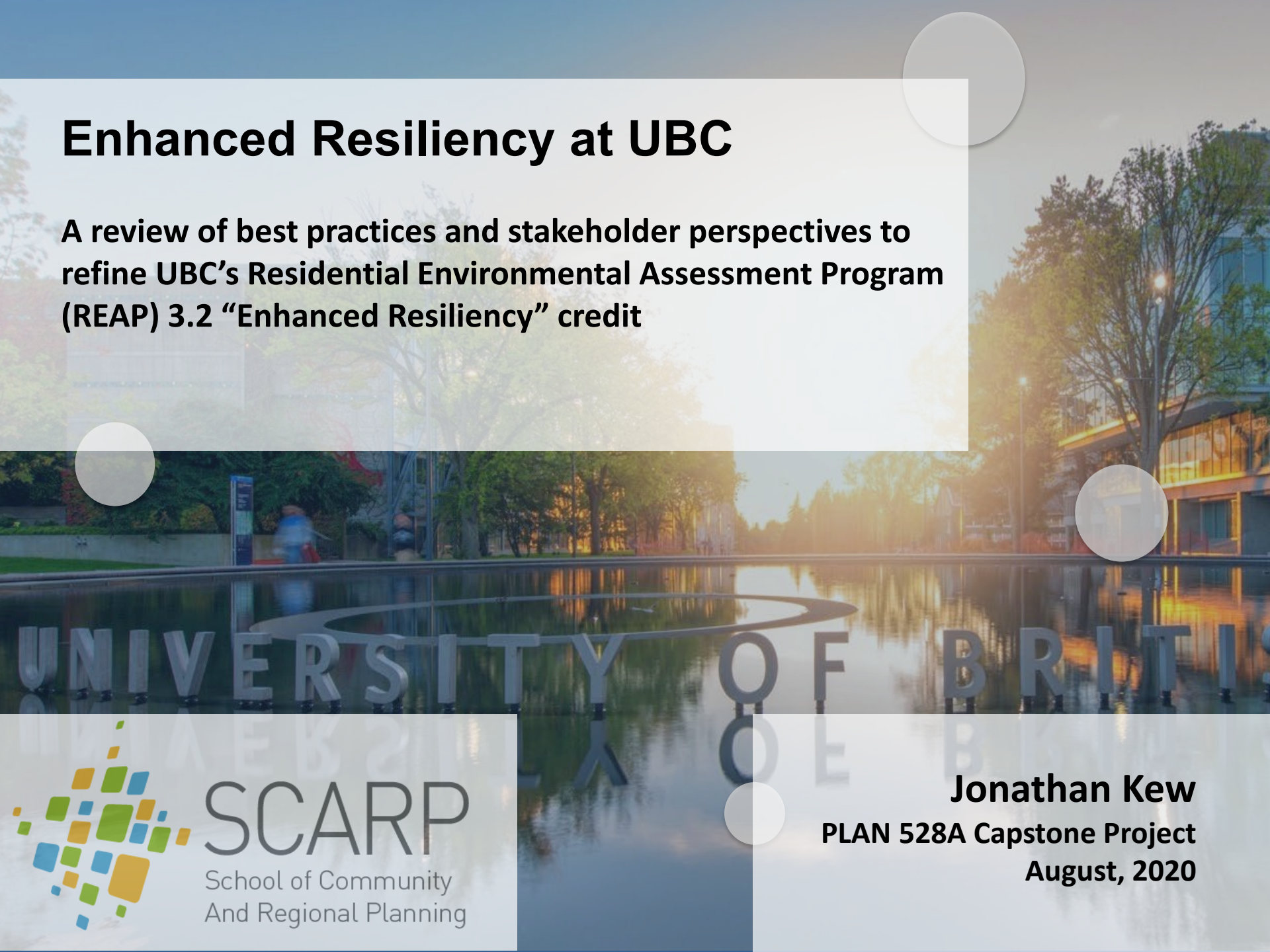
# Enhanced Resiliency at UBC

**A review of best practices and stakeholder perspectives to refine UBC's Residential Environmental Assessment Program (REAP) 3.2 "Enhanced Resiliency" credit**




SCARP
School of Community
And Regional Planning

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**PLAN 528A Capstone Project**
**August, 2020**

# TODAY'S PRESENTATION

1. BACKGROUND
2. FINDINGS
3. RECOMMENDATIONS
4. CONCLUSION

# 1.0 INTRODUCTION

# Project Objectives

**Research Purpose:**
Increase resiliency in MURB's using cost effective and locally appropriate policy incentives

- Evaluate the resilience design strategies and review proposed REAP 3.2 Enhanced Resiliency credit to determine appropriateness for this requirement
- Interview subject matter experts and architects (including MBAR stakeholders) to understand strategy appropriateness to UBC context
- Develop recommendations for refinements of the credit based on applicability of the MBAR primers and strategies

# Mobilizing, Building and Advancing Resilience Program (MBAR)

**Figure. Graphic from the BC Housing Mobilizing, Building, and Advancing Resilience Program**

# WILDFIRES

**Risks to Buildings, Occupant Safety & Environment**

- Damage to, or destruction of buildings
- Utility service interruption
- Potential loss of property and personal assets
- Decreased outdoor and indoor air quality and associated risk to human health
- Risk of human injury or loss of life through exposure to fire, smoke, and/or decreased air quality

Wildfires pose a serious threat to building safety. Risks occur when the close combustion of natural fuels (e.g. trees, grasses and shrubs) spread to human-made structures. Wildfires at the urban interface are made more complex because combustible building materials compound with out fuel sources. At the wildland-urban interface, fires can start either outside and spread to adjacent structures, or originate inside, then ignite vegetation and spread through the wilderness. Interface fires are projected to increase in severity and magnitude as a result of climate change, and can in turn lead to air quality advisories across the province. This sheet is intended to start conversations about mitigating these risks.

