DO WE REUSE OR BUILD ANEW?

A discussion and comparison of adaptive-reuse vs. new construction through case-studies

Left: Omega Center for Sustainable Living, Rhinebeck, NY
Right: Jean Vollum Natural Capital Center, Portland, OR

Currently buildings consume more energy than any other sector (nearly 49% of all energy produced in the United States). Additionally, 77% of all electricity produced in the U.S. is used to operate buildings. Globally these percentages are even greater. When we look at CO2 emissions, the building sector is responsible for nearly half as well (46.9%). By comparison, transportation accounts for 33.5% and industry just 19.6%. The build environment put a considerable strain on resources and fossil fuel consumption. The 2030 Challenge demands us to take action to build more efficiently and with less resources. In this paper, I examine a LEED certified Gold adaptive reuse project in downtown Portland, Oregon and compare it to a new construction, high performance living building in rural upstate New York.

OVERVIEW

The urban adaptive reuse project I'll be examining further is the **Jean Vollum Natural Capital Center**. The building was originally constructed in 1895 by J. McCraken Company as a warehouse and transfer station. In 1998, Ecotrust (a local rain forest conservation group) purchased the building and started renovations. The project was completed in 2001 and awarded the first LEED gold historic building in the nation. The building takes up an entire city block in the heart of Portland's emerging River District. It houses a diverse array of retailers, offices, for-profit and non-profit organizations.

The second project I'll be looking at is the **Omega Center for Sustainable Living**. Contrasting to the urban adaptive reuse, this project was a new construction in rural Rhinebeck, NY. The Omega Institute is the nation's largest holistic learning center. In 2006, they set out to develop a highly sustainable wastewater filtration facility for their 195-acre campus. The building is not only awarded LEED platinum, but it was also the first building in the U.S. to meet the requirements of the Living Building Challenge.

I've used the seven performance areas of the Living Building Challenge (Site, Water, Energy, Health, Materials, Equity (Economics) and Beauty) as a starting point to analyze the impacts of each building. I've also added an Education/Social piece to my analysis.

LIVING BUILDING CHALLENGE

"Living Building Challenge is a philosophy, advocacy tool and certification program that addresses development at all scales. It is comprised of seven performance areas: Site, Water, Energy, Health, Materials, Equity and Beauty. These are subdivided into a total of twenty Imperatives, each of which focuses on a specific sphere of influence. The Living Building Challenge (LBC) was conceived by Jason F. McLennan and has been operated by the Cascadia Green Building Council. It was not intended to compete with LEED but to go beyond it. Unlike LEED, whose goal is to make the built environment more sustainable, the LBC takes it even further to outline requirements for buildings to take nothing at all from the environment. Buildings must generate their own energy, use no outside water, and be built with locally sourced, sustainably harvested materials."

- International Living Building Insitute

[SITE]

McCraken warehouse , built in 1895, urban site of the Natural Capital Center

Location: Portland, OR
Building type(s): Commercial office, Restaurant, Retail
Renovation of a historic 1895 building
- 70,000 ft2 (6,500 m2)
- Project scope: 3-story building
- Urban setting
- Completed September 2001
- Rating: U.S. Green Building Council LEED-Gold

Jean Vollum Natural Capital Center

From the onset, the development team of the Jean Vollum Natural Capital Center sought to combine the concepts of urban renewal, sustainable development and historic rehabilitation into one project. The intent was to allow the characteristics of the natural ecosystem to inform the restoration and development of healthy, urban ecosystems. The team wanted the project to encourage other green development in the region and in the immediate Pearl District. The team also aimed at housing tenants who provide environmentally, socially, and economically responsible goods and services.

The selection for a permanent home for Ecotrust was a major part of the sustainable strategy. The warehouse was chosen in part for its proximity to a wide variety of transportation options - the streetcar runs directly in front of the building, a light rail stop is just 7 blocks away, Greyhound and Amtrak stations are only 3 blocks away, as well as 2 spaces for shared vehicles (ZipCar). Additionally the building is well equipped for bicycle-commuters, with space for 50 bicycles, as well as lockers and showers. There is also a small bike-sharing program in place, where tenants may check out 1 of 3 donated bikes. The site was developed to include limited car parking to promote alternative forms of transportation as well as to have as little an impact on the city's traffic as possible. Finally the parking lot is equipped with the infrastructure to charge 4 plug-in electric vehicles. The parking lot is also used for other purposes, including a farmers' market and outdoor event space.

