

UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program  
Student Research Report

**Ecocity at UBC: Propose a Framework to Evaluate and Amend UBC Plans and Policies**

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**University of British Columbia**

**LARC 581**

**Themes: Buildings, Biodiversity, Community**

**August 2019**

*Disclaimer: "UBC SEEDS Sustainability Program provides students with the opportunity to share the findings of their studies, as well as their opinions, conclusions and recommendations with the UBC community. The reader should bear in mind that this is a student research project/report and is not an official document of UBC. Furthermore, readers should bear in mind that these reports may not reflect the current status of activities at UBC. We urge you to contact the research persons mentioned in a report or the SEEDS Sustainability Program representative about the current status of the subject matter of a project/report".*

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Student Research Report

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## 1- EXECUTIVE SUMMARY

One of the primary goals of UBC is to transform its campus into a vibrant, connected and complete sustainable community by going beyond minimizing harm to become net positive contributors to human and environmental wellbeing. UBC has recently aimed to align itself with the United Nations' Sustainable Development Goals (SDGs). In doing so, UBC is one of three institutions in the world in delivering on the United Nations' Sustainable Development Goals, which aim to contribute to create sustainable communities, protect the planet, and ensure that all people enjoy peace and prosperity in a community.

UBC plans and policies play an important role in delivering these goals, they are guiding the university to reach sustainability at the heart of teaching, learning and research, operations and infrastructure, and community. For this reason, it is essential to evaluate the UBC plans and policies and amend where necessary to make them applicable and effective. The purpose of this research is to propose a framework to evaluate UBC plans and policies to understand relationships and identify potential gaps and synergies toward the United Nations' Sustainable Development Goals (SDGs). This proposed framework is based on SDGs, EcoCity pillars and standards, and four rating systems include LEED, SITES, ENVISION and RELI. The outcome is a new framework with potential indicators for UBC Campus and Community Planning to both measure the effectiveness of current policies and plans, as well as to guide the development of new plans moving forward.

With an increasing majority of the world's population living in urban centers, cities will need to take the lead in addressing numerous pressures that challenge the health of people and ecosystems [1]. Increasing evidence highlights that cities will be threatened by issues relating to housing, energy production, food or water security, climate change, economic uncertainty, urbanisation, social conflict and terrorism among others [1]. In response to these challenges, the United Nations has developed a collection of 17 Sustainable Development Goals (SDGs), which have been adopted by countries, as well as by cities and institutions [2]. The goals reflect a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity in a world where no one is left behind [2].

UBC aspires to teach and learn together how to foster sustainability in the larger world outside the campus [3]. According to the Times Higher Education (THE) ranking system, UBC is one of the top three institutions in the world in delivering on the United Nations' Sustainable Development Goals [4]. The university embraces sustainability as a societal conversation about the kind of world we live in, informed by an understanding of the ecological, social and economic consequences of our individual and collective actions [3]. UBC plans and policies play an important role in delivering these sustainability-related goals, they are guiding this university to reach sustainability at the heart of teaching, learning and research, operations and infrastructure, and community. For this reason, it is essential to have systematic comprehensive rating system in order to evaluate, monitor and amend plans and policies to make sure they are effective, comprehensive and in line with new knowledge pertaining sustainability and resiliency thinking.

This research aims to propose a framework to assess UBC plans and policies, especially those pertaining UBC Campus and Community Planning, and their alignment with the United Nations' Sustainable Development Goals (SDGs) to better understand relationships and identify potential gaps and synergies toward these goals.

The motivation for this research project arose from the EcoCity World Summit which will be held in Vancouver in October 2019. The EcoCity World Summit has brought focus to the International Ecocity Standards (IES) which were developed specifically for cities through a decade-long partnership between Ecocity Builders and BCIT School of Construction and the Environment. The IES has 18 standards pertaining to sustainable urban living grouped under 4 pillars addressing the full expression of a healthy human civilization operating within Earth's biocapacity [5]. On the outset, there are

significant overlaps between the SDG's and EcoCity Standards. Yet, whereas the SDG's speak to broader societal goals, the EcoCity Standards tend to be applicable at the scale of a city or neighborhood. With UBC identifying itself as a small but globally important city (or big neighborhood), this study seeks to answer the following research questions: how can UBC plans and policies reach to SDGs and can EcoCity Standards help us get there?

To answer this question, 29 UBC plans were mapped against SDGs to evaluate how UBC is currently addressing the SDG's. By doing this, we learned that SDGs provide broad but relatively shallow goals when it comes to developing precise and measurable indicators for evaluating UBC plans and policies. As such, SDGs and EcoCity Standard were compared and evaluated. However, while the EcoCity Standards begin to address social-ecological and spatial challenges at the scale of the city, few of them contain measurements or indicators that would enable a city or institution to evaluate how well they are doing.

As such, the next step of the study involved research in a number of recognized and certified rating systems for the design of buildings, neighborhoods and infrastructure. These rating systems provide a set of recognizable standards and criteria for sustainable developments that can be used to amend the SDGs and EcoCity Standards.

Among many, four rating systems were analyzed, including LEED, SITES, ENVISION and RELI. The different focus areas of each of these rating systems allow for a critical reflection of which measures and indicators can be used to assess and inform sustainable design across a range of scales. An in-depth analysis of these rating systems, combined with the overarching frameworks created by the SDGs and Ecocity Standards, has resulted in a proposal for a holistic evaluating system for UBC plans and policies. This new framework is meant to guide UBC, especially UBC Campus and Community Planning, to reach Sustainable Development Goals (SDGs) (see Figure 1 for research methodology summary).