## Site Strategies

| Strategy | Cost | Impact | Alignment |
|---|---|---|---|
| Identify prevailing wind direction and airshed characteristics to determine direction of potential fires | $ | *** | |
| Conduct a full risk assessment, considering fuel types, building location relative to slope, and the nature of the structure | $$ | *** | |
| Maintain 10m setback from all combustible materials to create a natural firebreak. Increase this setback for structures or vegetation closest to the forest interface | $ | *** | |
| Install outdoor water fixtures (e.g. taps and sprinklers) connected to a gravity-fed source in a location easily accessible to building occupants | $ | *** | |

## Design Strategies

| Strategy | Cost | Impact | Alignment |
|---|---|---|---|
| Include mesh debris screens (3 mm) in gutters, eaves and vents to reduce accumulation of flammable vegetation and limit areas exposed to sparks and embers | $ | * | |
| Install a chimney spark arrestor to reduce release of sparks and embers to surrounding areas | $ | * | |
| Select higher performance fire-retardant or -resistant siding materials (e.g. stucco, metal siding, brick, concrete and fibre cement) | $$ | *** | |
| Select fire-retardant roofing materials, such as metal, asphalt, clay and composite rubber tiles with Class A UL/ASTM rating – avoid green roofs for buildings at the wildland-urban interface | $$ | *** | |
| Use double-paned tempered windows and frames with an air barrier seal to provide greater air quality protection and heat resistance | $$ | ** | |
| Ensure building and garage entry doors are fire-rated and sealed with an air barrier | $ | ** | |
| Install high-efficiency air filtration media (MERV 11 or higher) for all outdoor air building ventilation systems to improve indoor air quality | $$ | *** | |
| Install air cleaners equipped with highest-efficiency particle air (HEPA) filters and activated carbon filters in refuge areas (e.g. amenity spaces) | $$$ | *** | |
| Make use of demand-controlled ventilation based on CO2 levels to reduce the introduction of outdoor air beyond required air flow rates. | $$$ | ** | |
| Install mechanical systems such as air source heat pumps that allow for cooling during fire events | $$ | *** | |
| Design a common building area to act as a cooling room or clean air refuge | $ | *** | |
| Connect cooling and ventilation systems in refuge areas to a source of back-up power. | $$ | ** | |
| Ensure a minimum of 72 hours of fuel storage for power to refuge area and key services, including building pumps, fans, emergency lighting, and security systems | $$ | *** | |
| Design building entry and exits that can be operated manually | $ | *** | |

Power Outages & Emergencies · Air Quality · Flood Events · Severe Storms · Seismic Events · Heat Waves

| Relative Cost/ Cost Premium | | |
|---|---|---|
| Low | Medium | High |
| $ | $$ | $$$ |

| Relative Impact | | |
|---|---|---|
| Low | Medium | High |
| * | ** | *** |

## Operations Strategies

| Strategy | Cost | Impact | Alignment |
|---|---|---|---|
| Trees should be set back 10m from all buildings and combustible materials | $ | *** | |
| Plant fire-resistant vegetation with moist, supple leaves and low sap or resin production | $ | * | |
| Ensure planting groups are a minimum of 6m apart, and trees are a minimum 3m apart | $ | * | |
| Prune lower branches within 6' (1.8m) of ground | $ | * | |
| Regularly mow lawn areas and check roof, gutters, and eaves to remove flammable vegetation | $ | * | |
| Inspect, maintain and replace high-efficiency air filtration media for all outdoor air building ventilation systems | $ | ** | |
| Close building openings to temporarily reduce the intake of outdoor air during extreme events | $ | *** | |
| Plan, rehearse, and identify preparedness procedures necessary to maintain a successful refuge area (e.g. testing equipment, checking shelf life of stored provisions) | $ | * | |
| Provide occupant education on refuge areas, evacuation measures, exit locations, etc. | $ | *** | |
| Educate building maintenance staff in firefighting/resistance measures (e.g. operating sprinklers, wetting down surfaces, removing flammables) | $ | *** | |
| Provide sufficient personal protective equipment for building occupants, (e.g. N95 masks or N95 respirators) to minimize exposure to particulate matter | $ | ** | |
| Ensure personal cooling devices are available to building occupants (e.g. cooling blankets) | $ | * | |
| Ensure there is adequate means for people who don't have cars or need assistance to evacuate the vicinity (e.g. public transportation or a carpool-evacuation plan) | $ | * | |
| Ensure alternate egress routes are available and known to building occupants | $ | ** | |

## Community Benefits

Consider the following strategies to help improve the resilience of the community overall:

- Provide access to local outdoor air quality data and indoor CO2 levels via occupant displays
- Design amenity rooms to act as cooling centres/clean air refuge areas for at-risk community members (e.g. seniors) and a central location for emergency support and services
- Ensure refuge areas and common spaces are designed to foster social connection, mental health, and overall cultural safety
- Ensure building connection to community fire response plans (e.g. notification systems)

## Potential Design Conflicts

Take care and ensure resilient strategies do no exacerbate vulnerability and other risks

- Vegetation setbacks may eliminate benefits associated with trees for shading and heat island reduction
- Consider the durability of siding materials to withstand storms, freeze/thaw and seismic events
- Consider the impact of roofing materials on the heat island effect
- Passive ventilation strategies that rely on natural air flow to cool and ventilate a building may exacerbate indoor air quality issues during times of poor air quality (e.g. forest fire smoke). Ensure buildings have back-up cooling and ventilation systems that allow for mechanical ventilation when necessary.

**Additional Resources**

- Government of BC: Current Air Quality Data Map – Air Quality Health Index
- Government of BC: FireSmart Homeowner's Manual
- Government of BC: FireSmart Your Property

INTEGRAL GROUP

BC HOUSING RESEARCH CENTRE

**Figures. REAP 3.2 Climate Adaptation Category Draft, Enhanced Resiliency Credit Draft, and UBC Integrated Design Process**

| Climate Adaptation (CA) | | 13 |
|---|---|---|
| P1 | 2050 Climate Ready Thermal Comfort Modelling | |
| 1.1 | 2050 Climate Ready Energy Efficient Design | 7 |
| 1.2 | Enhanced resiliency | 3 |
| 1.3 | On site backup power | 3 |

| Enhanced resiliency |
|---|
| Achieve appropriate design strategies from the Mobilizing Building Adaptation and Resilience (MBAR) discussion papers on "Air Quality", "Fire", "Heat waves" and "Power outages and emergencies".<br>10 different design strategies with at least 1 from each paper. — 1 point<br>15 different design strategies with at least 1 from each paper. — 2 points<br>20 different design strategies with at least 2 from each paper. — 3 points |

July 2020 — August 2020


- Review of
  - UBC Planning materials and precedent reports
  - BC Housing MBAR Primers and program documents
  - MURB Best Practices
  - Green Building Rating Systems and Critical Analyses

- Interviews with:
  - **Wilma Leung**, Senior Manager, BC Housing
  - **Lisa Westerhoff**, Principal, Integral Group
  - **Jennifer Cutbill**, Principal, Lateral Agency
  - **Ashleigh Fischer**, Project Performance Specialist, ZGF Architects

- Producing the:
  - Interview transcripts
  - Recommendations, insights, and complementary research
  - Final report and final presentation

# 2.0 FINDINGS

1. STRESSORS
2. SYSTEMS AND FRAMEWORKS
3. PROCESSES

## Stressors

- Seismic Resilience
- Disease Transmission
- Heat waves
- Power Outages & Emergencies
- Wildfires and Air Quality
- Community Resilience

## Systems and Frameworks

- ARUP REDi
- LEED Enhanced Resilience Pilot Credits
- RELi 2.0 Rating Guidelines
- Integrated Building Adaptation and Mitigation Assessment Framework (IBAMA)

## Practices

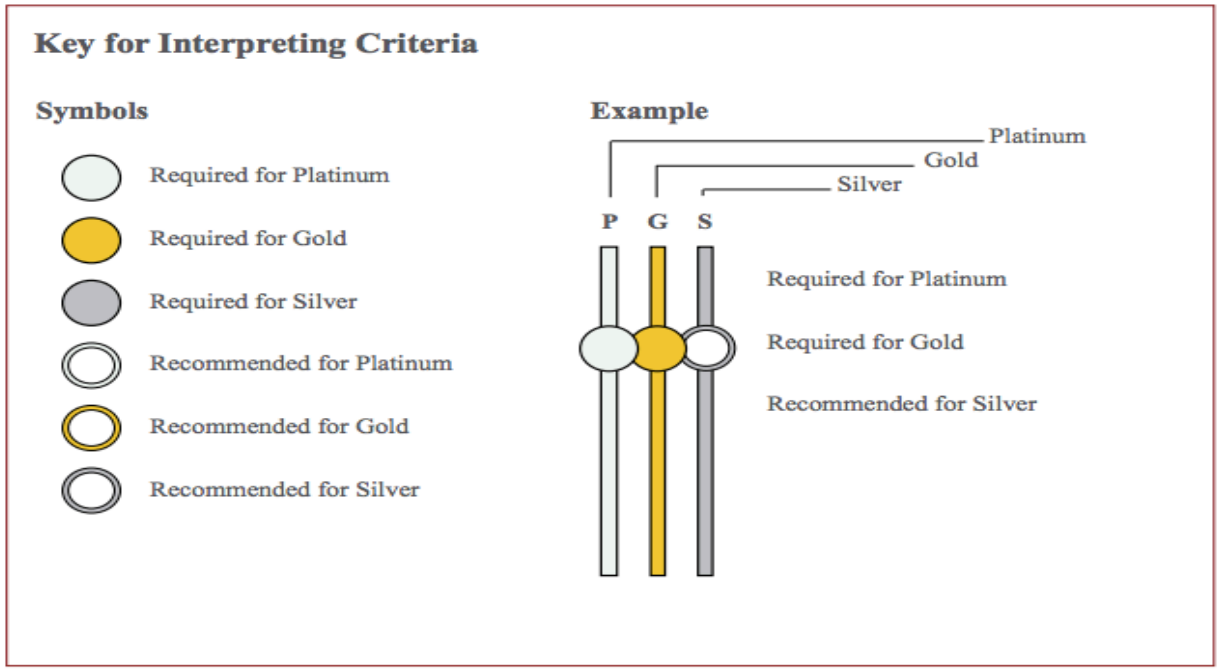
- Logistics
- Facilitation
- Research
- Using the MBAR Primers