Rural site of the Omega Campus in Upstate New York

Location: Rhinebeck, NY
Building type(s): Interpretive Center, Laboratory
- 6,200 ft2 (576 m2)
- Project scope: a single building
- Rural setting
- Completed May 2009

Omega Center for Sustainable Living

Contrasting to the urban condition of the Natural Capital Center, the Omega Center for Sustainable Living is located in the rural lower Hudson River Valley watershed basin, home to one of the world's most populated areas. Given the proximity to New York City, the Hudson is one of the most important bodies of freshwater on the planet. The neighboring communities have historically been causing degradation to the water supply- from agricultural runoff, landscaping chemicals, septic systems and urban water issues. By locating the campus within close proximity to this water supply ensured that leaching and other threats to the aquifer would cease.

The campus was constructed on land that was previously used as a burial spot for solid debris from years of operation with the previous owner. The site was nearly devoid of healthy biodiversity above and below the earth. The automobiles and waste from the original condition of the site have been replaced with deep-rooted native plants, a healthy water system, birds, insects and other species. The site is also pesticide and toxin-free. The landscape design has brought the site back to its native ecology as well as providing inspiring landscapes that reflect the ecological and cultural context of the campus.

Ecoroof for storm water management

PV panels for energy generation

Jean Vollum Natural Capital Center

Located in a temperate climate zone, the Natural Capital Center experiences its share of storm events and has been designed to pose no burden on Portland's storm water drainage system and the overburdened Willamette River. A key feature to the renovation was the addition of a vegetated roof on the third floor to capture and naturally filter rainwater. Any water that does not captured by the green roof is channeled into the on-site bioswales.

The site is further vegetated by native plants (some edible) and trees. The landscaping was designed to first be established by drip-irrigation, but now self-sufficient without the need for any permanent irrigation system.

The project uses about 1/3 lower the total water that a building of its size typically uses. Along with self-sufficient landscaping design, lower water usage was achieved with low-flow plumbing fixtures.

Omega Center for Sustainable Living

In terms of water and energy, the Omega Center has been designed to be net-zero. The loops of water and energy use have been carefully though out and designed to give back what the building uses. In terms of water, only potable water is drawn from the earth through on campus wells. After use, this water is passed through an Eco Machine system for natural treatment and eventually returned to the ground as a higher quality of water. For toilet flushing, rainwater is used. It is collected from the building roof in an underground cistern which is sized to provide adequate reserve for 100% of non-potable water use throughout the year. Low-flow plumbing fixtures have been installed to minimize water consumption. For all other uses on campus, blackwater and greywater are sent to the wastewater treatment Eco Machine. This consists of lagoons and constructed wetlands. The Eco Machine treats roughly 3 million gallons on water from the Omega Campus per year.

Occupancy sensor lighting

In terms of energy, the building consumes about 22% less than a comparable building designed in minimal compliance with Oregon code. This is due to energy efficient windows, lighting fixtures, building controls and the ventilation system. Daylighting has been used in the central atrium skylights and is provided via high-performance windows. All electric lighting is controlled with occupancy and daylight sensors. The efficiency saves about $13,000/year.

The 22" thick brick exterior walls have been largely kept in their original state, with the addition of insulation (sprayed foam) at the roof level. Microswitches on the windows suspend the mechanical ventilation when the windows are opened. Also the exhaust heat from the pizza oven on the first floor is recovered and used to preheat the building's hot water.

Jean Vollum Natural Capital Center

Annual Purchased Energy Use

Fuel	Quantity	Cost($)	$/ft2
Electricity	888,000 kWh	$72,434.84	$1.03
Natural Gas	464 therms	$341.04	$0.00

Total Annual Building Energy Consumption

Fuel	Cost($)	$/ft2
Total Purchased	$72,775.88	$1.04
Grand Total	$72,775.88	$1.04

Above: siting for Omega Center for Sustainable Living
Below: interior Living Machine and natural daylighting

Omega Center for Sustainable Living

In terms of energy use, studies show that the campus generates more energy annually than it uses. Achieving net-zero energy required a design that eliminated waste and maximized the use of renewable energy sources. The building is purposely compact, organized to harvest daylight, solar energy, and cooling breezes to reduce energy needs. Similar to the Natural Capital Center, the insulated thermal mass of the enclosure as well as the thermal mass of the water passing through the treatment cycle are instrumental in reducing demands upon the mechanical systems. During summer months the cool laboratory water has both a cooling and drying effect on the hot humid air entering the building. Efficient geothermal wells and heat pumps provide the heating during cooler months and cooling is only provided for the classroom.

