CBE Livable Building Awards

Chesapeake Bay Foundation

Philip Merrill Environmental Center

SMITHGROUP
architecture engineering interiors planning

PROJECT NARRATIVE

Site:
The site is situated on 31-acres of Chesapeake Bay shoreline, located about 15 minutes south east of Annapolis, MD. Previous to CBF's purchase, the site served as a community pool and Inn and was planned for significant development, creating a negative impact to the Bay.

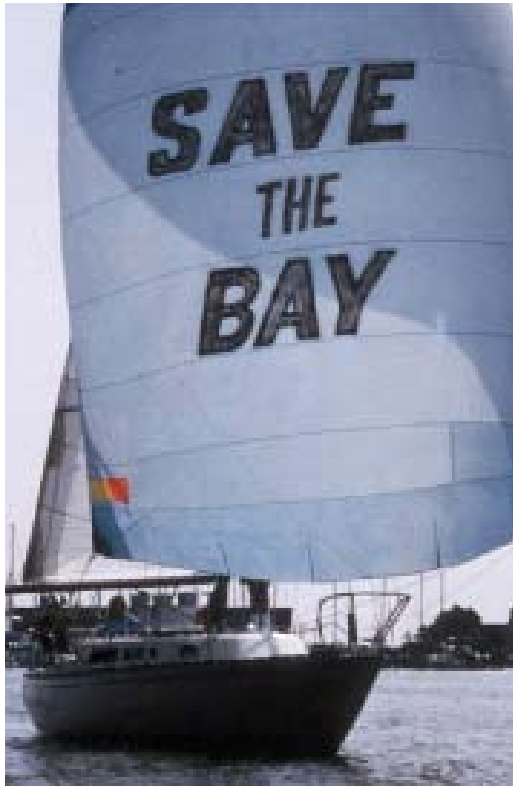
Program:
The project consolidates a 90-person environmental non-profit staff from four dispersed buildings into a single 32,000 sf facility. The interior of the headquarters features open office workstations for all staff members (including the president), dispersed meeting rooms throughout, and an 80-person conference center. The project includes a dining room and kitchen that provides a collaborative atmosphere and allows staff to eat meals on site (lunch is catered every day) rather than having them drive off site for meals.

Goals:
The center was designed to support and explicitly assert the principles of the Chesapeake Bay Foundation's mission – collaboration in achieving a sustainable relationship with the Chesapeake Bay watershed. Goals for design of our headquarters were:

- Creating an inspirational and efficient workspace for staff while supporting on-site education and volunteer training
- Developing the most environmentally sensitive building possible without compromising comfort or beauty.
- Establishing an example for others to create equally "green" buildings
- Being the best neighbor possible. (The center is located in a residential neighborhood.)
- Shaping a workplace and environment from which to monitor and investigate the state of the Bay

Design and Construction:
The design began by master planning the 31 acre site – all but 4.5 acres were set aside under a conservation easement allowing the majority of the site to permanently remain undeveloped. The site was restored to the representative ecosystems found within the Bay's watershed including woodlands, wetlands, and even an oyster reef. To minimize site disruptions, the building and parking lot were sited over the footprint of the former pool house.

The building design connects the Foundation to the bay. The form is strikingly simple. It does not try to compete with a rich site, but neither does it spread out and sink down apologetically. It is composed of two shed-roof structures oriented to the South, harnessing views of the bay, breezes, and the sun's energy for light and heat. One shed is long and narrow, presenting its broad face to the bay, and houses the reception area, offices, and support functions. Another shed structure is pulled away from the south bay-side, equal in height, but much smaller with an entirely square footprint. It serves as the conference space, with an attached staff lunchroom and kitchen. The two structures sit gracefully on slender pilings hovering above the landscape, and are connected by a large deck. Occupants can park under the building, thus minimizing site disruptions typically associated with parking. By expressing the conference space as a separate structure, the consistency of the longer, primary mass is relieved, and the resulting t-shaped building creates a degree of enclosure for the deck while focusing views to the bay. The north elevation integrates three huge rainwater storage tanks into its composition. Formally these provide relief to the expanse of the long north side of the building, marking an entry, but they also function as signage, communicating to visitors the idea that this is not a conventional office building, but one with alternative technologies.



The building interior is organized into four quadrants, two on each floor, each separated by the central lobby and exhibit space. Each quadrant accommodates a different department, whose layout of open workstations is unique to that department. Closed offices were minimized to promote an open exchange of ideas. Open workstations replace closed offices, allowing every employee views of the bay, as well as enabling sustainable strategies such as daylighting and natural ventilation. Meeting rooms and other shared spaces within each department provide opportunities for private dialogues.

Just as the exterior of the building exposed many of the building's environmental innovations, the interior continues this theme. Materials are left raw and unfinished, and ductwork is often exposed, minimizing the use and consumption of finish materials. Much of the time the sense of completeness is provided by choice of material and composition, rather than by conventional finish. None the less, when eco-sensitive finishes such as cork and engineered woods are used, they are able to achieve the same qualities of warmth and familiarity as their conventional hardwood counterpoints.

In construction, the building incorporated a "cradle-to-cradle" rather than "cradle-to-grave" philosophy. This philosophy requires consideration of all materials not only for what they are made of, but what they can be made into at the end of their useful lives. Materials were selected for recycled content (galvanized siding made from cans, cars, and guns, for example). Likewise, materials from renewable or regenerable resources were incorporated (cork flooring comes from the bark of the cork oak tree which can be harvested without killing the tree and regenerates in 7 to 9 years). All wood was either certified by U.S. Forestry Stewardship Council as coming from sustainable harvested forests, or was from renewable resources (like the main foyer's bamboo flooring that is harvested from plants that regrow in approximately three years).