# Stressors

- REAP 3.2's Climate Adaptation category corresponds to the predominant concerns among industry stakeholders
- Generally interviewees were resistant to recommend strategies on-the-spot, and encouraged site-by-site analysis
- Seismic Resilience was recognized by multiple stakeholders as the elephant in the room
- Resilience for disease is emerging and worth implementing in REAP 3.2
- Strategies for heat waves and wildfires demonstrate value for implementing a framework that can identify the trade-offs and co-benefits of various mitigation and adaptation strategies
- Multi-lingual community resilience is an important component of social adaptiveness and emergency response — there are a number of design and programming pilots in Vancouver for UBC to emulate

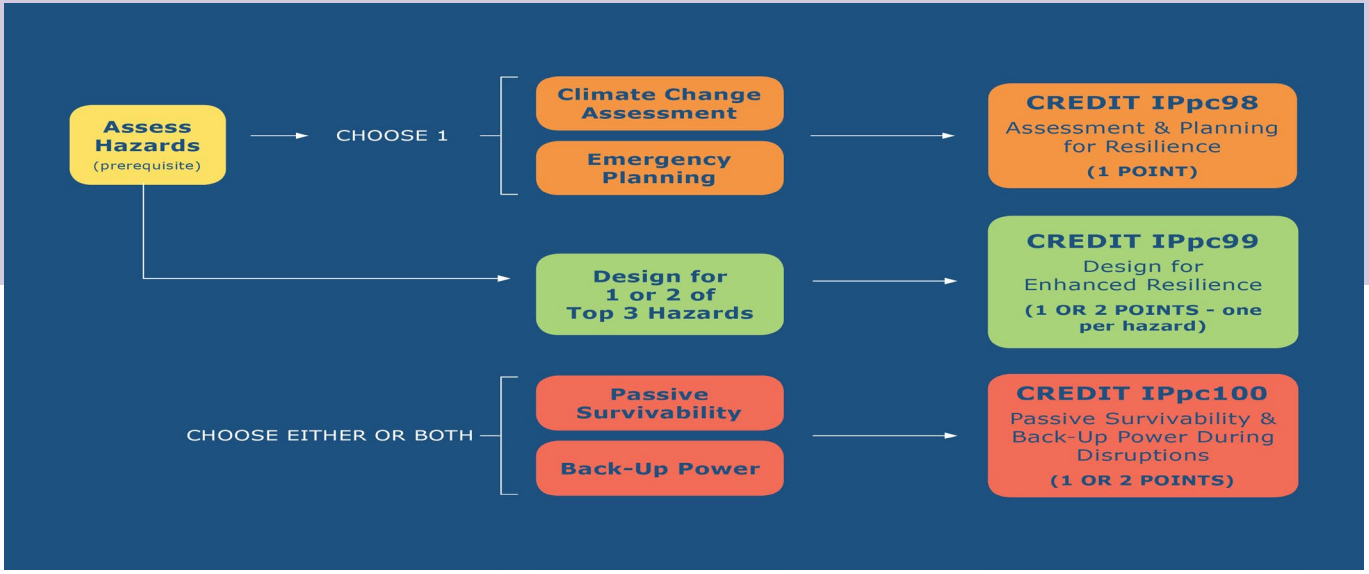
# Systems and Frameworks

- The **ARUP REDi** system provides a variety of approaches and strategies worth consideration
  - Low cost strategies include advocacy requirements
  - Prescriptive vs. Performance Based Approach: REDi provides example of performance-based criteria for seismic resilience



