • Copy of the off-site renewable energy contract.

9. WATER

9.1 Points Calculation Methodology for the Water Assessment Area

The Water Assessment Area is unique in that it contains several sections with extensive requirements for specialized building types and functions that may not apply to a given project. The total points available must first be determined by identifying the subsections that are applicable to the project being assessed. The available points and awarded points for this assessment area are normalized using the calculation method and table detailed below. The normalization factor ensures that the minimum percentage of points required for compliance in this area and the overall project rating are not skewed.

1. Review Column B and enter the maximum points available for sections that are applicable to the project into column C.
2. Sum Column C to determine the total maximum applicable points for the Water Assessment area that are available for the project.
3. Calculate the “Water Assessment Area Normalization Factor” by dividing 130 by the total of Column C.
4. Enter the actual points achieved for each applicable section into Column D.
5. The total points achieved for the Water Assessment Area are calculated by multiplying the sum of Column D by the “normalization factor”.

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Column A	Column B	Column C	Column D
Sections	Maximum Points Available for Each Section	Maximum Points Available for Sections Applicable to the Project	Actual Points Achieved
9.2.1.1 to 9.2.1.3 Plumbing Fixtures and Fittings, Appliances and Equipment.	46		
9.3.1.1 to 9.3.1.4 Cooling Towers.	18		
9.4.1.1 to 9.4.1.2 Boilers and Water Heaters.	4		
9.5.1.1 to 9.5.1.7 Commercial Food Service Operations.	12		
9.6.1.1 to 9.6.1.5 Medical/Dental and Laboratory Facilities.	11		
9.7.1.1 Commercial/Institutional On-Premise Laundry Operations	10		
9.8.1.1 to 9.8.1.3 Special Water Features	4		
9.9.1.1 to 9.9.1.4 Water Treatment.	5		
9.10.1.1 Alternate Sources of Water	14		
9.11.1.1 to 9.11.2.1 Metering.	6		
Totals			

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9.2 Plumbing Fixtures and Fittings, Appliances and Equipment (46 points)

9.2.1 Plumbing Fixtures and Fittings, Appliances and Equipment	
<p>9.2.1.1 The baseline water use, projected water use and percentage reduction in water use were calculated using Green Globes™ Water Consumption Calculator.</p> <p>The water consumption standard for the proposed building or project met or surpassed the requirements set forth in the US Energy Policy Act of 1992 (and subsequent revisions and additions up to 2005) by a minimum of 25%.</p> <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • Appendix M 	<p>Maximum = 24 points</p> <p>25% - 29% = 6 points 30% - 34% = 12 points 35% - 39% = 18 points >40% = 24 points</p>
<p>9.2.1.2 The following plumbing fixtures and fittings were certified as being in compliance with the requirements and specifications of the U.S. EPA’s WaterSense Program:</p> <ul style="list-style-type: none"> • All toilets • Urinals • Showerheads • Lavatory and kitchen faucets <p>For those plumbing fixtures and fittings not addressed by US EPA’s WaterSense Program requirements, consumption levels specified in the Green Globes™ Water Consumption Calculator were used.</p> <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • Appendix M 	<p>18 points</p>
<p>9.2.1.3 The following appliances met the following water use maximums:</p> <ul style="list-style-type: none"> • Residential clothes washers were EnergyStar certified with a maximum water factor of 22.71 L/m³ (6.0 gal/ft³) per full cycle. • Residential dishwashers were EnergyStar certified with a maximum water factor of 21.96 L/m³ liters (5.8 gal/ft³) per full cycle. 	<p>Maximum = 4 points or n/a</p> <p>For each appliance, 2 points will be assigned to a maximum of 4 points.</p>
9.2.1.4 Suggested Documentation	
<ul style="list-style-type: none"> • Construction documents; • Manufacturers specifications, cut sheets, and performance documentation for all plumbing fixtures, fittings and appliances; • Results from the Green Globes™ Water Consumption Calculator. 	

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9.3 Cooling Towers (18 points)

9.3.1 Cooling Towers	
9.3.1.1 Cooling towers for air conditioning systems achieved one of the following: <ul style="list-style-type: none"> • A minimum of 5 cycles of concentration for makeup waters having less than 200 mg/L (200 ppm) calcium carbonate or 3.5 cycles for makeup waters with more than 200 mg/L (200 ppm) calcium carbonate. OR <ul style="list-style-type: none"> • A minimum discharge conductivity of 1500 mg/L (1500 ppm), or 150 mg/L (150 ppm) of silica measured as silicon dioxide. 	6 points or n/a
9.3.1.2 Cooling tower (s) were equipped with makeup and blowdown meters. Blowdown meters were equipped with conductivity controllers.	6 points
9.3.1.3 One of the following strategies was used for cooling: <ul style="list-style-type: none"> • 20% of the cooling load was dissipated with dry cooling. • 21% to 50% of the cooling load was dissipated with dry cooling • 51% to 75% of the cooling load was dissipated with dry cooling • No wet cooling was utilized where any given compressor unit in a building exceeded 350 kW (100 tons) of total cooling capacity. 	Maximum = 4 points or n/a 20% dry cooling = 1 point 21% -50% dry cooling = 2 points 51% -75% dry cooling = 3 points no wet cooling = 4 points
9.3.1.4 Cooling tower (s) were equipped with drift eliminators that achieved an efficiency of 0.002% or less for counter flow systems and 0.005% or less for cross flow towers.	2 points or n/a
9.3.1.5 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for cooling equipment, makeup meter, blowdown meter, drift eliminators, conductivity controllers and wet/dry cooling towers. • Plumbing plans. 	

9.4 Boilers and Water Heaters (4 points)

9.4.1 Boilers and Water Heaters	
9.4.1.1 Boilers and/or water heaters were installed with the following features: <ul style="list-style-type: none"> • Boilers and water heating systems of 50 bhp and above were installed with a boiler feed makeup meter. • Boilers over 50 bhp were installed with condensate return systems. • Boilers were fitted with conductivity controllers. • Steam boilers were installed with conductivity meters. 	3 points
9.4.1.2 The steam system design bears a seal indicating that it was designed by a professional engineer.	1 point

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9.4.1.3 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for boilers, water heating systems, meters, controllers, and steam system plans; • Certificate from professional engineer for steam system. 	

9.5 Commercial Food Service Operations (12 points)

9.5.1 Commercial Food Service Equipment	
9.5.1.1 Once-through water-cooled equipment was not installed.	3 points
9.5.1.2 Water-fed garbage disposals were not installed.	2 points
9.5.1.3 Installed ice machines met Energy Star requirements.	2 points
9.5.1.4 Installed combination ovens used no more than 15.14 L or 37.85 L (4 or 10 gal.) of water per hour.	Maximum = 2 points or n/a 15.14 L (4 gal.) of water = 1 point 37.85 L (10 gal.) of water = 2 points
9.5.1.5 Pre-rinse spray valves met or exceeded the requirements of the US Energy Policy Act of 2005 (and subsequent revisions and additions up to 2005).	1 point or n/a
9.5.1.6 All boilerless/connectionless food steamers use no more than 7.5 liters (2.0 gallons) per hour.	1 point or n/a
9.5.1.7 Installed dishwashers met Energy Star requirements at a minimum.	1 point

9.5.1.8 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for pre-rinse spray valves, ice machines, food steamers, dishwashers and combination ovens; • Plumbing plans. 	

9.6 Medical/Dental and Laboratory Facilities (11 Points)

9.6.1 Medical/Dental and Laboratory Equipment	
9.6.1.1 Steam sterilizers were equipped with: <ul style="list-style-type: none"> • Mechanical vacuum equipment • Water tempering devices that only allow water to flow when the discharge of condensate or hot water from the sterilizer exceeds 60°C (140°F). 	Maximum = 4 points or n/a For each measure, 2 points will be assigned to a maximum of 4 points.
9.6.1.2 Laboratory or medical equipment used non-potable water for once through cooling.	3 points
9.6.1.3 Dry vacuum systems were installed for all medical/dental purposes.	2 points
9.6.1.4 Film processors capable of processing x-ray films of more than 150 mm (5.91 in) in length or width were equipped with water recycling units.	1 point
9.6.1.5 Installed wet scrubbers were equipped with water recirculation systems.	1 point

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9.6.1.6 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for steam sterilizers, water recycling units, and wet scrubbers; • Plumbing plans; • Description of alternate sources of water to be used.

9.7 Commercial/Institutional On-Premise Laundry Operations (10 points)

9.7.1 Commercial/Institutional On-Premise Laundry Equipment	
9.7.1.1 The water factor for installed clothes washers was 35.96 L/m ³ (9.5 gal/ft ³) per full cycle or lower.	Maximum = 10 points 28.39 L/m ³ (7.5 gal/ft ³) or lower = 10 points 28.76 L/m ³ (7.6 gal/ft ³) to 35.58 L/m ³ (9.4 gal/ft ³) = 2 points 35.96 L/m ³ (9.5 gal/ft ³) = 1 point

9.7.1.2 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for clothes washers.

9.8 Special Water Features (4 points)

9.8.1 Special Water Features (e.g. swimming pools, spas, ornamental fountains, water playscapes)	
9.8.1.1 Special water features filter and re-circulate water for <i>reuse</i> within the system.	2 points
9.8.1.2 Meters were installed for <i>potable water</i> makeup lines leading to all special water features.	1 point
9.8.1.3 Special water features use alternate sources of water for makeup water.	1 point

9.8.1.4 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for all special water features and for all meters.