The building has been properly designed and oriented to use sunlight as the primary light source, via windows, skylights, and shading devices. The electric lighting systems are efficient and controlled to be used only when supplemental light is needed. PV panels generate more energy than the building uses annually/ The excess energy is sold to the local utility. During evenings and certain winter months, energy is provided by the electric utility.

[HEALTH]

Both projects were designed to create an interior environment that is comfortable for its occupants. Both employ daylighting and natural ventilation through numerous operable windows. Air quality during and after construction was, and is important to both projects. In both cases the heating, ventilation, and air-conditioning ducts were sealed off during construction, to protect from dust accumulation.

Large openings for both daylight and natural ventilation

Third floor roof deck for socializing and city views

Jean Vollum Natural Capital Center

This project was ventilated prior to occupancy to purge any residual airborne pollutants. The existing shell contained a large number of well sized windows to allow daylight to reach more than 3/4 of the occupied areas, reducing the need for electric lighting and improving the quality of the working environment. Low VOC paint and carpet tiles were also used. The interior air quality of the space has been so well thought out that the janitorial storage closets are fully partitioned from floor to ceiling and independently ventilated, as well as all cleaning substances used in the building are biodegradable and free from harmful ingredients.

Omega Center for Sustainable Living

Not only did the Omega Center have a goal to create a comfortable interior environment for its occupants, at the same time, it was critical to provide a fertile environment for the plants. The result is a balance of passive (daylight, passive solar heating, natural ventilation) and mechanical (geothermal, fans, electric lighting) comfort systems. Plants growing in the interior lagoons required very precise solar energy levels on both their south and north exposures - the building was carefully designed as a integrated system, meeting the needs of the plants while also creating a memorable human experience. The plants contribute to interior air quality by removing carbon dioxide and other gasses, while producing oxygen - indoors and outdoors.

The building design and materiality was carefully considered to minimize extraneous surface treatments and materials. In most areas the building structure is left as exposed finish. Paints and sealers are all low VOC. A green cleaning program has been implemented to use healthier, less toxic cleaners.

One of the benefits of building anew, is that the project can be designed around current technologies and integrated daylight and ventilation features, such as solar tracking fenestration and stack ventilation. The building and site are integrated in a single system that is current with today's sustainable technologies. The landscape produces a micro climate of clean air and beauty beneficial to the occupants. Water from the building feeds the plants and other living systems of the landscape. The two are visually connected by the transparency of each indoor space.

[MATERIALS]

Interior reuse of building structure

Exterior/interior honest material approach

Jean Vollum Natural Capital Center

This is the area where the most disconnect happens between these two green projects. On one hand you have the Natural Capital Center which is inherently resource efficient, retaining the majority of the entire original structure. The materials used on the third floor addition were salvaged from the adjacent deconstructed warehouse annex. Any lumber material that was not existing to the original structure is FSC-certified. In most cases they used salvaged materials, such as reclaimed tires for rubber flooring, as well as a reclaimed cargo bay door used as a dividing curtain in the conference room.

Through the process of building, all by-products went through a very aggressive recycling program, which in the end diverted 98% of the project's waste from the landfill, setting a city record. Unlike the Natural Capital center's approach to predominately reclaimed materials, the Omega Center had a very detailed and organized material selection process, since new materials were being used. This process included the builder, Architect, MEP Engineer, Landscape Architect, and owner to work collaboratively to collect data and make decisions about each material.

Omega Center for Sustainable Living

Since the Omega Center's goal was the Living Building Challenge, each material had to pass certain criteria of location, company environmental policies, and toxins. Perhaps the most difficult to track down was what materials are in a given product. Often representatives and manufacturers don't know exactly what are in their products or components. We have globalization and outsourcing to thank for this difficulty. Materials that pass the LBC criteria are often obscure and hard to find and/or at a significantly higher price.

Since using new materials, they employed an honest material approach to help reduce the overall embodied energy of the building and minimize potential off-gassing. No effort was made to mask the underlaying nature of a material, but rather express its beauty - this greatly reduced or eliminated the use of interior finishes.

When at all possible salvaged lumber, doors and paneling were used. All other lumber is FSC-certified.

