

Building Design Standards For Renovation Projects

December 14, 2009

Executive Summary

Bowdoin College has had a long standing commitment to sustainability and environmental stewardship; concentrating on issues such as waste reduction, recycling, environmentally preferable purchasing, and energy conservation. One of the fastest growing sectors in the sustainability movement has been within the architecture and building trades. Emphasis has been placed on sustainable site location, water efficiency, energy conservation, indoor air quality and using materials that are either harvested sustainably or made from recyclable materials. As can be seen in Appendix A, Bowdoin had been incorporating sustainable design features into all of its new building projects since 2000, including the construction of Osher and West residence halls, Sidney J. Watson Arena, and The Peter Buck Center for Health & Fitness which have qualified for certification under the LEED™ process.

Bowdoin is publishing these guidelines to provide architects and contractors with a framework for helping us reach our goal of building efficient and environmentally friendly buildings that enhance the wellbeing of the people that live and work in them. These guidelines continue to be a work in progress. They are intended to serve as both a communication and working tool that aids in planning, design, and construction of renovation projects with an appropriate level of attention to economic and environmental concerns. We welcome your ideas, innovation and input to help strengthen the document and make the sustainable design process as clear and efficient as possible.

Bowdoin would like to thank Stanford University and their Offices of Land & Buildings, Facilities Operations, Capital Planning & Management, Environmental Health and Safety, and the University Architect/Planning Office for letting us use their document “**The Guidelines for Sustainable Buildings**” as a template for Bowdoin’s **Building Design Standards for Renovation Projects**.

Implementing Sustainable Design at Bowdoin College

At Bowdoin College, “sustainable buildings” refer to buildings that use energy, water, and other natural resources efficiently and provide a safe and productive building environment. Achieving these goals requires an integrated development and construction process.

Implementing sustainable building construction and renovation practices is an ongoing process. Key elements of implementation will include input from the Campus Planning and Design Committee, supplementing the project architect selection process, and project team education. The guidelines will be reviewed on a project specific case.

Project Architect Selection

The College’s Office of Capital Projects will include sustainable design qualifications as one of the criteria for selecting the design architect and contractor for each project. Requests for Qualifications/Proposals for design architects and contractors will include experience/qualification in the area of sustainable building design and construction and these qualifications will be considered during the selection process.

Project Team Education

Members of the Team (including the contractor and architect) will review these sustainable building guidelines and corresponding checklist in addition to other construction requirements of the College, including the Contract General Requirements and Bowdoin’s Standard Products and Procedures List.

Process

The Project Team will then meet to review these guidelines and checklist to establish an agreement as to which sustainable goals the project is to achieve. The Project Team will meet periodically throughout the duration of the project to review the project checklist and status of each goal.

At the conclusion of the project the architect will issue a written report documenting the final results of the team’s effort.

TECHNICAL GUIDELINES

These guidelines draw heavily from the Stanford University “Guidelines for Sustainable Development” and the LEED™ checklist developed by the U.S. Green Building Council.

The Technical Guidelines are organized into five different categories:

1. Site Design and Planning
2. Energy Use
3. Water Management
4. Materials, Resources, and Waste
5. Indoor Environmental Quality

The discussion of each category begins with a set of goals, followed by a list of suggested strategies to be used in achieving those goals. The strategies included here are not comprehensive; the Technical Guidelines are intended to provide ideas and not exclude any from consideration. The Project Team is encouraged to develop additional strategies.

“Whole Building” Design Approach

Following a category-based presentation of technical strategies potentially applicable to all building types, whole-system design is critical. The categories and strategies are interdependent; none stand in isolation. Decisions made in one area may affect the performance in another. A single design improvement might simultaneously improve several building systems’ performances; for example, careful decisions on building shape and window placement that take into account both prevailing wind and sun angles may not only enhance a building’s thermal performance but can also result in improved daylighting. On the other hand, considering one building system alone without regard to others may result in poorer performance in the other systems; for example, improving indoor environmental quality by increasing outside ventilation may compromise the energy performance of the building. Any conflicts among categories should be resolved by using an integrated design approach; careful decisions should be made to select those designs that can trigger multiple savings or other benefits. It is essential that all members of the Project Team work together and consider all sustainability categories in order to be aware of the influence of their decisions on the overall sustainability performance of the building in each category.

In addition, not all strategies suggested here are relevant for every project and certainly not all strategies will be implemented in every project. Considerations and decisions will have to be balanced by the Project Team and strategies worked out that make sense for each project.

1. Site Design and Planning

Sustainable site planning identifies ecological, infrastructural, and cultural characteristics of the site to assist designers in their efforts to integrate the building and the site. The intent is to encourage optimum use of natural/existing features in architectural and site design of campus buildings, such that the building energy use is diminished and the environment is enhanced.