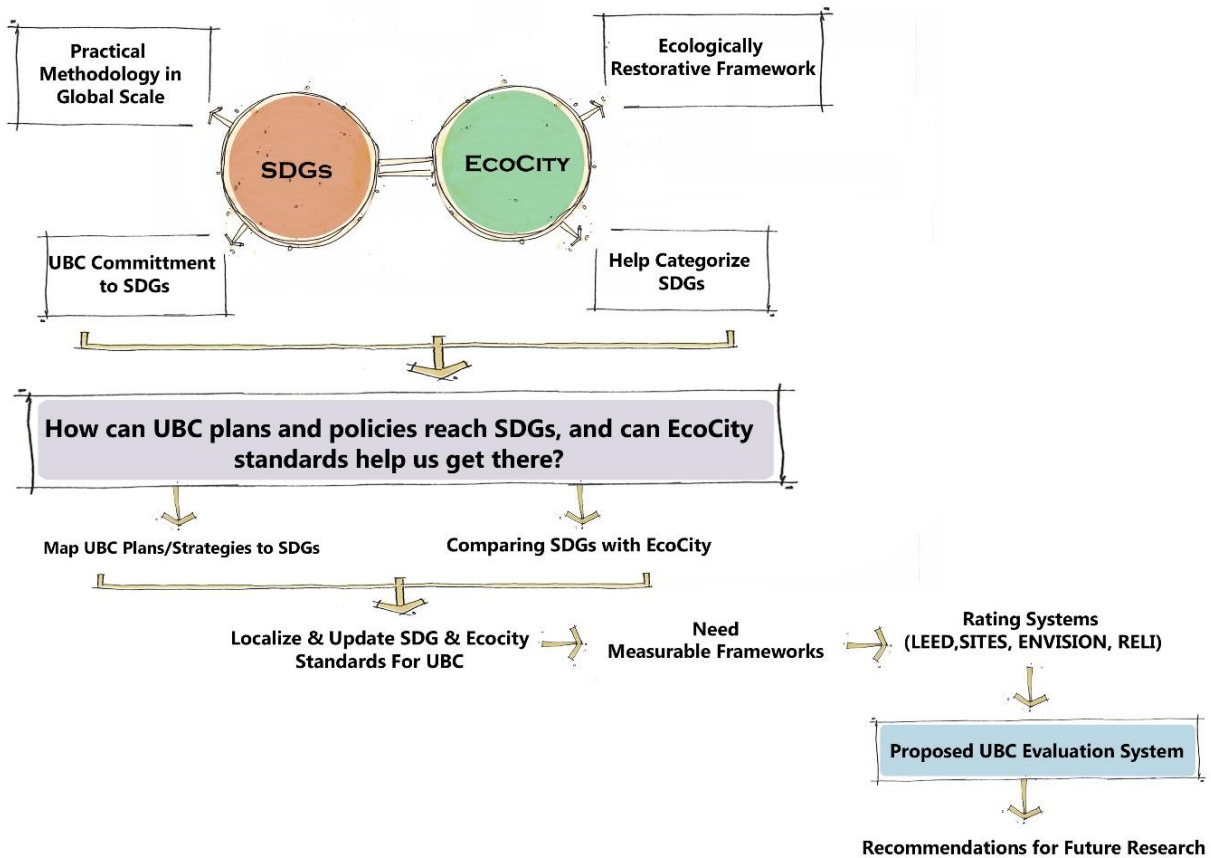


Figure 1: Research Methodology to assess SDGs and EcoCity

### 3- SDGS AND ITS APPLICATION

In 2018, The World Bank has created an Atlas of Sustainable Development Goals that tracks global and individual country progress towards achieving the United Nations (UN) Sustainable Development Goals (SDGs). There are 17 goals that were first articulated in 2009 and cover a wide range of topics including reducing poverty, sustainable cities and communities, sustainable consumption, climate action, and more [6].

The first phase of this research involved browsing through, 29 UBC plans and mapping them against SDGs. The goal of this exercise was to learn about the strengths and weaknesses of these plans with respect to addressing the SDGs. Table 1 describes the outcomes of this quick scan. We learn that certain reports and policies are very much in line with many elements of the SDG framework (i.e. Green Building Action Plan and Land Use Plan), whereas others only address a few components



(Public Art Strategy). This research also identifies significant gaps with respect to plans and policies developed by UBC to address SDGs related to 1-No Poverty, 2-Zero Hunger, 5-Gender Equalities, 8-Decent Work and Economic Growth, 10-Reduced Inequalities and 14-Life Below Water.

A major limitation of the SDG framework, however, is that it defines very broad and shallow goals, which is practical for developing/evaluating long-term plans such as the 20-year Sustainability Plan or Okanagan charter. For short-term plans and policies however, especially those that are spatial in nature, SDGs are perhaps not the best framework. Moreover, there were some aspects in UBC plans such as innovation, resilience, and management that were not addressed by SDGs. As a result, there is a need to refine, amend and update the SDG framework to address the spatial and temporal scales reflected in UBC's plans. As such, the following section describes an analysis of several other relevant standards and rating systems. Outcomes of this analysis are incorporated in an expanded evaluation system for UBC with respect to tracking its progress towards a sustainable and resilient campus.

	UBC Strategic Plan	20-Year Sustainability Strategy	Okanagan Charter	Vancouver Campus Plan	Okanagan Campus Plan	Climate Action Plan (CAP)	Green Building Action Plan	Land Use Plan	Neighbourhood Plans	Transportation Plan	Zero Waste Action Plan	Public Realm Plan	Emergency Response Plan (ERP)	Community Energy and Emissions Plan (CEEP)	Residential Environmental Assessment Plan	Housing Action Plan	Water Action Plan (*)	Stormwater Mgt Plan	Wellbeing Strategic Framework	Inclusion Action Plan	UBC Technical Guidelines	UBC Vancouver Design Guidelines	UBC Okanagan Design Guidelines	Public Art Strategy	Urban Forest Management Plan (*)	Biodiversity Strategic Framework	Framework for Food Action	Bird Friendly Guidelines	LEED Implementation Guide	SUM	
1. No Poverty																														4	
2. Zero Hunger																														8	
3. Good Health & Well-being																														21	
4. Quality Education																														22	
5. Gender Equality																														4	
6. Clean Water & Sanitation																														16	
7. Affordable & Clean Energy																														16	
8. Decent Work & Economic Growth																														4	
9. Industry, Innovation & Infrastructure																														21	
10. Reduced Inequalities																														7	
11. Sustainable Cities & Communities																														22	
12. Responsible Consumption & Production																														17	
13. Climate Action																														15	
14. Life Below Water																														5	
15. Life On Land																														17	
16. Peace, Justice & strong Institutions																														20	
17. Global Partnership for Sustainable Developments																														11	
SUM	10	12	7	10	10	8	12	12	7	5	8	6	6	9	10	6	7	7	7	5	7	11	8	4	8	6	10	4	8		
(*) Not Official Plan																															

Table 1: Mapping UBC plans against SDG

## 4- THE ECOCITY FRAMEWORK AND ITS APPLICATION

The Ecocity Framework comprises 18 standards in four categories – urban design, bio-geophysical conditions, socio-cultural features and ecological imperatives. It is a diagnostic tool for cities and citizens to measure progress towards ecocity conditions. Designed for a wide range of users, including both novices and experts, the Framework charts a city's steps forward - from existing conditions to “threshold” Ecocity standards and beyond [7].

