



RELi 2.0

Rating Guidelines for

Resilient Design + Construction

December 2018

INTRODUCTION

The RELi™ 2.0 Rating System (RELi 2.0) is a holistic, resilience-based rating system that combines innovative design criteria with the latest in integrative design processes for next-generation neighborhoods, buildings, homes and infrastructure.

By selectively bundling existing sustainable and regenerative guidelines – including many credits drawn from LEED® - with RELi's ground-breaking credits for emergency preparedness, adaptation, and community vitality, RELi 2.0 is the most comprehensive certification rating system currently available for socially and environmentally resilient design and construction.

The need for resilient design is urgent. Societies and structures must anticipate weather extremes, economic disruption and resource depletion. Our well-being depends on the cooperative interaction of all elements at work in our lives: social, economic and environmental. The RELi 2.0 criteria include acute hazard preparation and adaptation strategies along with chronic risk mitigation at the building and neighborhood scale.

RELi was first developed by the Institute for Market Transformation to Sustainability (MTS) and its RELi Collaborative, a network of professionals, experts and graduate students at Perkins + Will; the C3 Living Design Project; the Capital Markets Partnership's National Safety and Resiliency Committee; the American Institute of Architects Minnesota Committee on the Environment, the University of Minnesota School of Architecture; and the Upper Midwest hub of the American Institute of Architects Foundation National Resilience Initiative Network. RELi was released by MTS for use by pilot projects in 2014, following the American National Standards Institute-approved National Consensus Process.

Since 2017, RELi has been managed by the U.S. Green Building Council, Inc.® (USGBC®) which, in conjunction with MTS, is leading the evolution of RELi 2.0 to synthesize the LEED Resilient Design pilot credits with RELi's Hazard Mitigation and Adaptation credits.

The RELi 2.0 Rating System is a living product that will evolve over time as research, knowledge, and experience build greater understanding and new strategies. This living approach is crucial to the on-going and evolving pursuit of a resilient, regenerative, and sustainable world.

THE RELI 2.0 PROCESS

RELi 2.0 certification is based on a point system. The number of points that a project earns determines the certification level it receives. The 15 requirements within the rating system are mandatory and, therefore, do not carry a point value. Optional credits have point values, allowing projects to seek the certification level that fits their needs. Point values are as follows:

CERTIFICATION LEVEL	POINTS
RELi Certified	300-349 points earned
RELi Silver	350-449 points earned
RELi Gold	450-599 points earned
RELi Platinum	600-800 points earned

ELIGIBILITY AND FEES

As of December 2018, RELi 2.0 is only available to projects that are in the process of seeking LEED certification. This gives eligible projects the exciting opportunity to work with certification teams and pave the way forward in resilient design.

Because RELi 2.0 is being piloted, please contact reli@usgbc.org for pricing.

ASSUMPTION OF EMERGENCY RESPONSE

The RELi 2.0 Rating System assumes that there will be an initial emergency response from state and/or federal emergency authorities within four days after the occurrence of a major event. The RELi 2.0 Rating System is not intended to provide design guidelines for indefinite building and community operation following a catastrophe.

Disclaimer

RELi 2.0 is an in-depth, comprehensive rating system that provides valuable strategies and tools for resilient building and design. RELi 2.0 can help identify and reduce the risk of damage to a project in the event of a natural disaster or other crisis. However, no rating system can eliminate risk entirely. In offering RELi 2.0, USGBC does not represent or warrant that any suggested design component or project as a whole is sufficient for compliance with any state or local laws, building codes, or other regulations, or is able to withstand, in part or in whole, damage due to a catastrophic event. The owner is responsible for ensuring that the project complies with all relevant legal obligations.

Lastly, RELi 2.0 may contain typographical errors or technical inaccuracies. Applicants considering RELi 2.0 certification are solely responsible for determining whether to pursue certification and should obtain any information necessary to make an informed decision.

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PA Req. 1.0:

**Study: Short-Term
Hazard Preparedness
+ Mitigation**

*Structure/Community
(S/C)*

INTENT

Provide guidance to improve the safety of building and community occupants + property during periods of physical crisis. Increase resilience and long-term recovery prospects of the project and site from natural and man-made short-term hazards.

STRUCTURE + COMMUNITY REQUIREMENTS

Study and report on the potential physical and procedural actions that can be taken by the project to prepare for + mitigate short-term hazards to the building and community occupants, physical property + physical infrastructure.

The study should consider damage impacts within the immediate project boundary and relevant surrounding areas along with the disruption of essential services that may become unavailable including, but not limited to electricity, water, sewer, security and fire department services. Environmental crisis event studies should take into account anticipated climate change conditions for 2020, 2030 and 2060 (or similar time-lines based on available data). Socio-economic crisis event studies should assume that tension + risk issues stemming from deep levels of economic inequity and essential resource limits for water, energy + food will continue and increase over time. Opportunities for cooperative action should be identified as a means of mitigation. Those opportunities will vary depending on the project location.

Safe + Resilient issues reflecting site, local, regional hazards and opportunities may include but are not limited to:

- Extreme Weather + Rain, drought, landslide, fire/wildfire, flooding, seismic events, storm surge, snow slide, volcanic activity, wildfire
- Discordant Behavior + Physical Conflict, epidemics, exposure to hazardous materials

For all projects:

- Identify opportunities for cooperative behavior, collaboration and coordination to improve resilience and provide the socio-economic means for problem-solving.
- Identify technical opportunities that can be used to improve resilience and provide physical tools for problem-solving.

Reference: [Envision V2: Prepare for Short-Term Hazards | Conserving Level | Climate + Risk Credit CR2.4.](https://sustainableinfrastructure.org/) ↗ <https://sustainableinfrastructure.org/> (login for free access).
Include [IBHS + NYC Urban Green Proposals](#) (see p. 33)

PA Req. 2.0:

Integrative Process,
Development
+ Community
Stakeholder
Involvement

S/C

INTENT

The Integrative Process (IP) is a discovery based design + develop approach that starts during pre-design. IP is used to optimize all project elements and their interrelationships in the service of cost-effective, efficient and resilient design, engineering, operations and use.

STRUCTURE REQUIREMENTS

Follow the methods and techniques outlined in the LEED® v4 Integrative project planning and design prerequisite and other requirements set out in this requirement.

Starting at the pre-design phase and continuing throughout the design phase, integrate across disciplines, trades and building systems to optimize capital expenditures, resource efficiency and utilization potential. At the same time, provide for redundancy and diversity to improve the project's resilience to stress. It is important that integration goes beyond basic coordination, allowing one system to benefit another. Excessive integration can also lead to brittle systems with limited resilience if redundancy and diversity are not part of the design.

The following systems must be explored to earn this Requirement:

- Energy-Related Systems
- Water-Related Systems
- Transportation Related-Systems
- Systems and Community Commons Space (open space, parks, trails, community rooms, public facilities and facilities available to the public).

Along with using guidance in the [LEED® v4 Integrative Process Credit](#), consider resilience in the design of the all systems explored and describe measures taken to improve each system's resilience. The Safe + Resilient Checklist requires additional systems for compliance.

COMMUNITY REQUIREMENTS

Follow the methods and techniques outlined in the LEED® v4 Integrative Process Credit. Along with criteria described above and include broad community stakeholder participation in the process as described by the Envision Leadership Credit LD1.4, "Provide for Stakeholder Involvement." Involvement expands to the wider community, people and relevant groups that are affected by or have an interest in the project.

Reference: [Envision: Provide for Stakeholder Involvement | Conserving Level | Leadership Credit LD1.4](#). ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Req. 3.0:

Commissioning +
Long-Term
Monitoring/
Maintenance

S/C

INTENT

To elevate the project's quality assurance measures above the Industry Standard of Care in pursuit of performance outcomes that meet the project goals for energy, water, indoor environmental quality and durability.

STRUCTURE REQUIREMENTS

Follow the methods and techniques outlined in the LEED® v4 Fundamental Commissioning Requirement, the LEED® v4 Building Level Metering Requirement and the LEED® v4 Enhanced Commissioning Option 1, Path 2, monitoring-based commissioning credit. Systems requiring commissioning: mechanical, electrical, plumbing and renewable energy systems.

LEED® v4 reference requirements:

- Fundamental Commissioning description (LEED NC)
- Building-Level Energy Metering (LEED NC)
- Enhanced Commissioning, Path 2 (LEED NC)

COMMUNITY REQUIREMENTS

Adapt the methods and techniques outlined above for structures and include the Envision V2 Plan for Long-Term Monitoring and Maintenance Credit LD3.1. Systems requiring commissioning: mechanical, electrical, plumbing, transportation and renewable energy systems.

Reference requirements:

- LEED® v4 Fundamental Commissioning description (LEED NC)
- LEED® v4 Building-Level Energy Metering (LEED NC)
- LEED® v4 Enhanced Commissioning, Path 2 (LEED NC)
- Envision V : Plan for Long-Term Monitoring and Maintenance | Conserving Level | Leadership Credit LD3.1. ↗ <https://sustainableinfrastructure.org/> (login for free access)

STRUCTURE + COMMUNITY | REQUIREMENTS

Provide ongoing public access to biannually reported energy and water performance data.

PA Credit 1.0:

Business +
Community Case
Analysis, Post-
Development
Evaluation +
Reporting

2-18 points

INTENT

Provide triple bottom line economic rationale for the project and support continuous improvement practices for this and future projects.

STRUCTURE + COMMUNITY REQUIREMENTS (2 POINTS)

Implement the following practices in addition to those included in Requirement 2: Integrative Design, Development + Community Stakeholder Involvement.

➤ **PA Action 1.1 Business Case: (2 points)**

During the pre-design phase, develop a Fundamental Business Case for the project for energy-related systems, water-related systems, workplace productivity and public relations + community benefits. Update the Business Case throughout the design and after occupancy based on actual building performance.

Guidance: [Making the Business Case for Green Building, USGBC](#)

OR

➤ **PA Action 1.2 Comprehensive Business Case: (4 points)**

During the pre-design phase, develop a Comprehensive Business Case for the project covering the triple bottom line of economics, environment and equity. Update the Comprehensive Business Case throughout the Design Phases and after occupancy based on actual building performance.

Guidance:

- ▶ [Envision Business Case Evaluator \(example tool\)](#)
- ▶ [An Introduction to Cost Benefit Analysis, San José State University](#)
- ▶ [The Relationship between Private Profitability and Net Social Benefit, San Jose' State University](#)

AND/OR

➤ **PA Action 1.3 Health Impact Assessment (HIA): (3-6 points)**

During the pre-design phase develop a HIA appropriate to the project scope. HIAs may not be appropriate for building projects depending on the sphere of influence. The HIA should address the triple bottom line of economics, environment and equity. Update the HIA throughout the design phases and after occupancy based on actual project performance.

Guidance:

- ▶ [Health Impact Assessment, U.S. Centers for Disease Control and Prevention](#)
- ▶ [Human Health Risk Assessment, U.S. Environmental Protection Agency](#)

AND/OR

Local + Regional Economic and Socio-Economic Equity Study

▶ PA Action 1.4 Post-Development Evaluation + Reporting: (6 points)

Perform a post-occupancy evaluation covering: image, comfort, serviceability, operational management, physical systems (lighting, heating, ventilation + acoustics), environmental systems (energy, water + CO2), resiliency (adaptability, durability, system diversity + redundancy).

- ▶ [Post-Occupancy Evaluation Slide Deck, University of Westminster](#)
- ▶ [Guide to Post-Occupancy Evaluation, Higher Education Funding Council for England](#)

Report post-occupancy performance data to include: environmental systems (energy, water + CO2), resiliency (adaptability, durability, system diversity + redundancy) and one or more of the following: comfort, serviceability, operational management, physical systems. Make data available to the public.

PA Credit 2.0:

Establish a
Sustainability
+ Resiliency
Management System

2 points

INTENT

Create a project management system that manages the scope, scale and complexity of a project and seeks to improve sustainable + resilient performance.

STRUCTURE + COMMUNITY REQUIREMENTS (2 POINTS)

Document the organizational policies, authorities, mechanisms and business processes and determine that they are sufficient for the scope, scale and complexity of the project as described by the Envision V2 Establish a Sustainability + Resiliency Management System | Conserving Level | Leadership Credit LD1.2.2.

Reference Requirements: [Envision V2: Establish a Sustainability Management System | Conserving Level | Leadership Credit LD1.2.](#) ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Credit 3.0:

Address Conflicting Regulations + Policies

3 points

INTENT

Work with officials to identify and address laws, standards, regulations or policies that may unintentionally create barriers to implementing sustainable + resilient measures.

STRUCTURE + COMMUNITY REQUIREMENTS (3 POINTS)

Document efforts to identify and change laws, standards, regulations and/or policies that may unintentionally run counter to sustainability + resiliency goals. Follow objectives and practices in Envision V2 Establish a Sustainability Management System.

Reference Requirements: [Envision V2: Establish a Sustainability Management System | Conserving Level | Leadership Credit LD3.2.](#) ↗ <https://sustainableinfrastructure.org/> (login for free access)

Example Ordinance: [Seattle Wash. Ordinance allowing "Design Departures" for Living Building Challenge Pilot Projects](#)

PA Credit 4.0:

Study + Design for Byproduct + Underutilization Synergies

2-6 points

INTENT

Reduce waste, improve project performance and reduce project costs by identifying and pursuing opportunities to use unwanted byproducts or materials and resources from nearby operations.

Capture for use underutilized or undervalued resources and/or resources previously treated as waste including but not limited to energy, water, buildings + structures, sanitation, food, transportation, community common space, amenities, services + resources of all kinds.

Planning + design interventions should result in complementary systems and technics that have low demands for and/or produce water, energy, material + resources (of all kinds) while supporting: diversity + biodiversity that offer stabilizing levels of redundancy/ back-up; individual, community + ecological health, vitality + cohesion; local/regional self-reliance + development capacity; shock resistance + recovery potential.

STRUCTURE + COMMUNITY | REQUIREMENTS (2-6 POINTS)

Document the extent to which the project team identified project materials needs, sought out nearby facilities with byproduct resources that could meet those needs and captured synergy opportunities as described by the Envision V2 Pursue By-Product Synergy Opportunities | Leadership Credit LD2.1.

PA Action 4.1(A) (2 points)

Study: Explore Potential Byproduct + Utilization Synergies relevant to the projects

Identify and characterize site-specific neighborhood, local + regional facilities and waste streams. The assessment is to be done in sufficient depth to determine opportunities.

Contact decision-makers and clearly identify the availability of excess resources and/or energy + other possible synergies. Conduct local and/or regional research on byproduct synergy projects.

Core Opportunities for Exploration: Energy, water, materials

- Energy: Including but not limited to waste streams and waste heat opportunities
- Water: Including but not limited to waste water + existing but underutilized water harvesting opportunities such as roofs and paved areas
- Construction Materials: Including but not limited to industrial + municipal waste streams and reuse from deconstruction/demolition

Additional Opportunities (explore at least one):

- Food Production: Including but not limited to under-utilization of previously developed land not used for conservation/biodiversity needs, roof areas + edible landscaping
- Transportation: Including but not limited to waste to energy streams and the underutilization of surrounding facilities + transportation systems
- Community Common Space: Including but not limited to underutilization of surrounding facilities
- Project-specific opportunity: The opportunity must embody characteristics similar to the importance of the opportunities listed above.

Guidance: [Envision V2: Pursue By-Product Synergy Opportunities | Leadership Credit LD2.1](https://sustainableinfrastructure.org/). ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Action 4.1(B) (4 points)

Design: Develop and execute strategies from the opportunities studied in Part 1

The PA Action 4.1(A) study must be completed before PA Action 4.1(B).

Demonstrate improvements of at least 20% savings or utilization compared to the total resource needed or available, up to 100% of the conventionally designed project demand for the resource. Project demand must be greater than 5% of the total project cost or a significant ongoing demand. Savings and utilization improvement of 40% or greater for any one opportunity is equal to two opportunities.

Execute (1) Opportunity explored in the study (cannot be a core opportunity set out in 4.1(A))

Execute (2) Opportunities explored in the study (cannot include a core opportunity set out in 4.1(A))

Execute (3-6) Opportunities explored in the study

Execute (7) Opportunities explored in the study

Guidance: [Envision V2: Pursue By-Product Synergy Opportunities | Leadership Credit LD2.1.](#) ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Credit 5.0:

Study and Design
for Improved
Project Element
+ Infrastructure
Integration

3-9 points

INTENT

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

Use interlocking systems to increase the effective + efficient use of resources, including but not limited to energy, water, buildings + structures, sanitation, food, transportation, community common space, amenities, services + resources of all kinds.

Planning + design interventions should result in complementary systems and technics that have low demands for and/or produce water, energy, material + resources (of all kinds) while supporting: diversity + biodiversity that offer stabilizing levels of redundancy/ back-up; individual, community + ecological health, vitality + cohesion; local/regional self-reliance + development capacity; shock resistance + recovery potential.

STRUCTURE AND COMMUNITIES | REQUIREMENTS (3 POINTS)

Internal + external system, bundling + synergies: Project owner and designer look at the project and its delivered works as a system. Project gains in resource conservation and the use of renewable resources are significant due to efforts to optimize performance across the project and its delivered works. Efforts are made to integrate the design to eliminate design conflicts and find system synergies that enhance overall performance.

The project is planned and designed to account for other related community infrastructure + elements, i.e., how its design and operation will work in harmony and synergy with other infrastructure + elements external to the project. Additional investments are planned to create linkages, improve synergies, and by doing so, improve overall performance.

The project incorporates and takes advantage of valuable community assets, e.g., knowledge and social capital.

PA Action 5.1(A)

Study: Explore Improved Infrastructures + Element Integration Relevant to the Project Scope (6 points)

Identify and characterize site-specific, neighborhood, local + regional opportunities for integration across scales. The assessment is done in sufficient depth to determine possibilities with aggressive searching and screening of opportunities. Make contact with, pursue and include appropriate decision-makers across multiple disciplines and areas of expertise. Possible synergies must be clearly identified. Conduct research that is specific to the site, neighborhood, locality and/or region relative to the project's scope.

Core Opportunities for Exploration:

- Energy-related systems
- Water-related systems
- Building + Structure Related Systems

Additional Opportunities (explore at least one):

- Sanitation
- Food production-related systems
- Transportation-related systems
- Natural and Ecosystem services
- Community Common Space + Amenities
- Project-specific opportunity

Guidance: [Envision V2: Improve Infrastructure Integration| Leadership Credit LD2.1.](#) ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Action 5.1(B)

Design: Develop and Execute Strategies from the Opportunities Studied in Action 5.1(A)

The PA Action 5.1(A) study must be completed before PA Action 5.1(B).

Demonstrate improvements of at least 50% savings, utilization or production compared to the total resource baseline needed or available compared to 100% of the project demand or need.

Project demand must be greater than 5% of the total project cost if it is a fixed asset or a significant ongoing demand if it is a resource flow such as water, food, or energy. Savings and utilization improvement of 110% (net positive) or greater for any one opportunity is equal to two opportunities.

Execute (1) Opportunity explored in the study (cannot be a core opportunity set out in 5.1(A))

Execute (2) Opportunities explored in the study (cannot include a core opportunity set out in 5.1(A))

Execute (3-6) Opportunities explored in the study

Execute (7) Opportunities explored in the study

Guidance: [Envision V2: Improve Infrastructure Integration | Leadership Credit LD2.1](#). ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Credit 6.0:

Study + Design
for Long-Term
Adaptability, Diversity
+ Redundancy

4-12 points

INTENT

Prepare buildings, communities and infrastructure systems to be resilient to the consequences of long-term climate change, perform adequately under altered climate and resource conditions, or adapt to other long-term change scenarios. System diversity and redundancy should be considered and accounted for in the approach. There is preference for ecologically based resiliency approaches over a hardened infrastructure approach.

Utilize diversity, redundancy, adaptability + interlocking systems to enhance project, organization and community resilience. Explore shock-resistant planning and design for extreme weather events/heat waves along with ongoing adaptation to increasing ambient temperatures, sea level rise + flood intensity, water security + food security, energy security, transportation access, community cohesion and local self-reliance.

Planning + design interventions should result in complementary systems and techniques that have low demands for and/or produce water, energy, material + resources (of all kinds) while supporting: diversity + biodiversity that offer stabilizing levels of redundancy/back-up; individual, community + ecological health, vitality + cohesion; local/regional self-reliance + development capacity; shock resistance + recovery potential.

STRUCTURES AND COMMUNITIES | REQUIREMENTS (4 POINTS)

Implement plans and designs to prepare for long-term climate and resource change including the effects of increased intensity and frequency of extreme weather events, water scarcity, sea level rise, extended droughts and heat waves, and increased ambient temperature.

Restore and rehabilitate the effects of long-term change, including desertification, beach erosion, and loss of wetlands. Shoreline restoration activities also minimize the effects of climate change on inland populations, including flooding and extreme weather events.

Resilient systems include diversity, redundancy and buffers as essential principles. Design approaches should include modular + distributed design providing for partial system failure without total system failure. Subsystems nested into larger systems, coupled with stored resources, can offer short-term redundancy and they can be used to take the stress off larger systems during extreme events.

PA Action 6.1(A) (4 points)

Study: Explore opportunities for long-term adaptability relevant to the project scope

Identify and characterize site-specific, neighborhood, local + regional opportunities for long-term adaptation. The study is to be done in sufficient depth to determine possibilities with aggressive searching and screening of opportunities.

Make contact with, pursue and include appropriate decision-makers across multiple disciplines and areas of expertise. Possible synergies must be clearly identified. Conduct research that is specific to the site, neighborhood, locality and/or region relative to the project's scope.

Core opportunities for exploration:

- Food security
- Increased intensity and frequency of extreme weather events, sea level rise, heat waves, increased ambient temperatures, extended droughts
- Sea level rise and increased flooding
- Water security

Additional opportunities (explore at least one):

- Economic security
- Energy security
- Increased Community Cohesion + Self-Reliance
- Transportation
- Other project-specific issues

Guidance: [Envision V2 Prepare for Long Term Adaptability | Leadership Credit CR2.3](#). ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Action 6.1(B) (8 points)

Design: Develop and Execute Strategies from the Opportunities Studied

The PA Action 6.1(A) study must be completed before PA Action 6.1(B).

Demonstrate improvements of at least 30% more resilience and robustness than conventional design for issues pertinent to the site, neighborhood, location and region. Planned ecological restorations and simulations should demonstrate a 50% or greater improvement in productivity over 10 years + 80% improvement over 20 years.

Execute (1) Opportunity explored in the study (cannot be the project-specific opportunity)

Execute (2) Opportunities explored in the study (cannot include the project-specific opportunity)

Execute (3-6) Opportunities explored in the study

Execute (7) Opportunities explored in the study

Guidance: [Envision V2 Prepare for Long-Term Adaptability | Leadership Credit LD2.3](#). ↗ <https://sustainableinfrastructure.org/> (login for free access)

PA Credit 7.0:

Study + Living
Design for Advanced
Resiliency Using a
Diversity of Ecology
Based Perspectives

5-15 points

INTENT

Develop a living design approach for robust sustainability comprised of long-term adaptation + mitigation, restoration, regeneration + resilience that supports overall community vitality and quality-of-life. The approach should support mitigating the negative impacts of climate change, nonrenewable resource depletion, ecological degradation and socio-economic change + inequity.

Use multiple ecologically based design + planning perspectives including Green, Healthy, Just, Living, Net-zero/Net-positive, Sustainable, Resilient, Restorative + Regenerative to develop design interventions that result in emergent, relational systems.

Planning + design interventions should result in complementary systems and technics that have low demands for and/or produce water, energy, material + resources (of all kinds) while supporting: diversity + biodiversity that offer stabilizing levels of redundancy/ back-up; individual, community + ecological health, vitality + cohesion; local/regional self-reliance + development capacity; shock resistance + recovery potential.

Use multiple ecologically based design + planning frames including: Green, Healthy, Just, Living, net-Zero/Net Positive, Sustainable, Restorative + Regenerative to develop interventions.

STRUCTURE + COMMUNITY | REQUIREMENTS

Study and develop holistic scenarios that work across system scales (site, community + region), across system realms (social, economic + environmental) and across timelines (crisis, short-term + long-term) using credits from other sections of RELi and other leadership sources if needed.

Overall, the approach should seek to be net-positive with internalized and externalized benefits outpacing negative outcomes at multiple scales, in all realms, and across an extended arc of time.

Develop scenarios based on the project's sphere of influence that are both internal to the project's physical site boundaries, and external to those boundaries.

PA Action 7.1 Option One: Nested System Scenario (5 points)

PA Action 7.1(A)

Study: Explore opportunities for long-term adaptability relevant to the project scope.

During the pre-design phase study and document a series of Nested System Scenarios developed around the line-items on page 14.

First 3 Diagrams: At least 2 diagrams must contain a Basic Infrastructure System as identified in the System List. Additional Diagrams (up to 5).

PA Action 7.1(B)

Design + Execution

The PA Action 7.1(A) study must be completed before PA Action 7.1(B)

Design and document a series of Nested System Scenarios developed around the line-items from the System List (see page 12). Documentation can include versions of the Nested System Scenarios studied refined to reflect the final design. The diagrams should be combined with select construction documents and other documentation showing the system or system components. If systems were developed other than those studied, develop documentation consistent with those studied and as described above.

The 3 credits used to support the Sphere Diagrams must perform in the top quartile of the performance requirements for that credit: i.e., the credits must earn at least 75% of the points available or meet the top tiers of performance criteria.

PA Action 7.2 (10 points)

Design: Develop and Execute Strategies from the Opportunities Studied

First 3 Diagrams: At least two diagrams must contain Basic Infrastructure Systems.