GOALS:

- Contribute to the cohesiveness of the existing campus.
- Maintain and enhance the biodiversity of natural systems and/or existing character of the site.
- Respond to Bowdoin College's microclimates and natural site conditions.
- Reduce energy use for transportation and site related activities
- Promote sensitive infill development that relates well to both natural systems and existing infrastructure.

STRATEGIES:

Guide Development to Environmentally Appropriate Infill Areas

As much as possible, select a site that:

- Meets the conditions of the approved General Use Permit for Bowdoin College.
- Is characterized as previously developed land.
- Avoids habitat for any sensitive species and species on the Federal or State threatened or endangered list.
- Avoids the loss of mature trees.

Maintain and Enhance the Biodiversity and Ecology of the Site

Integrate the building with the site in a manner that minimizes the impact on natural resources, while maximizing human comfort and social connections. The development footprint should enhance the existing biodiversity and ecology of the site by strengthening the existing natural site patterns and making connections to the surrounding site context. Consider and apply the appropriate strategies below:

- Minimize the impacts of the development process to reduce alteration and ecological disturbance.
- Design this site to reconnect fragmented landscapes and establish contiguous networks with other natural systems both within the site and adjacent systems beyond its boundaries.
- Avoid major alterations to sensitive topography, vegetation, and wildlife habitat.
- Minimize the area of the site dedicated to the building, parking, and access roads.
- Site the building to create traffic patterns that promote non-motorized access.
- Maintain setbacks that effectively utilize the site while respecting surrounding environmental conditions.

Optimizing Building Placement and Configuration for Energy Performance

Place, orient, and configure the building on the site to minimize energy use by means of daylighting, solar heating, natural ventilation, and shading from vegetation or other buildings.

Use Microclimate and Environmentally Responsive Site Design Strategies

Design the site and building to respond to microclimate and environmental conditions. Consider and apply the appropriate strategies below:

- Locate trees and shrubs to support passive heating and to complement cooling in outdoor spaces and buildings and to create seasonally appropriate heatsinks and natural ventilation corridors.
- Locate site features (plazas, patios, etc.) to take advantage of seasonal sun angles, solar access, and solar orientation.
- Locate site elements to maximize heating and cooling benefits, to ensure proper drainage, and to make pedestrian/vehicular movements safe and coherent.
- Design the overall site to reduce "heat island" effects. Exploit shading opportunities, and explore the possible use of high-albedo materials. Consider pervious surfaces for parking, walkways, plazas, etc. Use permeable paving for roads with infrequent use (e.g., fire roads).
- Design site lighting to eliminate light trespass from the building and site.

Use Native or Drought-Tolerant Trees, Shrubs, Plants, and Grasses

Use vegetation on the site that conserves water, reduces pesticide use, reduces plant mortality, and lowers operational maintenance.

2. Energy Use

A building project utilizes energy both during construction and ongoing operation and maintenance. By making its building more energy efficient, Bowdoin College can reduce its energy consumption and the financial and environmental costs associated with the burning of fossil fuels.

GOALS:

- Reduce total building energy consumption and peak electrical demand.
- Reduce air pollution, contributions to global warming, and ozone depletion caused by energy production.
- Slow depletion of fossil fuel reserves.
- Achieve energy cost and related savings due to upgrades to infrastructure.

STRATEGIES: **Reduce Loads**

Optimize Building Envelope Thermal Performance

Design building envelope to optimize thermal performance. Consider and apply the appropriate strategies below:

- Size openings, select glazing, and utilize shading devices (interior or exterior) to optimize daylighting and glare control while minimizing unwanted heat loss and heat gain.
- Optimize insulation to reduce heating and cooling energy consumption by heat losses and gains through the building envelope.
- Moderate interior temperature extremes by using thermal mass where appropriate.
- Ensure the integrity of the building envelope to provide thermal comfort and prevent condensation. Use best air/vapor barrier practices and avoid thermal bridging.
- Reference to Bowdoin College's Standard Products and Procedures List

Providing Daylighting Integrated with Electric Lighting Controls

Ensure that daylighting is designed in coordination with the electric lighting system to reduce energy consumption while maintaining desired lighting characteristics. Consider and apply the appropriate strategies below:

- Shape the architectural plan and section and use appropriation strategies to maximize the amount of useful, controlled daylight that penetrates into occupied spaces (e.g., roof monitors, clerestory windows, atriums and courtyards).
- Use shading devices such as overhangs on south elevations, vertical fins on east and west elevations, and/or vegetation to let in natural light but reduce glare and overheating.
- Use light shelves combined with higher, more reflective ceilings to bring natural light deeper into perimeter spaces and control glare and excessive contrast.
- Select clear films or spectrally-selective low-e glazing to increase daylight while minimizing heat gains.
- Reference to Bowdoin College's Standard Products and Procedures List.