### 4-1- SDGS IN RELATION TO ECOCITY FRAMEWORK

Table 2 presents a preliminary map of connections between the Ecocity Standards and the SDGs. The SDGs address sustainability generally whereas the focus of the Ecocity Standards is on cities and their urban ecosystems [6]. The most obvious connection between the Ecocity Standards and the SDGs is through goal 11 that addresses sustainable cities and communities. However, there are other connections as well. Where the SDGs are stronger on social equity the Ecocity Standards are stronger on ecological integrity [6]. As such, it makes sense to combine the two frameworks for the purposes of this study.

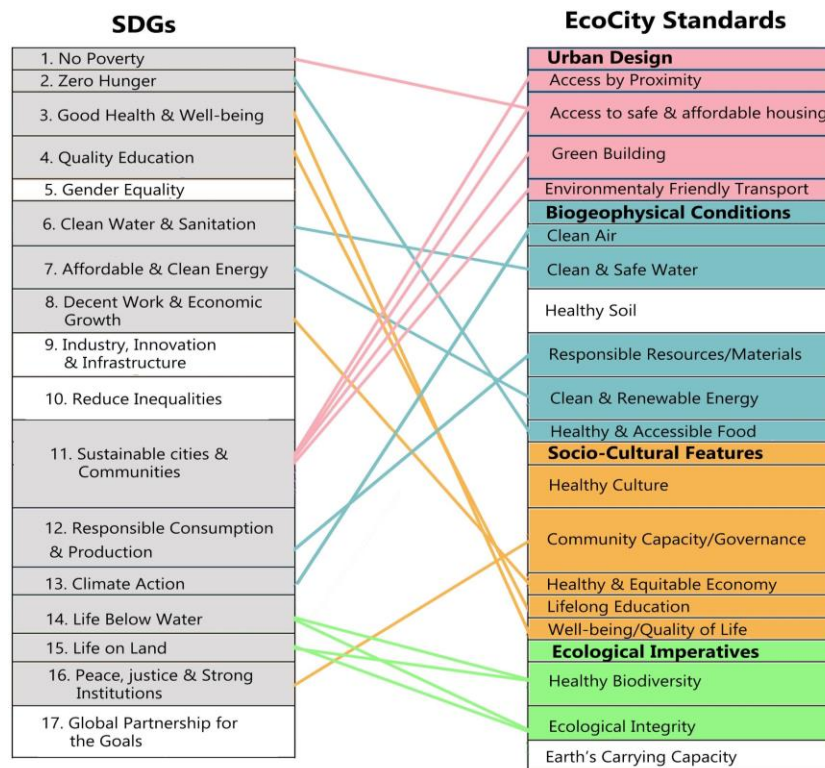


Table 2: SDG and Ecocity comparison, emerged from ecocitybuilders.org

Table 3 shows the SDG's rearranged in the four pillars of the EcoCity Standards (Urban Design, Bio-Geo-Physical, Socio-Cultural Features and Ecological Imperatives) There are two SDGs (Industry, Innovation and Resilient Infrastructure, and Global Partnerships) that currently don't fit within the established EcoCity Standards pillars. This will be addressed in the following section.

At the same time, similar to the SDGs, the EcoCity Standards do not have measurable indicators that allow users to track how well they are doing. To address this, we reviewed other certified rating systems currently used in the fields of architecture, urban design, landscape architecture and engineering.

EcoCity Pillars	SDGs	Ecocity Standards
Urban Design	Sustainable Cities & Communities	Access by Proximity
		Access to safe & affordable housing
		Green Building
		Environmentally Friendly Transport
Bio-Geo-Physical Condition	climate action	Clean Air
	Affordable and clean energy	Clean & Renewable Energy
	Clean water and sanitation	Clean & Safe Water
		Healthy Soil
	Zero hunger	Healthy & Accessible Food
	Responsible consumption and production	Responsible Resources/Materials
Socio-Cultural Features		Healthy Culture
	Peace, justice and strong institutions	Community Capacity/Governance
	No poverty	Healthy & Equitable Economy
	Decent work and economic growth	Lifelong Education
	Quality education	Well-being/Quality of Life
	Good health and well being	
	Gender equality	
Reduced inequalities		
Ecological Imperatives	Life on land	Healthy Biodiversity
	Life below water	
		Ecological Integrity
		Earth's Carrying Capacity
	Industry, innovation and resilient infrastructure	
	Global Partnership for The Goals	

Table 3: Recategorizing SDGs based on Ecocity's 4 pillars

## 5- OTHER RATING SYSTEMS (LEED, SITES, ENVISION, RELI)

As mentioned in previous chapters, Both Ecocity and SDGs have gaps and are not practical for the purpose of this research, which is forming a comprehensive evaluation system to evaluate and amend all UBC plans and policies in every level of detail. In order for the framework to be effective, it should provide measurable indicators and design criteria. To obtain these indicators, four rating systems were collected and analyzed, including LEED, SITES, ENVISION and RELI. Below is a summary of each rating system:

### 5-1- LEED FOR NEIGHBORHOOD DEVELOPMENT

The LEED (Leadership in Energy and Environmental Design) for Neighborhood Development was engineered to inspire and help create a better, more sustainable, well-connected neighborhoods. It looks beyond the scale of buildings to consider entire communities [8]. His rating system combines the principles of smart growth, New Urbanism, and green building into a set of national standards for green planning and design at the neighborhood scale. Sustainable neighborhood development, as defined by the LEED-ND rating system, was prepared by the Land Use Law Center at Pace Law School in conjunction with the U.S. Green Building Council (USGBC) in 2013 and aims to push both the public and private sectors to look beyond the individual building to the larger community, recognizing that a building is only as green as its surroundings [9].