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9.9 Water Treatment (5 points)

9.9.1 Water Treatment	
9.9.1.1 Filtration systems were equipped with pressure drop gauges that allow backwash to be based on pressure drop and not on timers.	2 points or n/a
9.9.1.2 Reverse osmosis systems of less than 379 L (100 gal.) per day capacity reject no more than 70% of the feed water volume.	1 point or n/a
9.9.1.3 Reverse osmosis systems producing more than 379 L (100 gal.) per day capacity reject no more than 60% of the feed water volume.	1 point or n/a
9.9.1.4 Water softeners were equipped with recharge controls based on volume of water treated or hardness and not on timers.	1 point or n/a

9.9.1.5 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for filtration systems, pressure drop gauges, reverse osmosis systems, water softeners, and recharge controls.

9.10 Alternate Sources of Water (14 Points)

9.10.1 Onsite and Reclaimed Sources of Water	
<p>9.10.1.1 <i>Non-Potable water</i> applications used on-site alternative sources of water that included, but were not limited to, the following:</p> <ul style="list-style-type: none"> • Air conditioner condensate • Cooling tower blowdown • Foundation drain water • <i>Greywater</i> • Pass-through cooling water • Rainwater harvesting • Recycled, treated wastewater • Stormwater harvesting • Swimming pool filter backwash water <p>Onsite Sources and Reuse of Reclaimed Sources can be combined in a building but no more than 14 points can be achieved together.</p>	<p>Maximum = 14 points</p> <p>Percentage of potable water-use replaced by on-site and reclaimed sources of water.</p> <p><u>Onsite Sources</u> 10% -20% = 2 points 21% - 30% = 4 points 31%-40 = 6 points 41%- 50% = 8 points 51%-60% = 10 points >60 = 14 points</p> <p><u>Reuse of Reclaimed Sources</u> 15% -25% = 2 points 26% -35% = 4 points 36% - 45% = 6 points 46% -55% = 8 points 56% -65% = 10 points >65% = 14 points</p>

9.10.1.2 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation; • Landscape and irrigation plan; • Description of alternate source of water and implementation for non-potable water applications.

9.11 Metering (6 points)

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9.11.1 Meter Data Management System	
9.11.1.1 The following measures were implemented: <ul style="list-style-type: none"> • A Meter Data Management System was installed to electronically store water meter and <i>sub-meter</i> data and create user reports showing calculated hourly, daily, monthly and annual water consumption for each meter or submeter. • All building meters and <i>sub-meters</i> were configured to communicate water consumption data to a Meter Data Management System. 	4 points

9.11.2 Makeup Meters	
9.11.2.1 Chilled or hot water loops were equipped with makeup meters.	2 points or n/a

9.11.3 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets, and performance documentation for the Meter Data Management System and meters. 	

10. RESOURCES/MATERIALS

10.1 Assemblies (*Structural System and Envelope*)

PERFORMANCE PATH – Assemblies (25 points)

10.1.1 Assemblies—Performance Path	
10.1.1.1 The Green Globes™ LCA Credit Calculator for Building Assemblies was used to select building assemblies (<i>structural system</i> and envelope) based on life cycle impacts. Informational Reference (s): <ul style="list-style-type: none"> • Appendix N 	Maximum = 25 points Points are assigned by using the Green Globes™ LCA Credit Calculator.

10.1.1.2 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets, and performance documentation; • Input and results from the Green Globes™ LCA Credit Calculator for Building Assemblies. 	

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PRESCRIPTIVE PATH – Assemblies (20 points)

10.1.2 Recycled Content – Assemblies	
<p>10.1.2.1 Recycled <i>post-consumer</i> or <i>post-industrial (pre-consumer)</i> content materials accounted for 1% to 20% or more of building materials.</p> <p>Percentage = $100 \times A \div B$, where:</p> <p>A = Total cost or weight of <i>recycled content</i> materials B = Total cost or weight of all building materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 6 points</p> <p>1% - 4% = 1 point 5% - 8% = 2 points 9% - 12% = 3 points 13% - 16% = 4 points 17% - 19% = 5 points 20% = 6 points</p>
<p>10.1.2.2 <i>Bio-based products</i> accounted for 1% to 20% of materials used in the building.</p> <p>Percentage = $100 \times A \div B$, where :</p> <p>A = Total cost of <i>bio-based products</i> B = Total cost of all building materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 6 points</p> <p>1% - 4% = 1 point 5% - 8% = 2 points 9% - 12% = 3 points 13% - 16% = 4 points 17% - 19% = 5 points 20% = 6 points</p> <p>Wood-based products must also meet 10.3.2.1 to obtain points.</p>

10.1.3 Transportation of Harvested, Recovered, Salvaged, or Extracted Materials	
<p>10.1.3.1 Between 1% and 20% of products used in the building were harvested, <i>recovered</i>, salvaged, or extracted:</p> <ul style="list-style-type: none"> • Within a radius of 800 km (500 miles) of the project site; and/or • Shipped primarily by rail or water within a radius of 2400 km (1500 miles). <p>In addition, at least 70% of the constituent materials of a product (by weight) met the distance requirements.</p> <p>If the extraction distance is a combination of rail and/or water and/or other method of transportation, then the calculated extracted combined distance ratio (ECD) must be less than or equal to 1.0:</p> <p>ECD (in IP units) = $EDR \div 1500 + EDO \div 500$ ECD (in SI units) = $EDR \div 2400 + EDO \div 800$</p> <p>EDR = extraction distance (distance between project and extraction, harvest, recovery or salvaging site) by rail or water in km (miles)</p> <p>EDO = extraction distance (distance between project and extraction, harvest, recovery or salvaging site) other than by rail or water in km (miles)</p> <p>Percentage = $100 \times A \div B$, where :</p> <p>A = Total cost or weight of regional materials B = Total cost or weight of all materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 4 points</p> <p>1% - 10% = 1 point 11% - 15% = 2 points 16% - 19% = 3 points 20% = 4 points</p>

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<p>10.1.4 Transportation of Processed or Manufactured Materials</p> <p>10.1.4.1 Between 1% and 20% of products used in the building were processed or manufactured:</p> <ul style="list-style-type: none"> • Within a radius of 800 km (500 miles) of the project site, and/or • Shipped primarily by rail or water within a radius of 2400 km (1500 miles). <p>In addition, at least 70% of the constituent materials of a product (by weight) met the distance requirements.</p> <p>If the distance from manufacturing is a combination of rail and/or water and/or other method of transportation, then the calculated extracted combined distance ratio (MCD) must be less than or equal to 1.0:</p> <p>MCD (in IP units) = $MDR \div 1500 + MDO \div 500$ MCD (in SI units) = $MDR \div 2400 + MDO \div 800$</p> <p>MDR = manufacture distance (distance between project and processing and/or manufacturing site) by rail or water in km (miles)</p> <p>MDO = manufacture (distance between project and processing and/or manufacturing site) other than by rail or water in km (miles) Percentage = $100 \times A \div B$, where:</p> <p>A = Total cost or weight of regional materials B = Total cost or weight of all materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 4 points</p> <p>1% -10% = 1 point 11% - 15% = 2 points 16% - 19% = 3 points 20% = 4 points</p>
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10. 2 Furnishings, Finishes and Fit-outs

PERFORMANCE PATH - Furnishings, Finishes and Fit-outs (20 points)

<p>10.2.1 Furnishings, Finishes and Fit-outs—Performance Path</p> <p>10.2.1.1 A life cycle assessment tool was used to select furnishings, finishes and fit-outs based on life cycle impacts. The life cycle assessment tool conforms to <i>ISO 14044-06</i>, and data was available from one or more of the following publicly available sources:</p> <ul style="list-style-type: none"> • BEES 4.0 or international equivalent; • Peer reviewed research reports. 	<p>20 points</p>
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<p>10.2.2 Suggested Documentation</p> <ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets, and performance documentation; • Associated calculations and results from the life cycle assessment tool for furnishings, finishes and fit-out’s. 	
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PRESCRIPTIVE PATH - Furnishings, Finishes and Fit-outs (15 points)

10.2.3 Recycled Content - Furnishings, Finishes and Fit-outs	
<p>10.2.3.1 Recycled <i>post-consumer</i> or <i>post-industrial (pre-consumer)</i> content materials accounted for 1% to 20% or more of building materials.</p> <p>Percentage = $100 \times A \div B$, where:</p> <p>A = Total cost or weight of <i>recycled content</i> materials B = Total cost or weight of all building materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 5 points</p> <p>1% - 4% = 1 point 5% - 8% = 2 points 9% - 12% = 3 points 13% - 16% = 4 points 17% - 20% = 5 points</p>
<p>10.2.3.2 <i>Bio-based products</i> accounted for 1% to 20% of materials used in the building.</p> <p>Percentage = $100 \times A \div B$, where :</p> <p>A = Total cost of <i>bio-based products</i> B = Total cost of all building materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 4 points</p> <p>1% - 5% = 1 point 6% - 10% = 2 points 11% - 15% = 3 points 16% - 20% = 4 points</p> <p>Wood-based products must also meet 10.3.2.1 to obtain points.</p>