Spheres of Influence:

The project will identify spheres of influence in which multiple subsystems are interconnected (Nested System Scenarios). These systems may exist at different scales and they do not all have to be contained within the project's immediate physical boundary. Develop Spheres of Influence for the project in which multiple project subsystems interconnect to improve efficiency and mitigate negative impacts. They must also exhibit at least two or more of the following resilience characteristics: adaptation, diversity, redundancy, buffers and/or stockpiles, health and/or social capital. If possible, the system contributes to the overall vitality and quality of all life in the area, exhibiting restorative and regenerative properties. Describe all of the system contributions on the diagram.

Guidance on System Scenarios + Spheres of Influence:

4-minute TED Talk: [Simplifying Complexity](#)

Nested System Scenarios + Sphere Diagrams:

The project team will generate Sphere of Influence diagrams (Sphere Diagrams) illustrating Nested Systems Scenarios for the project. Use 5-7 indicators per Sphere Diagram representing at least three different line-items from the System.

Sub-Indicators can be bundled to create the Indicators listed on the Sphere Diagram. Sub-Indicators must be clearly identified.

Include a minimum of three credits from this checklist that are used on the project and that support the line-items from the Systems List being developed. Up to three indicators from other leadership + next-generation sources used on the project and/or indicators developed specifically for the project can be included.

Guidance: Resiliency Case Study Using Systems Scenarios + Sphere Diagrams:
[Maldives Islands Carbon Neutral Project](#): University of Minnesota

► **SYSTEMS LIST**

Basic Infrastructure:

- Energy, Energy-related systems + thermal comfort, thermal safety
- Hazard preparedness and mitigation
- Sanitation-related systems (grey water, Blackwater + Contaminated Process Water)
- Transportation
- Water-related systems (efficiency + rain water, site water, potable water, recycled)

► **Essential Components:** Approaches that can extend the useful life of the project through robustness + diversity, and adaptability + reuse/recycling.

- Affordable + Intergenerational Housing
- Ecological Health + Wellness
- Food, Compost + Soil (including on-site, Community + Regional)
- Human Health + Wellness
- Local + Regional Economic + Knowledge Diversity
- Local + Regional Jobs / Employment (Living Wage 1X, Minimum Wage 1/3 Credit)
- Local + Regional Socio-Economic Equity
- Local + Regional Socio-Economic/Ecological Productivity
- Local Resources* + Production Capacity*
- Mixed-use districts / areas: general
- Mixed-use districts / areas: live-work, maker space, retail
- Open Space + Public Open Space
- Public Space + The Commons (must be mutually beneficial to all stakeholders)

AND

Nested Systems Overlay Mapping

As the Nested Systems Scenarios are developed, overlay the explorations on top of each other in a stacked diagram to identify indicators that are used frequently. Frequent use is an indicator of their importance in maintaining the integrity of multiple systems. Include these iterative studies in the documentation. Develop a final Nested Systems Overlay Diagram illustrating the five most frequently used indicators.

OR

Double Nested Systems Scenario

During the pre-design phase study and document a series of System Scenarios as described below for three diagrams.

DESIGN AND EXECUTION

The Study must be completed to pursue this credit. Design and document a series of System Scenarios as described above for Nested System Scenarios. Documentation can include versions of the Study adapted to reflect the final design combined with select Construction Documents and other documents showing the system or system components. If systems were developed other than those studied, develop documentation consistent with those studied as described above.

Apply the directions for Nested Systems Scenarios to Double Nested System Scenarios by developing a Sphere Diagram interconnecting indicators already included in other Nested System Scenarios and illustrating how the resulting Double Nested System exhibits an additional scale of improved efficiency, mitigated negative impacts, and preferably net positive results. The Double Nested System must also exhibit at least two or more of the following resilience characteristics: adaptation, diversity, redundancy, buffers and/or stockpiles, health and/or social capital. If possible, the system contributes to the overall vitality and quality of all life in the area, exhibiting restorative and regenerative properties. Describe all of the system contributions on the diagram.

HP Req. 1.0:

Fundamental Emergency Planning for Common Hazardous Events

S/C

INTENT

Provide fundamental safety for occupants during periods of disaster and/or emergency.

STRUCTURE + COMMUNITY REQUIREMENTS

- Develop an Emergency Preparedness Plan

Structures

Prepare and implement a Fundamental Common Hazards Emergency Preparedness Plan for the facility using the American Red Cross SMB (Small Business) Prepared Playbook: Emergency Preparedness Tips for Small Businesses. Use the Hazard Vulnerability Assessment Worksheet to assist the planning effort.

Supplement the basic SMB preparedness tips noted above with the hazard specific checklists for issues identified below.

Communities

Develop a Fundamental Common Hazards Emergency Preparedness Plan by adapting the Structures requirements identified above to serve the community. Identify residential + at-risk populations and provide them with planning and implementation assistance. Facilitate community outreach efforts between local entities.

Identify a Crisis Management Center (one or more of the Baseline Facilities identified in HA Req. 2.0, Back-Up Power Time Duration Table, p. 32) and develop a plan for appropriate improvements as identified under the Mission-Critical criteria of the Hazard Mitigation + Adaptation Requirements 1, 2, 3 + 4.

Large Operations and Businesses

The resources identified have been developed primarily for small businesses and organizations. Large entities may have organization-wide plans in place to improve safety + resiliency. The SMB checklists are valuable at the scale of an individual facility, business unit department. The Common Hazards are pertinent to any scale of operation.

- [American Red Cross SMB Prepared Playbook](#)
- [American Red Cross Hazard Vulnerability Assessment Worksheet](#)

Common Hazards Emergency Planning - All Structure + Community

Include: Fire, hazardous material incidents, technological emergencies, identification of critical business systems, communication planning and community outreach. For guidance on preparing for each, please consult the following resources:

- **Local Emergency Operations Plans:** Many U.S. states and municipalities have their own disaster response plans available for download. If your project is located within such a locality, align your emergency plan with the local disaster plan. Example: South Carolina's [Emergency Operations Plan](#).

Fire

- [FEMA Guide 141, Emergency Management Guide for Business and Industry](#) (Oct. 1993) | See pages 51-52, including Option 1 for evacuation; Options 2-5 regarding fire containment are optional. Note: A facility inspection by the Fire Department is not required.

Hazardous Materials Incidents

- [FEMA Guide 141, Emergency Management Guide for Business and Industry](#) (Oct. 1993) | Pages 53 and 54.
- [American Red Cross Fact Sheet on Shelter-in-Place](#)

Technological Emergencies

- [FEMA Guide 141, Emergency Management Guide for Business and Industry](#) (Oct. 1993) | Page 65

Identify Critical Business Systems

- U.S. Small Business Administration/PrepareMyBusiness.Org Checklist: [Identify Critical Business Functions](#)

Communications Plan

- U.S. Small Business Administration/PrepareMyBusiness.Org Checklist: [Emergency Communications](#)

Community Outreach

- [FEMA Guide 141, Emergency Management Guide for Business and Industry](#) (Oct. 1993) | Page 39, first section: "Involving the Community"

Common Hazards Emergency Planning based on geographic location - Structure + Community. Include: wildfire, floods and flashfloods, hurricanes, tornadoes, severe winter storms and earthquakes.

Identify Common Hazard risks based on geographic location for the project: Use the Insurance Institute for Business + Home Safety Home Page (IBHS) Zip Code tool located on their [webpage](#).

- **Earthquakes**
U.S. Small Business Administration/PrepareMyBusiness.Org checklist: [Earthquake Preparedness](#)
- **Floods and Flash Flood**
U.S. Small Business Administration/PrepareMyBusiness.Org checklist: [Flood Preparedness](#)
- **Hurricanes**
U.S. Small Business Administration/PrepareMyBusiness.Org checklist: [Hurricane Preparedness](#)

HP Req. 2.0:

Fundamental
Access To: First Aid,
Emergency Supplies,
Water, Food,
Communications

S/C

- **Tornadoes**
U.S. Small Business Administration/PrepareMyBusiness.Org checklist:
[Tornado Preparedness](#)
- **Severe Winter Storms**
U.S. Small Business Administration/PrepareMyBusiness.Org checklist:
[Winter Weather Preparedness](#)
- **Wildfire**
U.S. Small Business Administration/PrepareMyBusiness.Org checklist:
[Wildfire Preparedness](#)

INTENT

Provide fundamental safety for facility occupants during common emergencies for at least a 96-hour period (four days).

STRUCTURES

Provide the items listed below for Mission-Critical Facilities as defined in RELi HA Requirement 2.0, including residential facilities with overnight occupancy.

COMMUNITIES

Organize the community to provide the items listed below at the residential and commercial scale.

Stock and Provide a First Aid Kit

Meet OSHA and ANSI NSI Z308.1-2003 Minimum Requirements for Workplace First Aid Kits, including the additional items listed in the ANSI standard + items that do not duplicate the ANSI standard as recommended by the American Red Cross for first aid kits.

- [Page 2: OSHA Standards, First-Aid Kits \(mandatory\)](#)
- [Anatomy of a First Aid Kit - American Red Cross](#)
- [First Aid, CPR and AED Certification - American Red Cross](#)

Provide First Aid Training and CPR Training

Provide basic training in First Aid and CPR for at least 10-15% of the staff.

Provide Emergency Preparedness Supplies

Accommodate all occupants as identified in the FEMA/Ready Business Emergency Supplies Checklist. Food can be compressed food bars.

For Mission-Critical Facilities as defined in RELi HA Requirement 2.0, including residential facilities with overnight occupancy, provide 96 hours (four days) of emergency supplies including water + food. Accommodate all occupants as identified in the FEMA/Ready Business Emergency Supplies Checklist. Food can be compressed food bars.

For Fundamental Community Service Organizations, provide Emergency Preparedness Supplies including water + food adequate to serve the required operating timeline outlined in HA Requirement 2.0.

For all other facilities, provide 32 hours (1 ½ Days) of Emergency Preparedness Supplies including water + food.

- ▶ For reference, see the [World Health Organization's Guidelines](#) that recommend at least three liters of water per person, per day, in an emergency situation.
- ▶ Provide portable emergency toilets. Pre-fabricated kits with five gallon buckets or similar are acceptable. Provide heavy duty plastic bags and ties for waste containment, and sanitary wipes + sanitary gel for cleansing.
- ▶ [FEMA/Ready Business Emergency Supplies Checklist](#)
- ▶ [Disaster Supply Kit - University of Missouri Extension](#)

Provide Fundamental Communication Capacity + Equipment

Provide at least one telephone land-line along with a cell phone with text message capabilities and an emergency alert radio + walkie-talkies (or similar) at minimum.

- ▶ **Maintain service of at least one conventional land-line telephone** or provide one of the optional communication devices. There must be back-up power and/or back-up batteries provided for three days of service, 24/7.
 - ▶ **Option 1: Provide a Satellite Phone(s)** + train at least two individuals or 2% of occupants up to five people, or at least 0.66% of occupants, to use the device(s). Test communications quarterly with at least three points of contact.
 - ▶ **Option 2: Provide Citizen Band (CB) Radio(s)** + train at least two individuals or 2% of occupants up to five people, or at least 0.66% of occupants, to use the device(s). Identify and semi-annually test communications with at least three points of contact at least 15 miles away that can provide emergency assistance.
 - ▶ **Option 3: Provide an Amateur (HAM) Radio Unit(s)** + license at least two individuals or 2% of occupants up to five people, or at least 0.66% of occupants, to use the device(s). Identify and semi-annually test communications with at least three points of contact that can provide emergency assistance.
- ▶ **Be prepared to text via cell phone.** Train at least 2 individuals, or at least 10% of occupants, to use the device(s). Note: This device is required under all circumstances and is not an allowable substitute to a land-line telephone or any other communication device.

- ▶ **Provide and monitor a NOAA and Public Alert Certified Weather Radio** with battery back-up. Train at least two individuals, or at least 10% of occupants, to use the device(s).
- ▶ **Provide Family Radio Service (FRS) or General Mobile Radio Service (GMRS) or walkie-talkies for local use.** Train at least two individuals, or at least 10% of occupants, to use the device(s). Example: provide three devices for 200 occupants, four devices for 300 occupants, and so on. Provide at least two devices, or at least one device for 0.66% of occupants.

HP Credit. 1.0:

Enhanced Emergency
Planning for
Common Hazards +
Extreme Events

3-5 points

INTENT

Provide fundamental safety for occupants during periods of disaster and/or emergency.

STRUCTURE REQUIREMENTS (5 POINTS)

Enhanced Emergency Planning for Common Hazards + Extreme Events

American Red Cross Ready Rating

Join (at no cost) the American Red Cross Ready Rating Program. Complete self-assessment and qualify for the "Strong Preparedness Foundation" level.

Reference: [American Red Cross Ready Rating Program](#)

AND

Integrate FEMA Guide 141 and Other Considerations with the American Red Cross Ready Rating Program

In addition to the Ready Rating Program, prepare and implement an Enhanced Common Hazards Emergency Preparedness Plan by fulfilling the requirements of the Fundamental Common Hazards Emergency Preparedness Plan outlined in Requirement HPM Pr1 and conforming with Planning Process Steps and all Planning Considerations identified in the [FEMA Guide 141, Emergency Management Guide for Business and Industry](#) (Oct. 1993). See "Hazard-Specific Information" starting on page 51, and other pages noted below.

Include all Common Hazard categories included in the Fundamental Common Hazards Emergency Preparedness Plan and the following Planning Considerations as identified in the [FEMA Guide 141](#):

1. **Communications:** All items on pages 31 and 32
2. **Life Safety:** All items on pages 33 and 34

3. **Property Protection:** All items on pages 35 through 37
4. **Community Outreach:** All items on pages 39 through 41

Expand the FEMA Guide 141 Planning Considerations to include the following:

1. Mapping For Hazardous Materials Locations + Additional Planning for Incidents
 - ▶ Develop an Evacuation Plan. Post maps and procedures.
 - ▶ Shelter-in-Place: Prepare a plan and provide training and emergency supplies for shelter-in-place strategies. [American Red Cross Fact Sheet on Shelter-in-Place.](#)

Map the Hazardous Materials present in your Area

Identify the location and types of Hazardous Materials in your area so that you can be better prepared to respond in case of emergencies. At a minimum, use the tools referenced below to conduct your research.

Identify Extremely Hazardous Material Risks in your Area

Using the EPA “Vulnerable Zone Indicator System” webpage, submit a request to the EPA to identify facilities in your area that use extremely hazardous substances under the Risk Management Plan (RMP) Rule.

Guidance: [EPA Vulnerable Zone Indicator System](#)

Locate EPA, State and Tribal Facilities of Interest in Your Area

Use the [EPA Facility Registry System \(FRS\)](#) to identify Locate EPA, State and Tribal Facilities of Interest in your Area. (Learn more about FRS [here.](#))

Locate facilities with EPA non-compliance records

Search EPA compliance records using the EPA FRS Envirofacts ECHO/IDEA report using the “What are the compliance records for facilities in my area of interest.” Use this information to better understand potential hazardous material risks in your area.

- ▶ EPA Envirofacts ECHO/IDEA report using the “[Facility Search - Enforcement and Compliance Data.](#)”

Preparedness Planning for Radiological Events (Nuclear Reactor Incidents)

Locate U.S. Nuclear Reactors near the project location: [Nuclear Regulatory Commission Reactor Map](#)

- ▶ For Facilities and Communities within 50 Miles of Nuclear Power Plant: Obtain Potassium Iodide (KI) kits and/or tables for people under 40 years of age from the health authorities along with documentation on use precautions and side-effects, proper dosing and use instructions. They must be taken within a few hours of exposure. Distribution is required for state and local government in areas within 20 Miles (per the 2002 Bioterrorism Act). The National Academies (NA) recommends an Emergency Planning Zone (EPZ) of “(about 50 miles in radius, which also includes the 10-mile radius plume exposure EPZ)”. See [NA decision factors](#), p. 80.

Guidance: “[Distribution and Administration of Potassium Iodide in the Event of a Nuclear Incident](#)” (U.S. Food and Drug Administration, 2004) page 80, and [Frequently Asked Questions on Potassium Iodide \(KI\), dosing information and FDA-approved KI information](#).

For Facilities and Communities within 20 miles of Nuclear Power Plants and Reactors:

Develop an Emergency Preparedness plan and educate facility and community occupants.

U.S. Centers for Disease Control and Prevention: Radiation Emergencies - What Should I do?

- [Radiation Emergencies from CDC - What should I do?](#)
- [American Red Cross Fact Sheet on Shelter-in-Place](#)

Investigate the quality of the Public Water System

- Locate the public water system in your area, and check for the water source (groundwater or surface water) and reported contaminant violations. See EPA Envirofacts ECHO/IDEA report using the “[What public water systems are in my area of interest](#)” page.

Preparedness Planning for Violence and Other Direct Human Action Emergencies: Civil + Authority

Develop a plan to respond to violence and Other Direct Human Action Emergencies involving Civil and/or Authority actions that threaten occupant safety and/or civil rights. Educate occupants about issues and how they can protect themselves. For Guidance, please refer to:

- [Civil Disturbance: Risk Control and Mitigation Strategies](#) - Zürich Insurance Group
- [How to Survive a Riot](#)
- [What To Do If You Are Exposed to Tear Gas](#)
- [American Red Cross Fact Sheet on Shelter-in-Place](#)
- [Know Your Rights: What to do if you're stopped by authorities](#) – ACLU

General Exceptions

Planning considerations that call for significant modifications to the structures and/or infrastructure do not require implementation under this prerequisite, however, the analysis must be performed and reported. Implementation may be used to accrue points under the Innovation in Resiliency category of this checklist as exemplary performance unless implementation directly supports another credit or requirement in this checklist, in which case the actions must be applied to that requirement or credit and cannot be considered for Innovation in Resiliency credit.

Guidance:

- ▶ Business emergency planning checklists on [Fire](#), [Hazardous Materials](#), [Technological Hazards](#), [Community Outreach](#), and Continuity Planning, [Ready.gov](#)
- ▶ [Emergency Response Plan](#) for businesses, FEMA

OR

For Communities Only: Start or actively participate in a Citizens Corps (3 points)

Organize or participate in a Citizens Corps Renewal - Community Preparedness Team using the Five Steps on the Citizens Corps website. The team's primary purpose should be to facilitate, organize and assist community residents, businesses and organization to implement Enhanced Emergency Planning as described for Structures as part of their own residences and facilities. The effort should also coordinate individual efforts and resources in support of the broader community.

- ▶ [Getting Started | Community Renewal: Community Preparedness - Citizens Corps](#)

HP Credit. 2.0:

Enhanced Access:
Emergency
Care + Supplies,
Water, Food,
Communications

8 points

INTENT

Provide safety for occupants during periods of disaster and/or emergency.

HP Action 2.1 (A) Structure Requirements (4 points)

Provide the items listed below

COMMUNITY REQUIREMENTS

Organize the community to provide the items listed below at the residential and commercial scale.

- ▶ **Enhanced First Aid Kit:** Meet HP Req. 2.0 requirements. Provide Automated External Defibrillator.
- ▶ **High-Demand/Short Supply items:** Identify an on-site emergency care space and stockpile essential emergency care supplies not included in the fundamental First Aid Kit provided in Requirement HP Req. 2.0. Identify and consult with emergency responders that would serve the facility. Stock supplies that the emergency responders identify as likely to be in high demand and/or short supply in disaster scenarios.
- ▶ **Unique-need items:** Identify and stock supplies that are not part of Fundamental First Aid Kit required by HP Req. 2.0, but which reflect hazards specific to the project location and/or the special needs of the project occupants.

- **Enhanced First Aid Training:** Meet requirements in HP 2.0. Provide + maintain First Aid, CPR + AED training classes for at least 85% of occupants on average over time. Provide and maintain certifications for at least 35% of occupants on average over time.
- [First Aid, CRP and AED Certification](#) - American Red Cross
- [Article: OSHA Compliance for First Aid in the Workplace](#)
- **Enhanced Access to Emergency Care:** Organize and conduct a meeting with at least two emergency care providers near the facility and/or within the local community to facilitate coordination and emergency response capacity.
 - ▶ Create a written emergency action plan that outlines steps to improve the effectiveness of the off-site care providers in assisting facility occupants in an emergency. Identify barriers to care including coordination of transportation, pick-up and delivery to the facility; communication protocols + equipment; and possible on-site care options.
 - ▶ Collaborate with nearby facilities to purchase or share needed amenities, supplies and equipment that could enhance on-site emergency care.
 - ▶ Identify individuals with special medical needs who may require supplies or medication over a 10-day period. With their participation, develop plans to meet those needs.
- **Enhanced Emergency Sanitation:** Meet the requirements of HP 2.0 and provide improved sanitation for portable emergency toilets. Provide biodegradable + sanitizing compounds to encapsulate waste and improve control over the spread of disease.

AND/OR

HP Action 2.1 (B) (4 points)

Provide on-site sanitation infrastructure and all related resources required for stand-alone operation including, but not limited to trained facilities personnel and power and/or water for proper operation.

- FEMA/Ready Business [Emergency Supplies Checklist](#)
- [Disaster Supply Kit - University of Missouri Extension](#)

Enhanced Communication Capacity + Equipment: Meet the requirements of HP Req. 2.0.

Provide Portable Emergency Lighting

- Provide hand-held lighting equivalent to 6-8 LED diodes in brightness for groups of occupants. Direct occupants to share in groups of four.

Provide Work and Security Lighting

- Small facilities: Light output equal to two 100-watt incandescent bulbs

- Medium-sized facilities: Light output equal to five 100-watt incandescent bulbs
- Large facilities: Light output equal to ten 100-watt incandescent bulbs or more

**Provide Emergency Back-up Power for Communications and Portable
Emergency Lighting**

- Provide four days of emergency back-up power for communication and lighting devices.
- Store four days' worth of fuel worth and/or provide renewable energy and/or battery back-up to support all communication equipment 24/7. Maintain lighting after sun-down or 24/7 in critical locations without daylight.

Provide one of the following expanded communication devices, as described on page 25, in addition to the one selected under HP Requirement 2.0:

Option 1: Provide a Satellite Phone(s) and train at least two individuals or 2% of occupants up to five people, or at least 0.66% of occupants, to use the device(s). Test communications quarterly with at least three points of contact.

OR

Option 2: Provide Citizen Band (CB) Radio(s) and train at least two individuals or 2% of occupants up to five people, or at least 0.66% of occupants, to use the device(s). Identify and semi-annually test communications with at least three points of contact at least 15 miles away that can provide assistance.

OR

Option 3: Provide an Amateur (HAM) Radio Unit(s) and license at least two individuals or 2% of occupants up to five people, or at least 0.66% of occupants, to use the device(s). Identify and semi-annually test communications with at least three points of contact that can provide emergency assistance.

HP Credit. 3.0:

Provide Additional
Emergency
Provisions for the
Community + for
Longer Timeframes

4-10 points

INTENT

Provide safety for project occupants and others in the community during periods of disaster and/or emergency.

STRUCTURE + COMMUNITY REQUIREMENTS

HP Action 3.1 Provide fundamental first aid (4 points)

Provide supplies, water, food and sanitation to accommodate all project occupants and an equal number of people from the surrounding community, or other unaffiliated facilities, to last for four days.

OR

HP Action 3.2 Provide additional provisions and shelter for the community for four days. (4 points)

Provide shelter and provisions for an equal number of people from the surrounding community.

OR

HP Action 3.3 Provide additional provisions for the community for 10 days. (10 points)

Provide water, food and sanitation (or water purification supplies/infrastructure) to accommodate all project occupants and an equal number of people from the surrounding community, or other unaffiliated facilities, for 10 days. Food can be partially comprised of compressed food bars, but it should also include other options. Provide low-glycemic options for people with diabetes. Identify and provide other special health-related food needs in the occupant population. Provide back-up power and/or batteries for communication and lighting to last 10 days.

OR

HP Action 3.4 Provide additional provisions and shelter for the community for 10 days. (4 points)

Along with provisions, provide shelter for an equal number of people from the surrounding community. Provide back-up power and/or batteries for communications and lighting for 10 days.

OR

Provide additional provisions for facility occupants for 10 Days. (10 points)

Provide water, food and sanitation (or water purification supplies/infrastructure) to accommodate all project occupants for 10 days. Food can be partially comprised of compressed food bars, but it should also include other options. Provide low-glycemic options for people with diabetes. Identify and provide other special health related food needs in the occupant population. Provide back-up power and/or batteries for communications and lighting to last 10 days.

HP Credit. 4.0:

Community
Education: Authentic
Dialogues on ever-
increasing Weather,
Safety + Resiliency
Risks

4 points

INTENT

Inform the public and authorities about increasing weather, safety and resiliency risks including critical and non-renewable resource availability and long-term economic indicators.

COMMUNITY REQUIREMENTS

Education: Authentic Dialogues on Increasing Weather, Safety + Resiliency Risks

Host and facilitate quarterly no-cost, or very low-cost, education events open to the public covering safety and resilience topics. Presentations should be provided by knowledgeable persons and organizations. Information must include non-biased forecasts using the best available authentic science and data.

At least one meeting per year should cover forecasts for climate change and weather-related impacts. At least two meetings per year should cover forecasts on food, energy and water.

At least one meeting per year should be conducted as participatory workshop to develop ideas for addressing safety + resiliency issues that are pertinent to the community.

The meetings must be announced publicly, noticeably posted, and circulated at least two weeks in advance, preferably with prior notice one month in advance.

HA Req. 1.0:

Sites of Avoidance
+ Repair: 500-Year
Floodplain, Storm
Surge + Sea Rise

S/C

INTENT

Selecting a location for a structure is an important part of the design process. Understanding the importance of selecting the location and the impact to the design is an important first step in design. Where a structure is located impacts the safety and security of the structure and its residents.

Uncontrolled water, like floods and intense storms, can cause human and economic damage. Areas adjacent to ocean tides are at an increased risk from rising sea levels due to global warming/climate change. Avoiding these areas when building can substantially reduce risks to life, property, infrastructure (including water, wastewater removal + treatment, power, roads, transit, food supply/consumer access), health care delivery/access, solid waste, retail/consumer access, and business during extreme events.

