The Living Community Challenge at CSUMB:

Report of findings to support development of the Materials Petal

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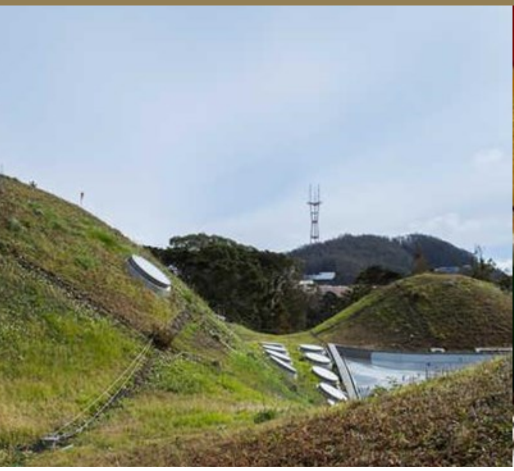

ENVIRONMENTAL STUDIES WORKING PAPER #7

The mission of the Environmental Studies Program at California State University Monterey Bay is to develop students and communities with the knowledge, skills, and compassion to promote social and environmental justice and sustainable communities.

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Executive Summary

The Living Community Challenge (LCC) is a framework for master planning, design and construction used to create a synergetic relationship between people and the built environment. California State University Monterey Bay (CSUMB) is the first university campus to undertake this challenge for its campus planning. Through an environmental studies research methods course (ENSTU 350) at CSUMB, students have assisted with research to support meeting this challenge. In 2017, students conducted a campus photovoice assessment and biophilic design interviews with campus stakeholders. Building on this research in 2018, students worked in teams to examine specific "petals" of the Living Community Challenge: the "Beauty and Spirit" petal and the "Materials" Petal.

This report summarizes findings from the Materials group. The intent of the Materials Petal is "to help create a materials economy that is non-toxic, ecologically restorative, transparent, and socially equitable," by sourcing materials that consider environmental impacts, habitat and species loss, pollution, and toxicity (ILFI, 2018). CSUMB has committed to three imperatives of the Materials Petal: i) The Red List Imperative which seeks to avoid toxic materials in buildings; ii) Responsible Industry, which advocates for third-party certifications and sourcing from Declare sources, and iii) Living Economy Sourcing, which seeks to limit the range of sourcing to minimize carbon costs from shipping (ILFI, 2018).

To advance campus understanding about how to meet these imperatives, the Materials research group conducted a photovoice assessment of campus focused on their research petal, conducted precedent research to identify examples of how other institutions integrate aspects of the Materials imperatives into building design, and conducted interviews with industry experts about the challenges and recommendations for meeting these imperatives.

Interviewees identified the importance of identifying and procuring sources in advance, sourcing non-Red List materials prior to construction, and having a contractor who is on-board with the challenge from the beginning. Four of the six experts interviewed recommended asking, and sometimes pressuring, manufacturers into developing new products that align with Red List standards. At least some of those interviewed stated that manufactures had not considered these factors and were willing to do so. One of the key recommendations from this research was the often repeated comment that:

the best way to meet the Materials Petal imperatives is to commit to doing so.

All experts interviewed identified the Materials Petal as a challenge but one that could be met with planning and commitment while working through some materials that still need exemptions. The growing number of buildings that have met the LBC challenge is testimony to the fact that this is indeed possible. We recognize that the research presented in this report only begins to scratch the surface on a complex topic that will require much more research and planning. We hope that these findings will be useful in setting a course toward meeting the Living Community Challenge at CSUMB.

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Report of findings to support development of the **Materials Petal**

Introduction

The Living Community Challenge (LCC) is a certification challenge created by the International Living Future Institute (ILFI) that encourages a transformative approach to community building and urban development (LCC, 2018). An innovative aspect of the LCC is the incorporation of biophilic design into master planning, design, and construction to challenge conventional design, which alienates people from nature. By emphasizing the integration and restoration of the valuable experiences of nature, natural environments, and local materials in an urban environment, biophilic design can help create communities that are beneficial to all who live and work within them (Kellert, 2018).

The LCC was adopted by the California State University, Monterey Bay (CSUMB) campus as a framework for master planning in February 2017 (LCC: CSUMB, n.d.). The Living Building Challenge (LBC) is a certification program under the LCC which provides the world's most rigorous standards for sustainability in building and design (LBC, 2018). This report focuses on the Materials Petal of the LBC with the goal of directing this standard toward future building development at CSUMB.

The intent of Materials Petal research is to identify responsible, sustainable, non-toxic, ecologically restorative, transparent, and alternative materials to avoid the adverse environmental issues that come with irresponsible development (Materials Petal Handbook, 2017). The three Imperatives from the LBC which the CSUMB implementation plan will follow and discuss include the Red List, Responsible Industry, and Living Economy Sourcing (Materials Petal Handbook, 2017).