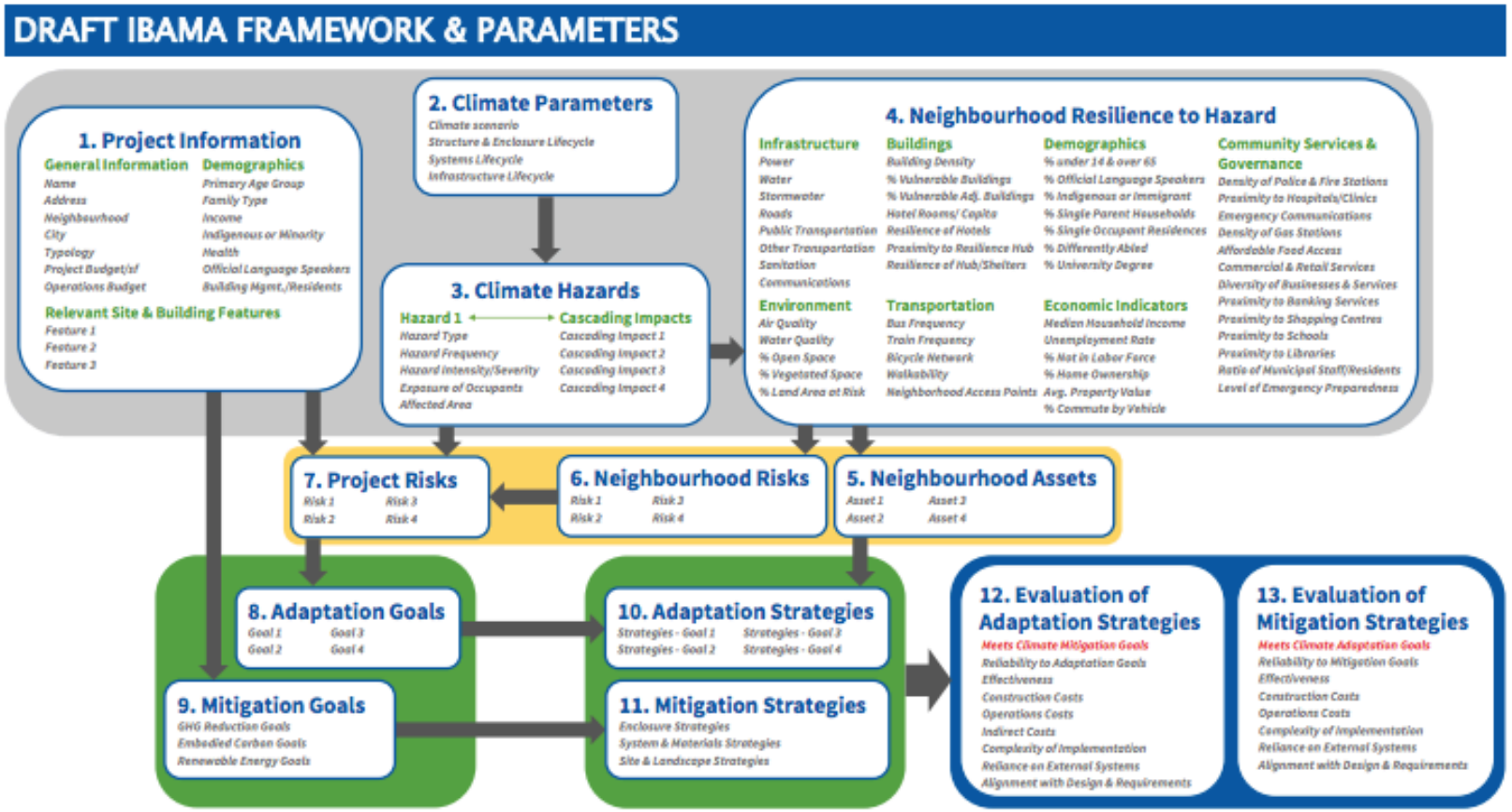
# Systems and Frameworks

- REAP 3.2 would bring the system on-par with the **LEED pilot credits in Enhanced Resilience**
  - Some interviewees recommended making Enhanced Resiliency, in-part or in-sum, mandatory, to bring REAP ahead of LEED with respect to resilience



# Systems and Frameworks

- **The Integrated Building Adaptation and Mitigation Assessment Framework (IBAMA)** is an emerging cost-benefit analysis process for the deliberation of resilience strategies that was identified as a tool for UBC to follow and pilot



# Practices

- **Facilitation** and **Logistics** were identified by most interviewees as equally critical to the success of the Enhanced Resiliency credit
- Facilitated approach is necessary when there is lack of design convergence
- A deliberate facilitation process can align goals, identify principles, and make the core purpose and vision clear
- Ensuring that this process is timely has been identified across a variety of UBC research projects

*"Before there is that consensus, my preference is to take a more bottom-up approach. What I mean by bottom-up is more facilitation: to provide all the information, look at each case, identify the opportunities and how we can maximize them." (Wilma Leung, personal communication, 2020)*

*"Things like backflow preventers are a proxy for developers avoiding things they don't really understand, they're not seeing, or are perceived to not have any value. So the more that a team can build this literacy around what is important, why we're doing things, what is available: doing that in the early stages can make a lot of cost fall away, to the tune of millions of dollars." (Jennifer Cutbill, personal communication, 2020)*

# Practices

- MBAR stakeholders also had thoughts about how to **best use the MBAR primers**
- The MBAR primers were designed as a conversation starter — UBC would be the first institution to use them in a regulatory context
- Many of the strategies repeat between primers
  - Some strategies are of questionable value or would be achieved in the ordinary course of design, others are critical
- The primary recommendation was the importance of UBC launching an internal process to weigh the MBAR strategies for its own development context
- One interviewee argued that designers and developers would be unfamiliar with MBAR, and uninterested in probing the primers deeply
  - This could be mitigated by using various tools to embed the strategies at UBC

*"So I think as a starting point it might be good, but at the same time, not all these strategies are created equally. So a designer could go for the lowest hanging fruit" (Lisa Westerhoff, personal communication, 2020)*