Existing structures on the site were deconstructed rather than demolished and all materials were auctioned, salvaged, or recycled. The existing foundations were chipped and used as road base. Seven loads of chipped concrete were hauled off-site to be reused. The contractor used a construction recycling plan during construction of the building to minimize contribution to landfills. All cardboard, metals, concrete, cmu, asphalt, and land-clearing debris were recycled. Erosion control measures were rigorously enforced to ensure construction sedimentation and erosion did not directly impact the Bay. An air quality management plan was used during the project's construction to minimize dust and debris from collecting inside the mechanical system and to prevent VOC's from being absorbed in porous building finishes. The building was commissioned in 2001 when it opened, and several small glitches in the mechanical controls were identified. Beyond formal commissioning, the center's facility manager fine-tuned the building systems to be as efficient as possible without sacrificing comfort.

Post Occupancy Performance:
Since moving into the Merrill Center in 2000, CBF has done extensive work with the National Renewable Energy Laboratory (NREL). NREL monitored the building's energy and water performance from November 2001 to November 2002. Annual energy usage was measured to be 39.9 kBtu/sf/year, inclusive of plug loads and miscellaneous loads like exterior lighting and elevators. This is 59.0% less than typical office buildings based on 1995 data collected by the Energy Information Administration. The center clearly leads by example and the research done post-operation will be helpful for planning future high-performing commercial building designs.

NREL's monitoring also looked at the building's water consumption. On average, 73% of the Center's water use comes from collected rainwater, and the remaining 27% is supplied by the on-site well. Total water usage at CBF averaged 1.25 gallons/sf/year. According to BOCA Plumbing Code, a conventional office building uses 12.66 gallons/sf/year. Thus, CBF uses ~10% the water of a conventional office building. Such a significant reduction is attributed to composting toilets and rainwater harvesting and reuse at lavatories, clothes washer and mop sinks. CBF reports that the composting toilets work better than expected. While CBF staff doesn't think twice about them, composting toilets are a real interest for visitors. Maintenance is minimal and compost is applied to grounds around the facility. For a 30 acre site that has been restored to native ecosystems, CBF could use all of the compost it can get.

While conserving water and energy, the Merrill Center would also have to be an effective and inspiring work place for the 105 staff who work everyday inside. The study conducted by the Center for the Built Environment at the University of California, Berkeley surveyed 25,000 occupants of 150 buildings to question users' satisfaction regarding air quality, comfort, acoustics and lighting. Of the 150 buildings rated, the Philip Merrill Environmental Center received the second highest overall satisfaction score. Mary Tod Winchester, CBF's Vice President of Administration, states, "The facility is a major recruitment tool. We have much higher level of job applicants and more applicants per job than before we moved here."

The Phillip Merrill Environmental Center has proven to be a cutting - edge teaching tool. CBF has conducted hundreds of tours and continues to receive consistent requests for more . Many of the tours are companies and institutions who are preparing to design / build office space and are interested in learning about the success of the Merrill Center as a "green" working environment. CBF also operates a full-time environmental education program from the Merrill Center and has incorporated a "green building" component into the program. Students, teachers and professionals learn about the Merrill Center's green features and the connection to the environment.

The Merrill Center is a dynamic environment and is still moving forward. CBF has partnered with SIEMENS Building Systems to complete the LEED Existing Building certification. This process will result in improvement of the building's already impressive energy performance.

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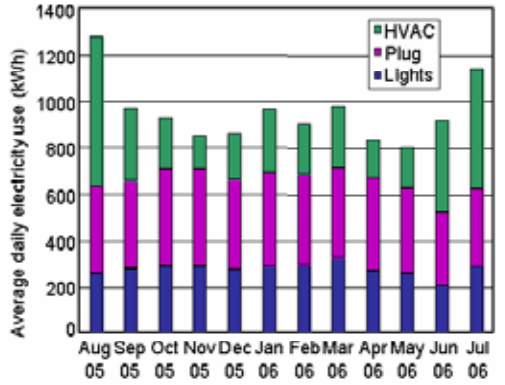
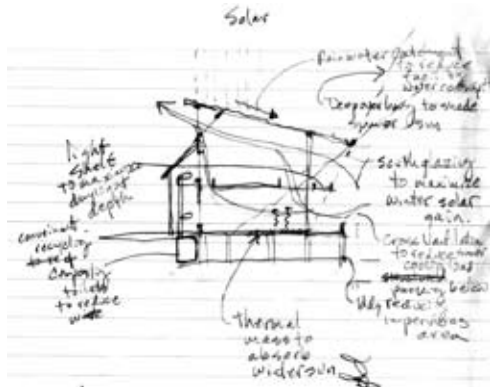
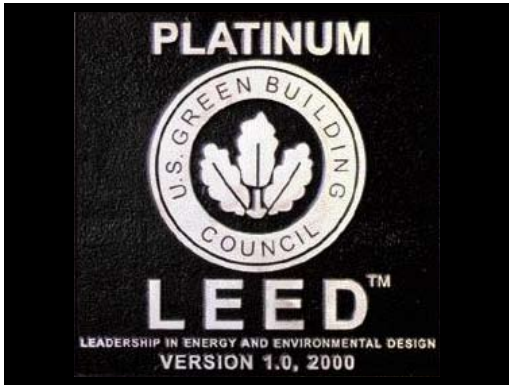






SUSTAINABLE FEATURES

Reduced impervious surfaces – Exterior hard surfaces were minimized by placing a portion of the parking at grade underneath the building. The remaining parking lots use gravel in lieu of impervious asphalt.

Bio-retention filters to treat all stormwater runoff – What little runoff is generated by the gravel parking lots is collected and treated by carefully selected plant material in a bio-retention garden feature within the parking lot.

Xeriscaping and native vegetation landscaping – All landscape material is drought tolerant, native landscaping. No turf lawn is included in the landscaping.