10.2.4 Transportation of Harvested, Recovered, Salvaged, or Extracted Materials	
<p>10.2.4.1 Between 1% and 20% of products used in the building were harvested, <i>recovered</i>, salvaged, or extracted:</p> <ul style="list-style-type: none"> • Within a radius of 800 km (500 miles) of the project site; and/or • Shipped primarily by rail or water within a radius of 2400 km (1500 miles). <p>In addition, at least 70% of the constituent materials of a product (by weight) met the distance requirements.</p> <p>If the extraction distance is a combination of rail and/or water and/or other method of transportation, then the calculated extracted combined distance ratio (ECD) must be less than or equal to 1.0:</p> <p>ECD (in IP units) = $EDR \div 1500 + EDO \div 500$ ECD (in SI units) = $EDR \div 2400 + EDO \div 800$</p> <p>EDR = extraction distance (distance between project and extraction, harvest, recovery or salvaging site) by rail or water in km (miles)</p> <p>EDO = extraction distance (distance between project and extraction, harvest, recovery or salvaging site) other than by rail or water in km (miles)</p> <p>Percentage = $100 \times A \div B$, where :</p> <p>A = Total cost or weight of regional materials B = Total cost or weight of all materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 3 points</p> <p>1% - 15% = 1 point 16% - 19% = 2 points 20% or more = 3 points</p>

10.2.5 Transportation of Processed or Manufactured Materials	
10.2.5.1 Between 1% and 20% of products used in the building were processed or	Maximum = 3 points

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<p>manufactured:</p> <ul style="list-style-type: none"> • Within a radius of 800 km (500 miles) of the project site, and/or • Shipped primarily by rail or water within a radius of 2400 km (1500 miles). <p>In addition, at least 70% of the constituent materials of a product (by weight) met the distance requirements.</p> <p>If the distance from manufacturing is a combination of rail and/or water and/or other method of transportation, then the calculated extracted combined distance ratio (MCD) must be less than or equal to 1.0:</p> <p>MCD (in IP units) = $MDR \div 1500 + MDO \div 500$ MCD (in SI units) = $MDR \div 2400 + MDO \div 800$</p> <p>MDR = manufacture distance (distance between project and processing and/or manufacturing site) by rail or water in km (miles)</p> <p>MDO = manufacture (distance between project and processing and/or manufacturing site) other than by rail or water in km (miles)</p> <p>Percentage = $100 \times A \div B$, where:</p> <p>A = Total cost or weight of regional materials B = Total cost or weight of all materials</p> <p>Cost or weight must be used consistently.</p>	<p>1% -15% = 1 point 16% - 19% = 2 points 20% = 3 points</p>
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10. 3 Other Material Properties (12 points)

<p>10.3.1 Off-Site Salvaged materials</p>	
<p>10.3.1.1 Off-site salvaged materials accounted for 1% to 10% of the building materials.</p> <p>Percentage = $100 \times A \div B$, where:</p> <p>A = Cost or weight of off-site salvaged materials B = Total cost or weight of all building materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 6 points</p> <p>1% - 2% = 1 point 3% - 4% = 2 points 5% - 6% = 3 points 7% - 8% = 4 points 9% -10% = 6 points</p>

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10.3.2 Certification of Wood-Based Products	
<p>10.3.2.1 Between 1% and 20% of solid lumber, engineered wood, and other wood-based products used in the building was certified by one of the following sustainable forestry programs:</p> <ul style="list-style-type: none"> • The American Tree Farm System (ATFS) • Canadian Standards Association (Z-809/CSA) Sustainable Forest Management Standard • Forest Stewardship Council Standard (FSC) • Sustainable Forestry Initiative program (SFI) • Other programs recognized by the Programme for Endorsement of Forest Certification (PEFC) <p>Percentage = $100 \times A \div B$, where</p> <p>A = Cost or weight of <i>certified wood-based products</i> B = Total cost of all wood-based materials</p> <p>Cost or weight must be used consistently.</p>	<p>Maximum = 6 points</p> <p>1% - 4% = 1 point 5% - 8% = 2 points 9% - 12% = 3 points 13% - 16% = 4 points 17% - 19% = 5 points 20% = 6 points</p>

10.3.3 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation; • List of salvaged materials and percentage calculations; • List of <i>recycled content</i> materials and percentage calculations; • List of <i>bio-based</i> materials and percentage calculations; • Purchasing and receiving records; • Wood-based products certification documentation. 	

10.4 Re-use of Existing Structure's (18 points)

10.4.1 Reuse of Building Façades	
<p>10.4.1.1 Excluding windows and doors, the new design re-used 1%-75% of the existing buildings façade.</p> <p>Percentage = $100 \times A \div B$, where</p> <p>A = Area of retained façade B = Total <i>existing building</i> façade area</p>	<p>Maximum = 6 points or n/a</p> <p>10% - 20% = 1 point 21% - 30% = 2 points 31% - 40% = 3 points 41% - 50% = 4 points 51% - 60% = 5 points 61% - 75% = 6 points</p> <p>n/a if there is no <i>existing building</i> or where the <i>existing building</i> floor area is less than 92.m² (1000 ft²)</p>

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10.4.2 Reuse of Structural Systems	
<p>10.4.2.1 The new design re-used 10% -100% of <i>existing building structural systems</i> by gross building volume.</p> <p>Percentage = $100 \times \frac{A}{B}$, where:</p> <p>A = Total volume of re-used existing structure B = Total volume of existing structure</p>	<p>Maximum = 6 points or n/a</p> <p>10% - 25% = 1 point 26% - 40% = 2 points 41% - 65% = 3 points 66% - 80% = 4 points 81% - 95% = 5 points >95% = 6 points</p> <p>n/a if there is no <i>existing building</i> or where the <i>existing building floor area</i> is less than 92.9 m² (1000 ft²)</p>

10.4.3 Reuse of Non-Structural Elements	
<p>10.4.3.1 The new design reused 10% -100% of <i>existing non-structural elements</i> by area.</p> <p>Percentage = $100 \times \frac{A}{B}$, where :</p> <p>A = Total area of re-used existing <i>non-structural elements</i> B = Total area of existing <i>non-structural elements</i></p> <p>Wall and roof areas are calculated as the projected area of the element (e.g. if an interior wall is re-used, the area is calculated as length x height of the wall).</p>	<p>Maximum = 6 points or n/a</p> <p>10% - 25% = 1 point 26% - 40% = 2 points 41% - 65% = 3 points 66% - 80% = 4 points 81% - 95% = 5 points >95% = 6 points</p> <p>n/a if there is no <i>existing building</i> or where the <i>existing building floor area</i> is less than 92.9 m² (1000 ft²).</p>

10.4.4 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation; • Calculation for percentage of façade retained; • Calculation for the percentage of existing major <i>structural systems</i> re-used; • Calculations for area of existing <i>non-structural elements</i> re-used. 	

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10.5 Reduction, Re-use and Recycling of Waste (9 points)

10.5.1 Demolition and Construction Waste	
<p>10.5.1.1 Between 25% and 100% of demolition and construction waste was diverted from the landfill.</p> <p>Percentage = $100 \times ((1 - A) \div B)$ where:</p> <p>A = Weight of waste sent to landfill B = Weight of total wastes</p>	<p>Maximum = 6 points</p> <p>Points are based on demolition and construction waste being diverted from landfill.</p> <p>25% - 49% = 2 points 50% - 74% = 4 points >75% = 6 points</p>

10.5.2 Reuse of Existing Materials for Site Development and Landscaping	
<p>10.5.2.1 The project re-used existing materials for site development or landscaping (e.g. crushing concrete for aggregate base or drain rock, shredding vegetative materials for mulch etc...)</p>	1 point

10.5.3 Operational Waste	
<p>10.5.3.1 The building design addressed operations-related recycling programs through one or more of the following:</p> <ul style="list-style-type: none"> • Built-in collection space in each kitchen; • Internally sealed storage areas; • External aggregation/pick up space; • Externally sealed storage areas; • Composting area or composting system provided on-site. 	2 points

10.5.4 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Waste Minimization Plan; • Lanscaping and Site Developments Plans showing incorporation of existing on-site materials; • Tipping records. 	

10.6 Resource Conservation through Design (14 points)

10.6.1 Materials and Raw Materials	
<p>10.6.1.1 An architect or design professional provided a letter documenting how the building design uses materials efficiently and/or minimizes the use of raw materials. The letter included specific measures, calculations, drawings and specifications.</p>	2 points

10.6.2 Multi-Functional Assemblies	
<p>10.6.2.1 An architect or design professional provided a letter documenting how the building design uses assemblies that perform multiple functions. The letter included specific measures, calculations, drawings and specifications.</p> <p>Informational Reference (s) :</p> <ul style="list-style-type: none"> • Appendix O 	2 points

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10.6.3 Building Service Life Plan	
<p>10.6.3.1 A building service life plan was prepared and included:</p> <ul style="list-style-type: none"> • Service life estimates for structural, <i>building envelope</i> and hardscape materials that need to be replaced during the life of the building, not including mechanical and electrical assemblies • Expected <i>service life</i> for building assemblies and materials that require inspection and/or need to be replaced during the <i>service life</i> of the building, where <i>service life</i> was based on the following: <ul style="list-style-type: none"> - temporary buildings < 10 years - medium-life buildings e.g. industrial and parking structures > 25 years - long life building types > 50 years • Documentation of the project design <i>service life</i>, the basis for determination and the following details for each assembly or component used in the building: <ul style="list-style-type: none"> - building assembly and material description - design <i>service life</i> in years - predicted <i>service life</i> in years - effects of failure - maintenance frequency and maintenance access <p>Informational Reference(s):</p> <ul style="list-style-type: none"> • CSA S478-95 • ISO 15686 (series) 	5 points
10.6.4 Design for Re-Configuration, Demounting and Dissassembly	
<p>10.6.4.1 The building design plans facilitated future re-configuration of the interior space by addressing, at a minimum, the following building systems:</p> <ul style="list-style-type: none"> • Light systems • air distribution system • cable/data/network • partition walls • raised floors <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ASTM E 1692-95 • CSA Z782-06 	3 points
<p>10.6.4.2 The building plans facilitated demounting or disassembling reusable materials without substantial damage to the materials or their surroundings.</p> <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • CSA Z782-06 	2 points
10.6.5 Suggested Documentation	
<ul style="list-style-type: none"> • Letters and building models from architect or design professional; • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation. 	