Communities protecting flood and surge prone areas reduce the impact of loss by prohibiting permanent structures and improving buffering and water adsorptive capacity. Parkland or golf course creation are secondary uses that reduce risk of loss.

STRUCTURE AND COMMUNITY REQUIREMENTS

Floodplain

Avoid areas within 500-year floodplain. Statistically, the traditional 100-year floodplain has been found vulnerable to extreme events and sea level rise. Even in areas with prolonged drought, storm events, when they occur, are more intense, making the 500-year floodplain level appropriate for underwriting.

Sites Not Permitted

Building on green field sites below the 500-year floodplain is not permitted.

Provide a permanent flood control mitigation system for new facilities on previously developed locations and/or within existing, built environments such as cities or towns located within the 500-year floodplain. The permanent flood control mitigation system must protect the entire facility and/or protect critical infrastructure and locate key functions and service areas above the 500-year floodplain to provide for business continuity.

If the 500-year floodplain is not available/has not been mapped, use the 100-year floodplain and add 3' (three feet) to that measurement. If neither floodplain is available, a civil engineer/engineering team must conduct an analysis to determine the 500-year floodplain.

Sea Level Rise

Avoid coastal zones inundated by 2'-6" of sea level rise, or provide an engineering solution as follows:

- Complete by 2020: areas inundated by more than 4' up to 5' sea level rise

- ▶ Complete by 2022 (and beyond): areas inundated by more than 5' up to 6' sea level rise

Storm Surge

Based on the sea level rise defined above, projects (except for significant, high-risk and/or mission-critical projects) should:

- ▶ Accommodate a Category 2 hurricane and storm surge with minimal or no interruption to the services, provided from the facility, beyond the immediate time frame of the storm.
- ▶ Provide for Category 4 hurricane and storm surge mitigation with expectation that there may be an interruption to non-essential functions and services provided by the facility beyond the immediate time frame of the storm.
- ▶ Provide permanent infrastructure as required to protect the entire facility and/or protect critical infrastructure.
- ▶ Protect or locate key functions and service areas above the Category 4 surge elevation to provide for emergency operations.

(Significant, high-risk and/or mission-critical projects should accommodate and mitigate Category 3 and Category 5 storms respectively.)

Use NOAA SLOSH Model data to interpolate storm surge. In the absence of SLOSH Model data use the Surging Seas Threat Map and Forecasting Tools to establish storm surge scenarios that take into account sea level rise. Sea Level Rise and Storm Surge for 2022 and beyond should use the NOAA 2012 Sea Level Rise "High Scenario" combined with a 1 in 100-year flood ("Extreme" flood scenario) to determine water levels for planning purposes.

- ▶ [Surging Seas Threat Map and Forecasting Tools for Sea Level Rise + Storm Surge](#)
- ▶ [NOAA Sea Level Rise Scenarios for the United States](#)

Develop an Inundation Map for the project as described by Architecture 2030 using the following tools:

2. Inundation Mapping. [Inundation Mapping Swatch - 2030 Palette](#)
3. Implement Coastal Adaptation Strategies. [Coastal Adaptation Strategies Swatch - 2030 Palette](#)
4. Implement Living Shoreline Strategies. [Living Shorelines Swatch - 2030 Palette](#)
5. Design for the Following:
 - ▶ Increased injury & loss of life
 - ▶ Decreased operating expenses including energy
 - ▶ Increased equipment life
 - ▶ Increased property life
 - ▶ Increased property value
 - ▶ Reduced capital outlays for repairs
 - ▶ Reduced insurance costs

- ▶ Reduced maintenance costs
- ▶ Reduced unexpected repairs, equipment downtime, business interruptions

Notes on Sea Level Rise

The year 2100 sea level rise based on the IPCC RCP8.5 Mean “High” Scenario with a Medium Confidence Rating or “Likely” rating is approximately 0.745 Meters or roughly 2-1/2 feet (about 2’-6”) (the actual change will vary based on local conditions). This level is below the NOAA “Intermediate High” scenario of 3’-9” and below the high level of 4’-9” or greater rise expected by 70 global sea level experts (see guidance, below). However, it is generally above the U.S. Army Corps of Engineers’ “Intermediate” scenario of roughly 1’-9” (Sea-Level Change Curve Calculator 2014.88). The 6’ increase recognized by the checklist roughly corresponds to the high case scenario of 6’-6” or 2 meters established by NOAA. Sea level-experts anticipate a 6’-6” to 9’-8” (2-3 meter) rise through 2300 (see guidance, below) and the 8’ minimum rise for higher-risk projects helps to limit the economic, social, health and environmental exposures from sea level rise that may otherwise overrun facilities that operate for extended time frames (or set baseline elevations for extended infrastructure) and could pose a significant risk to communities due to toxic exposures through flooding and/or failure to provide vital services such as energy generation or sewage processing.

There are several variables impacting sea level scenarios. Two important variables are: (1) climate change mitigation (or lack of mitigation) and (2) reinforcing feedback loops.

Aggressive mitigation of climate forcing gases (CO₂, CH₄, etc.) could reduce the extent of sea rise, but current indicators are not strong for near-term aggressive mitigation. NOAA’s “intermediate high” scenario sets a 3’-9” or 1.1 meter increase based on projected ocean warming + current levels of ice sheet melting. A lack of mitigation would increase the impact of reinforcing feedback loops and/or the strength of feedback loops could be greater than anticipated (which appears likely given the faster than expected decrease in Arctic sea ice), resulting in higher levels of warming and greater sea level rise due to thermal expansion and most importantly, greater ice sheet melting, particularly in Greenland and West Antarctica.

Guidance:

- ▶ “Sea-level rise: What the Experts Expect” Nov 2013, [Realclimate.org](https://www.realclimate.org)
- ▶ Underwriting Documentation: Recognized Map Showing Location Outside 500-Year Floodplain
- ▶ “Global Warming of 1.5°”, October 2018, Intergovernmental Panel on Climate Change

HA Req. 2.0:

Fundamental
Emergency
Operations: Back-up
Power + Operations

S/C

INTENT

The grid is increasingly stressed and less reliable due to storms, heatwaves, under-capacity, etc. causing loss of heating, cooling, refrigeration, essential and vital services, electronic payment processing, wholesale and retail business operations. Even for properties above the 500-year floodplain, intensified storms cause periodic flooding and disrupt power since most power lines are above ground.

STRUCTURE REQUIREMENTS

Fundamental Back-Up Power + Operations

Design for protection from power outages from the grid, including those caused by floods, under capacity, civil disturbances, hurricanes, high winds, and intense storms of all kinds including ice, and heatwaves.

Provide permanent back-up power, switching gear and/or power hook-ups, and infrastructure for temporary generators to provide power for critical utilities such as HVAC and boilers. Locate equipment and infrastructure above the 500-year floodplain. For existing facilities with switch gear, infrastructure and/or fuel storage located below the 500-year floodplain elevation, develop a detailed flood protection plan and provide on-site supplies and infrastructure for protecting electrical switch gear/critical infrastructure from flood water. Modify existing infrastructure in combination with the protection plan, if needed, to ensure protection.

If the equipment is not sufficiently elevated as described above, then dry flood protection such as flood gates, walls, doors and/or inflatable barriers must be provided to prevent water intrusion into these vulnerable areas. Flood depth, duration, velocity, and condition of water should be considered (including floating debris). Flood protection must be provided to the 500-year flood level height if known, otherwise 3 feet above the known Base Flood Elevation (100-year flood level) or Advisory Base Flood Elevation.

Duration over which back-up power must be provided:

Back-up power time durations for thermal safety and/or critical functions are identified below. Meet these requirements or meet requirements of local code, whichever is more stringent.

BACK-UP POWER TIME DURATION TABLE

FACILITY TYPE	TIME DURATION FOR BACK-UP POWER
BASELINE FACILITIES	
Residential Buildings, lodging, hospitals, nursing homes, emergency shelters and emergency facilities: fire stations, 911 call centers, police stations and similar.	Four consecutive days, 24 hours per day.
FUNDAMENTAL COMMUNITY SERVICE ORGANIZATIONS	
Pharmacies, convenience stores, grocery stores and facilities with significant stocks of refrigerated or frozen food and ATMs* (Automated Teller Machines) at these facilities	Four consecutive days, eight hours each day during daylight hours for general operations. Refrigeration and freezers, four consecutive days, 24 hours per day.
Gas Stations	Four consecutive days, 12-hours each day (or until fuel stocks are exhausted), primarily during daylight hours. Back-up power or built-in hand pumps for fuel distribution.
*ATMs at banks, credit unions and other similar facilities such as malls	Powered during regular business hours.
SOLAR + WIND ELECTRIC BACK-UP POWER SYSTEMS WITH ENERGY STORAGE	
For all facilities identified above, except hospitals, nursing homes and emergency facilities.	One-half of the duration of back-up power as identified as described above (excluding elevators) for solar or wind electric systems and battery storage. Gas stations must have built-in hand pumps for fuel distribution.

*Cleaner burning fuels include natural gas (if allowed by local code)

AND

Exception

Elevator operation must be maintained as required by code only for emergency facilities such as 911 call centers, fire or police stations. Hospitals must maintain the operation of elevators serving staff and patients.

AND

NYC Urban Green Proposals

Conform with the following Proposals developed by the Urban Green, NYC Building Resiliency Task Force: #8, #15, #21, #22, #23 and #24.

#8. Prevent Sewage back flow (New structures)

#15. Choose Reliable Back-up Power + Prioritize Needs (required for hospitals and emergency response facilities)

- ▶ For other facilities, where possible, provide co-generation and solar power systems as part of the back-up system because they are always in use and can be more reliable than generators.

Provide power for the following priorities and more if possible (Hospitals and Emergency Centers must provide power for all critical functions):

- ▶ Tier 1: Egress
- ▶ Tier 2: Extended Life Safety
- ▶ Tier 3: Water
- ▶ Tier 4: Parking Egress

#21. Keep Residential Stairwells + Hallways Lit During Blackouts

#22. Keep Gas Stations Open During Blackouts

#23. Supply Drinking Water without Power (from the public water main in Residential Common Areas)

#24. Ensure Toilets + Sinks Work without Grid Power (some toilets and faucets need electricity to function)

Guidance:

- ▶ Urban Green Building Resiliency Task Force: [Task Force Summary Report](#)
- ▶ Urban Green Building Resiliency Task Force: [Task Force Full Proposals June 2013](#)

HA Req. 3.0:

Fundamental
Emergency
Operations: Thermal
Safety (Passive
Survivability) During
Emergencies

S/C

Maximum + Minimum Temperature Management for Mission-Critical and/or Fundamental Community Service Organizations (see HA Requirement 2.0 for definitions) Except as noted below:

During periods of grid-provided power and fuel outages, provide operable windows and/or non-powered natural ventilation and passive cooling and/or provide adequate power to operate ventilation fans and/or provide active cooling adequate to maintain indoor temperatures at or below 103 degree heat index in hot seasons. In cold seasons, provide passive heating and/or heat retention strategies and/or back-up power and fuel that maintain interior building temperature at or above 50 degrees.

Temperatures must be maintainable for the duration set forth in HA Req. 2.0 in Table 1 without grid supplied power or fuel.

For Hospitals and Nursing homes:

Maintain an 81 degree F heat index maximum during the hot season, 71 degree F minimum during the cold season (required by federal law for nursing homes).

General residential buildings, facilities and areas:

Maintain a maximum 90 degree F heat index temperature during the hot season

All commercial buildings that do not fall into the mission-critical or Fundamental Community Service Organization category must maintain an interior temperature of not more than 103 degrees F heat index. These requirements are waived should the outside temperature rise to be higher than 103 degrees F on the Heat Index.

OR

Maximum + Minimum Temperature Management for facilities "Safe Zone" for Shelter-in-place Emergencies

During periods of grid-provided power and fuel outages maintain the temperature(s) and conditions identified above in a portion of the facility identified as a "Safe Zone" Providing at least 20 square feet of space per regular occupant. For hospitals and similar facilities provide 30 square feet of space per regular occupant. Meet all minimum local, state, or federal regulatory criteria that may exceed this criteria for specific occupancy and use types.

Manage other space to prevent freezing of water

- Refer to Appendix A of this document for guidance on natural ventilation
- The SET method can be used as an equivalent method to Heat Index on a case by case basis. Please see detailed guidance on using the SET method in Appendix B to this document.
- [OSHA Report on Safe Working Conditions in Extreme Heat](#)
- [Federal Law Regulating Temperature in Medicaid and Medicare Facilities](#)

HA Req. 4.0:

Safer Design for Extreme Weather, Wildfire + Seismic Events

S/C

INTENT

Design for extreme weather, wildfire, and natural and man-made earthquakes. Identify earthquake risks on seismic maps. Design underground tornado shelters to reduce risk of death and injury. Safeguard toxic materials stored in 500-year flood zones. Ensure operable windows in apartments and other multifamily buildings so they can be used during power outages.

Extreme weather encompasses more intense weather events particular to a location and its changing weather and climate. Wildfire risk is increasing, especially in regions west of the Mississippi where drought is more frequent.

STRUCTURE + COMMUNITY REQUIREMENTS

Hazards for all Structure + Community Include: Application Criteria for each are identified below.

Hazards based on geographic location: Structure + Community. Includes: earthquakes, floods, hail + tornadoes, hurricanes, severe winter storms and wildfire.

Identify Hazard risks based on geographic location for the project: Use the Insurance Institute for Business + Home Safety Home Page (IBHS) Zip Code tool located on their [webpage](#).

Earthquakes: Meet the ARUP REDi Rating System Requirements for a Project certified at the silver level or above OR meet the U.S. Resiliency Council Rating System Requirements for a Project certified at the gold level or above.

Reference: [ARUP REDi Rating System](#).

USRC's Implementation Manual USRC Building Rating System for Earthquake Hazards.

Hurricanes: Meet the FORTIFIED Commercial Hurricane Specific Design Requirements.

Reference: [FORTIFIED Commercial Hurricane](#)

Hail: Meet the FORTIFIED Commercial High Wind and Hail Specific Design Requirements for Hail.

Reference: [FORTIFIED Commercial High Wind and Hail](#)

Tornadoes: Projects in FEMA Wind Zones III or IV with public/community uses and multifamily housing facilities must include safe rooms designed and constructed to standards detailed in [FEMA P-361 Design and Construction Guidance for Community Safe Rooms, 2015 edition](#).

Projects in FEMA Wind Zones III and IV without community uses must include refuge areas designed and constructed to standards detailed in FEMA P-431 [Tornado Protection: Selecting Refuge Areas in Buildings](#).

OR

If a tornado shelter is installed, it is recommended that it meet the requirements of FEMA 320 "Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business," FEMA 361 "Design and Construction Guidance for Community Safe Rooms," or the International Code Council + National Storm Shelter Association (ICC/NSSA) - ICC-500 "Standard on the Design and Construction of Storm Shelters."

Severe Winter Storms: Provide hardening of the roof system to prevent potential collapse by designing the snow loads to be 1.2 times the ground snow loads shown in ASCE 7 (or the locally adopted ground snow loads in Case Study areas).

Protect against ice dam formation on low-sloped roofs by preventing ice from forming around drains. For steep-sloped roofs, designs should include increased attic insulation, sealed ceiling penetrations, and waterproofed membranes on roof deck at roof edge (ice and water barrier). This moisture barrier should extend from the roof edge to at least 2 feet towards the interior of the building, beyond the exterior wall enclosing conditioned space. No localized heat source should be installed in non-conditioned attic space such that it creates localized heating of the roof surface. Uninsulated recessed lights should not be installed where they could cause localized heating of the roof surface. Provide all attic or roof access doors between conditioned and non-conditioned space with proper insulation, sealant, and weather-stripping or gaskets and treat them as exterior doors.

Run water pipes through interior walls and heated spaces to prevent frozen pipes. Insulate/seal all wall, door, and wall penetrations. Monitor interior building temperature to prevent freezing of interior piping such as domestic water and fire protection sprinkler systems.

Prepare a Snow Event Response and Removal Plan based upon the [FEMA Snow Load Safety Guide](#). The Plan should define at what point snow removal should be initiated as well as how access will be provided to roof for snow removal.

Wildfire: Demonstrate compliance with ICC's 2012 International Wildland-Urban Interface Code (IWUIC) or 2013 NFPA 1144. Provide a signed Executive Summary from a report from a Licensed Design Professional that describes how the project met or will meet ICC's 2012 IWUIC and/or 2013 NFPA 1144.

Wind: All Hurricane, High Wind and Tornado/Hail Areas

Meet the "FORTIFIED Commercial Hurricane" and the "FORTIFIED Commercial High Wind and Hail" standards or the standards of any IBHS equivalent as displayed on the IBHS website.

Refer to the IBHS publications for wind zone classifications: Hurricane, High Wind and High Wind/Tornado. Reference: ["FORTIFIED Commercial Hurricane"](#) and ["FORTIFIED Commercial High Wind and Hail"](#)

HA Credit 1.0:

Adaptive Design for Extreme Rain, Sea Rise, Storm Surge + Extreme Weather, Events + Hazards

1-53 points

INTENT

Design for extreme weather, wildfire, and natural and man-made earthquakes. Identify earthquake risks on seismic maps. Design underground tornado shelters to reduce deaths and injuries. Safeguard toxic materials stored in 500-year flood zones. Ensure operable windows in apartments and other multifamily buildings so they can be used during power outages.

Extreme weather encompasses more intense weather events particular to a location and its changing weather and climate. Wildfire risk is increasing, especially in regions west of the Mississippi where drought is more frequent.

STRUCTURE + COMMUNITY REQUIREMENTS

HA Action 1.1 Rainwater Management for Extreme Rain Events

Structure + Community: (13 points)

Recalibrate the average 100-year, 24-Hour Storm Water Event upward based on the National Climate Assessment Report and the assumption that CO2 emissions will continue to rise at some level for the next 20 years before leveling off or declining.

To improve safety + resiliency, account for linear increases in precipitation over a 30 year period. Increase the amount of anticipated precipitation falling during a very heavy event by a factor of 1.55* X the observed change that has occurred over the past 54 years between 1958 and 2012.

Refer to figure 2.18 in [Observed Change in Very Heavy Precipitation of the U.S. National Climate Assessment Report](#).

Example: Observed Change for the area comprised of Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio and Wisconsin is 37%. The recalibrated storm water results would be: $37\% \times 1.55 = 57\%$ increase.

**30 years is approximately 55% of 54 years. The calculation assumes a linear increase in event strength.*

HA Action 1.2

Adaptive Design for Flooding, Sea Rise, Storm Surge + Extreme Weather, Events + Hazards (1-20 points)

Safer Design for Extreme Weather, Wildfire, Fire + Seismic Events

Develop a Hazard Map for the project as described by Architecture 2030.

[Hazard Mapping Swatch - 2030 Palette](#)

Hazards for All Structures + Communities

Applicable hazards include:

- ▶ Fire, Burglary and Electrical Surge Protection, and Hazardous Materials Incidents

Interior Fires

Meet the Fortified for Safer Business Standard Criteria 3.9: Wildfire Specific Design Requirements including all recommended practices.

Burglary

Meet the criteria for the Fortified for Safer Business Standard Criteria 3.10: Burglary Specific Design Requirements including all recommended practices.

Electrical Surge Protection

Meet the Fortified for Safer Business Standard Criteria 3.11: Electrical Surge Protection Specific Design Requirements including all recommended practices.

Hazardous Materials Incidents

Ventilation Shut-Down Switch: Provide an emergency shutdown switch, available to building occupants, that begins an automated, orderly, and rapid shutdown of the building's ventilation system, and a closure of outdoor air dampers.

With the permission of the appropriate authorities, provide a manual override that pauses the function of automated pressurization systems for elevator shafts and/or exit stairs in multistory buildings and/or high-rise buildings equipped with these features to stop an accidental introduction of outside air and hazardous airborne materials because of an activation of these systems by the building's life safety system.

Fundamental Building Systems: Protect High-Risk System Components

For projects or parts of projects or project infrastructure located below the 500-year floodplain OR at risk from 1,000-year rain events, conform to the NYC Urban Green Proposals #3 Relocate + Protect Building Systems.

Reference: [Urban Green Building Resiliency Task Force: Task Force Full Proposals June 2013 \(Online\)](#)

Hazards based on geographic location - Structure + Community

Includes: earthquakes, floods and flashfloods, hail + tornadoes, hurricanes, severe winter storms and wildfire.

Identify Hazard risks based on geographic location for the project using the Insurance Institute for Business + Home Safety Home Page (IBHS) Zip Code tool located on their [webpage](#).

- ▶ (The following risks must be addressed if they are applicable to a project: Wildfire, Flooding, Extreme Rain, Hurricanes, Sea Level Rise and Earthquakes)

Wildfire (4 points)

Demonstrate compliance with ICC's 2012 *International Wildland-Urban Interface Code (IWUIC)* or 2013 *NFPA 1144*. Provide a signed Executive Summary from a report from a Licensed Design Professional that describes how the project met, or will meet, ICC's 2012 *IWUIC* and/or 2013 *NFPA 1144*.

AND

For Mission-Critical Facilities:

Hospitals, emergency clinics, nursing homes, key government centers, data + internet critical communication centers, emergency response facilities and other essential facilities, including residential facilities with overnight occupancy:

Locate all important functions and services above the 500-year floodplain and design the facility rainwater infrastructure, footings, foundations and grounds to successfully deal with a 1,000-year rain event.

Sea Level Rise + Storm Surge: (4 points)

Comply with the HMA Requirement 1 Sites of Avoidance + Repair: Floodplain, Sea Level Rise + Storm Surge.

Sites Not Permitted

Projects on karst or sandy topography below the Sea Level Rise Planning Scenarios described in this checklist, relative to the project type, are not permitted. It is important to avoid karst or sandy topography in tidal areas due to the severe challenge of preventing sea water flooding from subterranean infiltration through the soil profile and below, sewers, subsidence, and erosion.

Sea Level Rise Planning Scenario (1): Low-Risk Projects

For projects using Previously Developed Sites and/or Sites Within Existing Built Environments such as cities and towns and/or projects that represent small financial investments, low-hazard risk implications, non-critical infrastructure and those NOT establishing baseline planning elevations (streets, light rail, etc.), avoid greenfield sites inundated by 3' sea level rise and provide an engineering solution for sites inundated by up to 6' of sea level rise (The IPCC RCP8.5 "High" Scenario estimates a 3'-2" or 1 meter Rise/The NOAA 2012 "High" Scenario estimates a 6'-6" rise).

Sea Level Rise Planning Scenario (2): Modest to High-Risk Projects

For projects of modest to significant financial investment, low to moderate-hazard risk implications, critical infrastructure and those establishing baseline planning elevations (streets, light rail, etc.), avoid sites inundated by 5' sea level rise and provide an engineering solution for sites inundated by more up to 6' of sea level rise. (The "High" scenario defined by the U.S. Army Corps of Engineers roughly corresponds to a 4'-9" or 1.5 Meter increase, but varies depending on location.)

Sea Level Rise Planning Scenario (3): *Significant, High-Risk and/or Long-term Mission-Critical Projects*

For projects involving significant financial and resource investment, high-hazard implications and/or long-term mission-critical infrastructure including, but not limited to, major sea level rise barriers and mitigating infrastructure, hospitals, communication + power hubs, energy infrastructure, hazardous material infrastructure, etc. Avoid all sites inundated by 7'-0" sea level rise and plan for a feasible engineering solution for sites inundated by up to 9' of sea level rise (Sea level experts anticipate up to a 9'-8' (3 meter) rise through 2300. The "High" scenario defined by NOAA is a 6'-6" or 2 meter increase by 2100.)

Enhanced Storm Surge Adaptation

Based on the sea level rise defined in this checklist, projects (except for significant, high-risk and/or mission-critical projects) should accommodate a Category 3 hurricane and the related storm surge with minimal interruption to services provided by the facility, beyond the immediate time frame of the storm.

Provide for Category 5 hurricane and storm surge mitigation, including permanent infrastructure as required to protect the entire facility and/or protect critical infrastructure. There may be an interruption to nonessential functions and services provided by the facility beyond the immediate time frame of the storm. Protect or locate key functions and service areas above the Category 5 surge elevation to provide for emergency operations. Significant, high-risk and/or mission-critical projects should accommodate and mitigate Category 4 and Category 5 storms respectively.

Notes on Sea Level Rise: Notes on Sea Level Rise

The year 2100 sea level rise based on the IPCC RCP8.5 Mean "High" Scenario with a Medium Confidence Rating or "Likely" rating is approximately 0.745 meters or roughly 2-1/2 feet (about 2'-6") (the actual change will vary based on local conditions). This level is below the NOAA "Intermediate High" scenario of 3'-9" and below the high level of 4'-9" or greater rise expected by 70 global sea level experts (see guidance below). However, it is generally above the U.S. Army Corps of Engineers' "Intermediate" scenario of roughly 1'-9" (Sea-Level Change Curve Calculator 2014.88). The 6' increase recognized by the checklist roughly corresponds to the high case scenario of 6'-6" or 2 meters established by NOAA. Sea level-experts anticipate a 6'-6" to 9'-8" (2-3 meter) rise through 2300 (see guidance below) and the 8' minimum rise for higher-risk projects helps to limit the economic, social, health and environmental exposures from sea level rise that may otherwise overrun facilities that operate for extended time frames (or set baseline elevations for extended infrastructure) and could pose a significant risk to communities due to toxic exposures through flooding and/or failure to provide vital services such as energy generation or sewage processing.

There are several variables impacting sea level scenarios. Two important variables are: climate change mitigation (or lack of mitigation), and reinforcing feedback loops.