Rainwater Collection, and Reuse – Rainwater from the building's roofs is collected and stored in exposed collection cisterns. Stored water is treated and reused for hand washing sinks, gear washing, and clothes washing.

Composting toilets – Waterless toilets and urinals using the composting process to convert waste to fertilizer used on site.

Mixed-Mode Natural Ventilation System – indoor/outdoor temperature and humidity sensors notify occupants when conditions are optimal for natural ventilation; employees manually open windows and the mechanical system turns off.

A photovoltaic system – a 3 KW array provides electricity for lighting and equipment.

Passive Solar Design – the building harnesses winter sun for heating, but fixed wooden louvers along the south facing porch, shield the summer sun from overheating the interior.

A solar hot water system provides all the domestic hot water for the building, saving approximately 120 kilowatt-hours (kWh) of electricity per day.

A geothermal exchange loop circulates water through 48, 300-foot wells using the earth's stable temperature to regulate indoor air conditions in both winter and summer.

A demand controlled ventilation system will save energy by utilizing CO2 sensors to control the amount of outside air introduced to the building based on building occupancy, optimizing indoor air quality.

Daylighting Including Dimmable Lighting and Daylight Sensors automatically dims artificial lighting on the majority of days when the ample windows provide sufficient natural light.

Occupancy Sensors and Controls used throughout so that lights, equipment, water coolers, and vending machines will be on only when people are in a room.

Energy Management – A computerized energy management system is used to control systems and monitor energy usage.

Efficient Envelope Insulation – To improve the envelope's thermal resistance the design uses low-E coated insulated glass filled with argon between the lites, wall insulation equating to an R-25, and roof insulation equating to R-32.

Parallel strand timber structural system, manufactured from scrap wood and new growth trees that are harvested and quickly regenerated, not old growth lumber. The resulting timber is stronger than conventional wood beams.

Structurally Insulated Panels (SIP's) roof and wall enclosure use high R-value insulating foam in place of conventional wood studs and rafters, resulting in a high performance building envelope that uses a fraction of the wood of conventionally framed structures.

High Recycled-Content Materials including galvanized steel siding and roofing, reclaimed concrete, acoustic ceiling tiles, interior fabrics, and rubber flooring.

Rapidly renewable interior finishes include bamboo and cork - natural resources that grow so quickly they also rate as sustainable, while still providing the texture and warmth of more traditional but non-sustainable hardwoods.

Salvaged wood from reclaimed pickle barrels was used for all exterior wood sun shades, and a portion of the exterior wood trim.

Certified wood / **ACQ treated wood –** All wood used on the job is certified as sustainable by the Forest Stewardship Council. Pressure treated wood uses a treatment process free from chromium and arsenic.

Non-off gassing, non-Volatile Organic Compound materials maintain interior air quality.

Regional materials – Over 35% of the materials used in the building were manufactured within 300 miles of the building site.

Carbon monoxide and VOC sensors incorporated to monitor indoor air quality.

Left: Exterior View from North. Rainwater collection tanks mark the building entry.

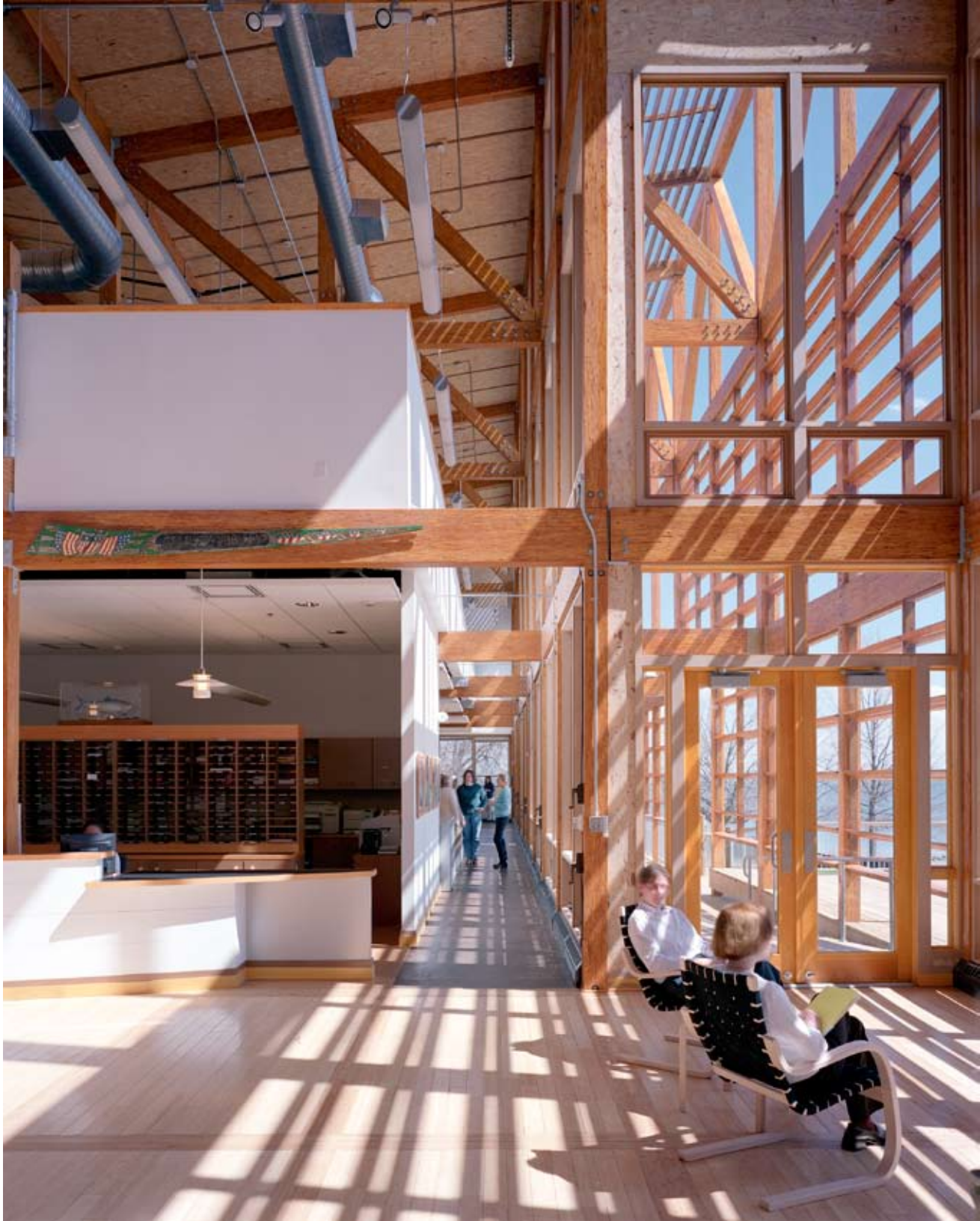
Above/**Below:** A wooden porch shades from the summer sun. View from South.