Similar to the Natural Capital Center, construction waste was also taken into consideration. 99% of metal, cardboard, rigid foam and wood scraps were recycled. All food waste was composted, and 100% of glass, paper, and plastic packaging waste were recycled.

Jean Vollum Natural Capital Center

Equity: Green building tax credits, Historic tax credits, Other tax credits
Grant: Private (foundation), Public agency
Loans: Private (bank, insurance)
Procurement process: Design-build

Cost Data

Cost data in U.S. dollars as of date of completion.
Total project cost (land excluded): $10,330,000
Property cost: $2,500,000
Soft cost: $26/sf
- professional fee: $12/sf
- management fee: $3/sf
- finance: $4/sf

Hard cost: $120/sf
- site work: $13/sf
- construction: $89/sf
- tenant improvements: $17/sf

In both cases, Omega and Ecotrust, the project owners, were very forward thinking in terms of efficient building strategies and renewable energy. In a lot of ways they are both atypical clients deciding in the beginning for goals of LEED certification and the Living Building Challenge (in the case of the Omega Center).

Ecotrust raised about $8 million from 12 foundations, 16 corporations and 36 individuals. The City of Portland's Bureau of Environmental Services provided a $75,000 grant to help offset the costs of the green roof and the Green Investment Fund provided $20,000 to help offset the costs of LEED certification. The building also qualified for $112,595 in Business Energy Tax Credits. The building also became eligible for a historic rehabilitation tax credit.

Because Ecotrust is a tax-exempt organization, with no use for tax incentives, it elected to use the pass-through option, enabling a transfer of tax credits to the partner - Walsh Construction Company.

Omega Center for Sustainable Living

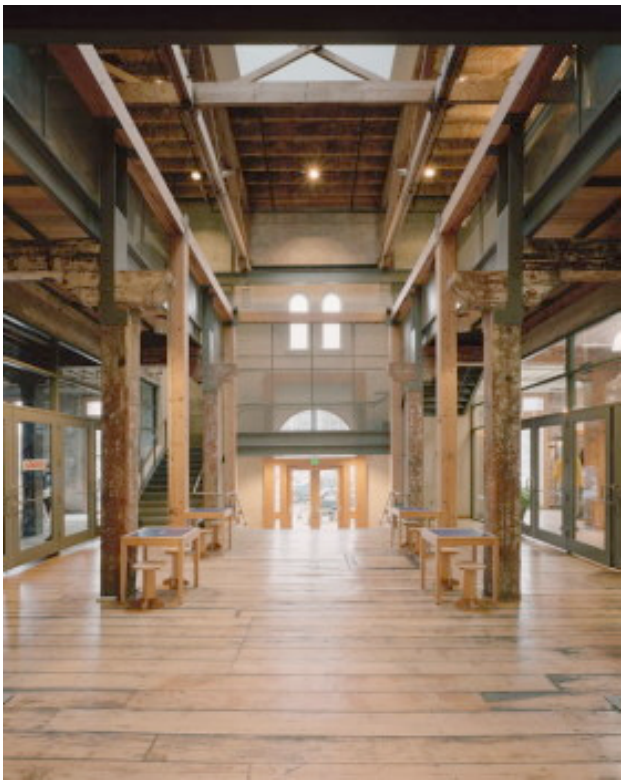
Cost Data

Cost data in U.S. dollars as of date of completion.
Total project cost (land excluded): $2,800,000

Omega was an extra atypical owner, as the sustainable decisions were made without cost analysis - it was just the right thing to do. They set out for the goals of LEED Platinum and LBC. Within the framework of these goals, efficient cost control was a constant challenge for the project, though it was treated somewhat typically in terms of project decision-making. Omega was extremely active in the design and construction process, becoming exceptionally knowledgeable about the costs of each item. Options were evaluated and decisions were made on the cost of every major building and landscape system. This process helped the team achieve project goals with the most economical solution.

[BEAUTY]

"Ecotrust has created a landmark of national significance. The Natural Capital Center proves that we can create a healthier brand of architecture that also is an outstanding example of beauty and historical integrity. It is a place that inspires people to think creatively and optimistically.
"—U.S. Green Building Council President and CEO Christine Ervin



Central atrium space showcases the local heavy timber industry see in original structure of the warehouse

Jean Vollum Natural Capital Center

I think many agree that the Natural Capital Center is a well done renovation. The project does a great job at preserving the original 1895 warehouse thus connecting the visitors to the rich history of the city. The juxtaposition of new/reused elements with the original structure portray Portland's focus on craftsmanship and tie us to the local timber industry. This juxtaposition of time periods also helps to create a richness and depth to the building, which in turn can possess a timeless quality. All the materials used and reclaimed are celebrated communicating a truth in material quality.