Collaboratively, community partners, including the CSUMB Campus Planning Department, the CSUMB Sustainability Office, and a group of fourteen students from the Environmental Studies 350: Research Methods class, worked to identify opportunities and challenges CSUMB may encounter with future development. To identify challenges in abiding by the three imperatives under the LBC standards to help campus meet the challenge goals (LCC Vision Plan CSUMB, 2018), students conducted research through photovoice exercises, precedent research, interviews, and analysis of the resulting data.

Methods

Students identified strengths and weaknesses of biophilic features on CSUMB's campus through a technique called photo framing. Using green and red frames, students documented their perceptions of successful and unsuccessful incorporation of biophilic features. Students then researched seven precedent-setting buildings to identify successful implementation of Materials Petal imperatives. The seven precedents were thematically analyzed to identify features to guide future construction and design at CSUMB.

Students also conducted interviews with planners, designers, architects, and contractors affiliated with LBC-certified buildings to identify materials and obstacles to implementing the three imperatives. Interviews were then coded to identify common themes and topics. Results can inform recommendations for future development at CSUMB. Students conducted interviews with industry professionals, including directors of sustainability from Architectural Nexus and Skanska USA, an LBC director from Miller-Hull, an architectural firm, principals from Bruner-Cott Architects, and from Integrated Eco Strategy, and another from Northern California Steinberg Hart.

Assessment of Biophilic Materials on Campus through Photovoice

Photovoice is a method that allows people to record their community's strengths and weaknesses (Derr, Chawla, & Mintzer, 2018). In pairs or small groups, students walked the CSUMB campus taking pictures of areas they believed displayed biophilic features and areas that did not (Figure 1). The photovoice assessment of biophilic design involved students using red or green frames to photograph areas on campus that portrayed an absence or presence of one of the six elements of biophilic design (Table 1), capturing at least four images from each category. Students then uploaded photos to a shared Google Drive folder, annotated, and sorted them into their corresponding folders:

Natural features

Natural shapes and forms

Natural patterns and processes

Light and space

Place-bound relationships

Evolved human-nature relationships

Table 1. Biophilic Design Elements and Attributes (Kellert, 2008)

Environmental Features	**Natural Shapes and Forms**	**Natural Patterns and Processes**
Color Water Air Sunlight Plants Animals Natural materials Views and vistas Façade greening Geology and landscape Habitats and ecosystems Fire	Botanical motifs Tree and columnar supports Animal motifs Shells and spirals Arches, vaults, domes Shapes resisting straight lines and right angles Simulation of natural features Biomorphy Geomorphology Biomimicry	Sensory variability Information richness Age, change, and the patina of time Growth and efflorescence Central focal point Patterned wholes Bounded spaces Transitional spaces Linked series and chains Integration of parts to whole Complementary contrasts Dynamic balance and tension Fractals Hierarchically organized ratios and scales
Light and Space	**Place-based Relationships**	**Evolved Human-Nature Relationships**
Natural light Filtered and diffuse light Light and shadow Reflected light Light pools Warm light Light as shape and form Spaciousness Spatial variability Space as shape and form Spatial harmony Inside-outside spaces	Geographic connection to place Historic connection to place Ecological connection to place Cultural connection to place Indigenous materials Landscape orientation Landscape features that define building form Landscape ecology Integration of culture and ecology Spirit of place Avoiding placelessness	Prospect and refuge Order and complexity Curiosity and enticement Change and metamorphosis Security and protection Mastery and control Affection and attachment Attraction and beauty Exploration and discovery Information and cognition Fear and awe Reverence and spirituality

Figure 1. A green frame indicates the presence of biophilic features on campus. In this case, the use of color and natural materials on Chapman Science as framed through native oak trees.

Precedent Research

A total of seven precedents were selected that in some aspect represented the Materials Petal of the LBC and integrated biophilic design in building construction (Appendix A). Information gathered for precedent research included key highlights, a brief description of the precedent, images, and contact information. A precedent analysis was also conducted for a variety of buildings that have achieved certification of the Leadership in Energy and Environmental Design (LEED) or LBC certification. Precedents were later analyzed to identify common themes and summarized in a table to identify key concepts and designs.

Interviews with Community Stakeholders

Six semi-structured interviews were conducted to gather information about how other campuses, contractors, architects, and institutions accomplished constructing a building that fulfilled the imperatives of the Materials Petal of the Living Building Challenge. Interviewees were chosen based on their identification as a key player in the construction or design of an LBC-certified building (Appendix B). Each interview followed a similar protocol and set of questions with the opportunity to pose questions tailored to the interviewee and the building with which they were involved. Questions pertained to Red List materials, Responsible Industry, and Living Economy imperatives (Table 2).

