The Willow School

Mission Statement

The Willow School, a small, independent coeducational day school for students in kindergarten through eighth grade, is committed to combining academic excellence and the joy of learning and to experiencing the wonder of the natural world. Mastery of the English language is an essential element in an integrated curriculum that helps students comprehend the patterns of how things are connected and prepares them for all areas of their secondary edcuation. The school is dedicated to maintaing an environment where respect for the individual, an outstanding faculty, and an understanding of place foster independent thinking, creativity, responsibility, and integrity. The Willow School education enables children to develop an ethical approach to all relationships, to realize their full potential, and to believe in their power to effect positive change.

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The Willow School's Integrated Building Design Team

Willow School Founders: Gretchen Johnson Biedron & Mark Biedron
Architect: Ford Farewell Mills & Gatsch
Landscape Architect: Back to Nature
Structural Engineer: Harrison-Hamnett, P.C.
MEP Engineer: Joseph R. Loring and Associates, Inc.
Stormwater/Waste Management: Natural Systems International, LLC
Civil Engineer: Apgar Associates
Environmentalist: Natural Logic
Commissioning Agent: Engineered Energy Systems
Building Forensics: Camroden Associates
Lighting Consultant: The Seven Group
Materials Consultant: The Seven Group
General Contractor: Solid Wood Construction, LLC
Site Analysis Consultant: Regenesis Group, Inc.

AN OVERVIEW

The Willow School, a small independent K-8 school, opened in September 2002 with a kindergarten and first grade class in rented facilities. The school is renovating and constructing new facilities on a 34-acre site in the New Jersey countryside, near the Gladstone town center, at the corner of Highway 206 and Pottersville Road. The Willow School has received the United States Green Building Council's Leadership in Energy and Environmental Design (LEED™) Gold Certification.

A chance meeting of Mark Biedron and Anthony Sblendorio, a landscape architect, is what sparked the decision of The Willow School to become a model of sustainability and ultimately to seek LEED™ certification. The initial assessment of the ecological health of the site set off a discovery process for the school's founders about sustainability that followed the proverbial peeling of an onion. This process began after the school's initial architectural drawings were 70% completed.

The health of the site was evaluated in an effort to take the current monoculture forest and accelerate its growth to become more diverse and productive, catching and storing water, nutrients and energy. The goal is to integrate the school within the forested site and re-establish system interconnections.

A Regional Vernacular Response to the Environment

by Jeffrey Brown, Executive Director, Global Learning, Inc.

The Willow School

RENOVATION OF EXISTING BUILDINGS AND THREE PHASED CONSTRUCTION

The original three-story Colonial home is being converted into an administration building, with offices for the head of the school, the office administrator, the advancement department, and the admissions department. The building also includes meeting rooms and a faculty workroom. The library, containing over 3,400 volumes, is temporarily housed in the administrative building. The barn, which is located behind the house, provides space for the mechanical, heating, and electrical systems for the school buildings.

Phase I of the school's master site plan involves the construction of a 13,500 square foot classroom building and site infrastructure including roadways, parking lots, stormwater and wastewater management system, and landscaping. Phase I construction began on April 20, 2002, was completed in September 2003 and documentation for LEED™ certification was submitted in March 2004.

With natural wood siding and barn-like roof, the building conforms to the rural character of the surrounding neighborhood. The interior consists of spacious classrooms to accommodate class limits of 12 students per grade, along with a teacher's lounge, an interim morning gathering space, and interim interior play space. Each classroom opens directly onto the surrounding grounds to facilitate both recreation and field studies as an integral part of the daily curriculum. The overall goal was to create a building that not only houses the students but serves as a model to study responsible living.

Phase II Construction Plans include three more buildings. **The second classroom building & art barn** will accommodate grades three, four and five and include specialized spaces for art and science instruction.

Phase III will include a **classroom building** to house grades six, seven, and eight, a **multi-purpose gymnasium and dining facility with greenhouse**.

The heart of the campus, the **lyceum**, will provide the nucleus for The Willow School experience. Central to the use of the lyceum will be the school's morning gathering, a program that will foster a strong sense of community through frequent and varied opportunities for student interaction.