The LEED rating systems focus on shaping land and development to have a lighter impact on the environment. They have the most detailed criteria in Urban Design category and some criteria related to energy efficiency, infrastructure and material. But these rating systems do not consider any criteria in social or economic aspect of community, pre-design process, biodiversity, soil, water, quality of life or resiliency [10]. The LEED-ND rating system consists of prerequisites that all projects must meet and a set of credits, from which each project can choose to earn enough points for certification. Each prerequisite and credit have a general statement of intent followed by specific performance thresholds or prescriptive measures. To earn LEED-ND certification, an applicant project must satisfy all of the prerequisites and qualify for a minimum number of points to attain the project ratings [9]. The image of this rating system and the evaluation criteria are provided in the appendix.

## 5-2- SITES

SITES V2 rating system for Sustainable Land Design and Development is owned by Green Business Certification Inc. The Sustainable Sites Initiative™ (SITES™) is a program based on the understanding that land is a crucial component of the built environment and can be planned, designed, developed, and maintained to avoid, mitigate, and even reverse these detrimental impacts [10]. This rating system -prepared in 2014- provides guidance and incentives that can transform land development and management practices towards regenerative design. The central message of the SITES program is that any project—whether the site of a university campus, large subdivision, shopping mall, park, commercial center, or even a home—holds the potential to protect, improve, and regenerate the benefits and services provided by healthy ecosystems [10].

SITES has 65 sustainability criteria organized into ten categories include: Site Context, Pre-design Assessment & Planning, Innovation or Exemplary performance, Performance & Monitoring, Operation & Maintenance, Water, Materials Selection, Soil & Vegetation, Human Health & Well Being and Education. An advantage of this rating system is its criteria related to pre-design assessment as well as emphasizing on monitoring and maintenance. The image of this rating system and the evaluation criteria are provided in the appendix.

## 5-3- ENVISION

As a planning and design guidance tool, Envision is about supporting more sustainable choices in infrastructure development. The system provides a flexible framework of criteria and performance objectives to aid local decision makers and help project teams identify sustainable approaches during planning, design, construction, and operation. It then further guides owners, communities, and designers in collaborating to make more informed decisions about the sustainability of infrastructure [11].

Envision takes a holistic view of infrastructure development and evaluating projects in terms of their value to communities, effective use of funds, and contributions to conditions of sustainability. Envision has 60 sustainability criteria (called 'credits') organized into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk [11]. Beside urban design aspect, social wellbeing is comprehensively addressed in this rating system as well as, restoration of natural resources and ecosystems. Envision was developed in collaboration between the

Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure (ISI) in 2015.

ISI is a not-for-profit education and research organization founded by the American Public Works Association, the American Council of Engineering Companies, and the American Society of Civil Engineers [11]. The image of this rating system and the evaluation criteria are provided in the appendix.

#### 5-4- RELI

The RELi™ 2.0 Rating System 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 [12]. RELi includes multiple pioneering requisites + credits focused specifically on Resilience. It also aggregates key indicators from other existing guides creating opportunities for highly advanced levels of resilience and living design [12]. The RELi has the breadth, depth and fundamental requirements needed to launch almost any project forward in pursuit of resilience or even regeneration, sustainability and wellness [12]. This rating system has 62 criteria organized in 4 high level categories include: panoramic approach, risk adaptation and mitigation for acute events, applied creativity and comprehensive adaptation and mitigation for resilient present. RELi 2.0 is the most comprehensive certification rating system currently available for socially and environmentally resilient design and construction [12]. 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 in 2014 [12]. The image of this rating system and the evaluation criteria are provided in the appendix.

## 6- COMPARISON OF SDG'S, ECOCITY AND 4 OTHER RATING SYSTEMS

In this chapter, the high-level categories identified in the four rating systems explained in the previous chapter, are compared to, and integrated into the combined EcoCity/SDG framework discussed in Section 4.

Table 4 shows how the categories from the rating systems map onto the SDGs and Ecocity standards. Criteria from LEED and SITES primarily fit into the Urban Design and Bio-Geo-Physical pillars while ENVISION and RELI have more criteria that match with the pillars of Bio-Geo-Physical, Socio-Cultural and Ecological Imperatives. Moreover, there are several criteria that emerged from the four rating systems that do not fit into any of the EcoCity Standards. These include criteria related to resilient infrastructure, monitoring and maintenance, risk preparedness, adaptation and mitigation, and innovation. The next section will discuss how these “left-over” criteria can be integrated into the overall framework by adding two more pillars to the framework.



EcoCity Pillars	SDGs	Ecocity Standards	Rating Systems					
			LEED	SITES	ENVISION	RELI		
Urban Design	Sustainable Cities & Communities	Access by Proximity	Smart Location & Linkage	Site Context				
		Access to safe & affordable housing	Neighborhood Pattern & Design					
		Green Building	Indoor Environmental Quality	Pre-design Assessment + Planning				
		Environmentally Friendly Transport	Green Buildings					
Bio-Geo-Physical Condition	climate action	Clean Air	Energy and Atmosphere	Resource Allocation	Energy, Water + On-site Food Production			
	Affordable and clean energy	Clean & Renewable Energy						
	Clean water and sanitation	Clean & Safe Water	Water Efficiency			Water		
		Healthy Soil				Soil + Vegetation		
	Zero hunger	Healthy & Accessible Food						
	Responsible consumption and production	Responsible Resources/Materials	Materials and Resources			Materials Selection	Material + Artifacts	
Socio-Cultural Features		Healthy Culture			Leadership (Collaboration, Management, Planning)	Community Cohesion, Social+ Economic Vitality		
	Peace, justice and strong institutions	Community Capacity/Governance						
	No poverty	Healthy & Equitable Economy						
	Decent work and economic growth					Education		
	Quality education	Lifelong Education				Human Health + Well Being	Quality of Life (Purpose, Well Being, Community)	Productivity, Health + Diversity
	Good health and well being	Well-being/Quality of Life						
	Gender equality							
Reduced inequalities								
Ecological Imperatives	Life on land	Healthy Biodiversity			Natural World (Water, Land, Biodiversity)			
	Life below water							
		Ecological Integrity						
		Earth's Carrying Capacity						
...	Industry, innovation and resilient infrastructure		Green Infrastructure Innovation & Design Process	Innovation or Exemplary performance		Applied Creativity		
...	Global Partnership for The Goals							
...				Performance + Monitoring		Panoramic Approach		
				Operation + Maintenance				
...					Risk (Resilience)	Hazard preparedness, Adaptation and Mitigation		

Table 4: Recategorizing rating systems (LEED, SITES, ENVISION, RELI) based on SDGs and Ecocity

## 7- PROPOSED UBC EVALUATION SYSTEM

Based on the primary focus of the “left-over” categories, this study proposes to expand the EcoCity Framework with two more pillars: Panoramic Approach and Applied creativity. By proposing these two pillars, all the indicators emerged from four rating systems could be organized, and the new evaluating framework will be formed to assess and amend UBC plans and policies. Table 5 shows the reorganization of all evaluation and design criteria drawn from the SDGs, EcoCity Standards, LEED, SITES, ENVISION and RELI into an expanded framework for UBC.