Table 2. Protocol for Interviews with Six Industry Experts
1. What are the challenges and needs for meeting sustainability goals under the Materials petal? a. Red List b. Responsible Industry c. Living Economy Sourcing (distance of sourcing) 2. What materials that you have been working with in the past trigger restrictions based on the LCC standards? 3. Can you identify which "materials" products are going to be impacted for CSUMB. Make a list of materials we would use that are restricted. 4. Have you found cost-effective alternatives to materials that are restricted under LCC (because of Red List, responsible industry or living economy standards)? 5. Do you know the entire GHG impact of the materials? (if the only alternative is from outside the reasonable sourcing radius, what are the broader environmental impacts…) What products might merit requesting an exemption? Names of products and sources that other projects have employed? How other projects have balanced cost?

Once interviews were conducted, students coded the transcripts into five categories using NVivo: Interviewee Name, Affiliation, Red List, Living Economy, and Responsible Industry. Within the Red List, Living Environment, and Responsible Industry nodes, students created subcategories including Challenges, Recommendations, Cost, Manufactures/Vendors/Sources, and Specific Materials. After each interview was coded and sorted the data was exported to a Word document and further sorted into a Code Summary Data Sheet in Excel. Students sent follow up emails requesting additional information on specific challenges and Red List materials after the initial round of coding (Table 3).

Table 3. Follow Up Questions after Initial Interviews
We are specifically interested in knowing more about the following materials: • PVC • Vinyl flooring • Concrete Do you have good alternative sources to these to meet the LBC standards? If so, could you share what they are? Have you experienced delays in construction due to LBC materials sourcing (delays in finding appropriate alternatives or delays as a new material is developed)? If so, how have you address this in subsequent projects?

Results

Biophilic Design on CSUMB's Campus

Photovoice analysis revealed a strong presence of biophilic features in the categories of natural patterns and processes and environmental features for both green and red frames (Figure 2). Of the photos categorized by a green frame, 37% fell under the category of natural patterns and processes and 32% fell under environmental features. The category in which there was the most significant dearth of biophilic design aspects was in environmental features at 34%, and in natural patterns and processes at 26% (Table 4). Evolved human/nature relationships, place-based relationships, and light and space had low overall representation in the materials group research at 4.9%, 3.6%, and 4.2% respectively (Table 4 & Figure 3).

Figure 2. Environmental features were both present (left, 32%) and lacking (right, 34%), depending on the place on campus assessed.

Table 4. Biophilic Design Materials Elements on Campus

Positive Aspects	**Red (Not Present or Not Well Developed)**	**Green (Present or Well Developed)**
Environmental Features	34%	32%
Natural Shapes and Forms	13%	16%
Natural Patterns and Processes	26%	37%
Light and Space	7%	6%
Place-based Relationships	16%	4%
Evolved Human-Nature Relationships	4%	5%

Figure 5. Relative Frequency of Biophilic Design Materials Elements on Campus

Precedent Research

Students researched a variety of precedents, most of which had achieved certification of the Leadership in Energy and Environmental Design (LEED). Precedents under LEED certification are the Lorry I. Lokey Graduate School of Business in Oakland, the Environmental Studies building at Oberlin College in Ohio, California Academy of Sciences and Coastal Biology Building at UC Santa Cruz. The Bullitt Center in Seattle has earned the Living Building Challenge (LBC) certification and Sand City's eco-resort under construction plans to achieve the LBC certification in the future. The School of Art Design Media in Singapore earned certification in the Building and Construction Authority Green Mark (BCA Green Mark). Students analyzed research for themes that cut across each precedent (Table 5). Thematic analysis revealed similarities in design materials and certification achieved with an emphasis on energy efficiency, innovative uses of landscaping and plants to help achieve this, and both salvaged and natural building materials (Table 5, Appendix A).

Table 5. Thematic Analysis of Precedent Research

Carbon Footprint	Landscaping	Specific Materials	Construction
Use of solar (x4)	Indoor (x2)	Large windows (x5)	LEED (x4)
Use of wastewater treatment (x4)	Green roof (x4)	Wood (x3)	Living Building Challenge (x3)
	Blending with surroundings (x3)	Salvaged materials (x3)	BCA Green Mark (x1)

Interviews

As described in methods, interviews were coded for each of the three major imperatives: red list, responsible industry, and living economy. Responses were grouped by challenges, recommendations, and additional themes that emerged from the interviews. Based on discussions with Sustainability and Development staff, follow-up questions were asked specifically regarding PVC, vinyl flooring, and concrete/cement alternatives and whether the interviewee had experienced delays with Living Building Challenge because of sourcing. Three of the original six interviewees responded to these questions. These results are summarized in Table 6.