Aggressive mitigation of climate forcing gases (CO₂, CH₄, etc.) could reduce the extent of sea rise, but current indicators are not strong for near-term aggressive mitigation.

NOAA's "intermediate high" scenario sets a 3'-9" or 1.1 meters increase based on projected ocean warming + current levels of ice sheet melting. A lack of mitigation would increase the impact of reinforcing feedback loops and/or the strength of feedback loops could be greater than anticipated (which appears likely given the faster than expected decrease in Arctic sea ice), resulting in higher levels of warming and greater sea level rise due to thermal expansion and most importantly, greater ice sheet melting, particularly in Greenland and West Antarctica (see guidance below).

➤ **Guidance:**

- ▶ "Sea-level rise: What the Experts Expect" Nov 2013, Realclimate.org
- ▶ Underwriting Documentation: Recognized Map Showing Location Outside 500-Year Floodplain
- ▶ "Global Warming of 1.5, a report of the Intergovernmental Panel on climate change, 2018 <http://www.ipcc.ch/report/sr15/>"

Additional Emergency Provisions for the Community

Projects should prepare to provide active community support and recovery by earning credit HPM CR3 - Provide Additional Provisions for the Community: Four Days.

Public Amenities: Provide and/or Manage and Operate a Community Space + Resource

Projects should prepare to provide active community support and recovery during and after emergencies by earning credit HM 4.0 by providing one or more of the following to the community: Provide a small (3-10 person) emergency shelter, provide kitchen space, provide space for a community tool share program, host or co-host and manage a community tool share program, provide meeting space for at least eight people, host or co-host and manage a meeting space, provide space for and/or host a community radio (or HAM radio station), host or co-host and manage community mesh network.

Wind – All Hurricane, High Wind and Tornado/Hail Areas (4 points)

Meet the "FORTIFIED Commercial High Wind and Hail" or the "FORTIFIED Commercial Hurricane" design criteria.

Reference: [FORTIFIED Commercial High Wind and Hail](#)

Reference: [FORTIFIED Commercial Hurricane](#)

Hurricanes

Meet the "FORTIFIED Commercial Hurricane" Design Requirements, including all recommended practices, or the equivalent as listed on the IBHS website.

Reference: [FORTIFIED Commercial Hurricane](#)

Hail +

Meet the FORTIFIED Commercial High Wind and Hail Design Requirements including all recommended practices, or the IBHS equivalent listed on the IBHS website.

Reference: [FORTIFIED Commercial High Wind and Hail](#)

Tornadoes

Projects in FEMA Wind Zones III or IV with public/community uses and multifamily housing facilities must include safe rooms designed and constructed to standards detailed in *FEMA P-361 Design and Construction Guidance for Community Safe Rooms, 2015 edition or most recent version*. (4 points)

Projects in FEMA Wind Zones III and IV without community uses must include refuge areas designed and constructed to standards detailed in *FEMA P-431 Tornado Protection: Selecting Refuge Areas in Buildings*.

OR

If a tornado shelter is installed, it is recommended that it meet the requirements of FEMA 320 "Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business," FEMA 361 "Design and Construction Guidance for Community Safe Rooms," or the International Code Council + National Storm Shelter Association (ICC/NSSA) - ICC-500 "Standard on the Design and Construction of Storm Shelters." (4 points)

Severe Winter Storms (4 points)

Provide hardening of the roof system to prevent potential collapse by designing the snow loads to be 1.2 times the ground snow loads shown in ASCE 7 (or the locally adopted ground snow loads in Case Study areas).

Protect against ice dam formation on low-sloped roofs by preventing ice from forming around drains. For steep-sloped roofs, designs should include increased attic insulation, sealed ceiling penetrations, and waterproofed membranes on roof deck at roof edge (ice and water barrier). This moisture barrier should extend from the roof edge to at least 2' towards the interior of the building, beyond the exterior wall enclosing conditioned space. No localized heat source should be installed in non-conditioned attic space such that it creates localized heating of the roof surface. Uninsulated recessed lights should not be installed where they could cause localized heating of the roof surface. Provide all attic or roof access doors between conditioned and non-conditioned space with proper insulation, sealant and weather-stripping, or gaskets, and treat them as exterior doors.

Run water pipes through interior walls and heated spaces to prevent frozen pipes. Insulate/seal all wall, door, and wall penetrations. Monitor interior building temperature to prevent freezing of interior piping such as domestic water and fire protection sprinkler systems.

Prepare a snow event response and removal plan based upon the FEMA Snow Load Safety Guide. The plan should include when snow removal should be initiated and how access will be provided to roof for snow removal.

Reference: [Snow Load Safety Guide \(FEMA P-957\)](#)

Earthquakes (4 points)

Meet the ARUP Redi Rating System including all recommended practices OR meet the U.S. Resiliency Council Rating System Requirements for a Project at the silver level or above.

Reference: [ARUP REDi Rating System](#)

USRC's Implementation Manual USRC Building Rating System for Earthquake Hazards

For areas subject to hydraulic-fracturing, design for seismic events measuring up to 4.5

Reference: Current active areas of [Hydraulic Fracturing in the U.S. – FracTracker](#)

Radiological Events

For projects located within 20 Miles of a Nuclear Power Plant or Nuclear Reactor along with the ventilation and pressurization controls provided for in the Hazardous Materials Incident section, provide a hot weather "Safety Zone" for regular building occupants that is passively cooled and can maintain a livable temperature for up to four consecutive days in case of a shelter-in-place order.

HA Action 1.3 NYC Urban Green Proposals

Confirm with the following proposals developed by the Urban Green, NYC Building Resiliency Task Force. (1-6 points)

#3 Relocate and Protect Building Systems (1 point)

#4 Remove Barriers to Elevate Buildings + Building Systems (Elevate the building and building systems) (1 point)

#5 Remove Barriers to Sidewalk Flood Protection (Design for Sidewalk Flood Protection) (1 point)

#6 Add Back-up Fire Safety Communication (1 point)

#9 Plant Wind + Flood Resistant Trees (1 point)

#13 Capture Storm water to Prevent Flooding (1 point)

References: Urban Green Building Resiliency Task Force: [Task Force Summary Report](#)

[Urban Green Building Resiliency Task Force: Task Force Full Proposals June 2013](#)

HA Action 1.4

Avoid Proximity to Hazardous Sites (3-6 Points)

Hazardous Material Production or Storage Sites: 1000 Km/3200 Feet Away (3 points)

Identify Hazardous Material Risks around the Project:

Using the EPA "Vulnerable Zone Indicator System" webpage submit a request to the EPA to identify facilities in your area that use extremely hazardous substances under the Risk Management Plan (RMP) Rule.

- ▶ [EPA Vulnerable Zone Indicator System](#)

Locate local EPA, State and Tribal Facilities of Interest

Use the EPA Facility Registry System (FRS) Envirofacts "What Facilities Report to FRS for my area of interest" to identify Locate EPA, State and Tribal Facilities of Interest in your area.

- ▶ [EPA Envirofacts: What Facilities Report to FRS for my area of interest](#)

Locate facilities with EPA non-compliance records

Search EPA compliance records using the EPA Facility Registry System (FRS) Envirofacts ECHO/IDEA report using the search feature: "What are the compliance records for facilities in my area of interest." Use this information to better understand potential hazardous material risks in your area.

- ▶ [EPA Envirofacts ECHO/IDEA report](#)

AND/OR

Nuclear Power Plants: 30 Km/20 Miles Away

Locate U.S. Nuclear Reactors near the project location using the NRC Reactor Map

- ▶ [Nuclear Regulatory Commission Reactor Map](#)

AND/OR

Safeguard Toxic + Hazardous Materials in Flood, Surge and Sea Rise Areas (3 points)

For projects or parts of projects located below the 500 floodplain OR at risk from 1000 year rain events, conform to the NYC Urban Green Proposals #7. Safeguard Toxic Materials Stored in Flood Zones.

Urban Green Building Resiliency Task Force: Task Force Full Proposals June 2013

HA Action 1.5 Conventional + Naturalized Rainwater and Flood Management (8 points)

Protect, Restore or Create naturalized Rainwater Flood Management Systems to support large tracts of land and large volumes of water using biomimetic techniques.

HA Credit 2.0:

Advanced Emergency Operations: Thermal Safety, Lighting, Critical Services, Water

3-72 points

HA Action 2.1 Meet the criteria of Requirement 2 Fundamental Back-up Power + Operations (36 points)

- ▶ **HA Action 2.1(A) (12-16 points):** All critical + important functions and 10% to 100% of all remaining functions, cooling and heating capacity.
- ▶ **HA Action 2.1(B) (8 points):** Back-up power is provided by cleaner burning fuel sources and combinations: Biomethane, Natural Gas, Propane, Biodiesel and/or Diesel bi-fuel generators allowing for operation on 100% Biomethane, Natural Gas, Propane after start-up.
- ▶ **HA Action 2.1(C) (3-6 points):** A percentage of islandable power and fuel needs come from renewable sources.
 - ▶ 10% (3 points)
 - ▶ 20% (4 points)
 - ▶ 50% (5 points)
 - ▶ 100% (6 points)
- ▶ **HA Action 2.1(D) (6 points):** Store on-site fuel and/or provide on-site/near-site renewable energy capacity to provide 10 days of continuous fuel for the operation of emergency power.

HA Action 2.2 Advanced Thermal Safety During Emergencies

Provide opportunities to moderate the indoor building temperatures in times of grid-supplied power and/or fuel outages, heat waves, shelter-in-place emergencies and other extreme events when local self-reliance is critical.

Maximum + Minimum Temperature Management: (8 points)

Except as noted below, during periods of grid-provided power and fuel outages, provide operable windows and/or non-powered natural ventilation and passive cooling and/or provide adequate power to operate ventilation fans and/or provide active cooling adequate to maintain indoor temperatures at or below 90 degree F heat index in hot seasons. In cold seasons provide passive heating and/or heat retention strategies and/or back-up power and fuel that maintain interior building temperature at, or above, 60 degrees F.

Temperatures must be maintainable for four continuous days without grid-supplied power or fuel.

For Hospitals and Nursing homes

Maintain an 81 degree F heat index maximum during the hot season, 71 degree F minimum during the cold season (required by federal law for nursing homes).

General residential buildings, facilities and areas

Maintain a maximum 81 degree F heat index temperature during the hot season.

OR

Maximum + Minimum Temperature Management for facilities "Safe Zone" for Shelter-in-place Emergencies: (12 points)

During periods of grid provided power and fuel outages, maintain the temperatures and conditions identified above in a portion of the facility identified as a "Safe Zone" providing at least 20 square feet of space per regular occupant. For Hospitals provide 30 square feet of space per regular occupant. Meet all minimum local, state, or federal regulatory criteria that may exceed this criteria for specific occupancy and use types.

Manage other space to prevent freezing of water and infrastructure vulnerable to freezing.

HA Action 2.2(A) 10 Days Maximum + Minimum Temperature Management (6 points)

HA Action 2.3 On-Site Water Storage for Operations (4-8 points)

Structure + Community: Reduce Potable water for building sewage conveyance by 50%.

Provide on-site water storage or processing to cover operations, including toilet flushing and mechanical equipment, if needed, for emergency, stand-alone operations for a period of at least 96 hours.

OR

Provide on-site water storage or processing to cover operations, including toilet flushing and mechanical equipment, if needed, for emergency stand-alone operations for a period of at least 10 continuous days.

Structure + Community

Provide on-site water storage or processing to cover operations, including toilet flushing and mechanical equipment (if needed) for emergency operation. Plan stand-alone operations for a period of at least 96 hours.

OR

Provide on-site water storage or processing to cover operations, including toilet flushing and mechanical equipment, if needed, for emergency operation. Plan stand-alone operations for a period of at least 10 days.

HA Action 2.4 Thermal Safety: Moderate to Large Cooling Center (8 points)

Provide community residents with access to moderate temperate space during heat waves (moderate size: 11-25 people; large size: 26 or more people). Provide the following Critical Criteria as identified by the NAPA County HHSA Public Health Division Annex H, Appendix 10, Item 10: Cooling Center Criteria:

- Communications, phone, computer, sign-language interpreters and child friendly with materials for children to play with
- Disability Accessible
- Facility has security service
- Maximum Temperature Management: Provide a Cooling Center(s) for Air Conditioning
- Medical Personnel such as nurses and/or aides
- Back-up Generators
- Public restrooms accessible to disabled and continuously maintained
- Seating for ten or more people with continuous staffing
- Area for pets

HA Action 2.5 Thermal Safety: Advanced Cooling Center *(12 points)*

Provide district residents access to moderate temperate space during heat waves (moderate size: 11-25 people; large size: 26 or more people). Provide the Critical Criteria and any of the Suggested Criteria as identified by the [NAPA County HHSA Public Health Division Annex H](#), Appendix 10, Item 10: Cooling Center Criteria.

- 24 hour/7 day operation; large capacity
- Assistance for people with disabilities
- Parking
- Proximity to transit
- Sleeping capacity including raised cots for accessibility
- Support procedures for those who need additional services (e.g., health care, social services)
- Television, books and games
- Toys and small furniture for children
- Transportation for those who need it

HA: Hazard Mitigation + Adaptation

HA Credit 3.0:

Passive Thermal Safety, Thermal Comfort + Lighting Design Strategies

2-30 points

INTENT

Provide opportunities to moderate the indoor building temperatures during normal operation and at times of grid-supplied power and/or fuel outages, heat waves, shelter-in-place emergencies and other extreme events when local self-reliance is critical.

STRUCTURE AND COMMUNITY REQUIREMENTS

Plan and execute passive thermal lighting, heating and cooling strategies as defined by the 2030 Palette and/or develop and execute, document and share strategies not currently included in the Palette.

- **2030 Palette** related to Thermal Safety, Lighting + Comfort

HA Action 3.1 Landscape Cooling: Up to 6 Points

- Heat Island Mitigation (*2 points*)
- Parks (*2 points*)
- Street Width and Orientation (*2 points*)
- Vegetative Cooling (*2 points*)

HA Action 3.2 Passive Lighting: Up to 8 Points

- Daylighting from Multiple Sides (*2 points*)
- Form For Daylighting (*2 points*)
- Intermediate Light Shelves (*2 points*)
- Side Daylighting (*2 points*)
- Side Daylighting Controls (*2 points*)
- Top Daylighting (*2 points*)
- Top Daylighting Controls (*2 points*)

HA Action 3.3 Passive Heating: Up to 8 Points

- Clerestories and Skylights (*2 points*)
- Direct Gain: Glazing (*2 points*)
- Direct Gain: Storage (*2 points*)
- Form for Heating (*2 points*)
- Indirect Gain: Sunspace (*2 points*)
- Solar Greenhouse (*2 points*)
- Thermal Storage Wall (*2 points*)

HA Action 3.4 Passive Cooling: Up to 8 Points

- Building Facades (2 points)
- Cool Roof (2 points)
- Cross Ventilation (2 points)
- Double Roof (2 points)
- East/West Shading (2 points)
- Evaporation Cooling Towers (2 points)
- Form for Cooling (2 points)
- Night Vent Cooling (2 points)
- Shading Divides (2 points)
- Solar Shading (2 points)

HA Credit 4.0:

Transit +
Transportation
System Protection
+ Continuous
Operations

5-23 points

INTENT

Provide and Maintain Flood Protection + Energy Resiliency in transportation systems for short-term and long-term resiliency.

STRUCTURE AND COMMUNITY REQUIREMENTS

Transit Protection from Flooding and Extreme Events

HA Action 4.1 (6 points)

Protect below ground system vents and entrances from flooding

HA Action 4.2 (6 points)

Plan systems for 500-year floods

HA Action 4.3 (6 points)

Plan systems for extreme rain events as calculated above

HA Action 4.4 (5 points)

Provide distributed generation power sources

HA: Hazard Mitigation + Adaptation

HA Credit 5.0:

Environmental
Protection +
Remediation for
Parks + Preserves

2-20 points

INTENT

Provide protection for public assets and the public commons in times of emergency and disasters.

STRUCTURE + COMMUNITY REQUIREMENTS

HA Action 5.1A (2 points)

Develop detailed action plans and stow needed supplies on-site to protect Parks + Preserves from Flooding.

OR

HA Action 5.1B (4 points)

Protect, Restore and Develop infrastructure, including natural based systems to protect Parks + Preserves from flooding.

HA Action 5.2 (2-7 points)

Define and secure buffer zones around parks and preserves to protect them from development and restore their natural capacities to support biodiversity and provide biophilic opportunities for people.

HA Action 5.3 (2-7 points)

Define and secure wildlife corridors between parks and preserves to protect, restore and enhance their capacity to support biodiversity and provide biophilic opportunities for people.

CV Req. 1.0:

Improve Common Quality of Life

S/C

INTENT

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

STRUCTURE + COMMUNITY REQUIREMENTS

All relevant community plans are reviewed and verified through stakeholder input. The project team works to achieve good project alignment with community plans, recognizing that the scope of the project is a limiting factor. Potential negative impacts on nearby affected communities are reduced or eliminated.

Baseline: Broad Community Alignment (*Envision Superior Level*)

- **Envision V2 Credit Improve Community Quality of Life QL1.1**

OR

Option 1: Holistic assessment and collaboration (*Envision Conserving Level*)

Structure + Community Requirements

The project makes a net positive contribution to the quality of life of the host and nearby affected communities. The project team makes a holistic assessment of community needs, goals and plans, incorporating meaningful stakeholder input. Project meets or exceeds important identified community needs and long-term requirements for sustainability. Remaining adverse impacts are minimal, mostly accepted as reasonable trade-offs for benefits achieved. The project has broad community endorsement.

- **Envision V2 Credit Improve Community Quality of Life QL1.1**

OR

Option 2 Community Renaissance (*Envision Restorative Level*)

Structure + Community Requirements

Through rehabilitation of important community assets, upgraded and extended access, increased safety, improved environmental quality and additional infrastructure capacity, the project substantially reinvigorates the host and nearby communities. Working in genuine collaboration with stakeholders and community decision makers, the project owner and the project team scope the project in a way that elevates community awareness and pride. Overall quality of life in these communities is markedly elevated.

- **Envision V2 Credit Improve Community Quality of Life QL1.1**

CV Credit 1.0:

Incorporate
Important
Community Views
+ Aspects of Local
Landscape

2-11 points

INTENT

Design the project in a way that maintains the local character of the community and does not have negative impacts on community views, helping to maintain or develop local connectivity and appreciation for place and nature, and local social connectivity and cohesion.

STRUCTURE + COMMUNITIES REQUIREMENTS

CV Action 1.1(A) Understanding and Balance (2 points)

Public view plan developed and project adheres to existing policies and regulations regarding fit with local character. Take into consideration the preservation of natural landscape features. Balance the need for safety measures and barriers against desire for protection or enhancement of views.

AND/OR

CV Action 1.1(B) (2 points)

Alignment with Community Values (2-4 points)

As part of the stakeholder consultation process, project team identifies community values and concerns regarding protection and enhancement. Based on evaluations, the project team submits a plan for how views will be protected and enhanced, important natural landscape or community features are preserved and the overall placement in landscape or urban context considered. Aesthetic quality of the project beyond regulations considered.

CV Action 1.2(A) (3 points)

Community Preservation and Enhancement (Envision QL3.2 Superior Level)
(3-7 points)

Complete the Envision Improved + Enhanced Level indicators and the following: Public view plan implemented with little to no deviation. Contract includes clauses on the preservation of high-value landscapes and landscape features. This includes the handling of on-site trees, vegetation, and other features as well as stated penalties for non-compliance and programs to enforce and inspect outcomes. Project implements significant measures to fit with local character either natural or man-made.

OR

CV Action 1.2 (B) (3 points)

Community Connections and Collaboration (Envision QL3.2 Conserving Level)
(3-7 points)

CV Action 1.2 (A) must be completed before CV Action 1.2(B)

Complete CV Action 1.2A and the following: Project team assists local community in establishing or enhancing regulations, policies and standards on view corridors, views from public/open spaces, views of features associated with community identity or natural features. Fit with local character is considered key aspect of the project and alternatives are developed and implemented in collaboration with community stakeholders. Significant efforts are made to site, design and construct project to preserve landscape features.

OR

CV Action 1.2 (C) (1 point)

Restoration of Community and Character (Envision QL3.2 Restorative Level)
(3-7 points)

CV Action 1.2 (A) and (B) must be completed before CV Action 1.2(C).

Complete CV Action 1.2A-B and the following: Owner seeks, where appropriate, to improve the local character of the natural landscape or urban fabric through restorative action as part of the project. This may include removing barriers, structures, or vegetation to restore views; restoring lost or damaged natural landscape features; and designing project to restore lost character features within the community.

CV Credit 2.0:

Community
Connectivity,
Walkability, Public
Transit, Non-
motorized Transit

1-49 points

INTENT

Improve accessibility to non-motorized transportation and public transit. Reduce congestion. Increase the diversity of the transportation options available in times of crisis. Increase connectivity with people and the surrounding environment to improve social cohesion + knowledge of the local surroundings.

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

STRUCTURE REQUIREMENTS

Satisfactory Access

Access design decisions are based on coordination with operators of adjacent facilities, amenities and transportation hubs. Principles and specifications for reducing negative impacts in the construction phase extend to adjacent facilities.

- Reference: [LEED BD+C V4 \(New Construction\)](#)

CV Action 2.1: (2-3 points) **Surrounding Density + Diverse Uses**
(Option 1, Surrounding Density)

CV Action 2.2: (1-7 points) **Access to Quality Transit**

CV Action 2.3: (3 points) **Bicycle Facilities**

CV Action 2.4: (3 points) **Reduced Parking Footprint**

DISTRICT REQUIREMENTS

More Livable Communities: Project team expands the range of discussion. The team works not only with decision-makers in adjacent facilities, et al., but also with local community officials. Design considerations have moved beyond access issues and now address the reduction of traffic congestion, improvements in walkability in the community, and other key measures of mobility and access. The location of the project has been chosen to utilize and improve the existing transportation infrastructure. It incorporates a community transportation strategy. Principles and specifications for reducing negative construction impacts require strong programs for working with affected community.

- For Reference, **LEED ND V4 (Neighborhood Development)**

CV Action 2.5: (1-10 points) **Preferred Location**

CV Action 2.6: (1-7 points) **Access to Quality Transit**

CV Action 2.7: (3 points) **Bicycle Facilities**

CV Action 2.8: (3 points) **Walkable Streets** (LEED ND Requirement.)

CV Action 2.9: (1-6 points) **Compact Development**

CV Action 2.10: (2 points) **Connected and Open Community: Surrounding Connectivity (Case 1)**

CV Action 2.11: (2 points) **Connected and Open Community: Internal Connectivity (Case 2)**

CV Credit 3.0:

Community
Connectivity: Mixed-
Use Commercial,
Housing + Public/
Community Space

1-53 points

INTENT

To facilitate social + economic interconnectivity and cohesion through the built environment by improving existing public space and/or developing new space including parks, plazas and recreational facilities, to enhance community livability. Also includes developing New and/or Enhancing + Restoring Mixed-Use areas that include a wide range of uses and satisfy a significant range of daily + weekly needs and activities include living, work and recreation.

Structure and Community Requirements (*application varies by credit*)
LEED BD+C V4 (New Construction)

CV Action 3.1 Surrounding Density + Diverse Uses: Option 2. (*location near*)
Diverse Uses (2-4 points)

Diverse Use Types Listing, LEED Defined Use Categories (*See Appendix 1. of the credit for a detailed list of uses*):

1. Civic and Community Facilities
2. Community Anchor Uses
3. Community-serving Retail
4. Food Retail
5. Services

AND/OR

CV Action 3.2 Safe + Resilient Checklist Defined Use Categories: Socio-Economic Equity + Vitality. Points each use up to 3 Uses. (2-6 points)

1. Emergency Shelter (including Thermal Safety)
2. Police and Fire Stations are included in the LEED® v4 above Appendix 1. (List above)
3. Hospital or Emergency Clinic
4. Health Clinic
5. Affordable Housing
6. Affordable Daycare/Cooperative Daycare
7. Affordable Live/Work Space
8. Affordable Maker Space
9. Affordable Retail Space

CV Action 3.3 Provide Community Access to Space + Resources

4 Points for each use up to three uses with one 4-point Exemplary Performance.

Provide Community Access to useful space either free of charge or at nominal expense: (4-12 points)

- Community Bike Repair Space and/or Day Stowage Space

- Community Car Share Space(s)
- Community Education Space For at Least 12 People
- Community Garden Space
- Community Indoor/Outdoor Recreation Space (For guidance see [LEED ND V4 Access to Recreation Facilities](#))
- Community Local Mesh Computer Network Hub
- Community Meeting Room for at least 8 People
- Community Radio Space
- Community Resource Reuse/Swap Space
- Community Tool Share Space
- Community Usable Open Space (For guidance see [LEED ND V4 Access to Civic and Public Space](#))
- Community Work Space (Indoor or Covered)
- Facilities for Community newsletter staff (Space, Furniture, Phone, Data, Internet)
- Kitchen Space - Available to the Community at harvest periods
- Provide a Bus or Transit Shelter
- Provide Small Emergency Shelter Space for Surrounding Facilities and Areas (Storm and/or Cooling Shelter)
- Space for a Farmers Market/Community Support Agriculture (Exchange Space) (For guidance see [LEED ND V4 Local Food Production](#), Option 3.)