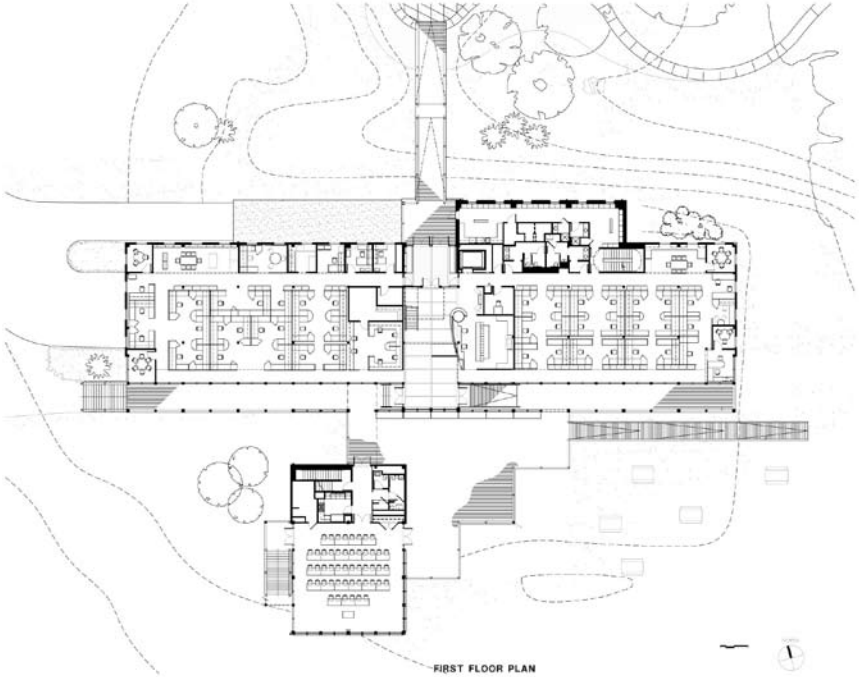
Above: Exterior View from East. A bridge connects the separate conference pavilion to the Headquarter's office.

Below: View from North. Visitors cross a bridge over meadows arriving at the entrance canopy. **Right:** Detail views of South Facade.

Views of the Entrance Lobby. The lobby showcases many sustainable materials, including bamboo floors, MDF millwork, and exposed parallel strand lumber. The reception desk includes a fish tank with a recreation of an oyster reef.

Views of the Office. Open office planning ensures that each workstation has access to natural light, views to the Chesapeake Bay, and natural ventilation. Daylighting strategies reduce dependence on artificial lighting. Cork flooring provides a healthy and sustainable alternative to carpeting.