Red List

Challenges

- Changing market and product availability (x3)
- Manufacturers being uninformed on products and unaware of what they can disclose (x3)
- Lack of ingredients transparency (x3)

Recommendations

- Have a thorough understanding of commitment and a list of materials and sourcing *prior to* building (x4)
- Involvement of all stakeholders (x2)
- Obtain materials from manufacturers with Declare labels (x2)

Cost

- Not cost-effective (x2)
- Soft-cost increases price (x2)
- Inadequate premium prices for some products (x1)

Manufacturers, Vendors, Sources

- Pressuring manufacturers to develop alternatives: some are willing, some not (x4)
- Manufacturers are unaware or unaccustomed to being asked about ingredients (x3)
- Some manufacturers have more compliant products (e.g., Sherwin-Williams and Benjamin Moore) (x2)

Specific Materials (Wood, Steel, PVC)

- Alternatives are hard to find for most materials (x1)
- If there are alternatives, they are expensive (x1)
- Locally-sourced materials are easier to dispose of (x1)

Table 6. Recommendations for Alternatives Materials to PVC, Vinyl, and Concrete or Cement. Causes of Construction Delays

PVC Alternatives	Vinyl Flooring Alternatives	Concrete Alternatives	Construction Delays due to Sourcing
Copper PEX (x2) HDPE (x3)	Rubber (x2) Linoleum (x2) Exposed concrete (x2)	CarbonCure Fly Ash Limestone Crushed rock (used in Europe)	Product Development General Contractor Code Issues (x2)

In response to the follow-up questions, Stacy Smedley, Director of Sustainability at Skanska, stated "the general contractor should be on board early to be bought-in and help with early procurement studies and outreach to manufacturers and suppliers." She said if the project is thoroughly vetted during the design phase, there should be no delays on construction. Patty Karapinar, Director of Sustainability at Arch Nexus, stated the construction manager changed twice while waiting for parts that were in production. Chris Hellstern, Living Building Challenge Services Director at The Miller Hull Partnership, said he had experienced delays on projects due to coding issues. Hellstern also recommended reducing the use of concrete by investing in alternative materials for structural systems, like mass timber, steel, and other forms of concrete structure like post-tensioned (PT) slabs. When concrete is necessary for elements like slabs and footings it is sometimes possible to adjust the concrete mix design, but in general attempting to reduce the amount of concrete used to as low a level as acceptable based on factors like structural strength, available substitutes, "and the biggest driver – schedule" is the best that can be done.

Responsible Industry

Challenges

- Finding a sustainable, alternative material that is cost efficient and of the same, if not better effectiveness.
- Documenting all materials to keep track of material usage and carbon emissions.

Recommendations

- Set aside enough time for planning and researching materials early on to simplify vetting https://materiallybetter.com/value/#savings-calculator
- Committed contractor that will fully incorporate LBC project.
- Seek out a contractor and leadership familiar with LBC imperatives from the beginning.
- Selective cutting of trees.
- Stone and brick over metal.
- Minimize drywall and sheetrock with natural resources such as wood, brick, or stone.

Cost

- LBC/LCC goal-oriented projects tend to be associated with higher costs due to use of alternative materials and additional effort for transparency around materials and manufacturing.
- Transparency around responsibly harvested wood increases its cost.
- Estimated 5-15% cost increase for LBC projects vs typical projects.

Manufacturers, vendors, sources

- Production and transportation of materials add to greenhouse gas emissions.

Living Economy

Challenges

- Highly specialized components and products may only be available from outside the sourcing radius and are often harder to find replacements for.
- Connect with local vendors who are familiar with LBC; if local vendors aren't familiar with LBC apply pressure to produce products without Red List ingredients so environmentally responsible products are available within the sourcing area.
- Prioritize product choices with lower embodied carbon footprint over ones that are available within the radius.
- High transportation costs for products sourced outside the sourcing area and high manufacturing costs for locally produced items.
- Keep products local when possible to help economy and ecosystems thrive.
- Pressure manufacturers to develop less environmentally impactful materials.
- Forced to use cast iron pipes: neoprene is necessary to join cast iron and plastic

Recommendations

- Embodied carbon footprint holds more weight than does the distance from which a product is sourced
- Local materials bought, less environmentally impactful
- Setting up a tracking sheet to document where you plan to get materials
- If possible work with vendors that you've already worked with or are familiar with LBC

Cost

- Transportation and manufacturing costs

Manufacturers, vendors, sources

- Pressure manufacturers to develop less environmentally impactful materials
- Many products produced out of country
- Products come from multiple vendors, so materials vary
- Most emissions of a product come from the manufacturer or extraction process

General Lessons for the Living Building Challenge.