The Life-Cycle Approach

To select environmentally preferable products, it is necessary to consider environmental impacts from all phases in the product's life cycle. This approach is called life-cycle analysis. A product's life cycle can be divided into the following phases:

– raw material extraction
– manufacturing
– construction
– maintenance/use
– reuse or disposal.

ANALYSIS

This case study is organized according to the four major categories and their subcategories defining "high performance schools," as developed by the New Jersey High Performance Building Design Workgroup (NJHPBDW)[1]: 1) healthy, 2) smart, 3) green and 4) cost effective.

I. HEALTHY - Good Indoor Air Quality Plan

A. No VOC producing products.
B. Ventilation design & standards include windows that open, clerestories that facilitate natural ventilation, and a mechanical ventilation system as well.
C. Two week flush-out of indoor air contaminants prior to occupancy.
D. Shoe cubbies – students remove shoes and wear slippers inside to reduce the tracking in of pollutants from outside.

II. SMART: PROMOTES STUDENT PERFORMANCE

A. Daylighting – strategies include clerestory windows and large windows facing natural areas.
B. Acoustic comfort – acoustic panels above salvaged cypress boards in the ceiling of each classroom help to manage sound.
C. Sustainability Curriculum – The school has made an explicit commitment to sustainability in its curriculum. The school uses the process of design, construction, and operation of its green campus as an ongoing source for developing the capacity for ecological thinking in its students, faculty, and community. Further, it uses the principles of sustainability and sense of place as "integrating concepts" for the curricullum, campus ecology, and community outreach programs. Partnership with University of Vermont's Rubenstein School of Environmental and Natural Resources. The School has entered into an agreement that brings graduate students to work with the school's teachers on the curriculum and to share information, such as results of local water tests, with Willow's students.

III. GREEN

A. Site planning and landscape design
1. The site is being designed not just to preserve elements of the existing landscape, but also to regenerate and re-saturate the site's exhausted soil and re-establish the "sponge" layer.
2. Minimal site disturbance – designed around significant wetlands area; commitment to limit cutting of existing trees.
3. Major replanting program involving native species – 60,000 perennial native grass plugs, diverse wetland plants, and 840 trees. Native grasses have 18" root depth compared with 2-3" roots of turf grass. No fertilizers or pesticides will be used.
4. The grounds will include gardens and woodlands for environmental study, including the creation of varied wildlife habitats.
5. Rainwater harvesting (Water Conservation section - #2).
6. Buildings are sited for passive solar gain.
7. Impervious surfaces will have high albedo to reflect solar heat gain.

Footnote1: The New Jersey High Performance Building Design Work Group exists to transform the market in New Jersey for the planning, design, construction, and operations and maintenance (O&M) of all new and existing buildings through sustainable design practices as measured by accepted standards of sustainable performance such as the LEED™ Rating System.

B. Environmentally sensitive building products and systems
   1. Recycled and salvaged products
      a. 70-80% of the lumber used in construction is salvaged wood.
         i. The structural timber framing is salvaged southern yellow pine beams from a former cotton mill in South Carolina that were cut on site.
         ii. Douglas fir was recycled from salvaged vinegar tanks at the Heinz ketchup factory in Pittsburg and was made into windows and trim by a fabricator in Colorado who specializes in working with salvaged wood.
         iii. Sill plates were made from hard western red cedar planks from Heinz pickle tanks.
         iv. 35,000 linear feet of cypress boards for interior ceilings came from old marine pilings from the North Carolina coast.
      b. 600 tons of hand cut limestone blocks were recycled from demolished barns in Easton, PA for the exterior walls.
      c. Truckloads of macadam removed from Pottersville Road by the Township were used as an under layer for the school's roads instead of a loads of virgin crushed rock.
      d. Granite curbing was salvaged from the side of the road in Connecticut for use as curbing in the parking areas, and salvaged bluestone from Boston is used for the sidewalks.
      e. Salvaged telephone poles for all light poles.
      f. Concrete mix with fly and mineral ash was used to reduce the amount of cement used because cement contains a large amount of embodied energy and also off-gases CO_2, a major greenhouse gas. Fly and mineral ash are recycled waste products from coal fired utility and steel plants.
      g. 100% recycled high density polyethylene (HDPE) piping was used in place of PVC pipes to reduce the use of vinyl.