The third floor addition incudes a green roof and roof terrace with views of the city, further connecting the building and its inhabitants to the larger city.

Site plan - showing the connection to the Hudson River Valley

Exterior view displaying the truth in materials

Omega Center for Sustainable Living

The Omega Center is truly an artifact of our time. It showcases a large handful of the modern sustainable techniques and technologies used in the building industry today. It serves not only as a great example of our present day techniques, it also educates the public.

This project is incredibly rooted in the connection to the land from the siting and building orientation create a tie to the Hudson River Valley, to the internal living machine, bringing natural processes to our attention.

Although its hard to say how this building will age and evolve, its understated form and truth in materials are timeless qualities. This project has the potential to age with grace.

[SOCIAL/COMMUNITY]

"I congratulate Ecotrust on achieving the U.S. Green Building Council's Gold LEED green building certification for the Jean Vollum Natural Capital Center. In achieving this key third-party certification, Ecotrust has demonstrated critical leadership and a common-sense approach to utilizing low-impact design while providing a key early example of what now defines successful development in Portland and in the entire Pacific Northwest."
—Portland City Commissioner Dan Saltzman

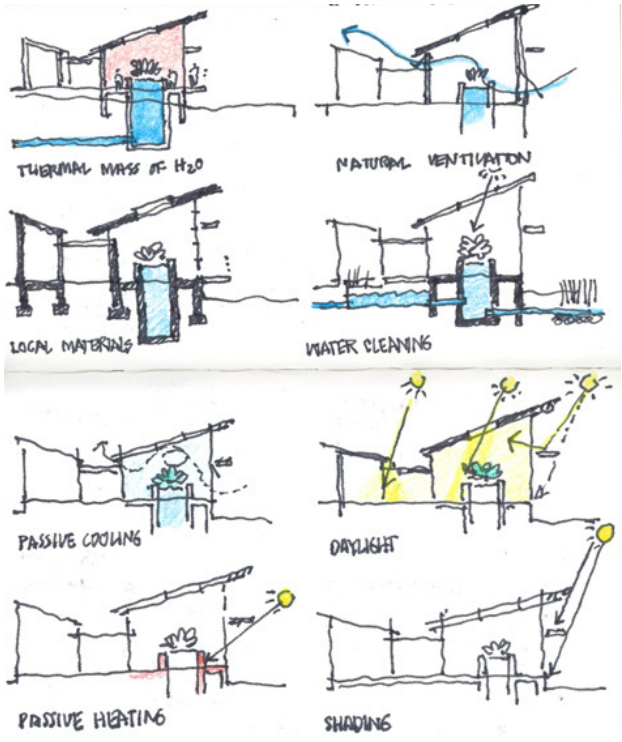
Parking lot used for farmer's markets and other community events

Jean Vollum Natural Capital Center

The atrium design of the Natural Capital Center, as well as the mixed uses promotes interaction and the development of a strong community. This community seemed to form more organically than the strict educational component of the Omega Center. The first floor features a range of businesses - including and outdoor clothing company, 2 restaurants, a health services center and a bank - surrounding a public atrium. The second and third floors provide a public atrium and mezzanine space, a conference center for business and community events and office space for businesses and nonprofit organizations as well as the City of Portland's Office of Sustainable Development. A strong community of environmentally-minded business have their offices here.

Along with hosing community events in the atrium space and conference room, the parking lot is also used during summer months for farmer's markets and outdoor events.

As far as educating its occupants, the building emits a ton of character in all the reclaimed materials used, bringing the building's commitment to sustainability apparent to guests and occupants.



The sustainable strategies are showcased, educating the visitors on these principles

Omega Center for Sustainable Living

The Omega Center had a much clearer social vision - education. Though the primary purpose of the building and site is cleaning water, its broader vision is to be a learning center that is adaptable for future needs. As a laboratory, the building and site are designed to embrace new technologies and emerging research along with educating the users about the processes. For example, the aerated lagoons are on display for all to see, carrying the greywater through the reclamation process.