- Frontload organization at, or before, the project begins. (get everyone on the same page from the beginning.)
- LBC projects are not always profitable, and sometimes don't even break even
- Available materials and codes are always changing
- You must have the will to do it
- Better communication between architecture and manufacturing industries for increased transparency

Discussion

Students at CSUMB have a unique perspective on campus development through their day-to-day experience living and taking classes on campus. Generally, students seemed more satisfied with biophilic design embodied in "environmental features" and "natural patterns and processes" on campus. This is likely due to the campus' use of natural shapes, decorations, murals, and structures found in the main focal-point buildings of the campus (i.e. library, BIT building, parking lot mural wall). Due to CSUMB's military history, students felt that many places on campus did not reflect place-based relationships. Students are more likely to feel a connection to place-based relationships if artful and nature-inspired concepts are present on campus as opposed to bare asphalt and concrete.

Precedent research revealed that there is no single path to achieving more sustainable development. With ingenuity, creativity, and dedication, remarkable buildings have been developed all around the world using sustainable materials and biophilic design. Learning more about the successes of other projects can help CSUMB in their vision to create beautiful, unique, and environmentally-responsible buildings. CSUMB has an opportunity to further inspire other building and development projects through their approach to biophilic design and embracing the Materials Petal of the LBC.

One of the more prominent challenges identified in the interviews was time management. Many manufacturing companies did not have a protocol for transparency with ingredients they use in their products. This slowed down the decision-making process for construction leading to delays. The delays associated with gathering information on ingredients in selected materials should be factored into the overall timeline to improve coordination throughout different stages of development. The initial investigation and organization of a project is important for the feasible completion of construction on budget. The more involved CSUMB and other development projects become in expressing interest in sustainable alternative materials, the faster the market will adapt, become less niche, and offer more sustainable alternative materials to a more mainstream consumer base.

Interview findings also indicated multiple strategies for more effective implementation of the materials petal at CSUMB. A major recommendation made by four of the six interviewees was to thoroughly understand the importance of being committed to LBC, and sourcing of non-Red List materials prior to construction. This recommendation can be dissected into multiple components. First, prior to embarking on any building project it is important to review the Living Building Challenge guidelines. Second, review the materials Red List and contact manufacturers for alternatives. Additionally, four interviewees recommended pressuring manufacturers into developing new products that align with Red List imperative standards.

A possible limitation of the study and data collection was the differing student engagement and perspectives, especially when quantifying qualitative data collected during the photovoice activity. Students may have unwittingly categorized images under the categories they understood the most, and neglected ones they did not feel familiar with. This study suggests that projects in the future would benefit from designating more time to exploring each of the other six categories used in photo-framing so that student perspective is captured as accurately as possible. A more through exploration of the LCC, LBC, and petal imperatives prior to commencing research may have also prepared students to contextualize their research and their findings.

CSUMB has a unique opportunity to become another precedent-setter for achieving sustainable development on a holistic level. Some of the initial hurdles taken by other projects can be avoided by learning from their experience. Through organization and determination CSUMB can be a driving force in creating a more sustainable, ecological, and responsible industry.