Pillars	Standards					
<b>Urban Design</b> (Sustainable cities and communities)	Access by Proximity	Green Building	Environmentally Friendly Transportation	Resilient Infrastructure	Safe & Affordable Housing	
<b>Bio-Geo-Physical</b> (Resource Allocation)	Clean Air	Clean and Safe Water	Clean and Renewable Energy	Responsible Material/Resources	Healthy and Accessible Food	Healthy Soil
<b>Socio-Cultural</b>	Good Health and well-being	Quality Education	Healthy & Equitable Economy	Community Capacity/Governance	Reduced Inequalities	
<b>Ecological Imperatives</b>	Healthy Biodiversity	Ecological Integrity	Earth's Carrying Capacity			
<b>Panoramic Approach</b>	Sustainable & Resilient Management	Monitoring & Maintenance	Hazard Preparedness, Adaptation & Mitigation			
<b>Applied Creativity</b>	Innovation or Exemplary Performance					

Table 5: Pillars and high-level categories of UBC evaluation framework

### 7-1- DEFINING MEASURABLE CRITERIA FOR THE PROPOSED UBC EVALUATION SYSTEM

Now that the pillars and high categories are defined and well-organized, the final step is to develop potential indicators that can be used to evaluate existing policies and plans, as well as to guide future plans and policies. These indicators are comparable with or derived from indicators already used in LEED, SITES, ENVISION and RELI. Table 6 to 11 indicate each of the six pillars along with their high-level categories (Standards). A maximum of five indicators has been proposed for each standard. Bear in mind that these indicators are potential indicators (placeholders) and future research should be defined to find the best indicators for addressing these standards. These

are the best indicators found in the four rating systems, by adding more rating systems or other sources in future research, it is likely to find more effective indicators.

1. Urban Design (Sustainable Cities & communities)	Standards	Indicators				
	Access by proximity	Housing and Jobs Proximity	Access to daily needs	Access to Civic & Public Space		
	Green Building	Certified Green Building	Optimize Building Energy Performance	Safer Design for Extreme Weather, Wildfire + Seismic Events	Plan the Site and Orientation for Sun + Wind Harvesting, Natural Cooling	Reduced Site Environmental Impacts: Lighting, Heat-Island, Airborne Toxins
	Environmentally friendly transportation	Encourage fuel efficient and multi-modal transportation	Access to Quality Public Transit	Walkable Streets	Bicycle Facilities	Green Vehicles
	Resilient infrastructure	Recycled and Reused Infrastructure	District Heating and Cooling	Safer, Non-Toxic Infrastructure Materials	Improve Infrastructure Integration	Design functional stormwater features as amenities
	Safe & affordable housing	Mixed-Income Diverse Communities	Encourage affordable housing development	Require affordable housing		

Table 6: Standards and indicators for pillar 1 (Urban Design)

2. Bio-Geo-Physical	Standards	Indicators				
	Clean air	Reduce Greenhouse Gas Emissions	Protect air quality during construction	Assess Climate Threat	Reduce urban heat island effects	Avoid Traps and Vulnerabilities
	Clean and safe water	Wastewater Management	Reduce Potable Water Consumption	Prevent Surface and Groundwater Contamination	Monitor Water Systems	
	Clean and renewable energy	Reduce Net Embodied Energy	Use Renewable Energy	Use vegetation to minimize building energy use	Reduce outdoor energy consumption	Commission and Monitor Energy Systems
	Responsible material/resource	Use recycled content materials	Support responsible extraction of raw materials	Minimum Material Effectiveness + Life Cycle Planning	Use Local Materials	Reduce Excavated Materials Taken Off Site
	Healthy & Accessible Food	Limit development on farmland	Local Food Production	Resilient Food Production		
Healthy soil	Restore soils disturbed during construction	Control and retain construction pollutants	Minimize pesticide and fertilizer use	Designate and communicate Vegetation and Soil Protection Zones		

Table 7: Standards and indicators for pillar 2 (Bio-Geo-Physical)

3. Socio-Cultural	standards	indicators				
	Good Health & Well-being	Enhance Public Health and Safety	Minimize Noise and Vibration	Support mental restoration	Support physical activity	Universal Design
	Quality Education	Promote sustainability awareness and education	Community Education on ever-increasing Weather, Safety + Resiliency Risks	Communicate and verify sustainable construction practices		
	Healthy and equitable economy	Develop or expand Local Skills and Capabilities				
	Community capacity & governance	Engage users and stakeholders	Support social connections	Enhance Resilient Organizations & Nonprofits	Enhance Public Spaces	
	Reduced Inequalities	Provide for Social Equity Opportunities				
	Healthy culture	Preserve Historic and Cultural Resources	Provide for Interdisciplinary/ Intercultural Opportunities			

Table 8: Standards and indicators for pillar 3 (Socio-Cultural)

4. Ecological imperatives	Standards	Indicators				
	Healthy biodiversity	Conserve and use native plants	Control and manage invasive plants	Conserve habitats for threatened and endangered species	Conserve aquatic ecosystems	
	Ecological integrity	Preserve Prime Habitat	Protect Wetlands and Surface Water	Site Design for Habitat or Wetland and Water Body Conservation	Avoid Unsuitable Development On Steep Slopes	Tree-Lined and Shaded Streetscapes
	Earth's Carrying capacity	avoid consuming Greenfields, wetlands and water bodies	Brownfield Remediation	Locate projects within existing developed areas	Redevelop degraded sites	

Table 9: Standards and indicators for pillar 4 (Ecological imperatives)