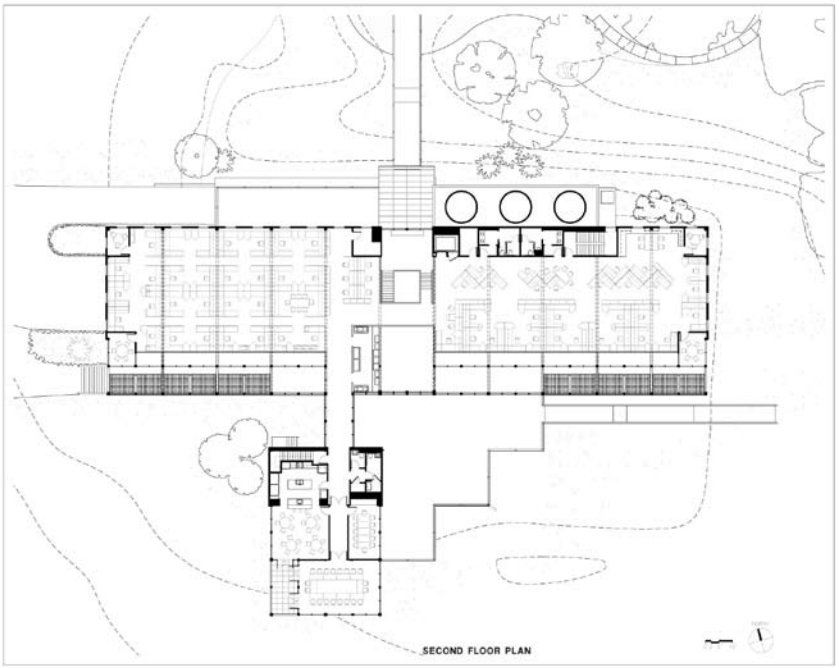




Above: First Floor Plan

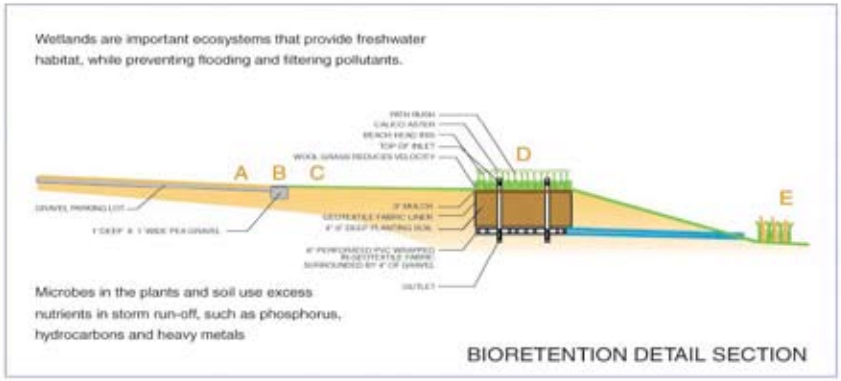
Left: Site Plan

Below: Second Floor Plan



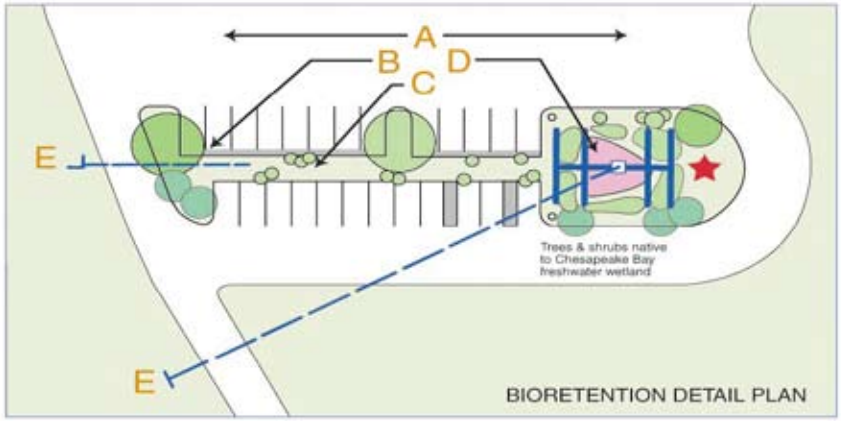
The design phase began with a comprehensive analysis of the Bayfront site. The center was sited to capitalize on views to the Bay, to capture prevalent summer breezes, and to harness the sun for heating. Development was planned over the former poolhouse leaving the undisturbed portions of the site to remain for restoration.

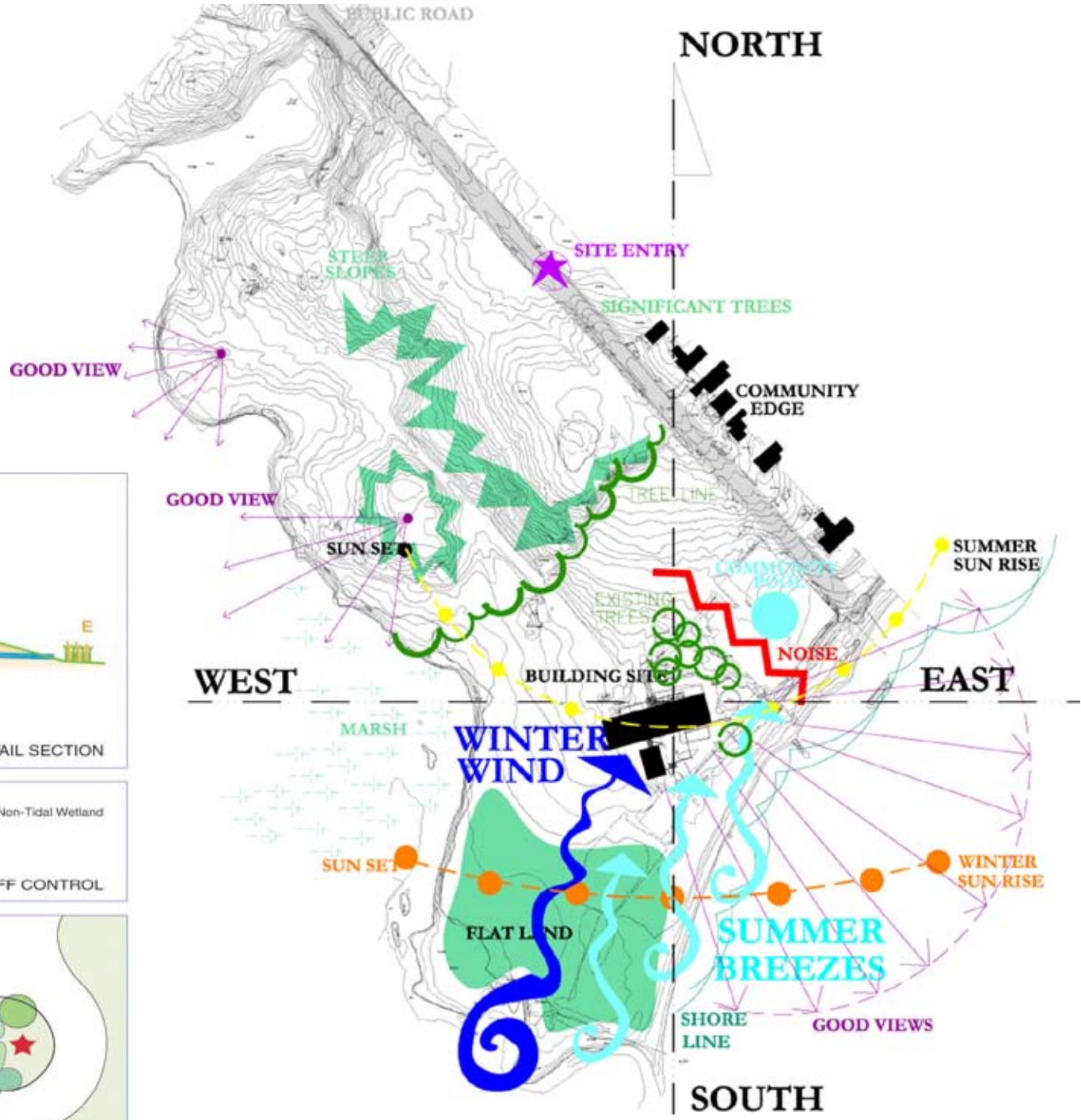
A gravel parking light minimizes stormwater runoff. What runoff is generated is collected and treated in a bio-retention filter.