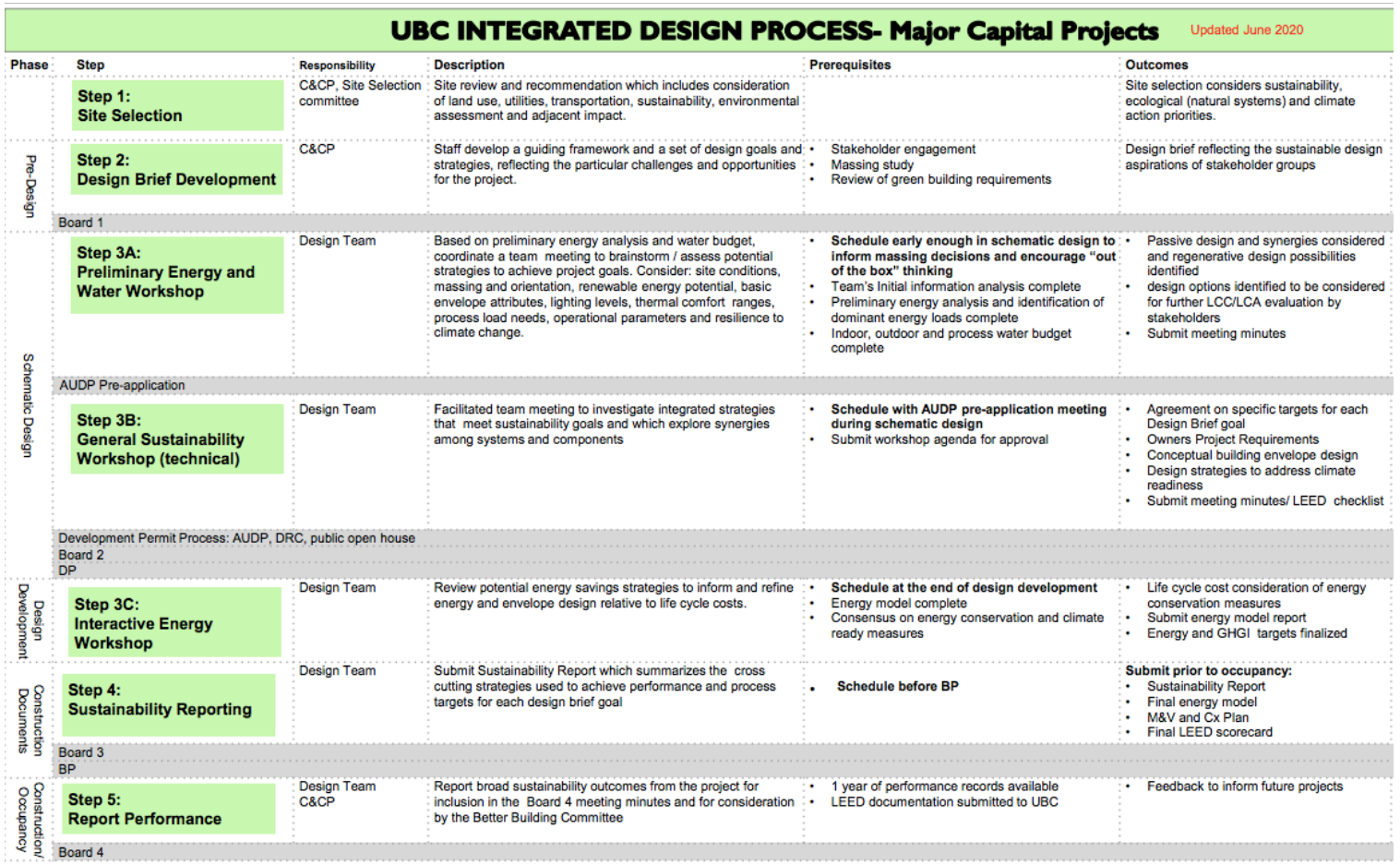
# 3.0 RECOMMENDATIONS

## 4.1 Recommendations

1. Weigh and order the MBAR Strategies
2. Focus on adding a facilitation component to the credit
3. Consider expanding the credit to include disease resilience and seismic resilience
4. Consider splitting the credit into tiers or prerequisite components
5. Consider more active publication of UBC building policies
6. Consider visualizing the MBAR strategies through UBC policy documents (e.g. a Stadium Neighbourhood Design Guidelines)
7. Pursue a pilot to enhance community resilience with Hey Neighbour
8. Utilize UBC's Research to fill in gaps