5. Panoramic Approach	Standards	Indicators			
	Sustainability & Resiliency Management	Use an integrative design process	Conduct a pre-design site assessment	Post-Development Evaluation	Study + Design for Long-Term Adaptability, Diversity + Redundancy
	Monitoring & Maintenance	Plan to monitor and report site performance	Plan for sustainable site maintenance	Address Conflicting Regulations + Policies	
	Preparedness, Mitigation, Adaptation	Fundamental Emergency Planning for Common Hazardous Events	Adaptive Design for Extreme Rain, Sea Rise, Storm Surge + Extreme Weather, Events	Prepare for Short-Term Hazards	Prepare for Long-Term Adaptability

Table 10: Standards and indicators for pillar 5 (Panoramic Approach)

6. Applied Creativity	Standards	Indicators		
	Innovation or Exemplary performance	Applied Creativity in Resiliency & Integrative Design	Applied Creativity in Resilient Economics, Equity, Education	Leadership Metrics and Measures from sources beyond UBC criteria

Table 11: Standards and indicators for pillar 6 (Applied Creativity)

## 8- RECOMMENDATIONS FOR FUTURE RESEARCH

Because of limitations in this research project, there are still a number of gaps in the proposed UBC evaluating system that needs to be addressed in future research properly. The 17th goal of UN Sustainable development goals (Global Partnership for Sustainable Developments) was addressed neither by Ecocity nor by rating systems, so it is necessary to find a series of indicators for this particular goal and add this category to the framework in the future. In addition, the framework needs to be refined by studying more rating systems, especially those that UBC is already participating in (e.g. STARS), to make sure all-important aspects of sustainability and possible problems during planning, design, construction, and operation have been addressed thoroughly. Moreover, new source of standards and indicators related to teaching, research and learning are needed to address UBC's goal to be a global leader in applied research on sustainability. Furthermore, the same as Ecocity framework, a spectrum from unhealthy to Gaia level could be defined for UBC framework to picture how would be the effect of applying different UBC guidelines and policies on the community and the natural environment.

After refining the framework, examination is another important step, all the UBC plans and policies should be read and evaluated carefully to find the gaps and synergies toward this framework and provide recommendations (including goals, targets, strategies) for their future amendment.

## 9- CONCLUSION

This study shows that SDGs are broad but relatively shallow goals, however, they can be made more applicable to cities by merging them with the EcoCity Standards and organizing them in Ecocity pillars. On the other hand, Ecocity standards, the same as SDGs, do not have measurable indicators to allow users to track how well they are doing. This study also shows that sustainable rating systems are one of the sources for defining potential indicators to make SDGs and Ecocity framework more effective. The main goal of proposing UBC Evaluation System is to establish a flexible framework of criteria and performance objectives to aid local decision makers and help project teams identify sustainable approaches during planning, design, construction, and operation. The proposed framework provides three levels of details include pillars, standards and indicators, suitable for evaluating a range of long-term and short-term UBC plans and policies with different levels of details. Furthermore, this framework includes some new aspects and categories that have been overlooked in the UN Sustainable Development Goals such as: restoration of natural resources and ecosystems (emerged from Ecocity Framework), innovation (emerged from all Rating Systems), resiliency and having holistic approach in planning and design process (emerged from RELI Rating System). UBC framework can be used as a diagnostic tool that helps UBC to find gaps among its plans and policies toward UN Sustainable Development Goals (SDGs). Moreover, UBC can use this framework to prepare new guidelines and plans or amend the existing ones to address the potential gaps diagnosed during evaluation.

## 10- REFERENCES

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LEED® FOR NEIGHBORHOOD DEVELOPMENT		110 TOTAL POINTS POSSIBLE
	<b>SMART LOCATION &amp; LINKAGE</b> 27 POSSIBLE POINTS	
PREREQ 1	Smart Location	REQ
PREREQ 2	Imperiled Species and Ecological Communities	REQ
PREREQ 3	Wetland and Water Body Conservation	REQ
PREREQ 4	Agricultural Land Conservation	REQ
PREREQ 5	Floodplain Avoidance	REQ
CREDIT 1	Preferred Locations	●●●●●●●●●●
CREDIT 2	Brownfield Redevelopment	●●
CREDIT 3	Locations w/ Reduced Automobile Dependence	●●●●●●●●
CREDIT 4	Bicycle Network and Storage	●
CREDIT 5	Housing and Jobs Proximity	●●●
CREDIT 6	Steep Slope Protection	●
CREDIT 7	Site Design for Habitat/ Wetland & Water Body Conservation	●
CREDIT 8	Restoration of Habitat/Wetlands and Water Bodies	●
CREDIT 9	Long-Term Cnsvrtn. Mgmt. of Habitat/Wetlands & Water Bodies	●
	<b>NEIGHBORHOOD PATTERN &amp; DESIGN</b> 44 POSSIBLE POINTS	
PREREQ 1	Walkable Streets	REQ
PREREQ 2	Compact Development	REQ
PREREQ 3	Connected and Open Community	REQ
CREDIT 1	Walkable Streets	●●●●●●●●●●
CREDIT 2	Compact Development	●●●●●●●●
CREDIT 3	Mixed-Use Neighborhood Centers	●●●●
CREDIT 4	Mixed-Income Diverse Communities	●●●●●●●●
CREDIT 5	Reduced Parking Footprint	●
CREDIT 6	Street Network	●●
CREDIT 7	Transit Facilities	●
CREDIT 8	Transportation Demand Management	●●
CREDIT 9	Access to Civic and Public Spaces	●
CREDIT 10	Access to Recreation Facilities	●
CREDIT 11	Visitability and Universal Design	●
CREDIT 12	Community Outreach and Involvement	●●
CREDIT 13	Local Food Production	●
CREDIT 14	Tree-Lined and Shaded Streets	●●
CREDIT 15	Neighborhood Schools	●
	<b>GREEN INFRASTRUCTURE &amp; BUILDINGS</b> 29 POSSIBLE POINTS	
PREREQ 1	Certified Green Building	REQ
PREREQ 2	Minimum Building Energy Efficiency	REQ
PREREQ 3	Minimum Building Water Efficiency	REQ
PREREQ 4	Construction Activity Pollution Prevention	REQ
CREDIT 1	Certified Green Buildings	●●●●●●●●
CREDIT 2	Building Energy Efficiency	●●
CREDIT 3	Building Water Efficiency	●
CREDIT 4	Water-Efficient Landscaping	●
CREDIT 5	Existing Building Use	●
CREDIT 6	Historic Resource Preservation and Adaptive Reuse	●
CREDIT 7	Minimized Site Disturbance in Design and Construction	●
CREDIT 8	Stormwater Management	●●●●●
CREDIT 9	Heat Island Reduction	●
CREDIT 10	Solar Orientation	●
CREDIT 11	On-Site Renewable Energy Sources	●●●●
CREDIT 12	District Heating and Cooling	●●
CREDIT 13	Infrastructure Energy Efficiency	●
CREDIT 14	Wastewater Management	●●
CREDIT 15	Recycled Content in Infrastructure	●
CREDIT 16	Solid Waste Management Infrastructure	●
CREDIT 17	Light Pollution Reduction	●
	<b>INNOVATION &amp; DESIGN PROCESS</b> 6 POSSIBLE POINTS	
CREDIT 1	Innovation and Exemplary Performance	●●●●●●
CREDIT 2	LEED Accredited Professional	●
	<b>REGIONAL PRIORITY CREDIT</b> 4 POSSIBLE POINTS	
CREDIT 1	Regional Priority	●●●●
<p>40-49 POINTS: CERTIFIED 50-59 POINTS: SILVER 60-79 POINTS: GOLD 80+ POINTS: PLATINUM                      FOR MORE INFORMATION SEE THE LEED REFERENCE GUIDE FOR GREEN NEIGHBORHOOD DEVELOPMENT</p>		

