



# U.S. Team GREEN BUILDING CHALLENGE 2002

## The Philip Merrill Environmental Center



### Chesapeake Bay Foundation Annapolis, Maryland

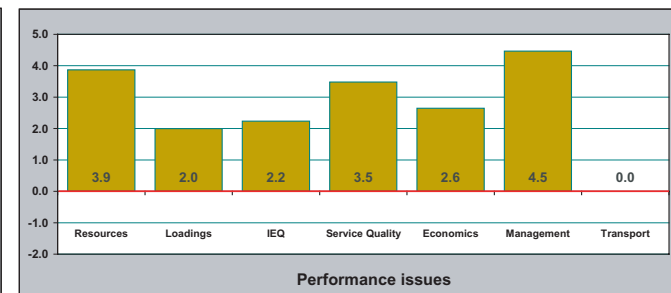
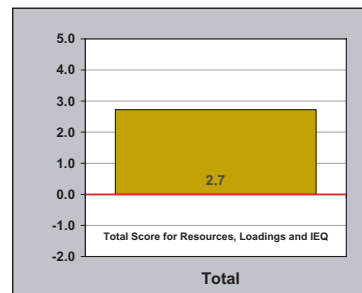
- Building function type:  
Commercial office building
- Location: Annapolis, Maryland
- Completed: 2000
- Owner: Chesapeake Bay Foundation  
[www.savethebay.cbf.org](http://www.savethebay.cbf.org)
- Designers/architects: Smith Group
- Site area: 127,475 m<sup>2</sup>
- Gross floor area, m<sup>2</sup> (32,000 ft<sup>2</sup> = 2,970 m<sup>2</sup>)
- Typical building population: 100 people  
(100,000 members and volunteers visit)

**Description:** A unique holistic design process produced the Chesapeake Foundation's new building. This award-winning, 32,000 ft<sup>2</sup> building serves as a global model of energy conservation and sustainable building techniques. The Center's primary purpose is to "Save the Bay" through resource restoration and protection, environmental advocacy, and education, and this principle was extended to their new headquarters building, which uses two-thirds less energy than a typical office building of the same size.

Energy efficiency features include natural ventilation, which takes advantage of the Bay's breezes to cool the building without relying completely on air conditioning. When sensors determine that the outdoor climate is suitable, the mechanical system shuts down, motor-operated windows open, and "open window" signs signal employees to open their windows. Active solar features produce a portion of the building's electricity using solar-electric panels. Solar water-heating reduces electricity demand.

Flushless composting toilets reduce nutrient pollution from human waste and rooftop cisterns capture rainwater for hand washing and fire suppression. Smart parking design reduces harmful runoff from surfaces by placing parking under the building and using gravel surfacing for parking outside the building. Remaining storm-water runoff flows through a bioretention storm-water treatment system designed to treat oils and then through a constructed wetland. Geothermal heat pumps are used for heating and cooling the building.

Selected Environmental Sustainability Indicators for the Design		per m <sup>2</sup> only	by area & by occupancy
ESI-1	Total net consumption of primary embodied energy, GJ	3.2	31.5 (MJ/m <sup>2</sup> )/(kaph/m <sup>2</sup> )
ESI-2	Net annualized consumption of primary embodied energy, MJ	65	631 (MJ/m <sup>2</sup> )/(kaph/m <sup>2</sup> )
ESI-3	Net annual consumption of primary energy for building operations, MJ	610	5923 (MJ/m <sup>2</sup> )/(kaph/m <sup>2</sup> )
ESI-4	Net annual consumption of primary non-renewable energy for building operations, MJ	604	5864 (MJ/m <sup>2</sup> )/(kaph/m <sup>2</sup> )
ESI-5	Net annualized primary embodied energy and annual operating primary energy, MJ	669	6495 (MJ/m <sup>2</sup> )/(kaph/m <sup>2</sup> )
ESI-6	Net area of land consumed for building and related works, m <sup>2</sup>	2.6	57.8 m <sup>2</sup> /occupant
ESI-7	Net annual consumption of potable water for building operations, m <sup>3</sup>	1	1 m <sup>3</sup> /(aph/m <sup>2</sup> )•yr
ESI-8	Annual use of grey water and rainwater for building operations, m <sup>3</sup>	0	1 m <sup>3</sup> /(aph/m <sup>2</sup> )•yr
ESI-9	Net annual GHG emissions from building operations, kg. CO <sub>2</sub> equivalent	98	950 (Kg eCO <sub>2</sub> /m <sup>2</sup> )/(kaph/m <sup>2</sup> )
ESI-10	Predicted CFC-11 equivalent leakage per year in gm	0.002140	0.020791 (gm CFC-11 equiv/m <sup>2</sup> )/(kaph/m <sup>2</sup> )•yr
ESI-11	Total weight of materials re-used in Design from on-site or off-site uses, kg	339	3297 kg/(aph/m <sup>2</sup> )•yr
ESI-12	Total weight of new materials used in Design from off-site uses, kg	851	8267 kg/(aph/m <sup>2</sup> )•yr