# 1. Weigh and order the MBAR strategies

# 2. Focus on adding a facilitation component to the credit



**UBC INTEGRATED DESIGN PROCESS- Major Capital Projects** Updated June 2020

| Phase | Step | Responsibility | Description | Prerequisites | Outcomes |
|---|---|---|---|---|---|
| | **Step 1: Site Selection** | C&CP, Site Selection committee | Site review and recommendation which includes consideration of land use, utilities, transportation, sustainability, environmental assessment and adjacent impact. | | Site selection considers sustainability, ecological (natural systems) and climate action priorities. |
| Pre-Design | **Step 2: Design Brief Development** | C&CP | Staff develop a guiding framework and a set of design goals and strategies, reflecting the particular challenges and opportunities for the project. | • Stakeholder engagement<br>• Massing study<br>• Review of green building requirements | Design brief reflecting the sustainable design aspirations of stakeholder groups |
| | Board 1 | | | | |
| Schematic Design | **Step 3A: Preliminary Energy and Water Workshop** | Design Team | Based on preliminary energy analysis and water budget, coordinate a team meeting to brainstorm / assess potential strategies to achieve project goals. Consider: site conditions, massing and orientation, renewable energy potential, basic envelope attributes, lighting levels, thermal comfort ranges, process load needs, operational parameters and resilience to climate change. | • **Schedule early enough in schematic design to inform massing decisions and encourage "out of the box" thinking**<br>• Team's Initial information analysis complete<br>• Preliminary energy analysis and identification of dominant energy loads complete<br>• Indoor, outdoor and process water budget complete | • Passive design and synergies considered and regenerative design possibilities identified<br>• design options identified to be considered for further LCC/LCA evaluation by stakeholders<br>• Submit meeting minutes |
| | AUDP Pre-application | | | | |
| | **Step 3B: General Sustainability Workshop (technical)** | Design Team | Facilitated team meeting to investigate integrated strategies that meet sustainability goals and which explore synergies among systems and components | • **Schedule with AUDP pre-application meeting during schematic design**<br>• Submit workshop agenda for approval | • Agreement on specific targets for each Design Brief goal<br>• Owners Project Requirements<br>• Conceptual building envelope design<br>• Design strategies to address climate readiness<br>• Submit meeting minutes/ LEED checklist |
| | Development Permit Process: AUDP, DRC, public open house<br>Board 2<br>DP | | | | |
| Design Development | **Step 3C: Interactive Energy Workshop** | Design Team | Review potential energy savings strategies to inform and refine energy and envelope design relative to life cycle costs. | • **Schedule at the end of design development**<br>• Energy model complete<br>• Consensus on energy conservation and climate ready measures | • Life cycle cost consideration of energy conservation measures<br>• Submit energy model report<br>• Energy and GHGI targets finalized |
| Construction Documents | **Step 4: Sustainability Reporting** | Design Team | Submit Sustainability Report which summarizes the cross cutting strategies used to achieve performance and process targets for each design brief goal | • **Schedule before BP** | **Submit prior to occupancy:**<br>• Sustainability Report<br>• Final energy model<br>• M&V and Cx Plan<br>• Final LEED scorecard |
| | Board 3<br>BP | | | | |
| Construction/ Occupancy | **Step 5: Report Performance** | Design Team<br>C&CP | Report broad sustainability outcomes from the project for inclusion in the Board 4 meeting minutes and for consideration by the Better Building Committee | • 1 year of performance records available<br>• LEED documentation submitted to UBC | • Feedback to inform future projects |
| | Board 4 | | | | |

# 3. Consider expanding the credit to include seismic and disease resilience

## 1.5 Advocacy for Resilience

| Criterion | Commentary |
| --- | --- |
| **1.5.1 - Improve Infrastructure**<br>Communicate to local and state representatives, utilities, and transportation departments the desire for improved/ enhanced infrastructure to withstand the effects of natural disasters, including earthquakes. | ***C1.5.1 - Improve Infrastructure*** |
| **1.5.2 - Incentives**<br>Request incentives from communities, cities, and states for building to 'beyond code' resilience objectives. | ***C1.5.1 - Incentives*** |

1.0 Organizational Resilience

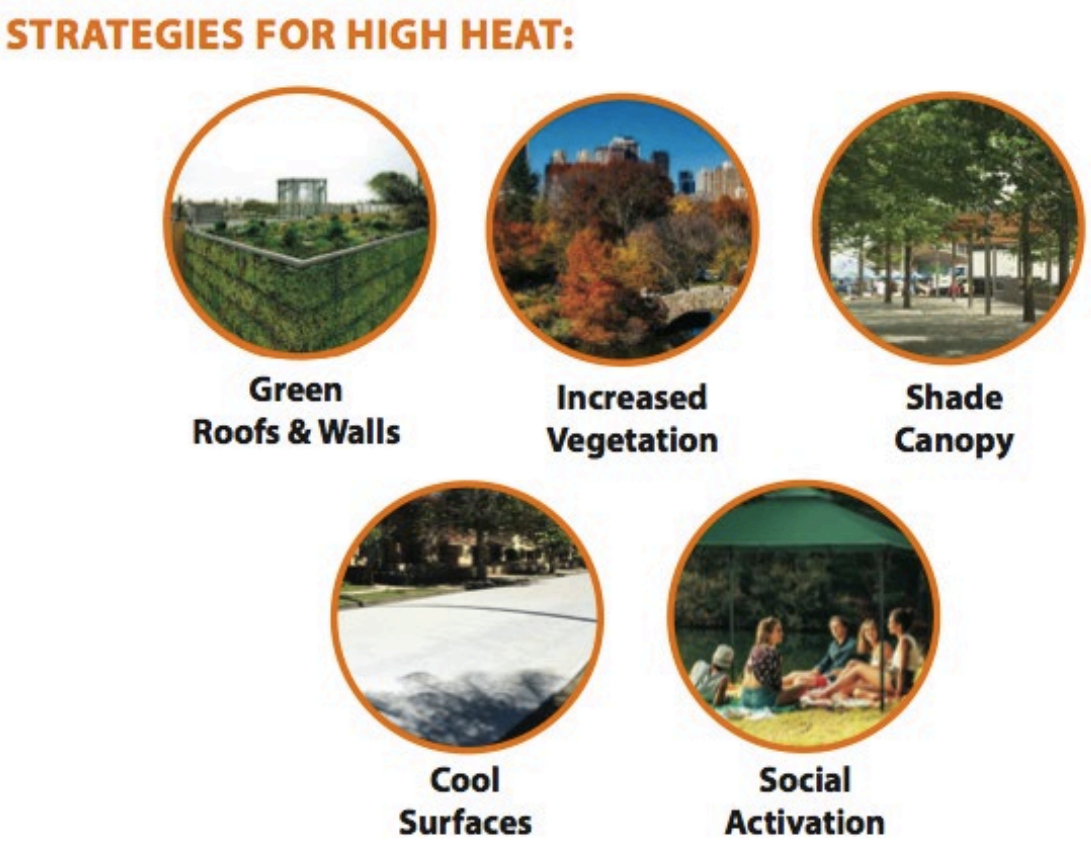
**4. Consider more active updates on the timeline for amendments to UBC building policy**