Table 12: LEED Rating System







**QUALITY OF LIFE**  
13 Credits

**1 PURPOSE**

- QL1.1 Improve Community Quality of Life
- QL1.2 Stimulate Sustainable Growth & Development
- QL1.3 Develop Local Skills and Capabilities

**2 WELLBEING**

- QL2.1 Enhance Public Health and Safety
- QL2.2 Minimize Noise and Vibration
- QL2.3 Minimize Light Pollution
- QL2.4 Improve Community Mobility and Access
- QL2.5 Encourage Alternative Modes of Transportation
- QL2.6 Improve Site Accessibility, Safety & Wayfinding

**3 COMMUNITY**

- QL3.1 Preserve Historic and Cultural Resources
- QL3.2 Preserve Views and Local Character
- QL3.3 Enhance Public Space
- QL0.0 Innovate or Exceed Credit Requirements

**NATURAL WORLD**  
15 Credits

**1 SITING**

- NW1.1 Preserve Prime Habitat
- NW1.2 Protect Wetlands and Surface Water
- NW1.3 Preserve Prime Farmland
- NW1.4 Avoid Adverse Geology
- NW1.5 Preserve Floodplain Functions
- NW1.6 Avoid Unsuitable Development on Steep Slopes
- NW1.7 Preserve Greenfields

**2 LAND+WATER**

- NW2.1 Manage Stormwater
- NW2.2 Reduce Pesticides and Fertilizer Impacts
- NW2.3 Prevent Surface and Groundwater Contamination

**3 BIODIVERSITY**

- NW3.1 Preserve Species Biodiversity
- NW3.2 Control Invasive Species
- NW3.3 Restore Disturbed Soils
- NW3.4 Maintain Wetland and Surface Water Functions
- NW0.0 Innovate or Exceed Credit Requirements

**LEADERSHIP**  
10 Credits

**1 COLLABORATION**

- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Establish a Sustainability Management System
- LD1.3 Foster Collaboration and Teamwork
- LD1.4 Provide for Stakeholder Involvement

**2 MANAGEMENT**

- LD2.1 Pursue By-Product Synergy Opportunities
- LD2.2 Improve Infrastructure Integration

**3 PLANNING**

- LD3.1 Plan for Long-Term Monitoring & Maintenance
- LD3.2 Address Conflicting Regulations and Policies
- LD3.3 Extend Useful Life
- LD0.0 Innovate or Exceed Credit Requirements

**RESOURCE ALLOCATION**  
14 Credits

**1 MATERIALS**

- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA1.5 Divert Waste from Landfills
- RA1.6 Reduce Excavated Materials Taken Off Site
- RA1.7 Provide for Deconstruction and Recycling

**2 ENERGY**

- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA2.3 Commission and Monitor Energy Systems

**3 WATER**

- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems
- RA0.0 Innovate or Exceed Credit Requirements

**CLIMATE AND RISK**  
8 Credits

**1 EMISSIONS**

- CR1.1 Reduce Greenhouse Gas Emissions
- CR1.2 Reduce Air Pollutant Emissions

**2 RESILIENCE**

- CR2.1 Assess Climate Threat
- CR2.2 Avoid Traps and Vulnerabilities
- CR2.3 Prepare for Long-Term Adaptability
- CR2.4 Prepare for Short-Term Hazards
- CR2.5 Manage Heat Island Effects
- CR0.0 Innovate or Exceed Credit Requirements