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## High-performance features help the Chesapeake Bay Foundation save the bay.

### A Simple, Healthy Design

Simple, natural approaches to building often result in the healthiest and the most efficient processes and designs. The **shed roof** of the Philip Merrill Center is a traditional indigenous form of architecture, historically visible along the shoreline of the Chesapeake Bay. The shed roof is particularly efficient for this building because it allows for easy collection of rainwater and encourages an open interior design, both important components of this office space. Natural light, views, and fresh bay air are never far from any desk or meeting room. Building occupants use **operable windows** for natural ventilation. Sensors keep track of outdoor temperatures and humidity and automatically shut down air conditioning and open motor-operated windows. Sensors also switch on indicator signs throughout the building when conditions favor open windows. As the bay's breezes cool the building, it relies less on air conditioning.

### Water

Slickly designed Swedish **composting toilets** reduce water use in the building, which is less than 90% of a typical office building this size. A **rainwater catchment system** captures water, also reducing the need to draw from wells. The shed roof, covered in galvanized metal, allows for a single rain gutter, which drains the water through filters and into cisterns. Since only residential taps were available for the area's water system, installing cisterns avoided a massive city infrastructure upgrade. A sand filter treats the rainwater and CBF employees use it for washing their gear and hands and for mop-sinks, laundry, irrigation, and fire suppression.

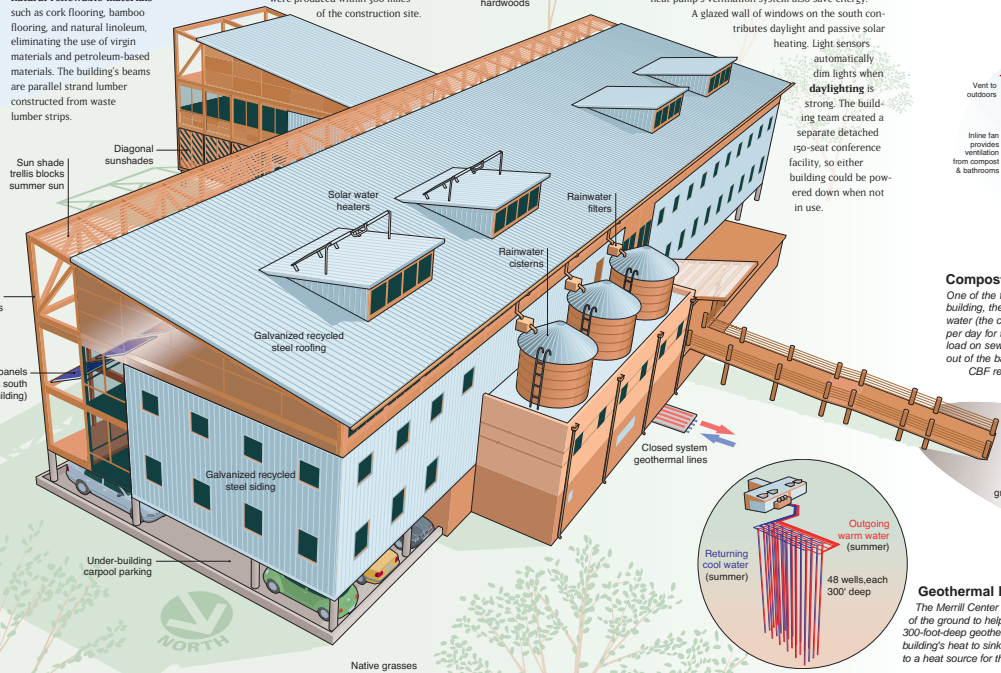
Parking is underneath the building, and a relatively small area designed to meet occupancy and covered by a permeable surface is used for outside parking. Storm water passes through a **bioretention storm water treatment system** in the form of manmade wetlands to filter water and treat oils before the water enters the bay or the adjacent Black Walnut Creek. Drought-tolerant **native plants** minimize irrigation, and mowing meadow and grasslands only once a year reduces fuel use and pollution on site.