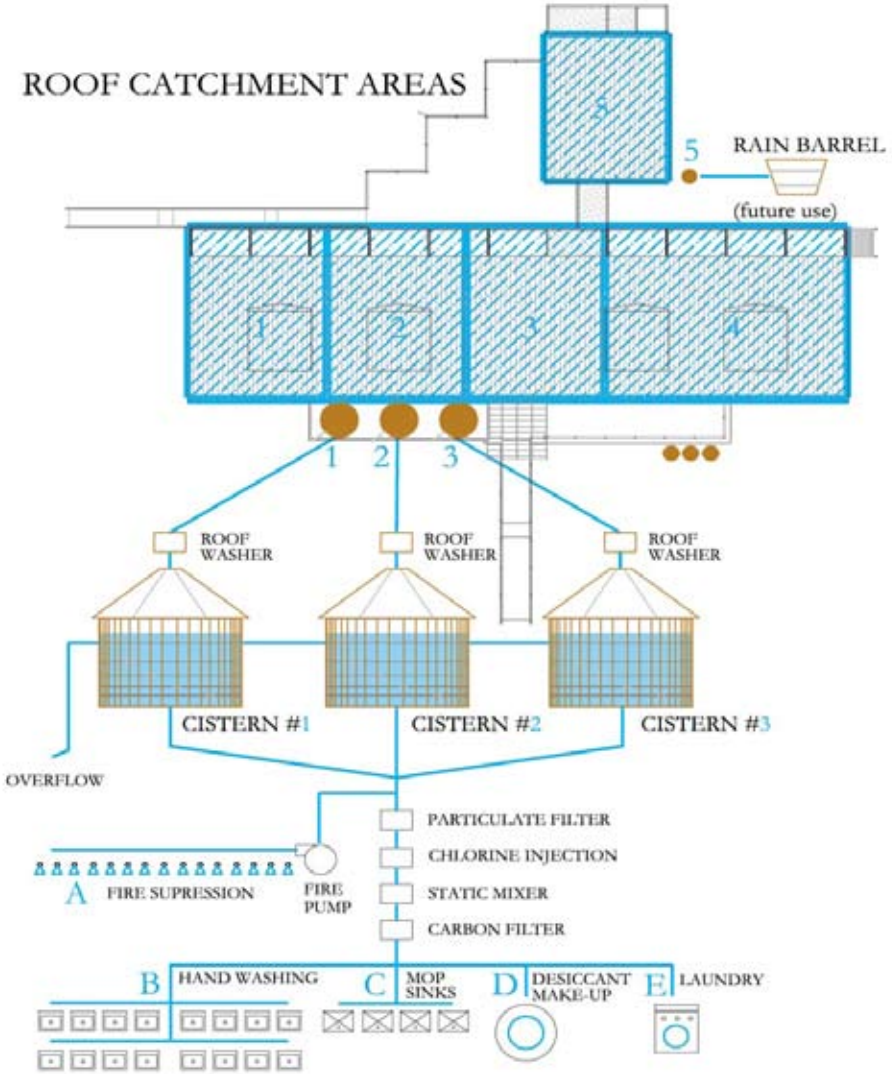


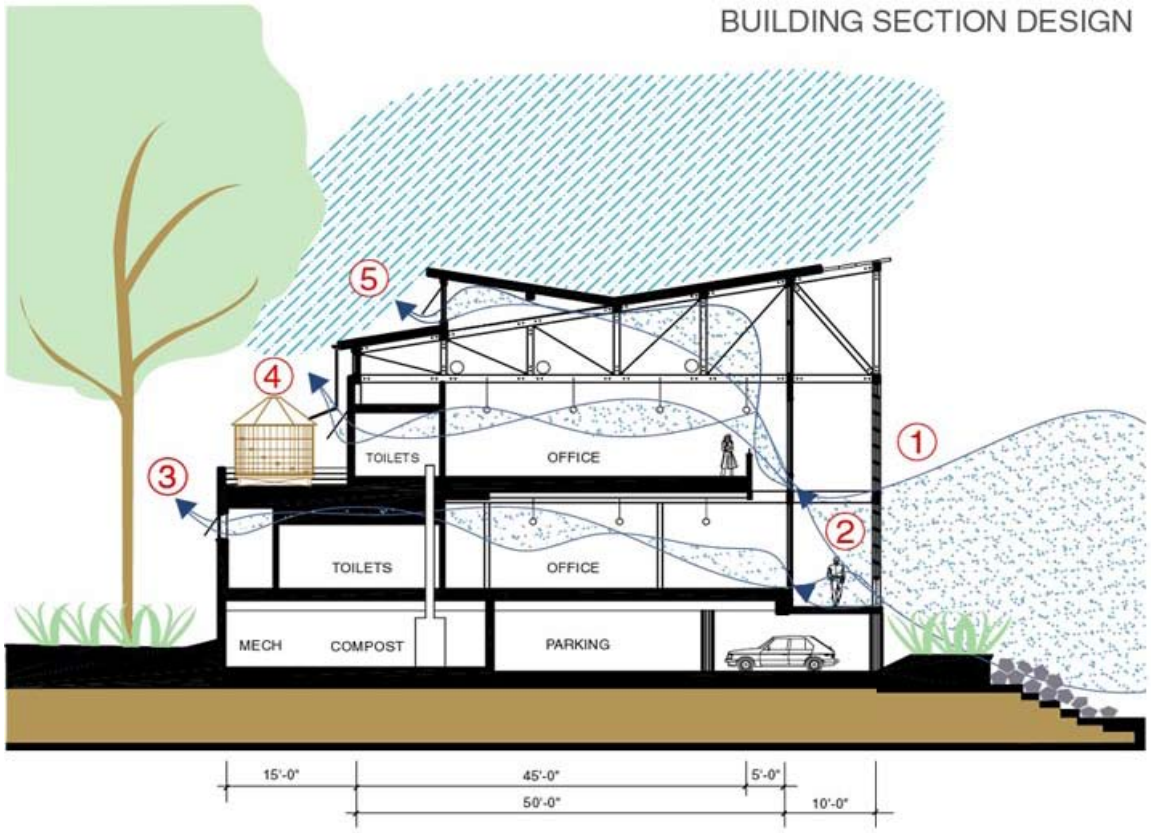
A Gravel Parking Lot
B Gravel Diaphram
C Pre-Treatment Grass Swale
D Bioretention Filter
E Constructed Non-Tidal Wetland