Table 14: ENVISION credit list

PANORAMIC APPROACH			COMPREHENSIVE ADAPTATION + MITIGATION FOR A RESILIENT PRESENT + F		
<b>PA PANORAMIC APPROACH TO PLANNING, DESIGN, MAINTENANCE, &amp; OPERATIONS</b>			<b>CV COMMUNITY COHESION, SOCIAL &amp; ECONOMIC VITALITY</b>		
S	C	Req 1 Study: Project Short-Term Hazard Mitigation and Adaptation Needs Including Climate	S	C	Poly-Req 1 Improve Community Quality of Life
S	C	Req 2 Integrative Process, Development & Community Stakeholder Involvement	S	C	Poly-Credit 1 Incorporate Important Community Views and Aspects of Local Landscape
S	C	Poly-Req 3 Commissioning & Long-Term Monitoring / Maintenance	S	C	Poly-Credit 2 Community Connectivity: Walkability, Public Transit, Non-Motorized Transit
S	C	Poly-Credit 1 Business & Community Case Analysis, Post-Development Evaluation and Reporting	S	C	Poly-Credit 3 Community Connectivity: Mixed-Use Commercial, Housing & Public / Community Space
S	C	Credit 2 Establish a Sustainability & Resiliency Management System	S	C	Poly-Credit 4 Expand Citizen Participation: Public Amenities, Councils, Organizations, Communication
S	C	Credit 3 Address Conflicting Regulations & Policies	S	C	Poly-Credit 5 Resilient Organizations: Cooperative & B-Corporation(s), Non-Profits & Social Equity Measures
S	C	Credit 4 Third Party Leadership & Next Generation Certifications and Programs	S	C	Poly-Credit 6 Develop or Expand Local Skills, Capabilities & Long-Term Employment & Mix
Credits 5-8 Below Expand the Integrative Process Required by Requisite 2 Above			S	C	Poly-Credit 7 Use Regionally Sourced & Manufactured Materials and Products
S	C	Poly-Credit 5 Study & Design for By-Product & Underutilization Synergies	S	C	Poly-Credit 8 Stimulate Sustainable Growth and Development
S	C	Poly-Credit 6 Study & Design for Improved Project Element & Infrastructure Integration	<b>PH PRODUCTIVITY, HEALTH &amp; DIVERSITY</b>		
S	C	Poly-Credit 7 Study & Design for Long-Term Adaptability, Diversity & Redundancy	S	C	Poly-Req 1 Minimum IAQ & Views to the Exterior
S	C	Poly-Credit 8 Study & Living Design for Advanced Resiliency Using a Diversity of Ecology-Based Perspectives	S	C	Poly-Req 2 Minimum Protection for Prime Habitat & Floodplain Functions
<b>RISK ADAPTATION &amp; MITIGATION FOR ACUTE EVENTS</b>			S	C	Poly-Credit 1 Human PHD: Expanded IAQ, Daylight & Views, Fresh Air
<b>HP HAZARD PREPAREDNESS</b>			S	C	Poly-Credit 2 Human PHD: Active Design for Buildings, Communities and Urban Environments
S	C	Req 1 Fundamental Emergency Planning & Preparedness for Common Hazardous Events	S	C	Credit 3 Human PHD: Provide for Social Equity, Interdisciplinary / Intercultural Opportunities
S	C	Req 2 Fundamental Access To: First Aid, Emergency Supplies, Water, Food, Communications	S	C	Poly-Credit 4 Human & Eco PHD: Reduce Pesticides, Prevent Surface & Groundwater Contamination
S	C	Poly-Credit 1 Enhanced Emergency Planning for Common Hazards & Extreme Events	S	C	Poly-Credit 5 Ecological PHD: Protect Wetlands & Avoid Slopes and Adverse Geology
S	C	Credit 2 Enhanced Access: Emergency Care & Supplies, Water, Food, Communications	S	C	Poly-Credit 6 Ecological PHD: Biodiversity, Habitat & Soil
S	C	Poly-Credit 3 Additional Emergency Provisions For the Community & for Longer Timeframes	<b>EW ENERGY, WATER &amp; FOOD</b>		
S	C	Credit 4 Community Education: Authentic Dialogue on Ever-Increasing Weather, Safety & Resiliency Risks	S	C	Poly-Req 1 Minimum Water Efficiency & Resilient Water and Landscapes
<b>HA HAZARD ADAPTATION &amp; MITIGATION</b>			S	C	Poly-Req 2 Minimum Energy Efficiency & Atmospheric Impacts
S	C	Req 1 Sites of Avoidance & Repair: 500-Year Flood Plain, Storm Surge & Sea Rise	S	C	Poly-Credit 1 Plan For Rainwater Harvesting, Resilient Landscapes & Food Production
S	C	Req 2 Fundamental Emergency Operations: Back-Up Power & Operations	S	C	Poly-Credit 2 Plan the Site and Orientation For Sun & Wind Harvesting, Natural Cooling
S	C	Req 3 Fundamental Emergency Operations: Thermal Safety During Emergencies	S	C	Poly-Credit 3 Water-Use Reduction, Near Zero / High-Efficiency Water Flows and Resilient Landscapes
S	C	Req 4 Safer Design for Extreme Weather, Wildfire & Seismic Events	S	C	Poly-Credit 4 Energy Optimization, Near Zero / Carbon Neutral, Net Zero, Net Positive Energy Flows
S	C	Poly-Credit 2 Adaptive Design for Extreme Rain, Sea Rise, Storm Surge & Extreme Weather, Events & Hazards	S	C	Poly-Credit 5 Edible Landscaping, Urban Agriculture & Resilient Food Production
S	C	Poly-Credit 3 Advanced Emergency Operations: Back-Up Power, Operations, Thermal Safety & Operating Water	S	C	Poly-Credit 6 Reduce Site Environmental Impacts: Lighting, Heat-Island, Airborne Toxins
S	C	Poly-Credit 4 Passive Thermal Safety, Thermal Comfort & Lighting Design Strategies	<b>MA MATERIALS &amp; ARTIFACTS</b>		
S	C	Poly-Credit 5 Transit & Transportation System Protection & Continuous Operations	S	C	Poly-Req 1 Minimum Material Effectiveness & Life Cycle Planning
S	C	Poly-Credit 6 Provide Environmental Protection & Remediation for Parks & Preserves	S	C	Credit 1 Safer, Non-Toxic Materials (SMaRT) or Equivalent Certified
<b>APPLIED CREATIVITY AND CONTEXTUAL FACTORS FOR RESILIENCY</b>			S	C	Credit 2 Material & Artifact Effectiveness: Full Life Cycle Design for Durability, Adaptability, Flexibility
<b>AC APPLIED CREATIVITY, INNOVATION &amp; EXPLORATION</b>			S	C	Credit 3 Material & Artifact Effectiveness: Design for Disassembly, Reuse, Recycling & Composting
S	C	Poly-Credit 1 Applied Creativity in Resiliency & Integrative Design	S	C	Poly-Credit 4 Material Effectiveness: Use Recycled Content Materials, Salvaged Materials & Local Materials
S	C	Poly-Credit 2 Contextual Factors & Project Responsive Topics	S	C	Credit 5 Use Legally Logged Wood from Ecologically Managed Forests (FSC Certified)
S	C	Poly-Credit 3 Exemplary Performance	S	C	Credit 6 Reduce Net Embodied Energy & Carbon, Water and Toxins
			S	C	Poly-Credit 7 Divert Waste from Landfills, Reduce Excavated Soils Taken from Site

Table 15: RELI scorecard