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Appendix A: Precedents

The Bullitt Center of Seattle, Washington

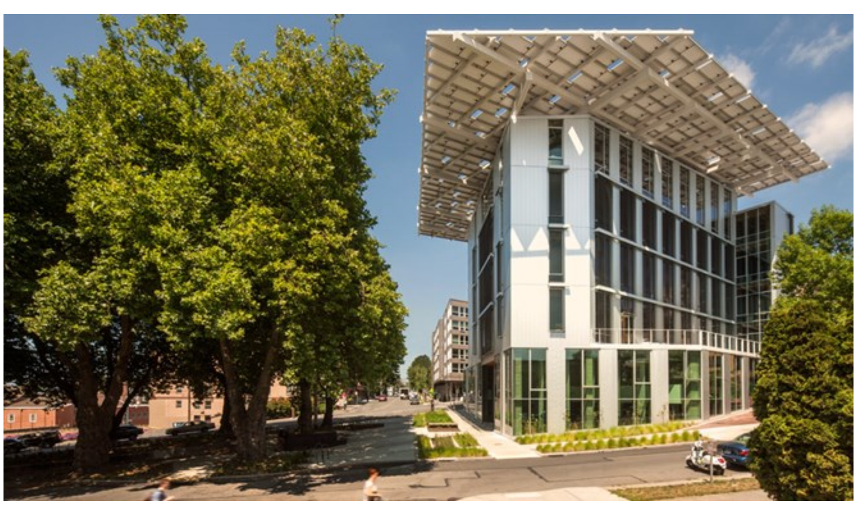
Highlights

- Six stories ("Miller Hull", n.d.).
- 52,000 square feet ("Miller Hull", n.d.).
- "100% onsite renewable energy, water and waste management" ("Miller Hull", n.d.).
- Heavy-timber framing (renewable, regional, carbon-sequestering) ("Miller Hull", n.d.).
- First and largest commercial building to receive Living Building certification ("Miller Hull", n.d.).
- Six Red List substitutions ("The Greenest Commercial Building in the World", n.d.).
- Pre-screening of products recommended by contractors and installers ("The Greenest Commercial Building in the World", n.d.).
- Project team contacted manufacturers individually to obtain MSDS and product information ("The Greenest Commercial Building in the World", n.d.).
- Project team referenced Pharos Project chemical database to assess chemical components of materials ("The Greenest Commercial Building in the World", n.d.).
- Salvaged wood and other materials ("The Greenest Commercial Building in the World", n.d.).
- Embodied carbon footprint -3,000 metric tons ("The Greenest Commercial Building in the World", n.d.).

The FSC Heavy Timber Structure used in the Bullitt Center reduces carbon and adds aesthetic value to the interior of the building. http://www.bullittcenter.org/building/building-features/tall-timbers/

Description

The Bullitt Center earned its Living Building certification because of the Bullitt Foundation's vision of designing a headquarters that would set a precedent for subsequent sustainable building projects. What they succeeded in doing was creating a "Living Building" with a negative net carbon footprint and virtually zero environmental impact. The project team met the Materials Petal imperatives by utilizing a collaborative relationship between the developer, contractor, and sub-contractors to research and evaluate products and materials ("Bullitt, n.d."). Establishing individual relationships with manufacturers helped the team procure the best and most accurate information about products, informing their decisions on



The Bullitt Center of Seattle, Washington was the first and largest commercial building to attain LBC certification. http://www.bullittcenter.org/

substituting toxic products with sustainable substitutes ("Bullitt Center", n.d.). Despite challenges in procuring documentation that the many and complex materials and equipment met the Living Building Challenge 10% rule, the project team was able to navigate a convoluted supply chain to source salvaged, regional, and Forest Stewardship Council (FSC) certified products to meet the Red List Imperative ("Bullitt Center", n.d.).

Contact Information

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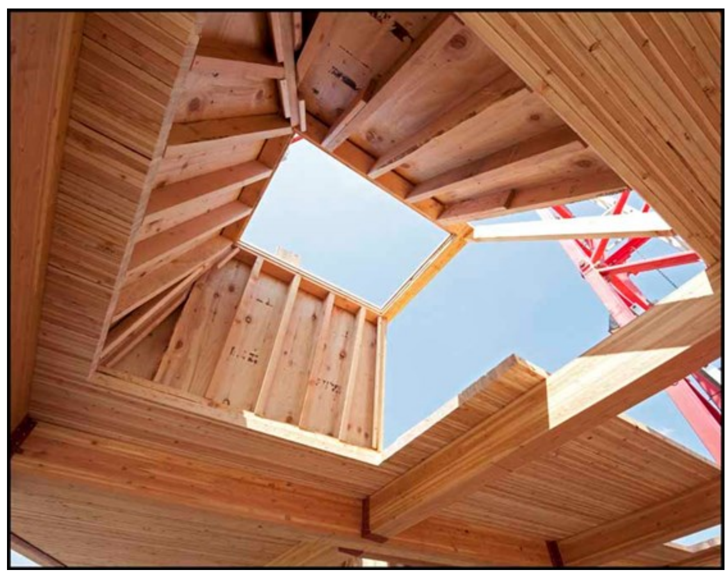
- Morris, Rashad. Program Officer, Bullitt Foundation. Manages "Energy, Climate, and Materials" and "Deep Green Buildings" programs. rmorris@bullitt.org
- Whitney, Steve. Senior Program Officer. swhitney@bullitt.org

Floor and salvaged wood on Level 3. http://www.bullittcenter.org/building/photo-gallery/?afg0_page_id=3#afg-0



Building the Skylight using salvaged wood. http://www.bullittcenter.org/building/photo-gallery/?afg0_page_id=5#afg-0

Appendix A: Precedents

Natural Lighting/Daylighting at the Lorry I. Lokey Graduate School of Business Building Description

The Lorry I. Lokey Graduate School of Business Building in Oakland, CA has been recognized for having numerous sustainable design features. The building was awarded the United States Green Building Council's LEED Gold Certification in 2010; a first for a business school building in California (Media, 2011). One of the features in this building is daylighting. The building was oriented to maximized solar exposure in the winter and indoor and outdoor porches and sunshades shield the building from the sun during the summer (USGBC, n.d.). The business building was constructed in an L- shape and has a southwest orientation. There are floor-to-ceiling windows and skylight to allows sunlight in (BCJ, n.d.). Since it's competition, the building has had a 32% annual reduction in energy consumption (Goodwin, 2012). The amount of light let into the building is controlled by a system to reduce the glare but still illuminate the whole building during the day. The windows allow 90% of the occupied spaces to have a view of the surrounding landscape. The building has received positive reception from staff, faculty, and students. The classrooms and venues in the building are highly sought after. There has also been an increase in enrollment after the building was completed (USGBC, n.d.).