   2. Locally harvested products – The school's desks and furniture were made from trees harvested from the school's property. The trees were shipped by train to Amish wood workers in Lancaster County, PA by Stubby Warmbold, CitiLog™.

   3. Rapidly renewable raw materials – Cork and linoleum were used for flooring, wheat board cabinets with FSC certified maple veneer.

   4. Terrazzo glass tile made from recycled airplane windshields.

   5. Finishes – The school's indoor air quality (IAQ) plan stipulates the following:
      a. Natural rugs
      b. Linoleum and cork, not vinyl
      c. Ultra low VOC water-based paints, adhesives and sealants
      d. Natural slate countertops

C. Water Conservation

1. Storm water is being managed on site, instead of being dumped into the municipality's storm sewers, with the use of vegetated swales, native plants, and the creation of a storm water wetland and retention basin. This storm water system produced major cost savings over the initial municipal hook-up design.
2. Standing seam metal roofs made from 95% recycled stainless steel facilitate harvesting of rainwater. Water is held in a 50,000 gallon underground tank made from 100% recycled plastic and is used both to water plants and flush all of the buildings low flow fixtures.
3. Waste water is being recycled through a second constructed wetlands based on the concept of a "living machine" for the septic system. A fiberglass septic tank that settles solids will be pumped like a traditional septic tank. Water flows from the tank to a constructed wetlands, where wetland plants are grown hydroponically, and remove suspended solids, phosphorous and nitrogen. Water is then pumped to a recirculating sand filter. When it leaves the sand filter, the water is swimmable quality. It is finally dispersed into the ground, recharging it, through a pressure dosed infiltration field. Because this field is smaller than a traditional leaching field and only 18 inches deep instead of 8 feet, the school is saved 20-30% in initial construction costs on this system.
4. Waterless urinals.

D. Recycling systems and waste management

1. The school is recycled 85-90% of its construction waste.
2. The school recycles paper, cardboard, metals and glass and composts vegetation and food wastes.

F. Energy efficient building shell

1. Insulation R factors.
   a. R19 recycled cotton wall insulation (no fiberglass).
   b. R30 roof Structural Insulated Panels (SIPs).
2. Windows are insulated low E glazing with a solar heat gain co-efficient of .37.

G. Energy efficient lighting and electrical systems

1. Daylighting design: Clerestories and large windows in each classroom with photocell dimming controls.
2. Installed electronically controlled ballasted flourescent lighting.
3. Students will monitor energy usage and be responsible for turning off lights when the room is not in use.
4. Variable speed motors.

H. Energy efficient mechanical and ventilation systems

1. Clerestories provide passive-solar heating.
2. High efficiency gas fire boilers (92%), high efficiency pumps, and outdoor temperature and humidity sensors. Use of heat recovery wheel in conjunction with ventilation system.
3. Radiant floor heating distribution system; allows for lower temperatures of hot water.
4. HVAC systems incorporate a "Hybrid Econimizer Mode". When outside temperature is between 65 degrees Farenheit and 80 degrees Fahrenheit no heating or air conditioning takes place. A green light in the classroom comes on and the students know to open the windows to introduce fresh outside air. The buildings' air handler also introduces outside air during this mode.

I. Renewable Energy

1. The buildings are sited for passive solar heating and lighting. Concrete floors near the large windows act as heat sinks/reservoirs.
2. 12 Kw Solar PV system – Solar arrays on clerestory roofs.

J. Cost Effective – expected cost = $300/sq ft.

Initial changes resulted from the decision to comply with LEED after 70% of the initial drawings had already been completed, and led to increased design costs. The owners also incurred significant expenses to educate local and state officials about innovations such as green building materials and the constructed wetlands wastewater system. Lower operational and maintenance costs are projected.

For more information contact:

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