CV Action 3.4: (1 point) Open Space LEED BD+C V4 (New Construction)

CV Action 3.5: (1-3 points) Joint Use of Facilities LEED BD+C V4 (Schools)

CV Action 3.6: (1-3 points) Housing and Jobs Proximity LEED ND V4 (Neighborhood Development)

CV Action 3.7: (1-4 points) Mixed-Use Neighborhoods LEED ND V4 (Neighborhood Development)

Use Types Listing: The LEED® v4 Defined Use Categories (See Appendix 1. of the Credit for a detailed list uses):

1. Civic and Community Facilities
2. Community Anchor Uses
3. Community-serving Retail
4. Food Retail
5. Safe + Resilient Checklist Defined Use Categories
6. Services

Refer to the Safe + Resilient Defined Use Categories list for Structures

CV Action 3.8: (2 points per option) Access to Civic and Public Space

OR

Parks: For Multiple Pocket Parks adding up to 1/6 acre, District Parks or City/Town Parks refer to the [2030 Palette: Parks Swatch](#).

CV Action 3.9: (1-4 points) Access to Recreation Facilities

CV Action 3.10: (1-12 points) Access to Public Schools + Libraries

CV Credit 4.0:

Expand Citizen Participation: Public Amenities, Councils, Organizations, Communications

1-20 points

INTENT

To facilitate social + economic interconnectivity and cohesion through active civic engagement and facilitation.

STRUCTURE + COMMUNITY REQUIREMENTS

CV Action 4.1 Public Amenities: Manage + Operate a Community Space + Resource (1-12 points)

Manage or Co-Manage + Operate a Community Space and/or resource free of charge or at nominal expense:

- Bus or Transit Shelter (Cleaning, minor maintenance, post schedule(s) + provide schedule(s) for other lines)
- Community Bike Repair Space and/or Day Stowage Space
- Community Car Share
- Community Education Space For at Least 12 People
- Community Garden
- Community Indoor/Outdoor Recreation (For guidance see [LEED ND V4 Access to Recreation Facilities](#))
- Community Meeting Room for at Least 8 People
- Community Mesh Network Computer System
- Community Radio Station
- Community Resource Reuse/Swap Space
- Community Tool Share
- Community Usable Open Space (For guidance see [LEED ND V4 Access to Civic and Public Space](#))
- Community Work (Indoor or Covered)
- Farmers Market/Community Support Agriculture (Exchange Space) (For guidance see [LEED ND V4 Local Food Production](#), Option 3.)
- Kitchen Space - Available to the Community at harvest periods.

- Small (3-10 person) Emergency Shelter for Surrounding Facilities and Areas (Storm and/or Cooling Shelter)

CV Action 4.2 Actively Participate in Local Disaster Recovery Programs (3 points)

Actively participate in a local, regional or national disaster recovery program(s) including but not limited to one organized under the National Recovery Framework.

CV Action 4.3 Actively Participate in a Local, Regional or National Groups + Organizations (1 point)

Actively participate in local, regional or national groups, councils, government and other organization(s) that contribute primarily to the social + public good. If officially organized they should be nonprofit and/or democratically governed with open participation.

CV Action 4.4 Organize and Develop a Community Communication Tool (1-4 points)

- Community Radio Station (can include fundraising for equipment)
- Community Newsletter (print, delivered door to door)
- Rural-Urban Community Forum + Newsletter

CV Credit 5.0:

Resilient
Organizations:
Cooperative + B
Corporation(s),
Nonprofits + Social
Equity Measures

2-30 points

INTENT

To facilitate social + economic equity and stability through: participatory ownership; the inherent nature of business responsibilities to and for the public good; business diversity in type, quantity + scale; the value of business entities being a stakeholder in the local community.

STRUCTURE AND COMMUNITY REQUIREMENTS

CV Action 5.1 Develop a socially + environmentally responsive entity related to the Project (2-12 points)

- B-Corporation
- Not-For-Profit
- Producer or Consumer Cooperative Corporation
- Worker Cooperative

Develop or Expand Local Skills, Capabilities + Long-Term Employment + Mix

CV Action 5.2: (2-6 points) Human PHD: [Social Equity Within the Community](#)

CV Action 5.3: (2-6 points) Human PHD: [Social Equity Within the Supply Chain](#)

CV Action 5.4: (2-6 points) Human PHD: [Social Equity Within the Project Team](#)

CV: Community Cohesion, Social+ Economic Vitality

CV Credit 6.0:

Develop or Expand
Local Skills,
Capabilities +
Long-Term
Employment + Mix

2-15 points

INTENT

To facilitate social + economic equity and stability through: participatory ownership; the inherent nature of business responsibilities to and for the public good; business diversity in type, quantity + scale; the value of business entities being a stakeholder in the local community.

STRUCTURE AND COMMUNITY REQUIREMENTS

CV Action 6.1 Develop or Expand Local Skills, Capabilities + Long-Term

- **Option 1: Hire Locally** - (Envision QL1.3 Enhance Level)
↗ <https://sustainableinfrastructure.org/> (login for free access)
- **Option 2: Specific Skills Outreach** - (Envision QL1.3 Superior Level)
↗ <https://sustainableinfrastructure.org/> (login for free access)
- **Option 3: Local Capacity Development** - (Envision QL1.3 Conserving Level)
↗ <https://sustainableinfrastructure.org/> (login for free access)
- **Option 4: Long Term Competitiveness** - (Envision QL1.3 Restorative Level)
↗ <https://sustainableinfrastructure.org/> (login for free access)

CV Credit 7.0:

Use Regionally
Sourced +
Manufactured
Materials + Products

2-6 points

CV Action 7.1: Regional Materials LEED NC 2009 (2-4 points)

CV Action 7.2 (1-2 points)

- **Option 1: Regional Materials** - 60% Materials, Soils, Aggregates (Envision RA1.1 Enhanced Level)
- **Option 2: Regional Materials** - 95% Materials, Soils, Aggregates (Envision RA1.1 Conserving Level)

CV Credit 8.0:

Stimulate Sustainable
Growth + Development

5-16 points

CV Action 8.1

- **Option 1:** Improve Local Productivity Envision V2 QL1.2 at the Superior level (5 points)
- **Option 2:** Business and People Attractiveness Envision V2 QL1.2 at the Conserving level (13 points)
- **Option 3:** Developmental Rebirth Envision V2 QL1.2 at the Restorative level (16 points)

PH: Productivity, Health, & Diversity

PH Req. 1.0:

Minimum IAQ
Daylight + View,
Thermal Safety:
Operable Windows
in Residences

S/C

INTENT

Improve the health + productivity of building + community occupants by providing an improved Indoor Environmental Quality including air + views.

STRUCTURE AND DISTRICT REQUIREMENTS

LEED BD+C V4 (New Construction)

- Minimum Indoor Air Quality Performance
- Environmental Tobacco Smoke Control
- Low-Emitting Materials

LEED BD+C V2009 (New Construction)

- Views to Exterior for 25% of Occupied Space

PH Req. 2.0:

Minimum Protection
for Prime Habitat +
Floodplain Functions

S/C

INTENT

Improve ecological health + productivity. Avoid placing the project and the site compound/temporary works on land that has been identified as having high ecological value or as having species of high value. Identify and protect soils designated as prime farmland, unique farmland, or farmland of statewide importance. Preserve floodplain functions by limiting development and development impacts to maintain water management capacities and capabilities.

Structure and Community Requirements:

- LEED BD+C V4 (New Construction)

PH Req. 2.1 Construction Activity Pollution Prevention

- Envision V2 For Sustainable Infrastructure

PH Req. 2.2 Preserve Prime Habitat | Superior Performance - Avoid Development of the following (and provide a buffer of no less than 100 feet)

- Home to Species of High Value, follow LEED® v4 NC Imperiled Species + Ecological Communities Criteria
- Land of High-Ecological Value
- National Parks, Monuments, Seashores, Forests
- Other Protected Area
- Patches of Old-Growth Forest
- Wildlife Refuges, Preserves, Wild + Scenic Rivers

PH Req. 2.3 Preserve Prime Farmland | Superior Performance - 95% Protection

For sites located in Prime Farmland designate at least 95% of the Prime Farmland as a Vegetation + Soil Protection Zone (VSPZ). Construction impacts must not decrease the growing capacity of the VSPZ. No more than 10 percent of the total area of the VSPZ can contain development.

PH Req. 2.4 Preserve Floodplain Functions | Improved Performance - Avoid or Mitigate Impacts

Avoid or limit new development within the design frequency floodplain for waterways of all sizes, unless water dependent infrastructure must cross or be adjacent to a waterway. Design water dependent infrastructure to minimize floodplain impacts or waterway crossings. Maintain predevelopment floodplain storage that does not increase flood elevations.

PH Credit 1.0:

Human HDP:
Expanded IAQ,
Daylight + Views,
Fresh Air

1-12 points

INTENT

Improve the health + productivity of building occupants by providing an improved Indoor Environmental Quality including air quality, daylight + views. Assist in providing thermal safety during power outages or heat waves through the use of natural ventilation and/or back-up power.

Structure and Community Requirements:

- LEED BD+C V4 (New Construction)
- PH Action 1.1: (1-2 points) Enhanced Indoor Air Quality Strategies
- PH Action 1.2: (1-2 points) Interior Lighting
- PH Action 1.3: (2-6 points) Daylight
- PH Action 1.4: (1 point) Quality Views
- PH Action 1.5: (1 point) Acoustic Performance

PH: Productivity, Health, & Diversity

PH Credit 2.0:

Human HDP: Active Design for Buildings, Communities, + Urban Environments

9 points

INTENT

Improve the health + productivity of building and community occupants by providing an environment that facilitates and promotes physical activity.

STRUCTURE AND COMMUNITY REQUIREMENTS

PH Action 2.1 Active Design for Buildings (1-3 points)

1 point for the first four line-items and 1 point for each additional two line-items.

Include a minimum of two line-items from two or more of the [Center for Active Design Checklist for Building Design Categories](#), up to 3 points.

Categories:

1. Appealing and Supportive Walking Routes
2. Appealing Stair Environment
3. Building Exteriors and Massing that Encourage Outdoor Use
4. Building Programming that Supports Physical Activity
5. Buildings Facilities that Support Exercise
6. Designating Stairs for Everyday Use
7. Elevators and Escalators as Secondary Vertical Transport Methods
8. Prominent Stair Location and Visibility
9. Stair Dimensions that Encourage Use
10. Visible Stair Prompts

PH Action 2.2 Active Design for Community Groups (1-3 points)

1 point for the first four line-items and 1 point for each additional two line-items.

Active Design for Community Groups include a minimum of two line-items from two or more of the [Center for Active Design Checklist for Community Group Categories](#) that are not required in other requirements or selected in other credits.

Guideline Categories:

1. Active Transportation
2. Supporting Pedestrians
3. Supporting Bicyclists Active Recreation
4. Active Buildings
5. Green Space and Nature
6. Healthy Foods and Beverages

PH Action 2.3 Active Design for Urban Environments (1-3 points)

One point for the first four line-items + one point for each additional two line-items.

Include a minimum of two line-items from two or more of the Center for Active Design Checklist for Urban Design Categories.

Categories:

1. Bicycle Networks and Connectivity
2. Bicycling Infrastructure
3. Bikeways
4. Children's Play Areas
5. Designing Pedestrian Pathways
6. Grocery Sales and Fresh Produce
7. Land Use Mix
8. Parks, Open Spaces, and Recreational Facilities
9. Programming Streetscapes
10. Public Plazas
11. Street Connectivity
12. Traffic Calming
13. Transit and Parking

PH Credit 3.0:

Human HDP: Provide for Social Equity + Interdisciplinary/ Intercultural Opportunities

2-8 points

INTENT

Improve social equity, opportunity and cooperation for and/or between diverse groups of people, professions and institutions as means to reduce tension + waste, increase efficiency + redundancy and expand creativity, flexibility + responsiveness to problem solving and crisis conditions.

STRUCTURE AND COMMUNITY REQUIREMENTS

Provide any combination of three line-items or more related to the facility or community infrastructure, operations + administration:

- ▶ Develop and implement an active Diversity Initiative. Adapt the following credits from the [Association for the Advancement of Sustainability in Higher Education \(AASHE\) STARS Rating Program](#) to the project:
 - ▶ PA 4: Diversity and Equity Coordination
 - ▶ PA 5: Assessing Diversity and Equity
 - ▶ PA 6: Support for Underrepresented Groups
 - ▶ PA 7: Support for Future Faculty Diversity

PH: Productivity, Health, & Diversity

- Develop and implement an Insight Program exploring differences + similarities in perspectives, methods, values between groups with identified integrative outcomes.
- Display diverse, multilingual and/or multidisciplinary accurate historical accounting and context as a means for cultural bridging
- Display diverse, multilingual and/or multidisciplinary art, artifacts + zymology
- Attempt to achieve diverse, multicultural and/or multidisciplinary Board and Staff representation
- Provide diverse, multilingual and/or multidisciplinary signage + communication
- Provide gender-neutral toilet rooms, mothers rooms + prayer rooms

PH Credit 4.0:

Human + Eco HPD:
Reduce Pesticides,
Prevent Surface
+ Groundwater
Contamination

4-13 points

INTENT

Reduce non-point source pollution by reducing the quantity, toxicity, bioavailability and persistence of pesticides and fertilizers, or by eliminating the need for the use of these materials. Preserve fresh water resources by incorporating measures to prevent pollutants from contaminating surface and groundwater and monitor impacts over operations.

STRUCTURE AND COMMUNITY REQUIREMENTS

Envision V2 for Sustainable Infrastructure.

➤ <https://sustainableinfrastructure.org/> (login for free access)

S/C PH Action 4.1 (4 points)

Option One Reduce Pesticide + Fertilizer Impacts | Conserving Level

No pesticide, herbicide or fertilizer use. The project team designs the landscaping to incorporate plant species that require no pesticides, herbicides and fertilizers. Increased use of composting. Practice integrated pest management.

AND/OR

Option Two: Prevent Surface and Groundwater Contamination, Combined Superior + Conserving Level (7-9 points)

Design for source elimination:

Designers focus on eliminating potentially polluting substances from operations. If unable to so eliminate such substances, designers should seek to recycle the substances, keeping them within the operation or sending them off-site for use in other applications.

Designers continue to address prevention measures by locating equipment and facilities containing potentially polluting substances away from sensitive environments.

Design for prevention:

At the design stage, if the polluting substances cannot be eliminated or recycled, design runoff interceptors and drainage channels to accommodate pollutants in stormwater runoff, ice melt, potential spills and leakage. Design spill prevention and response plans. Employ methods to monitor and minimize pollutants in stormwater runoff and ice melt.

OR

Option Three: Restorative Level

Remediate existing contamination:

Prevent future contamination by cleaning up previously contaminated land, restoring wellhead protection, and installing land use controls to prevent future contamination. Restoration also may include removal of materials storage piles, rerouting of surface runoff, or restoring groundwater infiltration patterns.

PH Credit 5.0:

Ecological HPD:
Protect Wetlands
+ Avoid Slopes +
Adverse Geology

1-24 points

INTENT

Protect, buffer, enhance and restore areas designated as wetlands, shorelines, and bodies of water by providing natural buffer zones, vegetation and soil protection zones. Avoid development in adverse geologic formations and safeguard aquifers to reduce natural hazards risk and preserve high quality groundwater resources. Protect steep slopes and hillsides from inappropriate and unsuitable development in order to avoid exposures and risks from erosion and landslides, and other natural hazards.

STRUCTURE + COMMUNITY REQUIREMENTS

Envision V2 For Sustainable Infrastructure

➤ <https://sustainableinfrastructure.org/> (login for free access)

PH Action 5.1: Protect Wetlands and Surface Water (4-18 points)

Establish a vegetation and soil protection zone (VSPZ) for an area within 100 feet of any wetland areas, shoreline, or bodies of water or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent.

Enhanced Level

Buffer > 100 feet or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent.

OR

Superior Level

Buffer > 200 feet or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent.

OR

Conserving Level

Buffer > 300 feet or waterbody or within setback distances from wetlands prescribed in state or local laws and/or regulations, whichever is more stringent.

AND/OR

Restorative Level

Aquatic and wetland restoration: In addition to points awarded for buffering, project may earn points for restoring previously degraded buffer zones to a natural state as part of establishing the VSPZ. Restoration must include stabilization of stream channel or shoreline (bulkheads are not an acceptable stabilization measure for this objective), and revegetation with native plant communities.

Stream channel restoration must include a geomorphic analysis of the reach and the planning for dynamical stable stream banks, based on channel dynamics and sediment transport.

- [Envision NW1.2](https://sustainableinfrastructure.org/). ↗ <https://sustainableinfrastructure.org/> (login for free access)

AND/OR

PH Action 5.2 Avoid Adverse Geology (1-3 points)

Comprehensive delineation: Prior to project siting, the owner and the project team identify and delineate any faults, low-lying coastline and karst areas in and around the project site. Identification and delineation includes location, distribution, characteristics and groundwater hydrogeology, including flow and quality.

Enhanced Level (1 point)

Sound risk management: Develop plans and designs to reduce the risk of damage due to ground motion, tsunami flooding and collapse of karst areas and associated aquifer damage, or from the hazards of these areas, e.g., subsidence, sinkholes, flooding. Design operation procedures for the constructed works are designed to prevent damage and contamination. Establish programs for monitoring.

- Refer to "Designing for Tsunamis: Seven Principles for Planning and Designing for Tsunami Hazards" by NOAA, USGS et. al. *March 2001 edition*.

OR

Superior Level (2 points)

Protection and risk management: Define the adverse geological areas and associate aquifers based on extensive geotechnical and hydrogeologic assessments. Define, designate, and avoid hazard areas. Create, and implement runoff controls, spill prevention, and cleanup plans.

OR

Conserving Level (3 points)

Total avoidance: The owner and the project team site the project in a safe area that has no adverse geologic features and no negative effects on aquifers.

- ▶ **Envision NW1.4.** ↗ <https://sustainableinfrastructure.org/> (login for free access)

PH Action 5.3 Avoid Unsuitable Development on Steep Slopes (1-3 points)

Identify relative landslide, subsidence and liquefaction risk, and critical slopes risk that may indicate unstable soil. Refer to state and local data¹ to determine whether the project is located in a high-risk landslide area and whether there is land on or uphill of the building site with a slope exceeding 15% (6.75°).

Reference:

- ▶ For general use only, not for site-specific information: USGS map, "**Landslide Overview Map of the Conterminous United States**"
 - ▶ For additional guidance, refer to the most recent works by the American Society of Civil Engineers and the U.S. Geological Survey on slope stability and steepness

OR

Superior Level

Optimal project siting

Work with local officials, property owners and other stakeholders to select and acquire a project site that is sufficiently suited for the project purpose. Seek to minimize siting on hillsides or steep slopes. Work to locate and acquire the best location that minimizes the possibility of excessive erosion and landslides.

- ▶ **Envision NW1.6.** ↗ <https://sustainableinfrastructure.org/> (login for free access)

¹ For projects outside the United States: Use the U.S. standard or a local equivalent, whichever is more stringent.

PH Credit 6.0

Ecological HPD:
Biodiversity, Habitat,
+ Soil

2-16 points

Landslide-Specific design measures

Demonstrate that any steep-slope ($\geq 15\%$ or 6.75°) soils and underlying geology on the building site and uphill from the building site have been investigated through a signed report from a geotechnical engineer.

Either provide a signed letter from a geotechnical engineer showing that landslides pose minimal landslide risk or a letter from professional engineer indicating that mitigation strategies for the project result in minimal landslide risk.

INTENT

Protect biodiversity by preserving and restoring species and habitats. Restore soils disturbed during construction, previous development and use to bring back ecological and hydrological functions.

STRUCTURE REQUIREMENTS

LEED® v4 BD+C NC (New Construction), ND (Neighborhood Development) + Envision V2 Sustainable Infrastructure

PH Action 6.1

STRUCTURE REQUIREMENTS

Option 1 (4 points)

LEED BD+C V4 NC (New Construction): **Site Development** - protect or restore habitat.

If a greenfield area exists, protect 40% from development and construction activity. Use native or adapted vegetation to restore 30% of all portions of the site identified as previously disturbed (including the building footprint).

Green Roofs can be used to support habitat restoration.

- Refer to the 2030 Palette: **Green Roof Swatch** for design guidance.

OR

Option 2 (2 points)

Provide financial support equivalent to at least \$0.40 per square foot (US\$4 per square meter) for the total site area (including the building footprint) to a land trust or conservation program.

OR

Option 3 (8 points)

Envision V2 Sustainable Infrastructure: NW3.1 Preserve Species Biodiversity - Restore and create habitats. ↗ <https://sustainableinfrastructure.org/> (login for free access)

Comply with the Improved Level criteria as a minimum. Project team works with state and local agencies to identify existing habitats in or near the project site. During the course of the project, not only protect and upgrade existing habitats, but restore and create new habitats. Reinstate appropriate vegetation, improve and expand wildlife corridors, and link existing habitats.

PH Action 6.2

Communities Requirements

LEED® v4 BD+C (New Construction), **ND (Neighborhood Development)** + **Envision V2 Sustainable Infrastructure.** ↗ <https://sustainableinfrastructure.org/> (login for free access)

Option 1. (2-4 points)

LEED® v4 ND Neighborhood Development: **Site Design for Habitat** or wetland and water body conservation Case2. Option 1. (Two Points if less than 40% of site and four Points if 40% or more)

- Refer to LEED® v4 NC New Construction: **Site Development** - protect or restore habitat for soil restoration criteria

OR

Option 2 (2 points)

Provide financial support equivalent to at least \$0.40 per square foot (US\$4 per square meter) for the total site area (including the building footprint) to a land trust or conservation program.

OR

Option 3 (8 points)

Envision V2 Sustainable Infrastructure: NW3.1 Preserve Species Biodiversity - Restore and create habitats. ↗ <https://sustainableinfrastructure.org/> (login for free access)

Project team works with state and local agencies to identify existing habitats in or near the project site. During the course of the project, not only protect and upgrade existing habitats, but restore and create new habitats. Reinstate appropriate vegetation, improve and expand wildlife corridors, and link existing habitats.

EW Req. 1.0

Minimum Water Efficiency + Resilient Water + Landscapes

S/C

INTENT

Conserve water and improve water availability for human and ecological use. Improve the integration of human development with the natural hydrology cycles, the biophysical environment and the geochemical flows of nature; maintain a dynamic balance with surface water, aquifers, rain events and water use; maintain a manageable condition with the site and regional hydrology during extreme rain events, periods of flooding and droughts, etc.

Structure + Community Requirements

LEED BD+C V4 (New Construction or Equivalent)

- Indoor Water Use Reduction (20%)
- Outdoor Water Use Reduction (30%)
- Rainwater Management-Option 1, 95th Percentile of Rainfall Events

EW Req. 2.0

Minimum Energy Efficiency + Atmospheric Impacts

S/C

INTENT

Conserve Energy in support of the following: Improve the balance of human development and its use of energy and natural energy cycles, the biophysical environment and the geochemical flows of nature; maintain a dynamic balance with energy needs and energy availability; maintain a manageable condition with energy use and availability during short-term shortages and/or supply interruptions improving passive survivability and long-term as non-renewable energy stocks are depleted and gross energy availability declines worldwide.

STRUCTURE + COMMUNITY REQUIREMENTS

LEED BD+C V4 (New Construction or Equivalent)

- Minimum Energy Performance
- Building Level Energy Metering
- Fundamental Refrigerant Management

EW Credit 1.0

Plan for Rainwater Harvesting, Resilient Landscapes + Food Production

1-2 points

INTENT

Plan fundamental systems, infrastructure and space for Rainwater Harvesting, Rainwater Management, Water Recycling/Reuse + food production to conserve resources in the long-term and to improve thermal-safety and passive survivability during extended power outage or loss of heating or cooling fuel.

STRUCTURE + COMMUNITY REQUIREMENTS

EW Action 1.1 Rainwater Management + Water Recycling/Reuse: Space and Planning (1 point)

Plan the structure and site to provide for roof and/or ground level collection of rainwater and/or for project uses such as landscape irrigation, toilet flushing, process water of all kinds, and with proper filtration, potable use. Plan a minimum of 50% of the roof area to capture water for reuse.

- [2030 Palette: Water Catchment and Storage Swatch](#)

Plan a minimum of 50% of parking areas and hard surface to capture water for reuse. Carefully evaluate water quality.

Plan a minimum of 50% of parking areas and hard surface to capture water for reuse.

- Refer to the [Twin Cities Metropolitan Council Water Supply Planning](#) website for design guidance.

Plan space and infrastructure to recover grey water and/or blackwater.

Provide adequate space and plan piping for constructed wetlands or other ecologically based treatment systems and/or biodigesters. And/or provide adequate space and plan piping for low-energy mechanical filtration systems. At a minimum treat water to levels safe for surface discharge and percolation.

- Refer to the [2030 Palette: Constructed Wetland](#) for design guidance.

EW Action 1.2 On-Site Food Production: Space and Planning (1 point)

For Structures, Refer to Sustainable Sites V2

Provide space and plan for on-site food production on at least 10% of the site area less than the building footprint. Adapt the Sustainable Sites V2 credit 6.7: Provide On-site Food Production criteria for edible landscaping in the form of vegetable gardens and/or site appropriate edible nut and fruit-bearing plants.

- [Sustainable Sites Rating System](#)

For Communities, Refer to LEED® v4 ND

Provide space and plan for on-site food production. Follow the LEED® v4 ND (Neighborhood Development) "Local Food Production" credit, Option 1. Neighborhood Gardens to define space and planning criteria.

- [LEED ND V4 Credit: Local Food Production Option 1. Neighborhood Gardens](#)

EW Credit 2.0

Plan the Site + Orientation for Sun + Wind Harvesting, Natural Cooling

1-5 points

INTENT

Plan fundamental systems, infrastructure and space to include Renewable Energy Sunlight + Wind Harvesting and Natural Cooling (Indoor and Outdoor) to conserve resources in the long-term and to improve thermal-safety during extended power outage or loss of heating or cooling fuel.