[CONCLUSION]

I think that both these project offer great lessons learned, with both being the first of their kind in their region. While one is deeply rooted in showcasing the regional craft and traditions in the building industry as well as drawing upon the historical ties, the other uses state-of-the-art technology and current techniques, rooting us deeply in the present.

Although these projects use many similar passive heating/cooling, storm water management and energy efficiency techniques; they vary greatly in their context. Its almost hard to compare them. One was designed for a urban community to work, shop, and congregate; the other was designed for a few visitors at a time to retreat to a peaceful and educational facility. Both appear to successfully utilize sustainable techniques and only time will tell if they truly are fully sustaining.

Furthering their contrasting nature, the Omega Center uses minimal natural resources during the operation, which has a tremendous positive impact, seeing as though 77% of all our electricity comes from operating buildings (architecture 2030).

On the other hand, what is the land worth in natural capital? Can we put a price tag on it? The Natural Capital Center is located in the heart of an urban concentration, utilizing already developed land. This decision to reuse a building is a large move towards sustainability, yet it also has its limitations.

In the end, whether building anew or renovating an existing structure analyzing and monitoring these projects will aid in making healthy decisions for our future and the future of our planet. In the end, I think that both these project offer great lessons learned, with both being the first of their kind in their region. Whether building anew or renovating an existing structure analyzing and monitoring these projects will aid in making healthy decisions for our future and the future of our planet.

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ECO MACHINE / WASTEWATER TREATMENT

1 SEPTIC TANKS –
The first step in the process, this is where the majority of suspended solids in the water are separated out. Naturally occurring microbial organisms living in the water work to digest the sludge that settles to the bottom of the tanks and the now partially clarified water is skimmed off into the Anoxic Tank.

2 ANOXIC TANK (aka ANAEROBIC TANK) –
Here further settling and a process known as anaerobic digestion occur.

3 CONSTRUCTED WETLANDS –
Here the water flows through the roots structure of wetland plants. The plants remove nitrates and reduce the Biological Oxygen Demand (BOD- a measure of the rate at which biological organisms use up the available oxygen) and suspended solids in the water.

4 AERATED LAGOONS –
In this step, additional wetlands plants are suspended in an Aerated Lagoon. In a symbiotic relationship, the plant roots act as a habitat for microbial populations that further scrub the water.

5 SAND FILTER –
This stage is the fi nal "polishing" of the water prior to being reintroduced to the environment. Microorganisms living on and between the grains of sand are fed by any remaining organic compounds in the water.

6 SUBSURFACE DISPERSAL –
At this stage the water is reintroduced to the soil via a subsurface network of chambers. The chambers are fi ooded with the processed water and allowed to percolate into the soil.

BUILDING COMPONENTS

7 RAIN GARDENS –
Here water running from the building roof is temporarily detained during a rain shower while plants work to cleanse the water of contaminants before it enters the Rainwater Cistern or is absorbed into the soil.

8 RAINWATER CISTERN –
Water is stored here to fulfill the Center's yearly water needs.

9 DEMONSTRATION WASTEWATER LAGOON

10 ENTRY VESTIBULE –
This feature works to reduce heating and cooling needs for the buildings conditioned spaces by acting as a buffer between indoor and outdoor conditions. It also helps to reduce the amount of dirt tracked into the building on the shoes of guests.

11 LEARNING LAB –
Part of the Classroom, this area provides a place for visiting students (everyone is a student here) to perform tests and experiments on the water.

12 PHOTOVOLTAIC COLLECTORS –
While being strategically located to reduce the buildings power needs (by shading the building from the summer sun), Photovoltaic collectors provide all of the buildings power needs.

13 METAL ROOF –
Made from recycled metal, the reflective properties keep the interior spaces cooler and mitigate the "heat island" effect.

14 GREEN ROOF –
This living roof system provides additional thermal insulation for the building while protecting the waterproofing material from the elements.

15 WOOD RAINSCREEN SIDING –
Either from FSC Certified or Reclaimed wood, this wall systems allows the building skin to "breathe" and eliminates the need for painting. The wood will weather naturally to a gray color.

16 AUTOMATIC VENTILATION WINDOWS –
To facilitate passive cooling of the Greenhouse, vent windows open automatically when the inside temperature reaches a set level.

17 INTERIOR FINISHES –
Building materials, such as the concrete floor and unit masonry walls, are left exposed and unfi nished where possible minimizing the amount of material and the overall embodied energy of the building. NOTE: Grayed items are shown on other diagrams.

Section Perspective