Image Source: Goodwin, 2012

Contact Information

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Appendix A: Precedents

Monterey Bay Shores Biophilic Design

Highlights

Living roofs, energy efficiency, renewable energy use, natural light and ventilation, water conservative, low and non-VOC emitting materials, dune revegetation, habitat restoration, sustainable materials, and community beach access.

Description

Sand City Proposed Eco-Resort

Monterey Bay Shores plans to incorporate the six elements of an eco-resort (Earth, Water, Air, Light, Energy, and the Human Experience) with the surrounding sand dune habitat. The resort is planned to be eco-friendly in both innovation and materials used for the project. The project claims thirty percent of its energy will come from wind, solar, geothermal sources. The resort will also work as a greywater treatment facility and function as a zero-runoff site in compliance with standards for Low Impact Development (LIDs), Best Management Practices (BMPs, and the California Coastal Commission Model Urban Runoff Program (MURP). The living roof of the resort will harvest rainwater for all its non-potable water use such as laundry and swimming pools.

Biophilic design is synonymous with the resort's layout and it is going to be built into the sand dunes so that it does not block the view of people passing on CA Highway 1. Part of its land use will also include 6.7 acres being set aside for habitat restoration for native species such as the Snowy Plover, Smith Blue Butterfly, and Spineflower. The goal of the resort is to blend the line between human development and the sand dune landscape while striving to revitalize the area rather than negatively impact it. The work and thought put into the plan for this project, and its proximity to CSUMB, makes it a great example to look to for inspiration for the campus' future projects.

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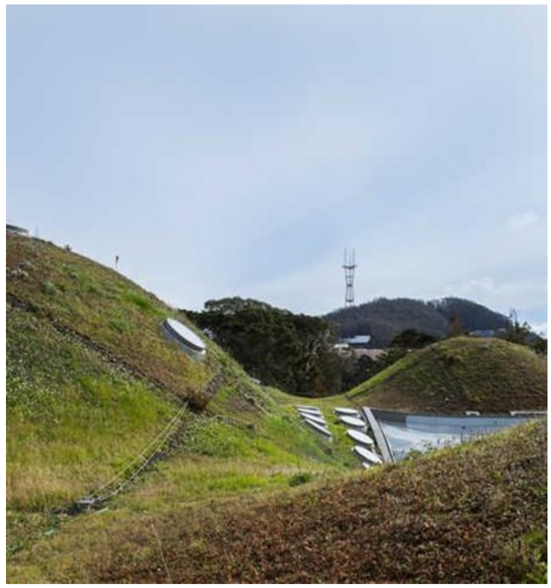
Appendix A: Precedents

Living Roof at California Academy of Sciences

Highlights

- The Living Roof provides insulation (reducing energy needs for heating and cooling)
- The Living Roof captures 100% of excess storm water (preventing runoff from carrying pollutants into the ecosystem)
- The Living Roof reduces the carbon footprint of the building
- The Living Roof is home to more than 1.7 million pants and many species of birds and insects



Description

The California Academy of Sciences, located in San Francisco, has a living roof that is a prime example of environmentally sustainable materials being used in urban development. Their 2.5-acre roof is 87% covered with natural terrain. The roof uses biodegradable vegetation trays made from tree sap and coconut husks. Around 1.7 million plants are located on the roof, most of which are species native to California. The roots interlock to create an extraordinary oasis for birds, insects, people, and other creatures, as well as holding sediment in place. The roof absorbs rainwater preventing it from polluting local water supplies. As well as providing benefits to the environment the building as provides many features for the indoors. The living roof insulates the building which in turn reduces energy needs to heat/cool the building. The roof is lined with solar panels to generate electricity for the building to operate. The roof also provides a semi-controlled environment to do research and hold classes in a natural setting. A living roof can bring many advantages to buildings, especially buildings meant to house education about environmental stewardship.