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10.7 Building Envelope (42 points)

10.7.1 Roofing Membrane Assemblies and Systems	
<p>10.7.1.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • All <i>low slope roofing</i> membrane systems and interfaces were detailed and installed in accordance with the manufacturer’s requirements and warranted by the manufacturer for the intended purpose. • All <i>low slope roofing</i> membrane systems and interfaces were field inspected by a roofing system manufacturer’s technical personnel or RCI-certified third party roofing inspector in accordance with one of the following methods: <ul style="list-style-type: none"> - ARMA/NRCA – “Manual of Roof Inspection and Maintenance of Built-Up and Modified Bitumen Roof Systems: A Guide for Building Owners.” - SPRI/NRCA – “Manual of Roof Inspection, Maintenance and Emergency Repair for Existing Single-Ply Roofing Systems.” • All <i>steep slope roofing</i> systems and interfaces were detailed and installed in accordance with the manufacturer’s requirements and warranted by the manufacturer for the intended purpose. A roofing system manufacturer’s technical personnel or RCI-certified third party roofing inspector performed a field inspection of the <i>low slope roofing</i> in accordance with the “NRCA Roofing and waterproofing Manual.” 	5 points
10.7.2 Flashings	
<p>10.7.2.1 All building envelope flashings and sheet metal assemblies, including but not limited to those listed below, were detailed and installed in accordance with <i>SMACNA’s</i> “Architectural Sheet Metal Manual.”</p> <ul style="list-style-type: none"> - Gutters and downspouts - Copings - Scuppers - Through wall flashing and associated end dams - Reglets and counterflashing - Equipment support flashing, openings flashing and roof edge flashings • All proprietary products were installed in accordance with the manufacturer’s instructions and recommendations. • A field inspection of all flashing assemblies was conducted in accordance with NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-4 for Flashing and Sheet Metal. 	5 points

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10.7.3 Roof and Wall Openings	
<p>10.7.3.1 All products for roof and wall openings were selected and configured to meet performance requirements of established Design Pressure, in accordance with AAMA/WDMA/CSA 101/I.S.2/A440-05</p> <ul style="list-style-type: none"> • Flashings at roof and wall openings were detailed and installed in accordance with ASTM E2112-07. • A field inspection of all installations was conducted in accordance with NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklists M.1-7 for Windows and M.1-8 Skylights. • A field test of water penetration was conducted with a minimum of 3 units per 100 of each type (doors, windows, skylights). These field tests were performed in accordance with the following: <ul style="list-style-type: none"> - ASTM E1105-00 - By applying same test pressures required to determine compliance with specified requirements AAMA/WDMA/CSA 101/I.S.2/A440-05 field testing requirements. - All detected failures were repaired and retested accordingly. 	5 points
10.7.4 Foundation Systems	
<p>10.7.4.1 Conditioned spaces were installed with slab-on-grade <i>vapor retarders</i> that were installed in accordance with ASTM E1745 – 97 (04).</p> <ul style="list-style-type: none"> • All slabs on grade were poured directly over <i>vapor retarders</i> and capillary-break basecourses. • A field inspection of all vapour retarder and waterproofing assemblies was conducted in accordance with NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-1 for Waterproofing. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ACI 302.2R-06 	2 points
10.7.4.2 Dampproofing was applied to all foundation walls in contact with grade, and the following measures were implemented:	2 points
<ul style="list-style-type: none"> • 5% slope grade away from the building for at least 3.05 m (10 ft) • Means for roof drainage to be directed at least 0.9144 m (3 ft) beyond the building <i>overhang</i>. • A foundation drainage system was installed. 	
10.7.5 Below Grade Walls, Slabs and Above Grade <i>Horizontal Assemblies</i>	
<p>10.7.5.1 Waterproofing membrane assemblies were installed at all below grade slabs and foundation/basement walls that were subject to hydrostatic pressures.</p> <ul style="list-style-type: none"> • Waterproofing assemblies were installed in accordance with the manufacturer’s requirements, and warranted by the manufacturer for the intended purpose. • A field inspection of installations was conducted in accordance with the following: <ul style="list-style-type: none"> - NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-1 for Waterproofing. - ASTM D5957 – 98 (05) 	4 points

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10.7.6 Exterior Wall Cladding Systems	
<p>10.7.6.1 The following exterior wall cladding systems were installed and field inspected in accordance with the following specifications:</p> <ul style="list-style-type: none"> • EIFS Cladding systems were installed as water-managed systems in accordance with the manufacturers' requirements. A field inspection was conducted in accordance with NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-2 for EIFS. • Aluminum Framed Glazing systems were installed in accordance with the manufacturers requirements and warranted by the manufacturer for the intended purpose. A field inspection was conducted in accordance with NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-6 for Entrances and Storefronts and M 1-10 for Glazed Curtain Walls. • Masonry Veneer Cladding systems were installed in accordance with the Brick Institute of America technical notes. A field inspection of Masonry Cladding was conducted in accordance with NIBS Guideline 3-06: Annex M.2 Example Construction Checklist for Building Envelope System for Brick. • Architectural Precast Concrete Cladding Systems incorporated pressure equalized two stage joints between precast concrete panels and adjacent cladding assemblies. • Joint Sealers were installed in accordance with NIBS Guideline 3-06: Annex M.2 Example Construction Checklist for Building Envelope System Joint Sealants. Checklist. A field inspection was conducted in accordance with NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-5 for Joint Sealers. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • PCI Architectural Precast Two-Stage Joint Guidelines 	5 points
10.7.7 Rainscreen Wall Cladding	
<p>10.7.7.1 Exterior rainscreen wall cladding systems installed over framed walls were installed with the following:</p> <ul style="list-style-type: none"> - A primary and secondary line of defense - An air barrier - A means for incidental bulk water intrusion to escape the cladding system assembly <ul style="list-style-type: none"> • Rainscreen cladding assemblies passed laboratory-testing requirements in accordance with AAMA 508-07 for both pressure-equalized and non-pressure equalized cladding assemblies. 	2 points
10.7.8 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Field testing reports; • Manufacturers laboratory test results; • Plans for foundation systems, flashings, roof and wall openings, roofing, and cladding systems. 	

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10.7.9. Continuous Air Barrier	
<p>10.7.9.1 A continuous air barrier was installed according to the following practices:</p> <ul style="list-style-type: none"> • The air barrier material of each assembly was joined in an airtight and flexible manner to the air barrier material of adjacent assemblies. • The air barrier was installed to withstand positive and negative combined design wind, fan and stack pressures on the air barrier without damage or displacement. • The air barrier was installed to withstand movement in the structure and not displace materials under full load. • Air barrier connections were made between: foundation and walls; walls and windows or doors; different wall systems; wall and roof; wall and roof over unconditioned space; walls, floors and roof across construction, control, and expansion joints; walls, floors, and roof to utility, pipe, and duct penetrations. 	3 points
<p>10.7.9.2 Compliance of the continuous air barrier for the opaque <i>building envelope</i> was demonstrated using the following strategies:</p> <ul style="list-style-type: none"> • Materials: Materials were tested in accordance with ASTM E2178-03 and it was determined that the air permeability of individual materials did not exceed 0.02 L/s·m² under a pressure differential of 75 Pa (0.004 cfm/ft²) under a pressure differential of 0.3 in. water (1.57 lb/ft²). In addition, all joint were sealed where plywood, exterior and interior gypsum wallboard, plaster, concrete, and steel were used. • Assemblies: Assemblies were tested in accordance with ASTM E2357-05 or ASTM E1677-05, and it was determined that the average air leakage did not exceed 0.2 L/s·m² @ 75 Pa (0.04 cfm/ft² under a pressure differential of 0.3" w.g. (1.57psf). In addition, all joints were sealed where assemblies constructed of plywood, exterior and interior gypsum wallboard, plaster, concrete and steel were used. Concrete masonry walls were painted or sealed. <p>OR</p> <ul style="list-style-type: none"> • Building: The completed building was tested in accordance with ASTM E779-03 or an equivalent approved method and it was determined that the air leakage rate of the <i>building envelope</i> did not exceed 2.0 L/s·m² @ 75 Pa (0.40 cfm/ft² at a pressure differential of 0.3" w.g. (1.57 psf). 	3 points
10.7.10 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Field testing reports; • Manufacturers laboratory test results; • Construction plans. 	

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10.7.11 Vapor Retarders	
10.7.11.1 The interior side of framed walls in Climate Zones 5, 6, 7, 8 and Marine 4 were installed with a Class I or II <i>vapor retarder</i> that was in accordance with the International Energy Conservation Code 2007 Supplement.	3 points
10.7.11.2 Crawl space walls located in unvented crawl spaces were insulated using the following strategy: <ul style="list-style-type: none"> • Insulation was permanently fastened to the wall and extended downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 60.96 cm (24 inches). • Exposed earth in unvented crawl space foundations were covered with a continuous Class I <i>vapor retarder</i> that was installed using the following strategy: <ul style="list-style-type: none"> - All joints of the <i>vapor retarder</i> were overlapped by 15.24 cm (6 in) and were sealed or taped. - The edges of the <i>vapor retarder</i> extended at least 15.24 cm (6 in) up the stem wall and was attached to the stem wall. 	3 points

10.7.12 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer’s specifications, cut sheets, and performance documentation; • Construction plans.

11. EMISSIONS AND STORAGE OF HAZARDOUS MATERIALS

11.1 Heating Equipment (18 points)

Points for Section 11.1 can be earned by following either Path A or Path B.