### A "Less Is More" Interior

On the interior, unfinished pressed wood fiberboard and the lack of finishes and fixtures reduces resource use and indoor air pollutants. The building team's decision not to fill nail holes on interior finish wood, for example, saved \$30,000. The designers capitalized on the aesthetic effect of a raw looking interior, intentionally emphasizing the beauty of the unfinished look. They also chose **natural renewable materials** such as cork flooring, bamboo flooring, and natural linoleum, eliminating the use of virgin materials and petroleum-based materials. The building's beams are parallel strand lumber constructed from waste lumber strips.

### Recycled Materials

Recycled materials in the building include galvanized steel siding, galvanized roofing, and medium density fiberboard. **Parallel strand lumber**, made from scrap wood that is normally wasted, was used for posts, beams, and trusses. The sun louvers are made of salvaged pickle barrel staves. Reused broken concrete from the previous structure covers the road beds. A majority of materials used for construction were produced within 300 miles of the construction site.



### Energy

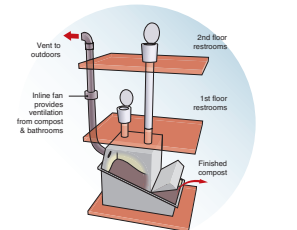
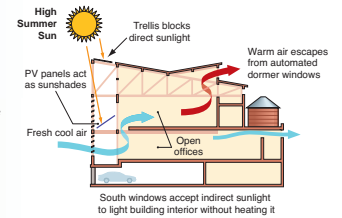
**Structurally insulated panels (SIPs)** form the building envelope, using less wood than conventional framing and resulting in a higher R-value. A SIP consists of foam core 4 to 8 inches thick with faces consisting of oriented strand board (OSB).

Renewable energy sources provide approximately 30% of the building's energy load. **Solar hot water heating** provides all the domestic hot water for the building, saving approximately 120 kilowatt-hours (kWh) of electricity per day. A 4 kWh photovoltaic system helps offset a portion of the building's electrical load.

The Merrill Center uses a **ground source heat pump system** for heating and cooling. Forty-eight wells, each 300 feet deep, use the earth's constant temperature as a heat sink in the summer and a heat source in the winter.

A desiccant dehumidifier and a heat recovery wheel on the heat pump's ventilation system also save energy.

A glazed wall of windows on the south contributes daylight and passive solar heating. Light sensors automatically dim lights when **daylighting is strong**. The building team created a separate detached 150-seat conference facility, so either building could be powered down when not in use.



### Composting Toilets

One of the first uses of flushless toilets in an office building, these composting toilets use hardly any water (the composting mister uses 1 gallon of water per day for the entire system). They also reduce the load on sewage treatment plants and keep nutrients out of the bay because waste does not leave the site. CBF recycles the compost as fertilizer for the native landscaping on site.

### Geothermal Heat Pumps

The Merrill Center uses the constant 54° temperature of the ground to help with heating and cooling. Forty-eight 300-foot-deep geothermal wells provide avenues for the building's heat to sink in the summer, and provide access to a heat source for the building in winter.