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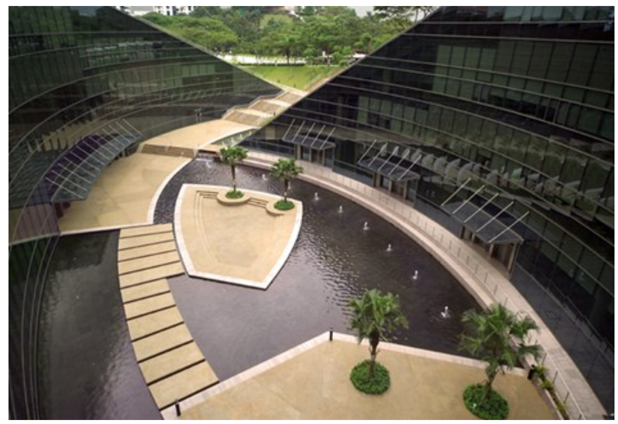
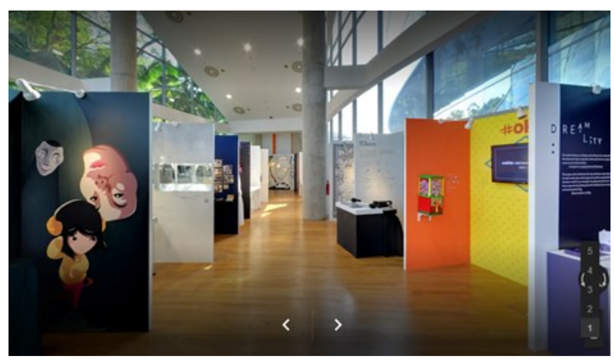
Appendix A: Precedents

School of Art Design and Media Nanyang Technological University, Singapore

Highlights

- BCA Green Mark Awards 2011 (Platinum)
- USA School Construction News Awards 2007
- Transparency and Connectivity with wooded valley and glass façade walls/windows
- Turf roofing to allow for outside classes and studying
- Pond and trees in open air courtyard to allow students and staff to connect to nature
- Uses natural shapes and materials to allow a student and nature connection
- Natural Lighting
- Designed building to fit its environment, not the environment to the building





Description

When the school was being designed, the architects knew it was imperative to integrate the environment and biophilic design into the new projects. This wooded-valley portion of the campus was originally just used as green space, so they planned to incorporate the green-space and materials into the new building. They wanted the shape to look as natural and organic as possible and fit into the environment, while still bringing the new age skyscraper look. The architects incorporated these large glass windows to allow the students inside to look out and feel immediately connected with nature. There is an open-air courtyard with a plaza in the middle consisting of trees, a pond and natural wood and gravel walkways. There is glass facade incorporated into the windows and walls to allows natural light to fill the building and rooms while keeping the heat out. Artificial turf covers the roof along with brick and stone stairs leading over the top alongside the turf. In the interior there are stone pillars supporting the building and wood flooring to give it a natural look. Many walls inside and out are left as blank canvases to be painted on and the building encourages visitors to use all their senses to engage with their learning environment. Many classrooms are not traditional shapes and allow for more of a personal teaching experience and allow classes to interact with nature around them.

Contact Information

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Appendix A: Precedents

Nature by Design

In 2007, The University of California Santa Cruz constructed a new Coastal Biology Building, which was designed by Scott Shell of EHDD in San Francisco. This brand-new building was awarded with a LEED Gold certification in 2018, just 6 months after it had been constructed, while checking off 21 of the 26 check points for sustainable site alone. The place where it lacked was in the Materials and Resource section, which only got a 5 out of 14 on the check list.

Appendix A: Precedents

Oberlin College, Wastewater Treatment System at the Adam Joseph Lewis Center for Environmental Studies

Description

The Adam Joseph Lewis Center for Environmental Studies, or AJLC, is a sophisticated model for infrastructure that showcases and incorporates sustainable and ecological design through its use of recycled and natural materials, energy efficiency, incorporations of biophilic design, and ecological landscaping within its architecture. The AJLC is located at Oberlin College in Oberlin, Ohio. The building was designed by architecture firm, William McDonough + Partners of Charlottesville, Va and reconsiders design by using natural sustainable and recycled materials and solar energy (AJLC, n.d.). Located inside the Center is an ecologically designed and engineered wastewater treatment system called "The Living Machine (LM)" which was created by Living Machines, Inc. The LM, is a small-scale sustainably constructed wetland located inside the Center and has been treating wastewater since February of 2000. Currently, it treats around 2,000 gallons of wastewater daily using engineered ecologies composed of anaerobic and aerobic tanks, marsh, UV filters, pressurized storage tanks and is built with sustainable and recycled materials. The treated wastewater is recycled throughout the building for non-potable reuse (Barista, 2001; Winnans et al., 2001). In addition, the LM is a teaching tool for students by acting as an environmental education laboratory where students are able to acquire hands-on knowledge on ecological design, sustainability, and other interdisciplinary sciences (Janas, 2000). The LM's educational laboratory teaches the generations of today and ensures that students understand the incorporation of design and materials in more sustainable and efficient approaches.

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The mission of the Environmental Studies Program at California State University Monterey Bay is to develop students and communities with the knowledge, skills, and compassion to promote social and environmental justice and sustainable communities.