Path A	Path B
11.1.1 – District Heating	11.1.2 - Ultra Low NO_x / Low CO Boilers and Furnaces
	11.1.3 - Low NOX / Low CO Boilers and Furnaces

START PATH A.

11.1.1 District Heating	
11.1.1.1 The district heating process did not use boilers and/or combustion processes for heat or water in the building.	18 points or n/a n/a if district heating is not used.

END PATH A.

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START PATH B.

11.1.2 Ultra Low NO_x / Low CO Boilers and Furnaces	
11.1.2.1 Ultra low NO _x / low CO boilers and furnaces have <ul style="list-style-type: none"> • NO_x emissions that do not exceed 0.012 g/L (12 ppm) corrected to 3% O₂, • CO emissions that do not exceed 0.4 g/L (400 ppm) corrected to 3% O₂. Informational Reference (s): <ul style="list-style-type: none"> • Rule 1146.2: South Coast Air Quality Management District 	10 points or n/a n/a if there are no boilers or furnaces.

11.1.3 Low NO_x / Low CO Boilers and Furnaces	
11.1.3.1 Low NO _x / low CO boilers and furnaces have <ul style="list-style-type: none"> • NO_x emissions that do not exceed 0.03 g/L (30 ppm) corrected to 3% O₂, and • CO emissions do not exceed 0.4 g/L (400 ppm) corrected to 3% O₂. Informational Reference (s): <ul style="list-style-type: none"> • Rule 1146: South Coast Air Quality Management District 	8 points or n/a n/a if there are no boilers or furnaces.

11.1.4 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for boilers and furnaces.

END PATH B.

11.2 Cooling Equipment (21 points)

Points for Section 11.2 can be earned by following either Path A or Path B. Section 11.2 should be marked as not applicable for those buildings that use district cooling.

Path A	Path B
11.2.1- Refrigerants	11.2.2 - Ozone-Depleting Potential
	11.2.3 - Global Warming Potential
	11.2.4 - Leak Detection

START PATH A.

11.2.1 Refrigerants	
11.2.1.1 No refrigerants were used in the building’s major equipment (not including portable cooling equipment, refrigerators, temporary cooling equipment, or equipment with less than 0.454 kg (1 lb) of refrigerant. OR <ul style="list-style-type: none"> • The building was equipped with only the following absorption cooling technologies: <ul style="list-style-type: none"> - Natural ventilation, or no use of mechanical cooling equipment - Absorption chillers - “Natural” Refrigerants (Ammonia, CO₂, Propane, Butane) - Refrigerants with zero ODP, and a GWP₁₀₀ of 10 or less 	21 points or n/a If 11.2.1.1 is applicable, proceed to 11.3.

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START PATH B.

11.2.2 Ozone-Depleting Potential	
11.2.2.1 Hydrofluorocarbon (HFC) or hydrochlorofluorocarbon (HCFC) refrigerants used in the building cooling equipment had an Ozone Depleting Potential (OPD) equal to 0.	7 points or n/a n/a if there are no halocarbon refrigerants
11.2.3 Global Warming Potential	
11.2.3.1 The refrigerant used in the building cooling equipment had a <i>Global Warming Potential</i> (GWP ₁₀₀) of 150 or less.	7 points
11.2.4 Leak Detection	
11.2.4.1 If HFC or HCFC refrigerants were used in cooling equipment, mechanical rooms were equipped with: <ul style="list-style-type: none"> • A leak detector capable of detecting leakage rates down to 1.0% per year for each chiller. • An alarm capable of alerting the building operator to leakage thresholds. 	7 points or n/a n/a if HCFC or HFC refrigerants were not used
11.2.5 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation for cooling equipment, leak detectors and alarms. 	

END PATH B.

11.3 Storage for Hazardous Materials (6 points)

11.3.1 Hazardous Materials/Janitorial Supplies	
11.3.1.1 Storage for <i>hazardous materials</i> / janitorial supplies was equipped with continuous floor-to-floor walls mechanical ventilation with no return air.	3 points or n/a n/a if <i>hazardous materials</i> /janitorial supplies are not kept on site.
11.3.2 Flammable Materials	
11.3.2.1 Storage for flammable materials was equipped with fire-rated walls and doors, and fire-dampened outlets.	3 points or n/a n/a if flammable materials are not kept on-site
11.3.3 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i>; • Manufacturer's specifications, cut sheets, and performance documentation. 	

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12. INDOOR ENVIRONMENT

12.1. Ventilation Systems (39 points)

12.1.1 Ventilation Air Quantity	
12.1.1.1 The following measures were implemented: <ul style="list-style-type: none"> • The quantity of ventilation air for the building was compliant with ASHRAE Standard 62.1-07 except where local codes or standards required a greater quantity of ventilation air. • <i>Construction documents</i> indicated the ventilation schedule for all occupied spaces. 	10 points
12.1.2 Air Exchange	
12.1.2.1 One of the following strategies was used for air exchange: <ul style="list-style-type: none"> • For mechanically ventilated buildings: <ul style="list-style-type: none"> - the zone air distribution effectiveness E_z value was determined to be greater than or equal to 0.9 in all regularly occupied spaces, excluding circulation and transitional spaces. <p>OR</p> <ul style="list-style-type: none"> • For naturally ventilated buildings : <ul style="list-style-type: none"> - All points within buildings and spaces considered to be naturally ventilated are within 7.62 m (25 ft) of a permanent or operable wall or roof opening to the outdoors. - The unobstructed area of the opening measured at least 4% of the net floor area that is being naturally ventilated. - Where interior spaces were ventilated through adjoining rooms, the openings between the spaces were designed to have a minimum area of 8% of the net floor area of the interior room and were at least 2.32 m² (25 ft²). - All operable openings were installed to be readily accessible to building occupants. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ASHRAE 62.1-07: Section 5.1 • ASHRAE 62.1-07: Section 6.2 	10 points

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12.1.3 Ventilation Intakes and Exhausts	
<p>12.1.3.1 Ventilation systems were equipped with the following features:</p> <ul style="list-style-type: none"> • Exhaust outlets and plumbing vent stacks were located at least 6.1 m (20 ft) away from outdoor air intakes. • Outdoor air intakes were located at least 9.14 m (30 ft) away from sources of pollution including dumpsters, parking areas, driveways, loading docks, natural gas lines, wet cooling towers, and garage doors/exhaust outlets. • Outdoor air intakes were protected with screens 6.4 mm (0.25 in) mesh. • For each air handling system in single or multiple arrangements, filters were compliant with ASHRAE 62.1-07: section 5.9. • Outdoor air inlets and outlets, including louvers and rain hoods, were sized appropriately per ASHRAE 62.1-07: sections 5.6.2 through 5.6.5. • Except in transfer air duct, all outdoor air, return air, and supply air systems were equipped with rigid or flexible ductwork without the duct liner exposed to the air stream. • Roof drainage was installed to be sloped away from outdoor air intakes. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ASHRAE 62.1-07: section 5.6 	8 points
12.1.4 CO₂ Sensing and Ventilation Control Equipment	
<p>12.1.4.1 CO₂ sensing and ventilation control equipment capable of active feedback and adjustment of ventilation in response to CO₂ monitoring was installed in the following spaces:</p> <ul style="list-style-type: none"> • High and variable occupancy spaces (e.g. meeting rooms, assembly areas, etc.); and • Regularly occupied spaces. 	6 points
12.1.5 Air Handling Equipment	
<p>12.1.5.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • Air handling equipment with a maximum supply volume greater than 16.99 m³ per minute (600 ft³/min.) was equipped with filters with a Minimum Efficiency Reporting Value (MERV) of 13 (or equivalent) or higher. <p>OR</p> <ul style="list-style-type: none"> • Terminal equipment with a maximum supply volume of 16 m³ per minute (600 ft³/min.) or less (e.g. fan coils, distributed heat pumps, fan-powered variable air valve boxes) were equipped with: <ul style="list-style-type: none"> - The highest filtration level commercially available for the specific equipment under consideration <p>OR</p> <ul style="list-style-type: none"> - Air handlers with a MERV of 13 (or equivalent) or higher. 	5 points or n/a n/a if equipment provides no ventilation air and serves only a single zone.
12.1.6 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents</i> and specifications; • Balancing reports for the ventilation systems; • Ventilation schedules; • Manufacturing specifications for ventilation systems, CO₂ sensing and ventilation control equipment; • Ventilation air quantity design data; • Local ventilation codes or standards. 	