STRUCTURE + COMMUNITY REQUIREMENTS

EW Action 2.1 Plan the Site and Orientation for Sun + Wind Harvesting, Natural Cooling (1-2 Points)

Provide space and plan for solar access + orientation to support daylight harvesting, passive heating and energy generation systems; provide shaded and/or vegetated outdoor space for passive cooling + sunny outdoor space for food production and in temperate or cold climates for parks, plazas, recreation areas. Organize space and form to take advantage of prevailing breezes for cooling and wind power; shield entrances and walks from harsh winter winds.

Solar Orientation and Access to support daylight harvesting, passive solar and on-site solar energy.

- ▶ Block Orientation (Refer to [LEED® v4 ND Credit: "Solar Orientation"](#) Option 1.)
- ▶ Building Orientation (Refer to [LEED® v4 ND Credit: "Solar Orientation"](#) Option 2.)

OR

- ▶ Street Width + Orientation (Refer to the [2030 Palette: Street Width + Orientation](#))
- ▶ Solar Access (Refer to the [2030 Palette: Solar Access](#))

EW Action 2.2 Site Strategies for Natural Cooling of indoor and outdoor spaces (1-2 Points)

- ▶ Vegetative Cooling (Refer to the [2030 Palette: Vegetative Cooling](#))
- ▶ Street Orientation (Refer to the [2030 Palette: Street Width + Orientation](#))

EW Action 2.3 Wind Access for Renewable Energy (1 Point)

Plan space to optimize wind access and minimize turbulence created by structures, trees and terrain.

- ▶ For preliminary planning refer to the [Michigan Land Use Guidelines for Siting Wind Energy Systems](#). Plan space for required setbacks and maintenance access.

EW Credit 3.0

Water Efficiency + Resilient Water + Landscapes

1-45 points

INTENT

Conserve water and improve water availability for human and ecological use. Improve the integration of human development with the natural hydrology cycles, the biophysical environment and the geochemical flows of nature; maintain a dynamic balance with surface water, aquifers, rain events and water use; maintain a manageable condition with the site and regional hydrology during extreme rain events, droughts and/or municipal service disruption to improve passive survivability.

EW Action 3.1 Indoor Water Use Reduction (1-6 points)

Structures: 25% to 50% reduction

- ▶ Refer to LEED® v4 NC (New Construction) or equal credit: "Indoor Water Use Reduction" for performance criteria

Communities: 40% estimated reduction

- ▶ Refer to LEED® v4 ND (Neighborhood Development) or equal credit: "Indoor Water Use Reduction" for fixture water for performance criteria)

EW Action 3.2: Outdoor Water Use Reduction (1-2 points)

Structures: No Irrigation or 50% reduction. Rainwater harvesting and/or reuse can be used to support the use reduction.

- ▶ Refer to LEED® v4 NC (New Construction) or equal credit: "Indoor Water Use Reduction" for performance criteria

Communities: No Irrigation or 30% to 50% reduction

- ▶ Refer to LEED® v4 ND (Neighborhood Development) or equal credit: "Indoor Water Use Reduction" for fixture water for performance criteria)

EW Action 3.3 Rainwater Harvesting, Recycled Water, On-Site And/or Neighborhood Water Storage (6 possible points)

Provide on-site rainwater or recycled water storage to cover operations, including toilet flushing and mechanical equipment (if needed) for emergency stand-alone operations for a period of at least 96 hours. (5 points)

OR

Provide on-site rainwater or recycled water storage to cover operations, including toilet flushing, mechanical equipment and edible landscaping (if needed) for emergency stand-alone operations for a period of at least 10 days. (5 points)

AND/OR

Reduce potable water for building sewage conveyance by 50% through the use of Rainwater Harvesting and/or the use of recycled water. (6 points)

EW Action 3.4 Alternative Sewage Management (6-8 points)

Treat 25% of wastewater on-site for reuse on-site. Refer to LEED NC V2009 Wastewater Management for criteria.

- ▶ Reference (Adapted) LEED BD+C V2009 Innovative Wastewater Technologies

Treat 50% of wastewater on-site to tertiary standards using ecological treatment methods and/or low energy filtration.

Constructed Wetlands:

- ▶ [2030 Palette: Constructed Wetlands Swatch](#)
- ▶ ["Ecological Wastewater Management in Iowa"](#) by The Iowa Policy

Living Machines® or Equal:

- ▶ ["EPA Wastewater Technology Fact Sheet: The Living Machine"](#)
- ▶ ["The design of living technologies of waste treatment,"](#) by John Todd and Beth Josephson
- ▶ ["Ecosystems as Infrastructure"](#) by Eric Lohan and Will Kirksey

OR

Low Energy Filtration Methods

Use composting toilets for at least 50% of on-site demand.

- ▶ [Compost Toilet Guidelines](#) by the Gisborne District Council, New Zealand
- ▶ [Composting Toilets at the Bullitt Center](#) by Nina Smith-Gardner

EW Action 3.5 Net Zero Water (7-20 points)

- ▶ Net Positive Water: 5% surplus water production (7 points)
- ▶ 20% surplus water production (9 points)
- ▶ 30% surplus water production (11 points)
- ▶ 50% surplus water production (15 points)
- ▶ 100% surplus water production (20 points)

EW Action 3.6 Rainwater Management (1-3 points)

Reduce run-off volume and improve water quality by replicating natural hydrology.

Structure + Community: 98th Percentile of Rainfall Events

- ▶ Refer to LEED NC [V4 Rainwater Management](#) credit or equal for defining criteria.

Structure + Community: Zero Lot-line projects or portions of project planned for Zero Lot Line: 85th Percentile of Rainfall Events

- ▶ Refer to LEED NC [V4 Rainwater Management](#) credit or equal for defining criteria.
- ▶ Rainwater Management for Extreme Rain Events: See HA Credit 2.1

EW Credit 4.0

Energy Efficiency + On-Site and/ or Neighborhood Renewable Energy

1-71 points

INTENT

Conserve Energy, improve access to clean energy + diverse energy sources in support of the following: Improve the balance of human development and its use of energy and natural energy flows, the biophysical environment and the geochemical flows of nature; maintain a dynamic balance with energy needs and energy availability; maintain a manageable condition with energy use and availability during short-term shortages and/or supply interruptions improving passive survivability; and plan for long-term as non-renewable energy stocks are depleted + gross energy availability declines worldwide.

Structure + Community Requirements

EW Action 4.1 Energy Optimization (1-18 points)

Reduce Energy Demand for the project through efficiency and conservation methods from between 6% and 50% below the ASHRAE 90.1 2010 baseline.

- Refer to the LEED® v4 NC (New Construction) “Energy Optimization” Credit or equal

EW Action 4.2 On-Site or Neighborhood Renewable Energy Production (1-14 points)

Renewable Energy

Meet Green-E Criteria for renewable energy qualifications. The following sources are included: Solar electric, solar thermal, wind, clean bio-mass/bio-digestion and micro-hydro. Up to 30%: 1-7 points per LEED renewable energy credit, then 1 point per additional 10% up to 100%

Structure + Community:

- 1% to 10% LEED® v4 NC (New Construction) or equal Credit: “Renewable Energy Production” for criteria
- 10% to 100% LEED® v4 NC (New Construction) or equal Credit: “Renewable Energy Production” for basic criteria

EW Action 4.3 Compliance with AIA 2030 Commitment or Minnesota SB 2030 (7-12 points)

Reduce non-renewable energy use through efficiency, conservation or on-site renewable energy below that of a similar building or set of buildings by the following amounts:

- 2015 through 2019: 70% = 7 points;
- 2020 through 2024: 80% = 8 points;
- 2025 through 2029: 90% = 10 points;
- 2030 through 2034: 100% = 12 points;

Baseline: [2030 Challenge U.S. Median Site Energy Use Energy Star Target Finder \(Portfolio Manager\)](#)

EW Action 4.4 Renewable Energy - Distributed Generation (1-10 points)

Structures

Provide energy to the Utility Distribution Grid with capacity up to 10,000 KW. Renewable Energy sources include wind electric, solar electric and biogas polished to a natural gas equivalent. Adapt renewable energy sources other than solar electric and/or lease base economic structures as appropriate.

- Refer to LEED® v4 “[Renewable Energy - Distributed Generation](#)” Pilot Credit for guidance.

Communities

Provide energy to a Neighborhood Micro-Grid with redundant connectivity to the main Utility Distribution Grid for electric and biogas polished to a natural gas equivalent. Renewable Energy sources include wind electric, solar electric, solar thermal + biomass derived natural gas. Adapt renewable energy sources other than solar electric and/or lease base economic structures as appropriate.

- Refer to LEED® v4 “[Renewable Energy - Distributed Generation](#)” Pilot Credit for guidance.
- Refer to the [Connecticut Guidelines for micro-grids](#) and energy storage.

EW Action 4.5 Net Positive Energy (1-11 points)

Net Zero Energy

Total amount of energy used by the building or community on an annual basis is roughly equal to or greater than the amount of renewable energy created on the site. The building must reduce its energy demand by at least 60% through efficiency.

- Net Positive Energy: 5% surplus energy production 3 Points
- 20% surplus energy production 2 Points
- 30% surplus energy production 2 Points
- 50% surplus energy production 2 Points
- 100% surplus energy production 2 Points

Baseline: CBEC Data base via the [Energy Star Target Finder](#)

EW Action 4.6 District Heating and Cooling (1-4 points)

Project with at least 2 buildings

Provide 80% of the project energy with district heating and cooling systems that perform at least 10% better than ASHRAE 90.1 2010.

- Refer to LEED ND V4 Credit “[District Heating and Cooling](#)” or equal for criteria.

EW Credit 4.7 Green Power + Carbon-Neutral Operations (1-2 points)

Provide 50%, 100%, 120% or 200% of the project’s annual energy with Green-E Certified RECs Reference: [LEED NC V4 Green Power Credit](#)

EW Credit 5.0

Edible Landscaping, Urban Agriculture + Resilient Food Production

2-14 points

INTENT

Conserve energy and improve access to affordable clean and local food. Improve the balance of human development and the biophysical and geochemical flows of nature; maintain a manageable condition with food availability during short-term shortages and/or supply interruptions and during long-term shortages as food availability becomes further stressed worldwide.

STRUCTURE + COMMUNITY REQUIREMENTS

EW Action 5.1 Amend or Implement Regulation Allowing On-Site Food Production (2 points)

Structures

If there are restrictions for the production of produce enforced by covenant, conditions, codes or deed restrictions in place have them removed to allow for the growing of produce in any location. Greenhouses must be acceptable, but can be restricted from front yards. For new developments, food production must be allowed.

- Refer to the [LEED ND V4 Credit "Local Food Production"](#) or equal for criteria regarding covenants, conditions, codes or deed restrictions is not required. Include aquaponics, chickens and bee aviaries in regulating language where possible.

EW Action 5.2 On-Site Vegetable, Nut + Berry Production (3 points)

General Requirements:

All on-site food production must at a minimum be actively managed and grown in a manner equal to Organic (transitional). Growing space must be provided for pollinator (bee) habitat. The use of neonicotinoids and pesticides listed on in the Stockholm Convention is strictly prohibited.

- Refer to the Xerces Society "[Making Room for Native Pollinators](#)" and "[Conserving Bumble Bees](#)" for guidance in developing bee habitat.

Structures

Fully develop the capacity for on-site food production including all needed infrastructure, site amendments and planting plan(s) for at least 10% of the site area less the building footprint. Adapt the Sustainable Sites V2 credit 6.7: Provide On-site Food Production criteria for edible landscaping in the form of vegetable gardens and/or site appropriate edible nut and fruit-bearing plants. Implement the plan.

- [Sustainable SITES Rating System](#)

OR

Communities

Fully develop capacity for on-site food production including all needed infrastructure, site amendments and planting plan(s). Implement the plans. Follow the LEED® v4 ND (Neighborhood Development) "Local Food Production" credit, Option 1. Neighborhood Gardens to define space and planning criteria. Refer to the LEED ND V4 Credit "Local Food Production" for criteria; revisions to existing covenants, conditions, codes or deed restrictions are not required. The use of Neonicotinoids and pesticides listed on in the Stockholm Convention is strictly prohibited.

- [LEED ND V4 Credit: Local Food Production Option 1. Neighborhood Gardens](#)

EW Action 5.3 On-Site Aquaponics + Poultry Production (6 points)

Structure + Community

Develop the capacity for on-site food production that includes aquaponics (fish) and/or free-range poultry (chickens or other birds, can be cages that meet free-range criteria) and/or bees including all needed infrastructure, site amendments and implementation plan(s). Implement the plans. Waste nutrients must be utilized on-site.

OR

Aquaponics or Poultry production meets the base credit requirements and is 90% closed-looped with extremely limited inputs of feed and stock. Waste nutrients must be utilized on-site.

EW Action 5.4 Transitionally Labeled or Organic Certification + Distributed (3 points)

Option 1

All production qualifies for being labeled as Transitional and at least 25% is distributed to organizations beyond those involved in production.

- Refer to the [USDA Transitional Recommendation](#) for criteria.

Option 2

All production is Organic Certified and at least 25% is distributed to organizations beyond those involved in production.

EW Credit 6.0

Reduced Site Environmental Impacts: Lighting, Heat-Island, Airborne Toxins

1-10 points

INTENT

Improve the integration of site development with surrounding sites by managing the following: artificial light, solar heat-absorption, and air emissions.

STRUCTURE + COMMUNITIES REQUIREMENTS

EW Action 6.1 Light Pollution Reduction (1 point)

Manage Vertical and Horizontal light trespass, glare and uniformity.

- ▶ Refer to [LEED® v4 NC Credit "Light Pollution Reduction"](#) or equal for criteria.

EW Action 6.2 Tree Lined and Shaded Streetscapes (1-2 points)

Tree-Lined Blocks:

Provide trees at intervals no more than 50' -0" excluding driveways for 60% of the street side property line(s) block and site boundaries.

- ▶ Refer to the [LEED® v4 ND "Tree-lined and Shaded Streetscapes"](#) or equal for criteria.

AND/OR

Shade Sidewalks:

Provide trees over 40% of existing and planned sidewalks bordering the Project.

- ▶ Refer to the [LEED® v4 ND "Tree-lined and Shaded Streetscapes"](#) or equal for criteria.

EW Action 6.3 Heat-Island Reduction, Roof and Non-Roof (2-4 points)

Use any combination of strategies involving heat reflective roofing and paving, vegetative roofs, parking under cover, plantings, and shading devices including but not limited to renewable energy systems to reduce the heat island effect of the project.

- ▶ Refer to the [LEED® v4 NC "Heat-Island Reduction"](#) or equal for criteria.

EW Action 6.4 Reduce Air Pollutant Emissions (3 points)

Improved Air Pollutant Emissions

The Project meets California's standards for six criteria air pollutants, throughout the life of the project:

- ▶ Particulate Matter (including dust)
- ▶ Ground level ozone
- ▶ Carbon monoxide

- ▶ Sulfur oxide
- ▶ Nitrogen oxide
- ▶ Lead and noxious odors

Refer to the [Envision V2 Credit Cr1.2 "Reduce Air Pollutant Emissions"](#) or equal.
↗ <https://sustainableinfrastructure.org/> (login for free access)

Conserving + Restorative Air Pollutant Emissions

The project achieves net zero impacts from California's standards and improves existing air quality to a level higher than pre-development for six criteria air pollutants throughout the life of the project. Refer to the [Envision V2 Credit Cr1.2 "Reduce Air Pollutant Emissions"](#) or equal. ↗ <https://sustainableinfrastructure.org/> (login for free access)

MA Req. 1.0

Minimum Material Effectiveness + Life Cycle Planning

S/C

INTENT

Improve the ecological and economic life-cycle of all materials used on the project by increasing material recycling + reuse; local extraction, harvesting, recovery and manufacturing; improving labor equity and work-environment practices; and reducing the inappropriate use of toxins in buildings, communities, the environment and living systems.

STRUCTURE + COMMUNITY REQUIREMENTS

MA Req. 1.1 Storage + Collection of Recyclables

Provide dedicated space for recycling a minimum of: mixed paper, corrugated cardboard, glass, plastics, and metals. Provide space for safely collecting, storing and managing discarded batteries, mercury-containing lamps and electronic waste.

- Refer to the [LEED® v4 NC "Storage and Collection of Recyclables"](#) Credit or equal for criteria.

MA Req. 1.2 Construction + Demolition Waste Management Planning

Develop and implement a construction and demolition waste recovery plan.

- Refer to the [LEED® v4 NC "Construction and Demolition Waste Management Planning"](#) credit or equal for criteria.

MA Req. 1.3 Project Material Selection + Use Planning

Develop a plan during conceptual design that identifies the main 10 to 15 materials and/or product needs that are likely be significant contributors to the project's overall material use in terms of weight, volume and/or environmental, economic, health impact. Identify materials, products or components that can potentially fill those needs early in the process so the information can be used to inform the design. Important product attributes for consideration include:

- **Manufacturing supply chains that are socially and ecologically responsible.** Companies treat the earth and the people that produce the materials, components and products with respect. They provide a safe work environment, reasonable work hours and pay a living wage. Guidance on living wages in the U.S. can be calculated by Zip code using the [MIT Living Wage Calculator](#).
- **Contain notable quantities of recycled content**, preferably post-consumer. The materials recycling and manufacturing preferably have modest, low or positive environmental impacts.
- **Contain notable quantities of locally extracted, harvested or recovered materials and are manufactured** (500 mile radius of the project site). The materials and manufacturing preferably has modest, low or positive environmental impacts.
- **Are salvaged and/or are presently on-site** and can be reused or refurbished with low or modest impacts.

- **Are designed and/or can be adapted, used flexibly, reused, recycled and/or composted.** The materials and manufacturing preferably have modest, low or positive environmental impacts.
- **Have developed Environmental Product Declarations (EPDs) and Life Cycle Assessment (LCA).** EPDs and LCAs preferably that include toxin reporting and cover all life cycle phases as recommended by the U.S EPA and United Nations. Products that show a positive life cycle or reduced impacts compared to other choices are preferred.
- **Have developed Health Product Declarations (HPDs),** preferably that include toxin reporting in compliance with U.S EPA and UN recommendations. Products that indicate a positive life cycle or reduced impacts compared to other choices are preferred.
- **Have leadership third party certifications** including Forest Stewardship Certification or SMaRT Certification that include meaningful performance minimums and requirements. Multi-attribute certifications should include toxins.
- **Have reduced and/or positive environmental and human health impacts.**
- **Identify products to avoid** that are known to have significant negative environmental and/or social impacts during their life cycle. **Products to avoid are identified,** including those known to have significant negative environmental and/or social impacts during their life cycle.

MA Credit 1.0

Safer, Non-Toxic Infrastructure Materials

*2-4 points (depending
on level of certification
awarded)*

INTENT

Improve the health + productivity of community occupants through the use of products and materials that reduce and limit exposure to toxins.

STRUCTURE + COMMUNITY REQUIREMENTS

Provide SMaRT or equivalent Certified products for Infrastructure.

MA Credit 2.0

Material + Artifact
Effectiveness: Full
Life Cycle Design
for Durability,
Adaptability,
Flexibility

1-4 points

INTENT

Encourage resilient product life cycles through the design of products that can be readily adapted to changing circumstances without extensive modifications.

STRUCTURE + COMMUNITY REQUIREMENTS

Identify an appropriate service lifetime and align durability with the potential for recyclability, reusability, deconstructability and reparability.

Select products and design assemblies that exhibit a combination of at least three of the following properties during their use phase:

- High degree of serviceability + reparability
- High degree of wear resistant and/or hides scuffs
- Construction has strong joints and reinforcing
- Gains character with wear and weather
- Timeless, classic aesthetics
- Loose fit and/or modular flexibility + adaptability
- Movable, scalable or convertible
- Upgradable

MA Credit 3.0

Material + Artifact
Effectiveness:
Design for
Disassembly, Reuse,
Remanufacturing,
Recycling +
Composting

1-4 points

INTENT

Encourage resilient product life cycles through the design of products that can be effectively modified to fit changing circumstances. Modifications may be extensive, but feasible.

Select products and design assemblies that exhibit a combination of a least three (3) of the properties during their use phase:

- Choose recycling-compatible materials (as far as possible).
- Avoid using materials which require separating before recycling (re-use is ok, subject to performance testing).
- Use as few components and component types as possible (without compromising the structural integrity or function of the product).
- Integrate components (which relate to the same function) where possible.
- Standardize the use of fasteners – use commonly available parts and maintain consistency within the design.
- Make components easily separable.
- Apply non-contaminating markings (e.g. through etching or molding) to materials for ease of sorting.
- Maintain good access to components and fasteners. Consider making the plane of access to components the same for all components.
- Do not paint plastic parts or apply other coatings which may contaminate other plastics when recycled.
- Consider the use of ADSM technology for non-temperature-critical products.

MA Credit 4.0

Material
Effectiveness: Use
Recycled Content
Materials, Salvaged
Materials + Local
Materials

1-8 points

INTENT

Improve the integration of site development with surrounding sites by managing the following: artificial light, solar heat absorption and air emissions.

STRUCTURE + COMMUNITY REQUIREMENTS

MA Action 4.1 Recycled Content

Use products with recycled content for a minimum of 10% or 20% of the materials for the project based on cost.

- 10% (1 point)
- 20% (2 points)
- Refer to the [LEED V3 2009 "Recycled Content" Credit](#) or equal for the criteria.

MA Action 4.2 Materials Reuse

Use salvaged, refurbished or reused materials for a minimum of 5% or 10% of the materials for the project based on cost.

- 5% (1 point)
- 10% (2 points)
- Refer to the [LEED V3 2009 "Materials Reuse" Credit](#) or equal for the criteria.

MA Action 4.3 Regional Materials

Use products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% or 20% for the project based on cost.

- 10% (1 point)
- 20% (2 points)
- Refer to the [LEED V2.2 MRc5.1 and MRc5.2](#) Regional Materials - 10% and 20% extracted, processed and manufactured regionally and credit or equal for the criteria.

MA Action 4.4 Certified Rapidly Renewable + Bio-Based Materials (1-2 points)

Use products with rapidly renewable content (self-replenishing within 10 years) and/or bio-based raw materials for a minimum of 2.5% of the materials for the project based on cost. Products must be either FSC Certified (Bamboo and/or other non-wood qualifying products) or meet the Sustainable Agriculture Network's Sustainable Agriculture Standard.

MA Credit 5.0

Use Legally Logged Wood from Ecologically Managed Forests

4 points

INTENT

Improve the integration of site development with surrounding sites by managing the following: artificial light, solar heat absorption and air emissions.

STRUCTURE + COMMUNITY REQUIREMENTS

FSC Certified Wood

Use a minimum of 50% of the wood-based materials that are FSC Certified. Refer to the LEED 2009 "Certified Wood" Credit or equal for the criteria.

MA Credit 6.0

Reduce Net Embodied Energy + Carbon, Water, and Toxins

1-2 points

INTENT

Improve the balance between human directed activities and the biophysical/geochemical flows of nature; maintain a manageable condition with food availability during short-term shortages and/or supply interruptions and long-term shortages as food availability becomes further stressed worldwide.

STRUCTURE + COMMUNITIES REQUIREMENTS

MA Action 6.1 Reduce Embodied Energy + Carbon, Water, and Toxins (1 Point)

Use products for at least 25% of costs of permanently installed products, use products that reduce their Life-Cycle Embodied Energy, Carbon, Environmental Pollutants + Toxins through any combination of the following documentation and disclosure methods:

- Use products that demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm) through a published Health Product Declaration disclosure tool (HPD) or equal with full disclosure of known hazards in compliance with the Health Product Declaration open Standard 3.
- Products must have fully inventoried GreenScreen v1.2 chemical ingredients to 100 ppm and have no Benchmark 1 hazards.
- Point of Use Chemical Inventory Disclosure + Greenscreen Benchmark 1 Hazard Reductions

MA Action 6.2 Full Disclosure Life Cycle Analysis + Environmental Product Declarations (EPDs) (1 Point)

For at least 25% of costs of permanently installed products, use products that report their impacts for all of the following categories + reduce impacts 10% below industry average in at least three categories. Products are to be evaluated across all Life Cycles Stages using Environmental Product Declaration conforming to ISO 14025, 14044 and EN 15804 or ISO 21930.

Full Disclosure EPDs include an Impact Category and Life Cycle Stage Matrix clearly identifying which categories and stages are modeled and which are not based on the list below.

EPDs modeling toxins with the Impact Categories listed and report on all Life Cycle Stages identified below receive triple credit.

Required Categories identified by the U.S. EPA TRACI 2.1 w/ USEtox and UNEP:

1. Acidification
 - ▶ Cancer
2. Ecotoxicity
3. Eutrophication
4. Fossil Fuel Depletion
5. Global Warming
6. Human Health (Toxicity)
7. Land Use
 - ▶ Non-Cancer
8. Ozone Depletion
 - ▶ Particulates
9. Photochemical Oxidation (Smog)
10. Water Use

Required Life Cycle Stages Identified by the U.S. EPA TRACI 2.1

- ▶ Stage 1 - Raw Material Acquisition
- ▶ Stage 2 - Manufacturing
- ▶ Stage 3- Transportation (Distribution)
- ▶ Stage 4 - Use (In-service/reuse/maintenance)
- ▶ Stage 5 - End-of-Life (Recycle/Landfill)

MA Action 6.3 Multi-Attribute, Third-Party Certified Products

Certifications must be transparent, developed through a consensus process and based on leadership standards that demonstrate best in class performance criteria and performance entry thresholds that require meaningful improvements across all categories and life cycle stages as identified by the U.S. EPA TRACI 2.1 w/ USEtox and UNEP.

- ▶ SMaRT Gold (or equal): 100% of Cost
- ▶ SMaRT Platinum (or equal): 150% of Cost

MA Credit 7.0

Divert Waste from Landfills, Reduce Excavated Soils Taken from Site

1-4 points

INTENT

Maintain basic capacity for long-term disposal of materials that are not recyclable or reusable. Reduce the environmental impacts associated with the extraction, harvest and production of virgin materials.