RUNOFF CONTROL







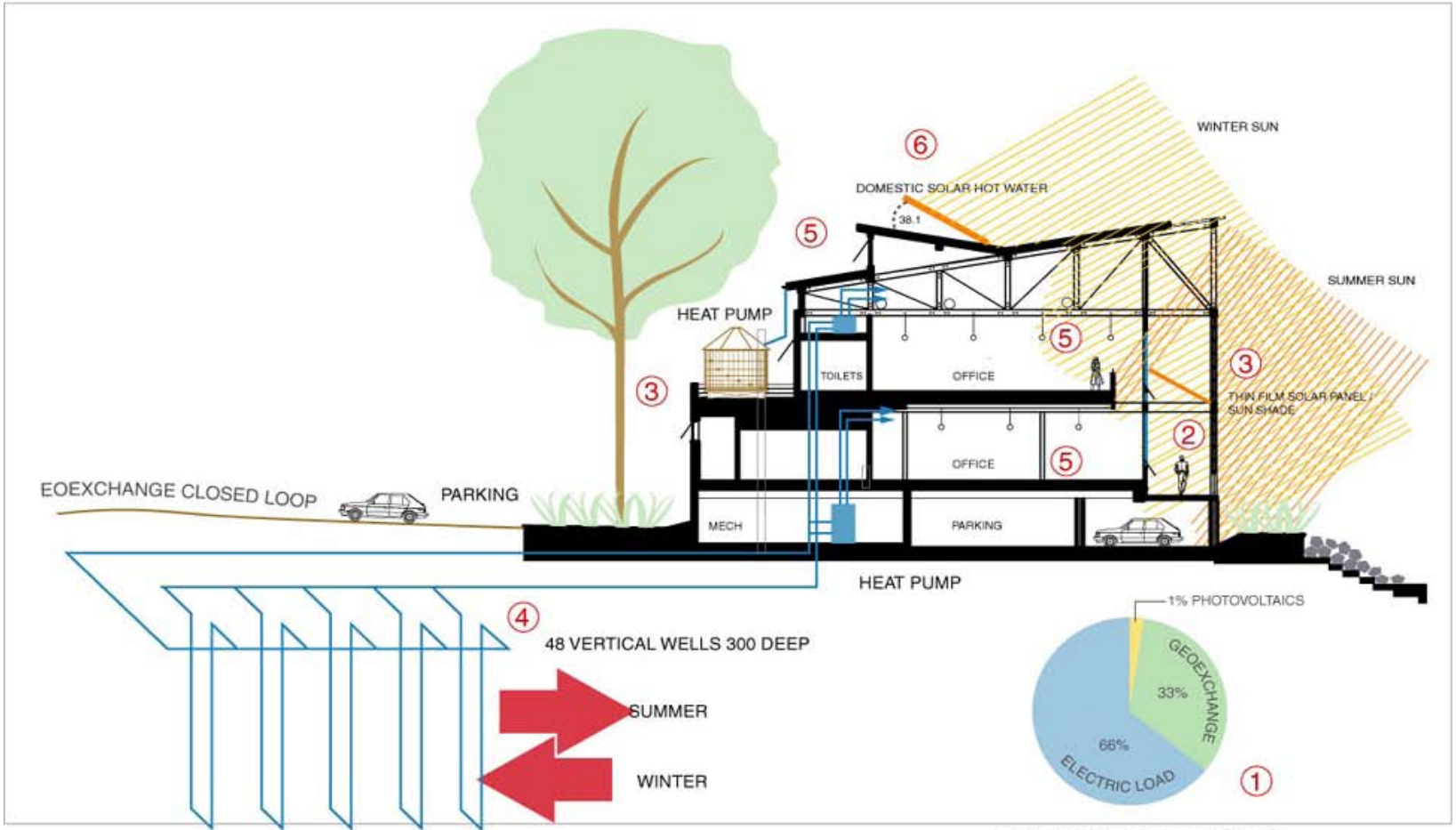


NATURAL VENTILATION

1. Building exposes maximum surface to breezes
2. Awning windows promote airflow into the building at 1st amd 2nd floors
3. Inlet and outlet openings are located in opposite pressure zones
4. Openings on all sides force airflow to change direction increasing ventilated area
5. Lager outlet area than inlet area products higher velocity --- best for hot/humid climates

Rainwater is collected from the Center's roofs, and reused for all allowable functions inside the building - contributing to the buildings low water use.