12.2. Source Control of Indoor Pollutants (39 points)

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12.2.1 Volatile Organic Compounds (VOC)	
<p>12.2.1.1 One or more of the following measures were implemented:</p> <ol style="list-style-type: none"> Materials identified in Tables 12.2.1-A and 12.2.1-B that were used in the building met the volatile organic content (VOC) and/or VOC emissions limits in these tables. VOC content requirements were tested in accordance with the South Coast Air Quality Management District test protocol and VOC emissions requirements were tested in accordance with ASTM 5116 “Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products”. Materials identified in Tables 12.2.1-A and 12.2.1-B that were used in the building were demonstrated to meet or exceed the criteria established in one or more of the following programs: <ul style="list-style-type: none"> - Carpet and Rug Institute®; - Ecologo^M; - Green Seal®; - GreenGuard Environmental Institute®; - Resilient Floor Covering Institute®; - Other equivalent Voluntary Certification Program applicable to the product or material that met or exceeded the VOC content or VOC emissions listed in Tables 12.2.1-A and 12.2.1-B. 	<p>5 points are awarded for materials in Table 12.2.1-A based on the following percentages:</p> <p>1 to 20% = 1 point 21 to 40% = 2 points 41 to 60% = 3 points 61 to 80% = 4 points 81 to 100% = 5 points</p> <p>5 points are awarded for materials in Table 12.2.1-B based on the following percentages:</p> <p>1 to 20% = 1 point 21 to 40% = 2 points 41 to 60% = 3 points 61 to 80% = 4 points 81 to 100% = 5 points</p>

Table 12.2.1–A : Adhesives and Sealants

Product Area	Product Sub-area	VOC Content*	VOC Emissions
Adhesives – Architectural Applications	Carpet / Carpet Pads	50 g/L	IVOCs < 0.1 TLV
	Wood Flooring	100 g/L	
	Rubber Flooring	60 g/L	Formaldehyde < 0.05ppm
	Subfloor	50 g/L	
	Ceramic Tile	65 g/L	4-PC < 0.0065mg/m3
	VCT / Asphalt Tile	50 g/L	Styrene < 0.07mg/m3
	Dry Wall Panel	50 g/L	
	Cove Base	50 g/L	TVOCs < 0.5mg/m3
	Multipurpose Construction	70 g/L	
	Structural Glazing	100 g/L	Total Aldehydes < 0.1ppm
Single Ply Roof Membrane	250 g/L		
Adhesives – Substrates	Metal to Metal	30 g/L	
	Plastic Foams	50 g/L	
	Porous Material (except wood)	50 g/L	
	Wood	30 g/L	
	Fiberglass	80 g/L	
Adhesives – Specialty	PVC Welding	510 g/L	
	CPVC Welding	490 g/L	
	ABS Welding	325 g/L	
	Plastic Cement Welding	250 g/L	
	Adhesive Primer for Plastic	550 g/L	
	Contact Adhesive	80 g/L	
	Special Purpose Contact Adhesive	250 g/L	
Sealants	Architectural	250 g/L	
	Non-membrane Roof	300 g/L	
	Single Ply Roof Membrane	450 g/L	

*VOC content is determined by subtracting water and exempt compounds and expressed as grams per liter, with no exception granted to chlorinated chemical species

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Table 12.2.1-B: Walls, Floors and Interior Fit-Outs

Product Area	Product Sub-area	VOC Content*	VOC Emissions
Walls	Paints - Interior Latex coatings flat	50 g/L	IVOCs < 0.1 TLV
	Paints - Interior Latex Coatings non flat	150 g/L	Formaldehyde < 0.05ppm 4-PC < 0.0065mg/m ³
	Untreated Masonry or Concrete	Negligible	Styrene < 0.07mg/m ³ TVOCs < 0.5mg/m ³ Total Aldehydes < 0.1ppm
Floors	Floor Coverings (including carpeting, resilient and other non-carpet flooring)	not applicable	IVOCs < ½ CRELs Formaldehyde < 0.0135ppm
Interior Fit-Out Building Products (insulation, laminates, hard surfaces and wall coverings)	Not applicable	not applicable	IVOCs < 0.1 TLV Formaldehyde < 0.05ppm 4-PC < 0.0065mg/m ³ Styrene < 0.07mg/m ³ TVOCs < 0.5mg/m ³ Total Aldehydes < 0.1ppm

*VOC content is determined by subtracting water and exempt compounds and expressed as grams per liter, with no exception granted to chlorinated chemical species

12.2.2 Leakage, Condensation and Humidity	
<p>12.2.2.1 The following measures were implemented:</p> <ul style="list-style-type: none"> • HVAC systems and equipment were installed to maintain indoor relative humidity at or below 50%. • Materials which are naturally resistant to mold growth (e.g. concrete, masonry, glass and metals) and other <i>moisture resistant</i> materials and finishes were specified in kitchens, toilet rooms, pools, shower areas and similar spaces that generate high humidity. • Floor drains were installed where fixture or appliance failures may cause plumbing leaks. <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ASHRAE 62.1-07:section 5.15 • ASHRAE Proposed 160, Design Criteria for Moisture Control in Buildings, September 2006 • Moisture Control in Public and Commercial Buildings: Guidance for Design, Construction, and Maintenance Professionals, US EPA, November 2006 	5 points

12.2.3 Access for HVAC Maintenance	
<p>12.2.3.1 For all portions of HVAC equipment requiring routine and periodic maintenance, the following measures were implemented:</p> <ul style="list-style-type: none"> • Access to equipment and equipment sections were provided in accordance with the manufacturer published and/or suggested recommendations. • Access locations and clearances, including clearances for full and partial equipment were indicated on design drawings. • Distribution systems were installed in accordance with ASHRAE 62.1-07: section 5.14 and SMACNA's "HVAC Duct Construction Standards: Metal and Flexible." • Architectural features related to access were installed in accordance with the International Building Code.[®] • Full degree swing for all hinged doors or fully removable access doors were indicated on design drawings adjacent to areas servicing HVAC equipment 	4 points

12.2.4 Carbon Monoxide Monitoring	
<p>12.2.4.1 Carbon monoxide monitoring devices which provided an alarm (that were independent of, or in addition to, HVAC control/mitigation of carbon monoxide) were installed in enclosed parking garages and other areas with sources of combustion (e.g.</p>	3 points or n/a n/a if there are no parking

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boiler rooms).	garages or other areas with combustion sources.
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12.2.5 Cooling Towers	
12.2.5.1 No wet cooling towers were installed.	4 points or n/a n/a if no cooling towers
12.2.5.2 Wet cooling towers were equipped with high-efficiency drift eliminators and covers. Informational Reference (s): • ASHRAE Guideline 12-00	2 points or n/a n/a if no cooling towers
12.2.5.3 Wet cooling towers were not equipped with side air louvers or open basins. Informational Reference (s): • ASHRAE Guideline 12-00.	2 points or n/a n/a if no cooling towers

12.2.6 Domestic Hot Water Systems	
12.2.6.1 To address the accumulation of stagnant water, the following measures were employed: • Piping was not capped. • Dead legs and collection tanks were not used Informational Reference (s): • ASHRAE Guideline 12-00	2 points
12.2.6.2 The domestic hot water system was designed to maintain hot water storage at or above 55 ° C (131° F). Informational Reference (s): • ASHRAE Guideline 12-00	2 points

12.2.7 Humidification and Dehumidification Systems	
12.2.7.1 Drain pans for dehumidifying cooling coils were equipped with a 0.32 cm slope per meter (0.126 in slope per foot) in two directions toward the drain outlet, and were equipped with a drain seal and sufficient width to span the cooling coils Informational Reference (s): • ASHRAE 62.1-07 : section 5.11	2 points or n/a
12.2.7.2 Steam humidification systems or ultrasonic humidification systems were installed.	1 point or n/a

12.2.8 Ventilation and Physical Isolation for <i>Specialized Activities</i>	
12.2.8.1 Separate ventilation and/or physical isolation was provided for <i>specialized activities</i> .	1 points or n/a n/a if there are no specialized ventilations
12.2.8.2 Where separate ventilation systems were installed for <i>specialized activities</i> , they were maintained at a negative pressure of at least 5.0 Pascals a (0.02 in of water gauge) on average with respect to adjacent spaces (with doors closed).	1 points or n/a n/a if there are no separate ventilation systems

12.2.9 Suggested Documentation

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<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation for HVAC systems, humidification / dehumidification systems, CO₂ monitoring devices, wet cooling towers and domestic hot water systems list of mold resistant materials; • Documentation demonstrating compliance with ASHRAE 62.1-07: section 5.14, SMACNA’s “HVAC Duct Construction Standards: Metal and Flexible,” and ICC’s “International Building Code®”; • Materials Safety Data Sheets or proof of certification for low-VOC materials.

12.3 Integrated Pest Management (7 points)

12.3.1 Insects and Rodents	
12.3.1.1 The following <i>integrated pest management</i> strategies were used: <ul style="list-style-type: none"> • Outdoor air inlets were equipped with insect screens of 18x14 mesh for plenum systems feeding multiple air handlers. • Structural and mechanical openings were fitted with permanent protection (e.g., screens, sealants, etc.). • Building surfaces were fitted with building wall assemblies and advertising signs to reduce habitation and disallow entry from behind the building façade. 	2 points
12.3.1.2 A sealed storage area for food / kitchen solid waste and recycling was provided.	2 points

12.3.2 Bird Collisions and Roostings	
12.3.2.1 Measures to address bird collisions and contamination from roostings included, but were not limited to, the following: <ul style="list-style-type: none"> • The building did not have any points with an unobstructed view through from one exposure to the opposite exposure. • Non-reflective glass assemblies were installed. • Mullions and ledges were less than 2.5 cm (1 in) deep. <p>Informational Reference:</p> <ul style="list-style-type: none"> • Bird Safe Building Guidelines 	Maximum = 3 points For each measure implemented, 1 point will be assigned to a maximum of 3 points.

12.3.3 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets, and performance documentation; • Description of pest management strategies. 	