STRUCTURE + COMMUNITY REQUIREMENTS

MA Action 7.1: Reduce Construction and Demolition Waste 50%/75% (1-2 points)

MA Action 7.2: Reduce Excavated Materials Taken Off Site 80%/95%+ (1-2 points)



**AC Credits
1.0 - 3.1**

1-100 points

INTENT

Similar to the LEED Innovation and Design Credits, the RELi Applied Creativity credits were created with the intent of providing projects and designers the opportunity to be awarded points for exceptional performance.

AC Credits are awarded for creative thinking and innovative techniques. For example, AC credits for are awarded for comprehensive strategies which demonstrate quantifiable environmental benefits. A representative list of possible AC credit topics is found below. RELi AC Credits are evaluated for each project. It is important to note that the award of an AC Credit for one project at a specific point in time does not constitute automatic approval for a similar strategy in a future project. Applied Creativity credits are not awarded for the use of a particular product or design strategy if the technology aids in the achievement of an existing RELi credit.

AC Credits must be preapproved by the RELi Certification Team. This process includes identifying the proposed innovation credit intent, the proposed requirement(s) for compliance, the proposed submittal(s) to demonstrate compliance, and a summary of potential design approaches that may be used to meet the requirements.

AC Credit 1.0 Applied Creativity in Resiliency & Integrative Design (1-20 points)

AC Action 1.1 Applied Creativity: Resilient Economics, Equity, Education And/or Ecology Indicators (1-5 points)

AC Action 1.2 Applied Creativity: Green, Healthy, Living, Restorative, Regenerative of Sustainable Indicators (1-5 points)

AC Action 1.3 Applied Creativity: Leadership Metrics and Measures from sources beyond RELi (1-5 points)

AC Credit 2.0 Contextual Factors & Project Responsive Topics (20 points max)

AC Action 2.1 Contextual Factors: Project specific Leadership & Next Generation Certification/Program Indicator (1-5 points)

AC Action 2.2 Contextual Factors: Improving Safety & Resiliency (1-5 points)

AC Action 2.3 Contextual Factors: Influential Regional, District or Site Contextual Factors (1-5 points)

AC Action 2.4 Contextual Factors: Leadership Metrics and Measures from sources beyond RELi (1-5 points)

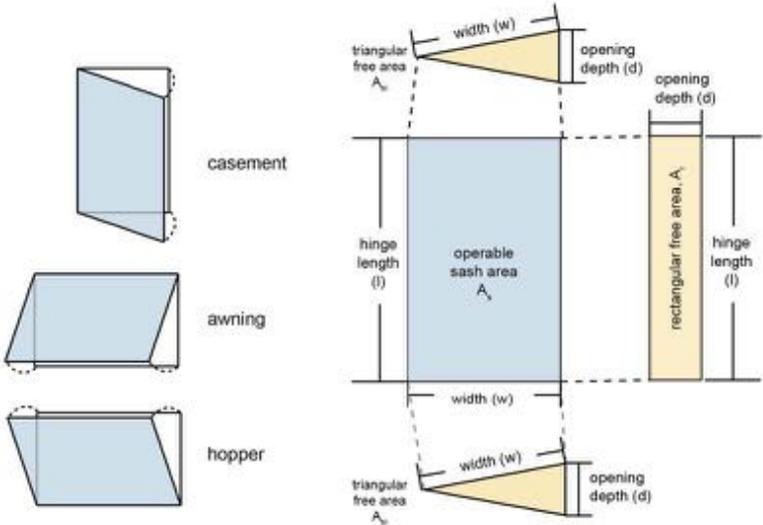
AC Credit 3.0 Exemplary Performance (20 points max)

AC Action 3.1 Exemplary Performance: Performance exceeding the Credits identified in the RELi Action List (1-5 points)

APPENDIX A: Natural Ventilation for Passive Survivability

<p>Occupant Density</p>	<p>Habitable zones shall be modeled with the occupant density necessary to accommodate the total building population in the habitable zones. The zone occupant density shall be no greater than 1 person per 20 ft² (1.9 m²).</p>
<p>Ventilation</p>	<p>All habitable zones must have access to natural ventilation. Windows, doors, panels, and louvers are all acceptable.</p> <p>The extreme cold week simulation shall assume a natural ventilation rate between 5 cfm/person (8.5 m³/hour per person) and the maximum available natural ventilation rate (defined below).</p> <p>The extreme hot week simulation shall assume a natural ventilation rate between 5 cfm/person (8.5 m³/hour per person) and the maximum available natural ventilation rate (defined below).</p> <p>Extreme cold weeks and extreme hot weeks may use different natural ventilation rates as long as the above criteria are met.</p> <p>The maximum available natural ventilation rate shall be calculated based on opening size according to the methodology below. The result of this calculation shall be greater than or equal to 5 cfm per person (8.5 m³/hour per person) (based on the power outage occupant density).</p>
<p>1-Sided Ventilation</p>	<p>For zones with operable vents on one side only:</p> <p>Zone ventilation rate = 100 ft/min (0.51 m/s) x 0.4 x Total Openable Area in ft² (m²) (Note: multiply by 3600 to convert to m³ /h)</p>

APPENDIX A: Natural Ventilation for Passive Survivability

<p>Occupant Density</p>	<p>Total Openable Area for natural ventilation shall be calculated according to the actual free area of the opening based on the opening geometry. This varies depending on opening type.</p> <p>The example below shows calculation of the opening free area for a casement, awning, or hopper window. Similar logic shall be applied to other opening types (single- or double-hinge, parallel hinge, etc.)</p>  <table border="0" data-bbox="899 1052 1390 1167"> <tr> <td>triangular free area</td> <td>A_{t1}</td> <td>$= 0.25 \times d \times \sqrt{4w^2 - d^2}$</td> </tr> <tr> <td>rectangular free area</td> <td>A_r</td> <td>$= d \times l$</td> </tr> <tr> <td>sash area</td> <td>A_s</td> <td>$= w \times l$</td> </tr> <tr> <td>total openable area</td> <td>A_{total}</td> <td>$= \text{minimum of } (A_s + 2A_{t1}), A_s$</td> </tr> </table>	triangular free area	A_{t1}	$= 0.25 \times d \times \sqrt{4w^2 - d^2}$	rectangular free area	A_r	$= d \times l$	sash area	A_s	$= w \times l$	total openable area	A_{total}	$= \text{minimum of } (A_s + 2A_{t1}), A_s$
triangular free area	A_{t1}	$= 0.25 \times d \times \sqrt{4w^2 - d^2}$											
rectangular free area	A_r	$= d \times l$											
sash area	A_s	$= w \times l$											
total openable area	A_{total}	$= \text{minimum of } (A_s + 2A_{t1}), A_s$											
<p>Cross Ventilation</p>	<p>If there is an unobstructed ventilation path from a perimeter vent to another perimeter vent opposite or adjacent, the zone ventilation rate shall be increased by 2 times.*</p>												
<p>Stack Ventilation</p>	<p>If there is an unobstructed ventilation path from a perimeter to an overhead vent, the zone ventilation rate shall be increased by 2 times.</p>												
<p>Combined Ventilation</p>	<p>If cross ventilation and stack ventilation are both present they may NOT be combined.</p>												
<p>Engineering Calculation</p>	<p>Alternatively, design teams may calculate ventilation rates via accepted engineering methods such as CIBSE AM10: 2005.</p>												

Window Ventilation Image Source: Transsolar KilmaEngineering

* Airflow due to stack and cross ventilation depends on a number of variables that are complex to model and calculate. Doubling the single-sided rate for cross or stack ventilation is a conservative approximation method loosely based on ASHRAE 62.1-2013, Section 6.4/

APPENDIX B:

PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

APPENDIX B - PART 1: Expanded Detail on Options for Establishing Habitable Temperatures (Passive Survivability / thermal safety)

Demonstrate through thermal modeling or Passive House certification that a building will passively maintain thermally safe conditions during a power outage that lasts four days during peak summertime and wintertime conditions of a typical meteorological year. This performance will be achieved through a combination of design measures that could include careful building orientation, a highly insulated building envelope, natural ventilation, cooling-load-avoidance measures, passive solar heating, and integration of thermal mass. The precise systems and designs employed to achieve passive survivability are not specified; the required performance is demonstrated through thermal modeling. Any of three compliance paths may be used to demonstrate compliance with these requirements.

Note that some buildings are required by code to provide thermal conditions that may not be achievable through passive means. Most nursing homes, for example, must not fall below 71°F (22°C) in the wintertime, or exceed 81°F (27°C) during the summer. Back-up power may be required to maintain these conditions. Such buildings could still be designed to achieve passive survivability as defined herein, but such buildings would also need to rely on back-up power to achieve those code-mandated comfort conditions.

Three thermal safety compliance paths exist:

Path 1: Psychrometry

Using the Center for the Built Environment (CBE) Comfort Tool's psychrometric chart, demonstrate that indoor conditions (dry-bulb air temperature and humidity) never breach the specified overheating and under-heating thresholds, which include Heat Index and / or WBGT (wet-bulb globe temperature) during the peak summer and winter analysis periods (see Documentation for Heat Index and WBGT threshold values and requirements).

Use either:

Heat Index (U.S. NOAA and OSHA Heat Advisory Levels)

During hot-season periods of utility-grid power outages or heating fuel interruptions, provide operable windows and/or non-powered natural ventilation and passive cooling to maintain indoor temperatures at or below Heat Index calibrated temperatures identified in the Thermal Modeling Table 1.0. In cold seasons provide passive heating and/or heat retention strategies to maintain interior building temperatures as identified in Thermal Modeling Table 2.0. located in the Appendix Requirements.

OR

Wet Bulb Globe Temperature

Using the Center for the Built Environment (CBE) Comfort Tool's psychrometric chart or USGBC approved local equivalent, demonstrate that indoor conditions never breach the specified overheating and under-heating WBGT (wet-bulb globe temperature) thresholds identified in the Thermal Modeling Table 2.0 located in the Appendix Requirements.

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PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

OR

Path 2: Standard Effective Temperature (SET)

Limit deviations from the defined livable Standard Effective Temperature (SET) thresholds (see Definitions) to the specified number of degree-days (degree-hours) during the peak summer and winter analysis periods (see Documentation for threshold values and degree day requirements, or meet requirements of local code, whichever is more stringent). Maximum temperatures at any given time may not exceed those established and measured by Path 1: Psychrometry.

OR

Path 3: Passive House certification

Using either Passive House Institute U.S. (PHIUS) or Passive House Institute standards and methodologies, confirm the project has earned the relevant Passive House certification AND includes operable windows or other means of natural ventilation to meet the requirements in Table 3. The very high standards for energy performance with Passive House is an adequate indicator that the building will maintain passive survivability as described in this credit.

Standards applicable to all three compliance paths:

Thermal Safety Zones:

The design team may designate which zones are considered thermal safety zones during the power outage. The total population in all thermally safe zones must be equal to or greater than the normal building occupancy.

Occupant Density:

Thermal Safety zones shall be modeled with the occupant density necessary to accommodate the total building population in the thermally safe zones. The zone occupant density shall be no greater than one person per 20 ft² (1.9 m²).

Ventilation:

All habitable zones must have access to natural ventilation. Windows, doors, panels, and louvers are all acceptable.

APPENDIX B:

PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

Documentation Passive Survivability/Thermal Safety

Path 1: Psychrometry and Heat Index

Provide graphic comparison of all indoor hourly conditions during cooling analysis period in relation to either the appropriate WBGT or the Heat Index threshold. Whole building energy modeling hourly output data for indoor dry-bulb temperature (DBT) and Relative Humidity (RH) shall be inputted into the provided Comma Separated Value File (CSV) which contains DBT and RH values for the WBGT and Heat Index thresholds; model output data shall be inputted below the existing DBT and RH values listed in the CSV file. The resulting composite CSV file shall be uploaded to the CBE Comfort Tool (<http://comfort.cbe.berkeley.edu/upload>) in order to graphically illustrate compliance via the CBE comfort tool Psychrometric Chart function for either I-P or SI values; capture the resulting CBE comfort tool image and include it with the credit documentation.

Alternatively, teams may calculate the peak indoor WBGT or Heat Index values for the simulation period, and minimum DBT, and compare them to the corresponding threshold values.

Path 2: SET

Building plans demarcating Thermal Safety Zones

Calculation of maximum available natural ventilation rate, minimum required ventilation rate and emergency occupancy for each thermal safety zone.

Summary of calculated °F SET-hours for heating and cooling for each representative thermal safety zone.

Emergency Operation Plan. Explain how the building should be operated in the case of emergency in order to provide livable thermal conditions. Explain the rationale behind vent operation that was modeled given likely outside temperature and humidity.

Thermal Habitability - Definitions and Methodology:

Thermal Habitability: 100% of the normal building occupancy can occupy thermal safety zones that maintain "livable temperatures" during a power outage for durations as presented.

SET: Livable temperatures are defined using standard effective temperature (SET) as the metric. SET factors in relative humidity and mean radiant temperature and is a more relevant metric than dry-bulb temperature for defining livable conditions in buildings that lose power or fuel for space-conditioning systems. The influence of air temperature (dry-bulb temperature) and relative humidity on the SET can be seen in the CBE Thermal Comfort Tool from the Center for the Built Environment at UC Berkeley.

SET: defined in ASHRAE 55 as:

The temperature of an imaginary environment at 50% rh, <0.1 m/s (20 fpm) average air speed (v_a), and $t_{mrt} = t_a$, in which the total heat loss from the skin of an imaginary occupant with an activity level of 1.0 met and a clothing level of 0.6 clo is the same as that from a person in the actual environment, with actual clothing and activity level.

APPENDIX B:

PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

Thermal Modeling Table 2.0 – Thermal Safety Temperatures for Paths 1, 2 and 3

<p>Thermal Safety temperatures</p> <p>PATH 1: Psychrometry / Heat Index</p>	<p>REFERENCED FROM RELI 2.0</p> <p>Except as noted below, maintain indoor temperatures at or below (103) degree heat index in hot seasons. In cold seasons maintain interior building temperature at or above (50) degrees. Manage other space to prevent freezing of water.</p> <p>General residential buildings, facilities and areas: Maintain a maximum (90°F/32.2°C) degree (the “Extreme Caution” threshold) heat index temperature during the hot season.</p> <p>For Hospitals and Nursing homes: Thermal requirements for hospitals and nursing homes—maintaining an (81°F/27°C) degree heat index maximum during the hot season / (71°F/21.7°C) degree minimum during the cold season (required by US federal law for nursing homes)—typically cannot be maintained passively, and must be maintained with back-up power.</p> <p>All commercial buildings not falling into the mission critical or Fundamental Community Service Organization category must maintain an interior temperature of not more than (103°F/39.4°C) degrees heat index. These requirements are waived should the outside temperature rise to be higher than (103) degrees (the “Danger” threshold) on the Heat Index.</p> <p>No hours during the summertime analysis period are permitted to exceed the heat index temperatures above. Refer to the Psychrometric chart in Figure P3-1 for corresponding Dry Bulb temperatures and Humidity Ratios.</p>
<p>Thermal Safety temperatures</p> <p>PATH 1: Psychrometry / WBGT</p>	<p>Cooling (Summer): For Commercial buildings or buildings without overnight occupancy: No hours during the summertime analysis period permitted to exceed above either the 88°F (31°C) WBGT overheating threshold indicated on the Psychrometric chart in Figure P3-1.</p> <p>For Residential buildings or building with overnight occupancy (such as lodging): No hours during the summertime analysis period permitted to exceed above either the 82.5°F (28°C) WBGT overheating threshold indicated on the Psychrometric chart in Figure P3-1.</p> <p>Heating (Winter): No hours during the wintertime analysis period permitted to fall below 50°F (10°C) (residential or non-residential buildings) dry-bulb air temperature on the psychrometric chart in Figure 3-1.</p> <p>For hospitals and nursing homes: It is assumed that they will have sufficient back-up power to enable them to meet their legal obligations—at no point during the year are they permitted to exceed above 81°F (27°C) on the Heat Index or fall below 71°F (21.7°C) on the Heat Index. This is a back-up power requirement and is separate from this passive survivability requirement.</p> <p>For more information on the CBE Thermal Comfort Tool: https://cbe.berkeley.edu/research/thermal-tool.htm#publications</p>

APPENDIX B:

PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

Thermal Safety temperatures

PATH 2: SET

Cooling:

Not to exceed 9 °F SET-days (216 °F SET-hours) above 86°F SET for residential buildings. (Metric: *Not to exceed 5°C SET-days (120 °C SET-hours) above 30°C SET for residential buildings.*)

Cooling:

Not to exceed 18 °F SET-days (432°F SET-hours) above 86°F SET for non-residential buildings. (Metric: *Not to exceed 10°C SET-days (240 °C SET-hours) above 30°C SET for non-residential buildings.*)

Heating:

Not to exceed 9 °F SET-days (216 °F SET-hours) below 54° SET for all buildings. (Metric: *Not to exceed 5°C SET-days (120 °C SET-hours) below 12°C SET for all buildings.*)

°F SET-days and °F SET-hours are degree-days and degree-hours in Fahrenheit degrees, using SET rather than air temperature.

°F SET hours are calculated as follows:

Cooling:

Sum of the difference between the zone calculated SET and 86°F, only if the zone SET is greater than 86°F, for all hours of the extreme hot week.

Heating:

Sum of the difference between 54°F and the zone calculated SET, only if the zone SET is less than 54°F, for all hours of the extreme cold week.

Use the same method for °C SET-days and °C SET-hours.

PATH 3: Passive House certification

Habitable temperatures are not defined for Passive House, but it is assumed that buildings achieving a Passive House level of energy performance will meet the habitable temperatures requirements called for in Paths 1, 2, or 3. (Note that in addition to meeting Passive House requirements, to fulfill this credit requirement operable windows or other means of natural ventilation must be provided as per Figure 3.0, below.)

Additional Thermal Safety Temperature Reference and Guidance Materials

Option 1 - Psychrometry

The following details on Thermal Habitability relate to Path 1 and 2:

ASHRAE 55 compliance via the Psychrometric chart. The ASHRAE 55 psychrometric charts only indicate what is considered “uncomfortable,” not what is considered a health risk. However, various heat/health indicators can be overlaid onto the Psychrometric chart given specific assumptions for air-speed, radiant temperature, MET and CLO. There is no perfect science here (particularly with MET and CLO as all occupants will vary), but the environmental variables can be more closely approximated. The method outlined here and in the table assumes low air-speed, radiant temperatures equal to DBT, and MET and CLO values of 1.

APPENDIX B:

PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

For overheating, the method proposed overlays both WBGT and Heat Index thresholds onto the CBE comfort tool psychrometric chart. Currently, Path 2 includes two overheating thresholds for each metric in an effort to represent environmental conditions that produce incrementally higher heat-stress risk for humans; these thresholds can be seen below in the Figure P2-1. The WBGT and Heat Index thresholds each represent environments in which human heat stress is possible (not just discomfort); therefore these thresholds are “not to exceed” limits as opposed to allowing a certain number of total exceedance hours during the analysis period.

The WBGT thresholds are based on Thermal Limit Values used in numerous Occupational Safety Standards and represent 8 hours of continuous exposure for healthy male adults under light working conditions; a series of standard WBGT thresholds are illustrated in Figure P2-2 based on NIOSH standards (NIOSH, 2013). The two WBGT threshold values are identified as assumptions for Healthy building occupants (88F/31C) or vulnerable occupants (82.5F/28C) by Holmes, Phillips, and Wilson (2015). Though a singular WBGT value is determined, DBT and RH are not constant. The WBGT threshold values illustrated in Figure P2-1 are calculated using a series of equations validated by Lemke and Kjellstrom (2013) and Stull (2011) using the indicated DBT and RH values. In an effort to differentiate building use and occupant vulnerability types, Path 2 utilizes the two WBGT thresholds as follows: (88F/31C) for commercial buildings assuming no overnight occupancy, and (82.5F/28C) for residential buildings and other buildings designated to serve as emergency shelters—where occupants sleep and might occupy for the entire analysis period.

The Heat Index thresholds are based on the National Weather Service (NWS) Heat Index chart illustrated in P2-3 (NOAA, 2017) and on 42 CFR § 483.15, “Requirements for States and Long Term Care Facilities”. The heat index is typically used outdoors and assumes a light wind conditions in a fully shaded environment (meaning no direct sun). Though this metric does not directly relate to indoor environments, it is utilized in this methodology to contextualize the otherwise potentially “exotic” nature of the WBGT metric. Figure P2-1 illustrates the similarities between the Heat Index’s “Extreme Caution” and “Danger” thresholds with the 82.5F/28C WBGT and 88F/31C WBGT thresholds respectively. Similar to the WBGT thresholds, the two Heat Index thresholds are associated with Commercial buildings (Danger) and Residential/Emergency-shelter Buildings (Extreme Caution) to accommodate different building use and occupant vulnerability types. Projects seeking credit through Path 2 must demonstrate that all hours in the overheating period are below the appropriate WBGT or Heat Index threshold.

APPENDIX B: PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

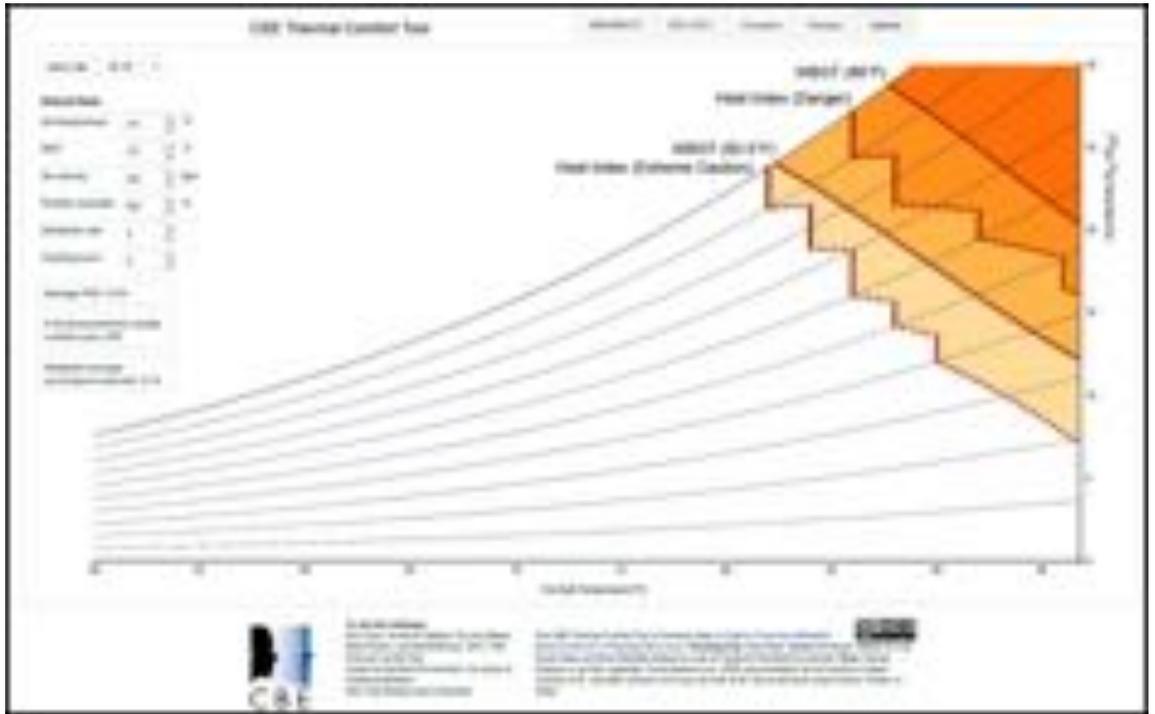


Figure P3-1: Overheating Thresholds (WBGT and Heat Index) in relation to the Psychrometric Chart assuming: radiant temperature = dry-bulb air temperature, air-speed = 60fpm, MET=1 and CLO=1.

To comply with Path 3 on Thermal Habitability, the indoor conditions in the Habitability Zone of the building during the summer design week may not exceed the relevant line on the above chart from the CBE Thermal Comfort Tool. The thresholds differ by building type and the methodology used, as described above under **"Habitable temperature - Path 1: Psychrometry."** Modeled indoor conditions falling within the white zone of this chart are acceptable for any building type or methodology.