Natural Ventilation allows the building to be passively cooled for about one third of the year - reducing the building's dependence on mechanical cooling and energy use.



RENEWABLE ENERGY SOURCES

1. Renewable energy sources account for 34% of the building's nergy load, thus reducing its dependance on fossil fuels
2. The building was oriented and formed to maximize natural ventilation through operable windows
3. Photovoltaics systems are integrated with building's architecture as sun shades and skylight
4. Geothermal exchange uses the earth's stable temperature to regulate indoor air condition
5. Daylighting has been maximized by the building's orientation and fenestration.
   Sensors dim and turn-off artificial lighting as daylight satisfies the established light level, thus reducing the electric load.
6. Domestic solar hot water is implemented to reduce energy on heating water

ENERGY PERFORMANCE DATA

Energy use and production have been monitored since the center first opened in December of 2000. Initial energy use in 2001 was elevated since commissioning activities were on-going. By 2002, the building had been tuned for optimal energy performance. Starting in 2003, the building's hours of operation were extended to accommodate staff, and the facility has been increasingly rented out for weddings and social events, extending the days of operation from 5 to 6 days per week on average. This additional usuage accounts for the increase in energy use observed in recent years.

	2001		2002		2003		2004		2005		2006	
	MMBtu	kBTU/ft2	MMBtu	kBTU/ft2	MMBtu	kBTU/ft2	MMBtu	kBTU/ft2	MMBtu	kBTU/ft2	MMBtu	kBTU/ft2
Purchased Electricity	1,312	39.00	1,203	35.00	1,250	37.00	1,246	37.00	1,426	42.00	1,414	42.00
Purchased Natural Gas	244	7.20	106	3.10	65	1.90	182	5.30	152	4.50	97	2.80
PV Production	7.6	0.22	7.3	0.22	3.4	0.10	6.6	0.19	5.4	0.16	5.2	0.15
Solar Thermal Production	95	2.80	144	4.20	139	4.10	149	4.40	202	5.90	156	4.60
Total Purchased	1,556	46	1,309	38	1,315	39	1,428	42	1,578	47	1,511	45
Total On-Site Renewable	102.6	3.02	151.3	4.42	142.4	4.2	155.6	4.59	207.4	6.06	161.2	4.75
Net Energy Use	1,453	**43**	1,158	**34**	1,173	**35**	1,272	**38**	1,371	**40**	1,350	**40**

ADDITIONAL INFORMATION - LEED SCORECARD

The Merrill Center was the first project to earn a LEED Platinum rating, under LEED version 1 - the pilot version of LEED. The scorecard below indicates which credits were achieved.

LEED

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architecture engineering interiors planning

LEED Version 1 - Registered Project Checklist

Chesapeake Bay Foundation Philip Merrill Environmental Center

Planning Sustainable Sites — Yes 8 / No 3

Yes	No		
1		Credit 1	Landscape for Erosion Control
2		Credit 2	Reduce Heat Islands
	1	Credit 3	Infill Development
1		Credit 4	Reduce Habitat Disturbance
1		Credit 5	Site Preservation / Restoration
	1	Credit 6	Efficient Building Location
2		Credit 7	Alternative Transit Facilities
1		Bonus 1	Alternative Fueling Facilities
	1	Bonus 2	Brownfield Development

Safeguarding Water — Yes 5 / No 3

Yes	No		
Y		Prereq 1	Water Conservation
Y		Prereq 2	Elimination of Lead
1		Credit 1	Water-Conserving Fixtures
1		Credit 2	Water Recovery System
	1	Credit 3	Water Conserving Cooling Towers
1		Credit 4	Water Efficient Landscaping
1		Credit 5	Surface Runoff Filtration
1		Credit 6	Surface Runoff Reduction
	1	Bonus 1	Biological Waste Treatment
	1	Bonus 2	Measurement & Verification

Improving Energy Efficiency — Yes 8 / No 3

Yes	No		
Y		Prereq 1	Building Commissioning
Y		Prereq 2	Energy Efficiency
5		Credit 1	Energy Efficiency
	1	Credit 2	Natural Ventilation, Heating, and Cooling
1		Credit 3	Waste Heat Recovery System
1	2	Credit 4	Renewable / Alternative Energy
1		Bonus 1	Measurement & Verification

Conserving Materials & Resources — Yes 7 / No 5

Yes	No		
Y		Prereq 1	Elimination of CFC's
Y		Prereq 2	Storage & Collection of Recyclables
	2	Credit 1	Existing Building Rehabilitation
1	1	Credit 2	Resource Reuse
1	1	Credit 3	Recycled Content
2		Credit 4	Construction Waste Management
1		Credit 5	Local Materials
1	1	Credit 6	Elimination of HCFC's / Halons
1		Credit 7	Occupation Recycling

Indoor Environmental Quality — Yes 7 / No

Yes	No		
Y		Prereq 1	Elimination / Control of Asbestos
Y		Prereq 2	Indoor Air Quality
Y		Prereq 3	Smoking Ban
Y		Prereq 4	Thermal Comfort
2		Credit 1	IAQ Management Plan
2		Credit 2	Low VOC Materials
1		Credit 3	Permanent Air Monitoring
1		Credit 4	Chemical Storage Areas
1		Credit 5	Architectural Entranceways

Innovation & Design Process — Yes 1 / No 2

Yes	No		
	1	Credit 1.1	**Innovation in Design**: Low Water Use
	1	Credit 1.2	**Innovation in Design**: Exceptional Energy Measures
1		Credit 2	**LEED® Accredited Professional**

Project Totals — Yes 36 / No 16

Bronze 22-26 points **Silver** 27-30 points **Gold** 31-35 points **Platinum** 36+ points