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12.4 Lighting Design and Integration of Lighting Systems (39 points)

12.4.1 Daylighting	
<p>12.4.1.1 Primary occupied spaces were designed to receive indirect minimum daylight illumination levels of 25 footcandles on a clear day.</p>	<p>Maximum = 9 points or n/a</p> <p>Points are assigned based on the percentage of occupied area with minimum daylight illumination levels of 25 footcandles versus the total occupied area.</p> <p>10% - 30% = 3 points 31% - 59% = 6 points >60% = 9 points</p>
<p>12.4.1.2 Interior spaces were designed to have views to the building exterior or to atria with a maximum distance of approximately 7.62 m (25 ft) or less from task area to window.</p>	<p>Maximum = 9 points or n/a</p> <p>Points are assigned based on the percentage of number of task areas that have a view to the building exterior versus the total number of task areas in the building.</p> <p>10% - 30% = 3 points 31% - 59% = 6 points >60% = 9 points</p>
<p>12.4.1.3 The following measures were implemented:</p> <ul style="list-style-type: none"> • Shading devices were installed for southern, western and eastern exposures. • Shading devices were employed to eliminate direct sunlight from reaching task areas. 	<p>Maximum = 6 points</p> <p>For each measure implemented, 3 points will be assigned to a maximum of 6 points.</p>

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12.4.2 Lighting Design	
<p>12.4.2.1 Primary occupied spaces were equipped with lighting levels as recommended in the most recent IESNA Lighting Handbook, for the types of major tasks anticipated in the various building spaces.</p>	<p>Maximum = 9 points</p> <p>Points are assigned based on the percentage of primary occupied spaces installed with lighting levels recommended by IESNA versus the total occupied area.</p> <p>20% = 1 point 30% = 2 points 40% = 3 points 50% = 4 points 60% = 5 points 70% = 6 points 80% = 7 points 90% = 8 points 100% = 9 points</p>
<p>12.4.2.2 To address reflective glare from electrical lighting on Visual Display Terminal's (VDT's), the following measures were employed:</p> <ul style="list-style-type: none"> • Walls were provided with adequate luminance to meet a 10:1 task to far surround luminance ratio. • For direct lighting, the average luminance did not exceed the following values for given luminaire angles: <ul style="list-style-type: none"> - 850 cd/m² (248.1 fL) at 65° from the vertical - 350 cd/m² (102.2 fL) at 75° from the vertical - 175 cd/m² (51.1 fL) at 85° from the vertical • For indirect lighting, ceiling uniformity was lower than 8:1 (Max: Min) between rows of luminaires. For maximum ceiling luminance not exceeding 425cd/m² (124.1 fL), the Max:Min ratio did not apply. <p>OR</p> <p>Spaces were designed such that source/task eye geometry did not require IESNA Standard VDT compliant luminaires.</p>	<p>Maximum = 6 points or n/a</p> <p>For each measure implemented, 2 points will be assigned to a maximum of 6 points.</p> <p>OR</p> <p>6 points for alternate.</p>

12.4.3 Suggested Documentation
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Percentages and calculations for occupied areas with daylight illumination levels; • Percentages and calculations for views to building exterior or atria; • Percentages and calculations for primary occupied spaces with IESNA recommended <i>task lighting</i> levels; • Specifications for solar shading devices and luminaires; • Lighting Plans.

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12.5 Thermal Comfort (19 points)

12.5.1 Thermal Control Zones	
12.5.1.1 One of the following thermal comfort strategies were used:	Maximum = 10 points
<p>Office Buildings A: Thermal control zones were designed to be less than 92.9 m² (1000 ft²) for open areas or 111.48 m² (1200 ft²) for single rooms (e.g. office or conference room). OR B: Thermal control zones were designed to be less than 46.45 m² (500 ft²) for open areas or 69.68 m² (750 ft²) for a single room or workstation.</p> <p>For mixed-use buildings, score each functional area and prorate score by floor area.</p>	A: 5 points or n/a OR B: 10 points or n/a n/a if not an office building
<p>Educational Buildings (Classrooms) Classrooms were designed to be single thermal control zones under 139.35 m² (1500 ft²). AND Thermal control zones were designed to be less than 92.9 m² (1000 ft²) for all other educational areas (excluding gyms and assemblies).</p> <p>For mixed-use buildings, score each functional area and prorate score by floor area.</p>	10 points or n/a For each measure implemented, 5 points will be assigned to a maximum of 10 points. n/a if not an educational building.
<p>Healthcare Buildings (Patient areas) A: Thermal control zones were designed to be less than 92.9 m² (1000 ft²). OR B: Thermal control zones were designed to be less than 46.45 m² (500 ft²).</p> <p>For mixed-use buildings, score each functional area and prorate score by floor area.</p>	A: 5 points or n/a OR B: 10 points or n/a\ n/a if not a healthcare building
<p>Mercantile Buildings A: Thermal control zones were designed to be less than 464.52 m² (5000 ft²). OR B: Thermal control zones were designed to be less than 185.81 m² (2000 ft²).</p> <p>For mixed-use buildings, score each functional area and prorate score by floor area.</p>	A: 5 points or n/a OR B: 10 points or n/a n/a if not a mercantile building
<p>Other Building Types Documentation was provided demonstrating how thermal control zones were designed to address thermal comfort.</p> <p>For mixed-use buildings, score each functional area and prorate score by floor area.</p>	10 points or n/a n/a if not 'other building type.'
12.5.2 Design for Thermal Comfort	
12.5.2.1 The building design was determined to be in conformance with ANSI/ASHRAE Standard 55-04.	9 points
12.5.3 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer's specifications, cut sheets, and performance documentation; • Documentation demonstrating compliance with ANSI/ASHRAE Standard 55-04. 	

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12.6 Acoustic Comfort (17 points)

<p>12.6.1 Mechanical and Plumbing Systems</p>	
<p>12.6.1.1 Measures were implemented to achieve enhanced background sound level performance associated with mechanical e systems. One or more of the following measures were implemented:</p> <ul style="list-style-type: none"> • Sound Power level for the HVAC unit • Duct-borne fan noise • Airflow/turbulence noise (Duct generated “Self Noise” due to air velocities and duct layout design) • Duct breakout noise • Airborne radiated noise through partitions, over demising walls, drop ceilings, or through air-transfer ducts • Structure-borne noise from vibration transmission • Duct –borne terminal box noise • Radiated terminal box noise • Room Surface Treatment (Reverberation Time) • Duct Cross-Talk noise transmission between rooms • Grille and diffuser noise <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ASHRAE Handbook – HVAC Applications (Chapter 47) • ANSI S12-2-99 • ARI 885-90 • ASTM E336-07 	<p>4 points</p>
<p>12.6.2 Design for Acoustic Comfort</p>	
<p>12.6.2.1 Implement acoustic design strategies for specific interior sound control performance targets:</p> <ul style="list-style-type: none"> • Noise Criterion (NC) • Room Criterion (RC) • Speech Intelligibility Index (SII) levelReverberation time (RT60)Adjacent wall, floor, or ceiling assembly Sound Transmission Class (STC) • Adjacent floor or ceiling assembly Impact Isolation Class (IIC) <p>Informational Reference (s):</p> <ul style="list-style-type: none"> • ASHRAE 1322-RP • ASA/ INCE/ NCAC Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities • CHPS – California High Performance Schools • HUD Guide to Airborne, Impact and Structure Borne Noise • WBDG – Federal Green Construction Guide for Specifiers: 01 57 19.12 (01353) Noise and Acoustic Management • WBDG – DG 1110-3-122 Design Guide for Interiors, 1997. • ASTM E989-06 	<p>4 points or n/a</p> <p>n/a for the speech intelligibility index for multi-unit residential buildings (MURBs).</p>
<p>12.6.2.2 Design targets for the following were established for:</p> <ul style="list-style-type: none"> • The Sound Transmission Class (STC) rating of building assemblies (including interior partitions, ceilings/floors, doors, windows and exterior wall configurations). • The Outdoor-Indoor Transmission Class (OITC). 	<p>3 points</p>

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Informational Reference (s): <ul style="list-style-type: none"> • ASTM E1332-03 • ASTM E90-04 • ASTM E1686-03 • ASTM E413-04 • ASTM E966-04 • ANSI S12-2-99 • ASA/ INCE/ NCAC Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities • ASTM E1374-06 • ANSI S 12.60-2002 • ASTM E336-07 	
12.6.2.3 The field impact insulation class (FIIC) of all flooring assemblies was specified.	3 points
12.6.3 Sound Levels at the Property Line	
12.6.3.1 Where sound levels at the property line exceeded 65 decibels (dBA), the building itself was sited and spaces within the building were acoustically located to provide isolation from outside noise.	3 points or n/a n/a if sound levels at the property line are below 65 dBA
12.6.4 Suggested Documentation	
<ul style="list-style-type: none"> • <i>Construction documents;</i> • Manufacturer’s specifications, cut sheets and performance documentation; • Sound level measurements taken at the property line; • Description of acoustic design strategies and all design targets; • FIIC value for flooring assemblies; • Acoustic mitigation measures for mechanical equipment and plumbing systems. 	

Note that the Foreword and Appendices are informative only and do not contain mandatory requirements necessary for conformance to this standard. As such, they may contain material that has not been subjected to public review or a consensus process.

Referenced documents cited within the standard are mandatory unless they are clearly identified as being informational references. Adherence to documents identified as informational references and/or guidelines is not mandatory.

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14. Appendices

Note that the Appendices are informative only and do not contain mandatory requirements necessary for conformance to this standard. As such, they may contain material that has not been subjected to public review or a consensus process.

Appendix A - GDDC Progress Meeting Agendas for Design

GDDC progress meeting agendas should include the following topics:

- Introduction of new team members to the overall sustainable strategies that have been incorporated into the project.
- Review of established (and/or modified) *performance goals*.
- Integration of language regarding *performance goals* and acceptable outcomes into project documents (plans and specifications).
- Identification of missing requirements and establishment of required steps to correct.
- Modification, if necessary, of established *performance goals*/requirements.
- Establishment/tracking of responsibilities for gathering documentation.
- Operations and maintenance training.