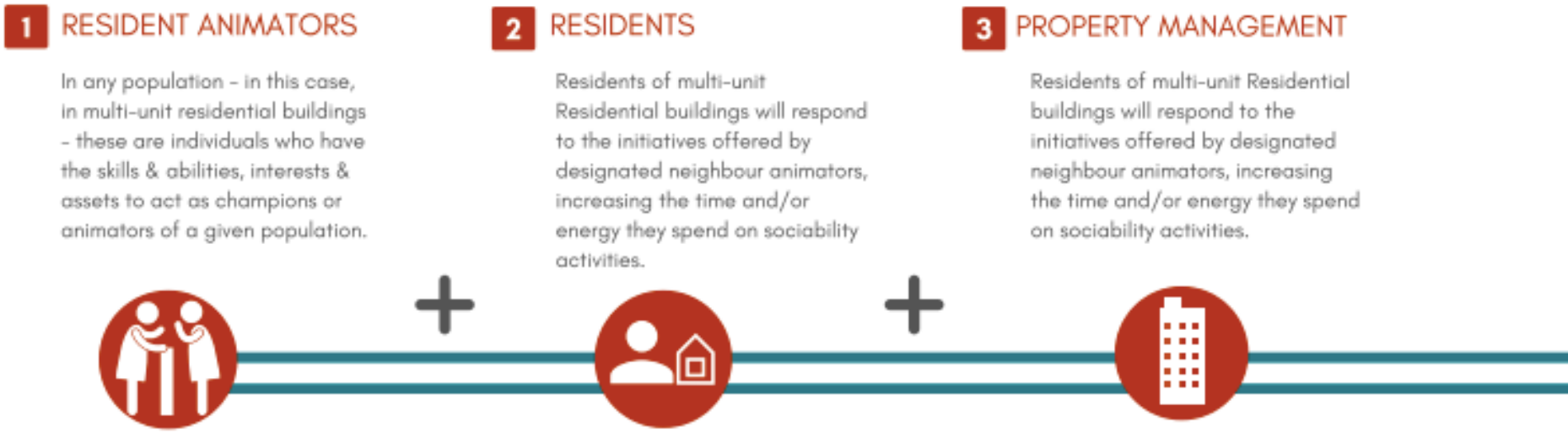
**5. Consider splitting the Enhanced Resiliency into tiers, making some strategies prerequisites, or coding strategies**

Design Strategies

| Strategy | Cost | Impact | Alignment |
|---|---|---|---|
| Select a minimum of double-paned tempered window and frames with an air barrier seal to provide greater air quality protection | $$ | ** | |
| Include mesh debris screens for gutters, eaves and vents to reduce accumulation of allergens | $ | * | |
| Include mesh screens into operable windows to prevent and insects pests from entering occupied areas | $ | *** | |
| Ensure the building air intake is away from local sources of outdoor air pollution | $ | *** | |
| Exceed industry standards for ventilation to keep indoor air pollutants and carbon dioxide levels low. Consider including a carbon dioxide monitor to monitor ventilation needs | $$ | *** | |
| Use demand-controlled ventilation based on carbon dioxide levels to reduce the introduction of outdoor air beyond required air flow rates | $ | ** | |
| Ensure HVAC systems are HEPA ready and/or procure portable HEPA filters with carbon filters to be used during wildfire smoke events | $ | ** | |

# 6. Build investment in MBAR and help developers visualize the primers by incorporating the strategies into UBC documents






**7. Pursue a pilot to enhance disaster readiness and community resilience**

**8. Utilize UBC's research to fill in the gaps**

# 4.0 CONCLUSION

# Conclusions

- The Climate Adaptation category and Enhanced Resilience credit represent a good step in the right direction
- UBC can emphasize a discretionary approach or narrow down the best strategies, considering the facilitation approach will always be critical
    - There are emerging frameworks and methodologies that can enhance this process

- Primary limitation of the project was time
    - Interviewees were reticent to provide strategy recommendations — instead encouraged an internal weighing process

- Many research opportunities emerged from the project, including:
    - The development of an MBAR database in collaboration with BC Housing
    - Evaluation of MBAR primers and their application in Stadium Neighbourhood
    - More qualitative and post-occupancy research to evaluate the entire development process and how sustainability design is applied on the ground
    - Emergency preparedness pilots that integrate the multi-lingual dimension of UBC neighbourhoods

# Questions?