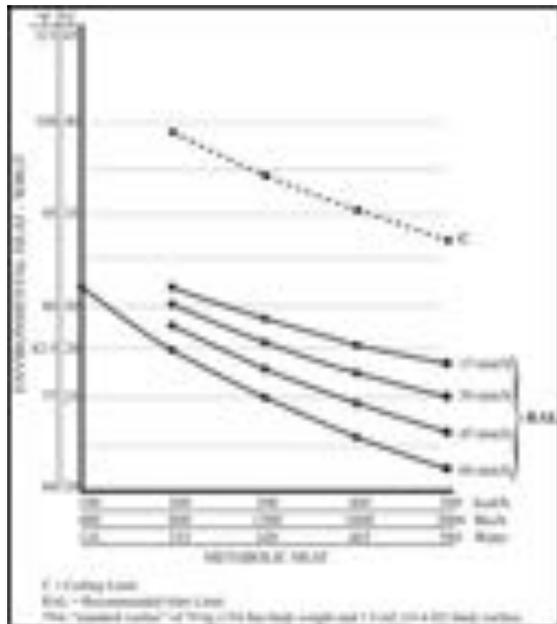


Figure P3-2: WBGT heat stress thresholds for unacclimatized individuals (NIOSH, 2013)

APPENDIX B: PART 1: Options for Establishing Thermal Safety / Habitable Temperatures

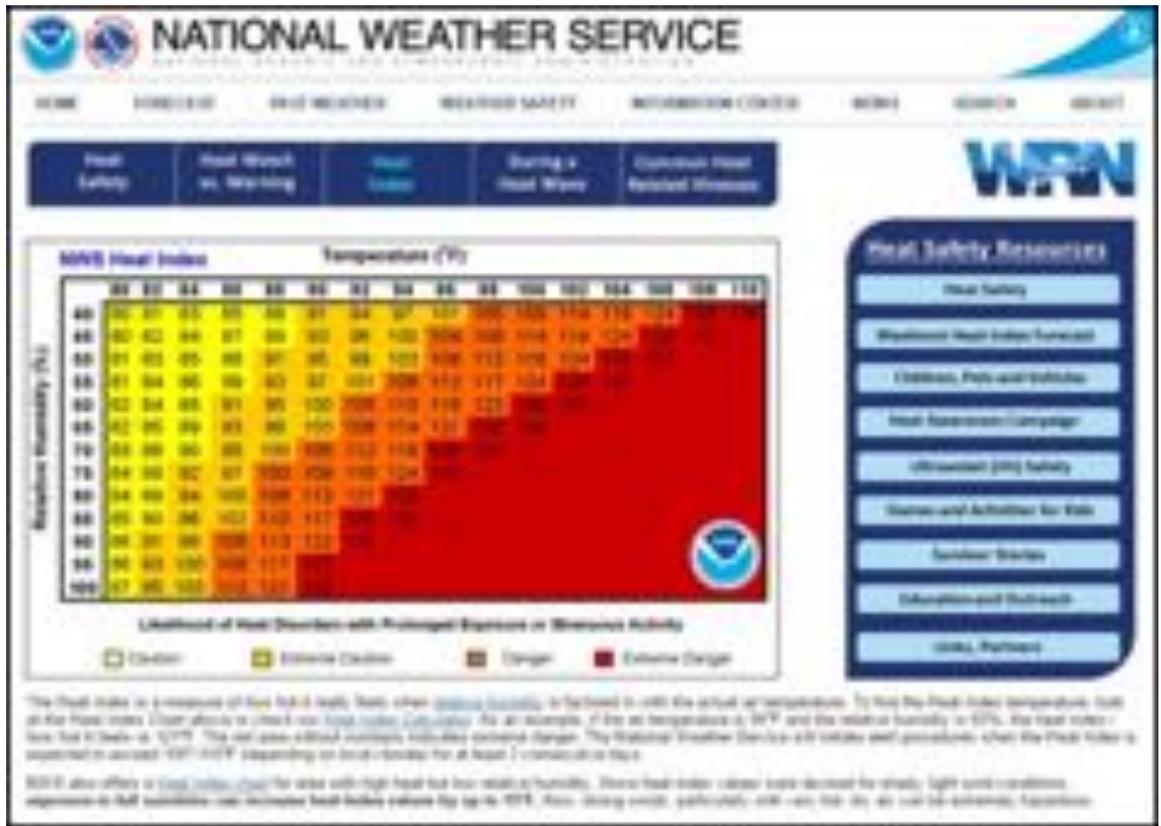


Figure P3-3: National Weather Service Heat Index Chart (NOAA, 2017)

The web-based CBE comfort tool allows users to map environmental data output from a whole-building energy model onto a psychrometric chart in order to evaluate the data’s response to a defined comfort zone based on additional occupant assumptions (Hoyt et al, 2013). Both the WBGT and Heat Index thresholds are mapped onto a Psychrometric Chart in Figure P2-1 using a CSV (Comma Separated Value) file containing the associated DBT and RH data for each threshold. The Path 3 method assumes project teams will utilize the CBE Comfort Tool to graphically demonstrate compliance.

The under-heating threshold was informed by an under-heating chart developed by The American Conference of Industrial Hygienists as illustrated in Figure P2-4. This chart indicates an under-heating “safe-zone” at 40F dry-bulb temperature (DBT) and does not directly consider humidity, which is less of a factor at lower temperatures (ACGIH, 2013). A safety factor of 10°F was added to this to arrive at the low-temperature threshold for Path 2: 50°F (10°C) DBT. The safety factor was added because of the long period of time during which occupants may be exposed to those conditions and the wide range of health conditions (and vulnerability) within the general population. Project teams can document compliance by simply tabulating all DBT values for the wintertime analysis period.

Estimated Wind Speed (ft mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Limit Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
1	49	37	27	16	5	-5	-15	-26	-36	-47	-57	-68
10	40	28	18	7	-4	-14	-25	-36	-47	-58	-69	-80
15	36	22	9	-5	-16	-27	-38	-49	-60	-71	-82	-93
20	32	18	5	-10	-21	-32	-43	-54	-65	-76	-87	-98
25	30	16	3	-13	-24	-35	-46	-57	-68	-79	-90	-101
30	28	14	2	-16	-27	-38	-49	-60	-71	-82	-93	-104
35	27	13	1	-18	-29	-40	-51	-62	-73	-84	-95	-106
40	26	12	0	-20	-31	-42	-53	-64	-75	-86	-97	-108
	LITTLE DANGER In < 10 with dry skin. Maximum danger of skin burn of severity.			INCREASING DANGER Danger from freezing of exposed flesh within one minute.				GREAT DANGER Flesh may freeze within 30 seconds.				
Thresholds and exposures that may occur at any point on the chart.												

* Derived by U.S. Army Research Institute of Environmental Medicine, Natick, MA.
 □ Equivalent limit temperature resulting by adding to actual wet bulb temperature minus 40°F (24°F) per additional 10°F.
 Source: ACGIH. 2013 TLVs and BEIs: Based on the documentation of Threshold Limit Values for chemical substances and physical agents & biological exposure indices. Cincinnati, OH: The American Conference of Industrial Hygienists.

Figure P3-4: Cooling Power of Wind on exposed flesh expressed as Equivalent Temperature (ACGIH, 2013)

References:

ACGIH. (2013). 2013 TLVs and BEIs: based on the documentation of Threshold Limit Values for chemical substances and physical agents & Biological Exposure Indices. Cincinnati, OH: The American Conference of Industrial Hygienists.

Holmes, S., Phillips, T., & Wilson, A. (2016). Overheating and passive habitability: indoor health and heat indices. *Building Research & Information*, 44(1), 1-19.

Hoyt, T., Schiavon, S., Piccioli, A., Moon, D., and Steinfeld, K. (2013). CBE Thermal Comfort Tool. Center for the Built Environment, University of California Berkeley. <http://cbe.berkeley.edu/comforttool/>.

Lemke, B., & Kjellstrom, T. (2013). Calculating Workplace WBGT from Meteorological Data: A Tool for Climate Change Assessment. *Industrial Health*, 50, 267-278.

NIOSH. (2013). Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments. Atlanta, GA: National Institute of Occupational Safety and Health.

NOAA. (2017). National Weather Service, NWS Heat Index Chart. Retrieved from www.nws.gov/om/heat_index.shtml on April 18, 2017.

Stull, R. (2011). Wet-Bulb Temperature from Relative Humidity and Air Temperature. *Journal of Applied Meteorology and Climatology* (50), 2267-2269.

APPENDIX B: PART 2: Expanded Criteria for Back-up Power

APPENDIX B - PART 2: Expanded Criteria for Back-up Power

These emergency power requirements identified can be met with a fuel-fired back-up generator with adequate fuel stored on-site; a solar-electric system with on-site battery storage; or by being part of a microgrid with "islanding" capability. Non-solar renewable energy such as wind power, while less common, can also be used to meet the requirements of this credit. Meet credit requirements or local code requirements for back-up power, whichever is more stringent. Specific requirements by building type are as follows:

1. Fuel-fired back-up generator(s) must be able to operate on clean burning fuels and fuel that can be stored on site. This may require a bi-fuel generator. Cleaner burning fuels include natural gas, bio-methane and propane that emit lower levels of particulates and noxious fumes than diesel or gasoline. Natural gas is commonly provided through a distribution network and may not be available during an emergency, requiring another on-site stored fuel option such as diesel or gasoline to provide power. Bio-methane and propane pose explosion risks that may make them unsuitable for storage in dense, urban locations. Bi-fuel generators allow operation with cleaner fuels when those fuels are available, but provide for operation if those fuels are not available. For stored diesel fuel and gasoline, a management plan must be in place to periodically consume or replace stored fuel.
2. A solar-electric system with battery storage. With a solar system and battery storage, the required duration of back-up power is reduced, compared with fuel-fired generators, because it is assumed that solar electricity will be generated relatively soon following a disaster. With solar-electric systems and battery storage, the stored electricity must be sufficient to satisfy one-half (1/2) of the duration of back-up power as identified as described above (excluding elevators).
3. A microgrid with islanding capability serving the building as part of a larger cluster of buildings or community. "Islanding" means that the smaller microgrid can continue operation even when the larger power grid is down. In this case the critical loads and back-up power requirements do not apply, because the microgrid is assumed to provide all of the building's electrical loads, not just critical loads, and it is assumed that the microgrid will continue operating even if the larger grid is down.

This Mandatory Annex was balloted and approved as part of RELi 1.0 and thus is necessarily included, verbatim, as part of 2.0.

1. SOURCES / REFERENCED STANDARDS

- ▶ *Building Resiliency Task Force Report to NYC Mayor & Speaker*© (Urban Green Building Council 2013) *Measuring Code Compliance Effectiveness for Fire-Related Portions of Codes Final Report*, National Fire Protection Association and Fire Protection Research Foundation (2008)
- ▶ *Eaton Outline of Safety Underwriting Attributes (2012)*
- ▶ *Envision Sustainable Infrastructure Rating System & Guidance Manual*, Institute for Sustainable Infrastructure (2014)
- ▶ *Fire Safe Adaptable Home (NAHB)*
- ▶ *Fortified*© Home & Business Stds. (IBHS 2007-12). "IBHS fortified structures cannot be designated in the following areas: low-lying barrier islands and coastal regions, close proximity to known seismic fault lines, close proximity to major levees, and steep slopes potentially subject to either erosion or wildfire." Fortified requires adherence to its compliance process including renewal after a designated term limit expires. Fortified accumulated by State the areas of peril defined with mandatory, strongly recommended and higher achievement level recognition by design and structural performance metrics for:
 - ▶ Hurricane prone regions
 - ▶ Tornado + Hail Regions
 - ▶ High wind regions with windspeed maps
 - ▶ Earthquake regions
 - ▶ Wildfire
 - ▶ Flood zones
 - ▶ Severe winter weather
- ▶ *International Existing Building Code 2009 Edition*
- ▶ *MTS ANSI 2.0 Integrative Process Standard for Sustainable Structures & Communities (2012)*
- ▶ *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention*© (World Bank & UN 2010)
- ▶ *NFPA 72 National Fire Alarm Code 2007 Edition*
- ▶ *NFPA 70 National Electrical Code 2011 Edition*
- ▶ *NYC Plan NYC + Post Sandy Building Code (2013)*
- ▶ *Perkins+Will Resiliency Framing Issues*© (2014)
- ▶ *Resilience Scoring Utility 2011 Edition*

- UN Sustainable Development Goals (SDGs), Key Summary Points - EGM on Science + SDGs (Mar. 21, 2013)
- *Wall Street Due Diligence*© Peer-reviewed + Released at NYSE on Sustainable Investment Business Case + Dangerous Climate Risk (2009, 2013, 2017). Dangerous climate change is a word of art referenced in the Kyoto Protocol and defined by leading climate scientists including Jim Hanson formerly of NASA, as the state of climate change when the Earth's atmospheric CO2 concentrations exceed 350 ppm. Levels as of Sept. 2018 are at 405 ppm and rapidly rising.
- *Weathering the Storm: Building Business Resilience to Climate Change*©, Center for Climate and Energy Solutions (2013)

2. BACKGROUND / PERSPECTIVE / VALUATION GOALS + PRINCIPLES

Underwriting Defined:

Standards for raising capital for debt & equity including to issue bonds.

Resilient Defined:

1. Able to bounce back after change or adversity
2. Capable of preparing for, responding to, and recovering from difficult conditions.
Syn.: TOUGH ("Plan NYC" 2013)

The Australian mantra for adapting to climate change: Protect, Redesign, Rebuild, Elevate, Relocate and Retreat.

Resilient is also being defined as bouncing back from any extreme event which can include an internet crash, global epidemic, or climate change intensified events.

For Purposes of This Standard, Resilient Means both mitigation (carbon pollution reductions) addressing the need to prevent near term irreversible unmanageable dangerous climate change (climate bubble / crash), and adapting to the increasing intensified weather and climate events causing well-documented systemic damages to all economic sectors. This includes safety and acute and chronic events.

Wall St. Due Diligence Released at NYSE on Added Sustainable Investment Value Documents:

- High probability of unmanageable dangerous climate change without 60 gigaton climate pollution reduction in next 12 years, pursuant to IPCC deadline (Oct. 7, 2018) estimated to cost \$6 trillion. This is called Climate Bubble / Crash. However, investors with over \$70 trillion in assets are ready to deploy this capital through green + resilient bonds and stocks.
- JPMorgan publication states it is a high probability Black Swan event.
- Secondary market is expected to create \$1trillion private sector stimulus.
- Leading investors, insurers and governments publicly document that accelerating systemic climate damages exist in all economic sectors caused by more intense and severe weather / climate events.

- ▶ Fluctuating Deaths, Rising Damages – 3.3 million deaths in the 40 years to 2010, Disasters can strike anywhere, + Damages are rising.

Peer-reviewed due diligence is comprised of over 60 reports, consensus standards, and investor surveys and was updated in 2013 by leading economists. The due diligence findings on added green property value including national statistically valid data, were “baked into” the Underwriting Standards which have achieved higher credit ratings for Green Property Bonds. For example, the due diligence showed that energy and water efficiency have substantially increased economic value by reducing operating costs. Accordingly, 40% of the Underwriting Green Value Score is energy efficiency.

Design, Construction + Valuation Principles + Goals

- ▶ Green building secondary financing market can provide the required near term \$6 trillion to keep dangerous climate manageable, because investors with over \$70 trillion in assets want to invest in green buildings / buy green property bonds. Green Bonds are vibrant \$150 billion / yr. market with all bonds quickly selling out thus providing cheaper capital and about 20% more bond proceeds, and more valuable and less risky bonds.
- ▶ Fluctuating Deaths, Rising Damages – 3.3 million deaths in the 40 years to 2010, Disasters can strike anywhere, + Damages are rising.
- ▶ Even with the 60 gigaton climate pollution reduction in the next 12 years, severe weather / climate events will keep intensifying due to latent effect of carbon pollution in the atmosphere and positive feedback loops / natural accelerators like: methane releases from decaying organic matter in unfrozen permafrost, arctic lakes and ocean bottom methane hydrates, and cessation of ocean CO2 adsorption due to very high ocean CO2 levels.
- ▶ The top priority is to prevent unmanageable dangerous climate, otherwise resilience + safety will not work.
- ▶ Resilient design + construction is cost sensitive thus like rating systems, minimum prerequisites are required with recognition for superior performance above the minimum.
- ▶ Use of integrative process (IP) already incorporated into the Underwriting Standards, substantially reduces construction costs and risk, thus the financial community encourages it to be a condition of financing. Higher achieving green + resilient design is only cost effective with IP.
- ▶ Address vulnerabilities to natural and manmade stressors in buildings, cities, communities, and design responses to them to help achieve stability + adaptability through the following goals:
 - ▶ Provide Underwriting Achievement metrics reducing risk so insurers can write reasonably-priced risk-adjusted coverage again for climate change damages.
 - ▶ Strengthen building, infrastructure, organization and community resistance to chronic stressors arising from a changing climate and resource drawdown.
 - ▶ Reduce physical risks posed by extreme weather events to property occupants, building systems, infrastructure, organizations, and communities.
 - ▶ Improve safety and stability during acute shocks from both manmade events and natural phenomena.

- ▶ Maintain business, organizational and community continuity reducing interruptions including in the supply chain.
- ▶ Reimagine + Rebuild the emotional, social, economic and physical systems to go beyond original conditions and standards to create stronger buildings, homes, infrastructure, cities and communities.
- ▶ The built environment has a profound impact on safety, economy, health and productivity and is the World's largest industry.

3. UNDERWRITING STANDARDS SCORING MECHANICS + BOND + PORTFOLIO CERTIFICATION

Based on the safety + resiliency features present at the asset / property or community level, these criteria are identified and summarized as to its value impact. Each safety + resiliency criteria identified has a description of underwriting / valuation impact.

Once these asset-specific features are identified and appropriate value is attributed through a numerical score on the Green Building Underwriting Standard, underwriters can use this information to appropriately assess an asset's risk profile and determine the Green + Resilient Value Score.

Once the Green + Resilience Value Score is derived, it is intended to ride with the asset based on a vintage year. The Value Score is applicable to both internal decision making and external reporting to relevant parties including rating agencies, secondary market investors, corporate-level financial and environmental reporting, and other pertinent applications.

If the asset undergoes capital improvements at a future date, the Value Score should be recalculated, a new vintage year assigned, and then re-reported accordingly.

Certification to the Standard of bonds or portfolios should be conducted by professional assurance providers (CPA firms) engaging qualified environmental professionals.

4. RESILIENCE ATTRIBUTES INCREASING TANGIBLE ECONOMIC VALUE

1. PA* Study: Short-Term Hazard Preparedness + Mitigation
2. PA* Integrative Process, Development + Community Stakeholder Involvement
3. PA: Commissioning + Long-Term Monitoring / Maintenance
4. HP* Fundamental Emergency Planning + Preparedness for Common Hazardous Events
5. HP* Fundamental Access To: First Aid, Emergency Supplies, Water, Food, Communications
6. HP: Enhanced Emergency Planning for Common Hazards + Extreme Events
7. HP: Enhanced Access: Emergency Care + Supplies, Water, Food, Communications
8. HP: Additional Emergency Provisions For the Community + for Longer Timeframes
9. HA* Sites of Avoidance + Repair: 500 Year Flood Plain, Storm Surge + Sea Rise
10. HA* Fundamental Emergency Operations: Back-up Power + Operations
11. HA* Fundamental Emergency Operations: Thermal Safety During Emergencies
12. HA* Safer Design for Extreme Weather, Wildfire + Seismic Events

13. HA: Adaptive Design for Extreme Rain, Sea Rise, Storm Surge + Extreme Weather, Events + Hazards
14. HA: Advanced Emergency Operations: Back-up Power, Operations, Thermal Safety + Operating Water
15. HA: Passive Thermal Safety, Thermal Comfort + Lighting Design Strategies
16. HA: Transit + Transportation System Protection + Continuous Operations
17. CV: Community Connectivity: Walkability, Public Transit, Non-motorized Transit
18. CV: Community Connectivity: Mixed-Use Commercial, Housing + Public / Community Space
19. PH* Minimum IAQ + Views to the Exterior
20. PH* Minimum Protection for Prime Habitat + Floodplain Functions
21. PH: Human PHD: Expanded IAQ, Daylight + Views, Fresh Air
22. PH: Human + Eco PHD: Reduce Pesticides, Prevent Surface + Groundwater Contamination
23. PH: Ecological PHD: Protect Wetlands + Avoid Slopes and Adverse Geology
24. EW* Minimum Water Efficiency + Resilient Water and Landscapes
25. EW* Minimum Energy Efficiency + Atmospheric Impacts
26. EW: Plan for Rainwater Harvesting, Resilient Landscapes + Food Production
27. EW: Plan the Site & Orientation for Sun + Wind Harvesting, Natural Cooling
28. EW: Water Use Reduction, Near Zero / High Efficiency Water Flows & Resilient Landscapes
29. EW: Energy Optimization, Near Zero / Carbon Neutral, Net Zero Net Positive Energy Flows
30. EW: Edible Landscaping, Urban Agriculture + Resilient Food Production
31. EW: Reduced Site Environmental Impacts: Lighting, Heat-Island, Airborne Toxins
32. MA: Safer, Non-Toxic Materials (SMaRT or equivalent Certified)
33. MA: Material + Artifact Effectiveness: Full Life Cycle Design for durability, adaptability, flexibility
34. MA: Material + Artifact Effectiveness: Design for Disassembly, Reuse, Recycling + Composting
35. MA: Use Legally Logged Wood from Ecologically Managed Forests (FSC Certified)
36. MA: Reduce Net Embodied Energy + Carbon, Water + Toxins

* Indicates that Credit is a Required Prerequisite

Sustainable + Resilient Value Score

Sustainable + Resilient Value Score Formula

For Sustainable + Resilient Infrastructure: 25-100 Score. Pass / Fail for Prerequisite / Credit Achievement

National Consensus *Green Property, Safety, Resiliency & Infrastructure Underwriting Standards*©

	SCORE	VALUE RATIO	ADJUSTED SCORE
Prerequisites		60%	30
Resiliency Score form Credits: 5 points per credit achieved		35%	65 possible
Envision Certification	YES NO	5% 0%	5 possible
Sustainable + Resilient Value SCORE		100%	100 possible

BACKGROUND

Green Building Underwriting Standards' Revenues, Expenses + Intangibles

COMMERCIAL

Revenues / Expense Reduction (some attributes are revenues, some expense reduction, some both but no double counting)

1. Energy Star / HERS Score / ASTM BEPA Standard result
2. Energy Star Certification
3. Climate Neutral Certified
4. Site Selection / Sustainable Sites: avoiding floodplains & wetlands
5. Development density / connectivity: redeveloped sites
6. Public transportation access
7. Water use reduction / Water efficiency / EPA Water Sense
8. Water efficient landscaping

9. Onsite Green-e Power
10. Outdoor air monitoring: ventilation system performance
11. Ventilation effectiveness: increasing outdoor air in the structure
12. IAQ Management Plan
13. Measurement + Verification: optimization of building energy / water over time
14. Adhesives + Sealants: reduced VOCs
15. Paints + Coatings: reduced VOCs
16. Composite Wood: no added formaldehyde
17. Chemical / Pollutant Control: improved indoor air quality
18. Daylight + Views
19. Green roof / heat island
20. Reducing Heat Island Effect
21. Stormwater management: reducing rate + quantity
22. Underfloor air: controllability of systems + thermal comfort
23. Integrative Process
24. Commissioning
25. Enhanced Commissioning
26. Recycling

Intangibles

1. LEED Rating
2. Mandatory Onsite Recycling (MR Prerequisite)
3. Building Reuse (MR 1)
4. Construction Waste Recycling (MR 2)
5. Resource Reuse (MR 3)
6. Local / Regional Materials (MR 5)
7. FSC Certified Wood (MR 7) (see Sustainable Manufacturing Underwriting Standards)
8. SMaRT Certified Sustainable Products (LEED Innovation Credit and Climate Neutral Credit) (see Sustainable Manufacturing Underwriting Standard)
9. Light Pollution Reduction (SS 8)
10. Open Space Restoration

HOMES

Revenues / Expense Reduction (some attributes are revenues, some expense reduction, some both)

1. Energy Efficiency Strategies Employed / HERS Score / Energy Star Certification
2. Energy Star Certification
3. Climate Neutral Certification
4. Energy Reduction: HVAC / Hot Water / Appliances

5. Home Orientation for Natural Solar Gain Efficiencies
6. Onsite Renewable Energy
7. Water Efficiency / Use Reduction
8. Non-Toxic Pest Control
9. Preferred Location and Infrastructure Stability
10. Community Resources and Public Transportation
11. Improved Durability
12. Integrative Process
13. Commissioning
14. Site Selection
15. Heat Island Reduction
16. Homeowner Education
17. LEED for Neighborhood Development Certification
18. Access to Open Space
19. LEED Low-VOC Materials
20. ENERGY STAR IAQ Verification
21. Indoor Environmental Quality / Ventilation / IAQ Effectiveness
22. Reduced Site Disturbance / Tree Protection

Intangibles

1. FSC Certified Wood (LEED-MR 7) (see Sustainable Manufacturing Underwriting Standard)
2. SMaRT Certified Sustainable/EPP Products (LEED Innovation and Climate Neutral) (see Sustainable Manufacturing Underwriting Standard)
3. Local / Regional Materials (LEED-MR 2)
4. Construction Waste (LEED-MR 3) (prerequisite: construction waste planning leads to reduced costs to builder, and to homeowner for construction costs if passed through)
5. Previously Developed (LEED-LL 3) (reduced costs to builder and to homeowner for construction costs if passed through)
6. Erosion control, minimized site disturbance, stormwater runoff (LEED-SS 1.1, SS 1.2, and SS 4)
7. Landscaping: no invasive species (LEED SS 2.1)
8. Ensure use of refrigerants that do not cause ozone layer depletion and climate change (LEED-EA 11)
9. Material Efficient Framing (LEED-MR 1) (framing order waste factor limit results in reduced costs to builder and to homeowner for construction costs if passed through)
10. LEED or GreenPoint Rating

Infrastructure Intangibles (For Information Only. Not Part of Sustainable + Resilient Value Score)

- a. Reduce project costs by reducing construction waste (comparable to existing underwriting standard attribute).
- b. Increased cash flow to manufacturers & retailers in Sustainable Manufacturing Underwriting Standard:
 - I. Reduce Net Embodied Energy using LCA covering all products stages
 - II. Sustainable Procurement Practices
 - III. Use Recycled Materials
 - IV. Use Regional Materials
- c. Divert Waste from Landfills
- d. Reduce Excavated Materials Taken Off Site
- e. Provide for Deconstruction and Recycling
- f. Preserve Species Biodiversity
- g. Control Invasive Species
- h. Restore Disturbed Soils
- i. Maintain Wetland and Surface Water Functions
- j. Envision Sustainable Infrastructure Rating (achieves points for Underwriting Green + Resilient Value Score)
- k. Social resiliency by maintaining community social infrastructure, e.g., community meeting facilities, sidewalks promoting non-vehicle transportation, maintaining local retail, restaurants, day care community organizations bringing people together like library groups improving local communication to reach out for help and assistance.
- l. Chronic long term food supply — Recognizing the interdependencies among food / water / energy / land / climate systems