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Appendix B - GDDC Progress Meeting Agendas for Construction

GDDC progress meeting agendas should include the following topics:

- Introduction of new team members to the overall sustainable strategies that have been incorporated into the project.
- Review of established (and/or modified) *performance goals*.
- Integration of language regarding *performance goals* and acceptable outcomes into project documents (plans and specifications).
- Identification of missing requirements and establishment of required steps to correct.
- Modification, if necessary, of established *performance goals*/requirements.
- Establishment/tracking of responsibilities for gathering documentation.
- Determination of whether sustainable performance contract documents requirements have been implemented.
- Identification of non-conformances of the sustainable performance contract documents and establishment of requirements for immediate correction.

Appendix C - Carbon Dioxide (CO₂) Monitoring Protocol

The CO₂ Monitoring should contain the following:

- The maximum acceptable differential between indoor and outdoor CO₂ concentrations as recommended by the lower of *ASHRAE 62.1-07* or the authority having jurisdiction;
- The documentation of an alarm condition, diagnosis of the condition and documentation of any *remediation* necessary.

Appendix D - Carbon Monoxide Monitoring Protocol

The Carbon Monoxide Monitoring Protocol should contain the following:

- Instructions for review, follow-up and remediation.

Appendix E - Chemical Management and Minimization Policy

The Chemical Management and Minimization Policy should address the following:

- Processes for purchasing, ordering, receiving, handling, storage and disposal of high hazard substances;
- Staff training and education;
- Proper labeling and usage;
- Air monitoring;
- Employee health monitoring, as appropriate, with special consideration for chemicals that have been identified as posing increased risk for occupational and community exposure.

Appendix F - Energy Measurement and Verification Protocol/ Energy Metering Reporting Plan

The Protocol or Plan should contain measurement, verification and metering information for the following building systems:

- Lighting and lighting controls;
- Plug loads;
- Major electric HVAC equipment (such as chillers, cooling towers, AHU fans, major pumps);
- Chilled water generation;
- Heating water or steam generation;
- Furnaces;
- Boilers;
- Secondary electric HVAC equipment as appropriate (e.g. heat pumps, fan coils, fan powered boxes);
- Speciality or process electrical equipment;

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- Status monitoring and verification of critical HVAC controls (e.g. scheduling, economizer operation, temperature resets);
- Potable water use;
- *On-site renewable energy* power generation.

Appendix G - Low-impact Site and Green Building Exterior Management Plan

The Low-impact Site and Green Building Exterior Management Plan should address the following:

- Maintenance equipment.
- Plantings.
- Animal and vegetation pest control.
- Landscape waste.
- Fertilizer use.
- Snow removal (where applicable).
- Cleaning of building exterior.
- Paints and sealants used on building exterior.
- Other maintenance of the building exterior.
- Narrative overview of an organizational management plan that highlights all of the included topics.
- Quarterly reporting over a specified period.

Appendix H - Pest Reduction Plan

The Pest Reduction Plan should include strategies for the following:

- Building and maintaining healthy soils.
- Site-appropriate plants;
- Smart watering practices;
- Holistic pest management;
- Natural *lawn-care* management.

Appendix I - Site Maintenance Contract

The Site Maintenance Contract should include the following:

- Site map to identify locations for meters, controllers, valves, filters, hose bibs, back flow prevention devices and water sources;
- Identification of site square footage of each irrigated landscape zone to use in the formulation of a site water budget by a certified or degreed irrigation designer or auditor;
- Requirement that a certified or degreed irrigation designer or auditor check irrigation system by turning it on manually to inspect for leaks, breaks, overspray, etc... every month or more, if possible;
- Description of actions to be taken to quickly find and fix irrigation to avoid substantial loss of water;
- Requirement to use mulch and to renew mulch on an annual basis or as needed;
- Requirement to grass-cycle with every mowing, if turf is used on site;
- Requirement to use mulching mowers and to leave grass clippings on the site, instead of removing clippings and taking to the landfill;
- Requirement for use of organic fertilizers;
- Limitation on the use of non-organic herbicides and pesticides and that they only be applied by certified applicators;
- Requirement that maintenance contractors are certified landscape professionals accredited by a local water provider and/or university;
- Requirement that plant replacements be done within an approved or provided plant list, or in the context of the site goals for efficiency;
- Requirement that “Extra” work be spelled out in the contract and agreed to by owner, manager and contractors.

Appendix J - Sustainable Purchasing Policy for Cleaning Products and Materials

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This Sustainable Purchasing Policy for Cleaning Products and Materials should include the following:

- Purchasing of cleaning products and materials for use by both in-house staff and out-sourced service providers.
- An organizational policy that assigns control for all high level chemical disinfectants and sterilants.

Appendix K - Waste Minimization Plan

The Waste Minimization Plan should include waste minimization measures through requirements in the following areas:

- Zoning permits.
- Conditions, Covenants and Restrictions (deed restrictions) (CC&Rs).
- Lease agreements.

Appendix L - Water Efficiency Measurement and Verification Plan

The Water Efficiency Measurement and Verification Plan should include monthly reports (annual, monthly, hourly, and daily) of calculated water consumption data from whole building metering *or sub-metering* for the following building systems:

- Potable Irrigation
- Cooling Towers
- Waste

Appendix M - Green Globes Water Consumption Calculator

The Green Globes Water Consumption Calculator is designed to provide the user with a simple and standard means of determining expected indoor water use on a proposed project *and* compare that use against a baseline water consumption profile of an identical project.

The calculator's water consumption thresholds for individual water-consuming items are based either upon (1) the maximum water use as defined in various ASME/ANSI national plumbing standards OR (2) in the absence of a provision in the prevailing standards, common practice in the field of new construction. Where the various national plumbing codes are more stringent than the national standard, the code-mandated thresholds are used for the baseline.

The following indoor fixtures, fixture fittings, and appliances are accounted for in the calculator:

Plumbing Fixtures and Fixture Fittings

- Toilets
- Urinals
- Residential showerheads
- Residential kitchen faucets
- Residential lavatory faucets
- Commercial lavatory faucets

Appliances

- Residential dishwashers
- Residential clothes washers

Other items will be added to the calculator upon the next revision and/or update to the standard, including landscape irrigation, HVAC, exterior water features, and commercial process equipment.

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The daily (or annual) per person use of the above fixtures and appliances is based upon studies conducted and documented by water efficiency professionals and others¹. Appliance use (full cycles per year) are based upon studies and publications of the U.S. EPA's Energy Star Program. The project proponent is allowed to vary these figures based upon expected real world applications.

The calculator requires the project proponent to enter specific project data into the following fields of variables:

Project Physical and Occupancy Factors

Project gross square footage

Project net usable square footage

Total expected occupancy count and male/female ratio

- Net usable square feet per person (for non-residential)
- Work or occupancy days per year (for non-residential)
- Number of residential dwelling units
- Water factor for residential dishwashers
- Water factor for residential clothes washers (if installed)

Personal Usage (residential)

- Daily flush fixture usage
- Daily usage of residential lavatory faucets
- Daily usage of residential kitchen faucets
- Residential showerhead usage (minutes per shower)

The calculator determines the water use by the proposed project's plumbing fixtures, fixture fittings, and appliances, totals that water use and compares it with the baseline condition.

Appendix N - Green Globes™ LCA Credit Calculator for Building Assemblies

The Green Globes™ LCA Credit Calculator for Building Assemblies is a spreadsheet tool that assigns points within the LCA section of the standard, based on the estimated environmental impacts associated with common building assemblies selected by the user. The Green Globes™ LCA Credit Calculator is based on the ATHENA® EcoCalculator for life cycle assessment of building assemblies.

The ATHENA® EcoCalculator is a life cycle assessment software tool that provides environmental impacts for common building assemblies based on results from the ATHENA® Impact Estimator for buildings. The tool includes the following six types of building assemblies and takes account of the use phase assuming a 60-year service life:

- Columns and beams
- Intermediate floors
- Exterior walls
- Windows
- Interior walls
- Roofs

The ATHENA® EcoCalculator uses five environmental impact indicators—global warming potential, primary energy use, air pollution index, water pollution index, and weighted resource use to compare one assembly to another. Different versions of the EcoCalculator are available to account for the varying life cycle impacts of

¹ Two such documents are the *Handbook of Water Conservation*, by Amy Vickers and the *Residential End Uses of Water Study*, by Aquacraft, Inc. for the American Water Works Association Research Foundation (1999).

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building assemblies in different locations with differing climates, varying material sources and transportation distances.

Detailed descriptions and access to the tools are available at:

Green Globes™ LCA Credit Calculator for Building Assemblies, www.thegbi.org

ATHENA® EcoCalculator and *ATHENA*® Impact Estimator:
<http://www.athenasmi.ca/tools/ecoCalculator/index.html>

Appendix O - Multi-Functional Assemblies

Examples of multi-functional assemblies include the following:

- A wall spine assembly for a modular office system comprising multiple panel assemblies that provide support functions, accommodate cabling, and mounting of office components such as shelves, storage cabinets, lighting fixtures and the like anywhere along the horizontal length of the wall.
- Rectangular floor panels fitted together to define a raised floor capable of accommodating wires/cables in a space within a building, accessible through openings in the top panel.
- A wall constructed of foam blocks manufactured using a two part urethane foaming agent with a facing, with intersecting horizontal and vertical channels which may be filled with concrete and reinforcing rod to produce a wall with high horizontal and vertical load capacity as well as superior insulating properties.
- Roofing tiles used in the construction of multi-functional roofs are fit together to define an internal cavity which can be sealed to maintain a gas, liquid and/or other material therein. Filling materials include such things as fire retardants, colored materials, heatable liquid or other materials to provide different functional aspects for a roof made from the tiles.
- Forming walls including a dual-wall cavity, with the outer cavity filled with a filler material for providing structural and insulation features and the inner cavity housing utility materials such as plumbing, air ducts, heating and electrical.