Design Efficient Systems

Provide Efficient Electric Lighting Systems and Controls

Design the electric lighting systems and components to minimize electric lighting energy use while still meeting project requirements and high visual quality. Consider and apply the appropriate strategies below:

- Use high efficiency lamps and luminaries with electronic ballasts
- Use controls to reduce energy use (e.g., dimmers, occupancy sensors, and time clocks)
- Use low levels of ambient light with task lighting where appropriate. Direct/indirect lighting fixtures illuminate ceilings and walls, producing low-level ambient light that minimizes glare in computer rooms
- Use of whole-building lighting management systems
- Reference to Bowdoin College's Standard Products and Procedures List

Maximize Mechanical System Performance

Design the building heating, ventilating, and air conditioning (HVAC) system to minimize energy use while maintaining standards for indoor air quality and occupant comfort. Consider and apply the appropriate strategies below:

- Use central campus steam when building is in the core campus

- Group similar building functions into the same HVAC control zone so those areas can be scheduled separately (e.g., separate around-the-clock areas from classrooms and offices)
- Apply direct/indirect evaporation cooling and/or pre-cooling for conditioned spaces
- When not using central steam, design boilers using high efficiency equipment
- Modulate outside air according to occupancy, activities, and operations. Use occupancy sensors and variable air volume distribution systems to minimize unnecessary heating or cooling
- Use heat recovery systems to reduce heating energy use
- Use of whole-building energy management systems
- Use zero CFC-based refrigerants in HVAC and refrigeration equipment. Phase out CFC-based refrigerants for renovation projects
- Reference to Bowdoin College's Standard Products and Procedures List

Use Efficient Equipment and Appliances

Design and/or select any building equipment to optimize energy efficiency. Consider and apply the appropriate strategies below:

- Use equipment with premium efficiency motors and variable speed drives.
- Select new equipment (including transformers) and appliances that meet EPA ENERGY STAR® criteria.
- Use efficient equipment to heat and supply service water to the building. When feasible, consider use of tankless water heaters.
- Reference to Bowdoin College's Standard Products and Procedures List

Use Energy Sources with Low Environmental Impact

Use Renewable or Other Alternative Energy Sources

Consider the use of alternative energy sources and supply systems to reduce the building's total energy load and minimize environmental impacts of burning fossil fuels such as air pollution and global warming.

- Evaluate possibilities for the use of renewable energy (such as solar water heaters, geothermal heating and cooling systems, and solar walls).
- Evaluate feasibility of geothermal systems.

3. Water Management

Sustainable design dictates that water and its relationship to building design, development and operation are managed carefully. The principle of sustainable building seeks to increase the value we derive from our water resources by designing and operating our structures more efficiently.

GOALS:

- Preserve site watersheds and groundwater aquifers
- Conserve and reuse stormwater
- Maintain appropriate level of water quality on the site and in the building(s)
- Reduce potable water consumption
- Reduce off-site treatment of wastewater

STRATEGIES:

Manage Site Water

Stormwater

Implement an effective stormwater management plan. Consider and apply the strategies below:

- Select a site and develop design strategies that will require minimum alterations and ecological impacts to the watershed.
- Use biologically based stormwater management features such as swales, sediment control ponds, pools, wetlands along drainage courses, and infiltration basins to retain and treat stormwater on site and/or in adjacent areas.
- Retain and/or maximize pervious and vegetated areas of the site.
- Capture rainwater from impervious areas of the building for groundwater recharge or reuse.

Erosion Control

Consider and apply the appropriate strategies below:

- Prevent soil erosion before, during, and after construction by controlling stormwater runoff and wind erosion. Consider silt fencing, sediment traps, construction phasing, stabilization of slopes, and maintaining and enhancing vegetation and groundcover.
- Protect hillsides using adequate erosion control measures such as hydro seeding, erosion control blankets, and/or sedimentation ponds to collect runoff.

Irrigation and Specialty-Use Water

Minimize the need for irrigation. Consider and apply the appropriate strategies below:

- Select drought tolerant plant species
- Use efficient irrigation systems that utilize technologies such as drip irrigation, moisture sensors, and weather data-based controllers.
- Match system to water use.
- Use correct nozzles on irrigation heads.
- Incorporate gray water systems.

Reduce Building Water Consumption

Design strategies and systems to reduce building water use to exceed the requirements of the Energy Policy Act (EPACT) of 1992. Consider and apply the appropriate strategies below:

- Use infrared faucet sensors and delayed action shut-off or automatic shut-off valves.
- Use low flow toilets, preferably dual-flush, that have been tested and rated to function reliably. EPACT requirement: 1.6 gallons (6 liter) per flush (GPF).
- Use waterless urinals or 0.5 gallons per flush urinals. EPACT requirement: 1.0 GFP
- Use lavatory faucets with flow restrictors for a maximum rate of 0.5 gallons per minute (GPM), or use metering faucets at 0.25 gallons per cycle. EPACT requirements: 2.5 GPM.
- Use low-flow kitchen faucets. EPACT requirement: 2.5 GPM.
- Use low-flow showerheads. EPACT requirement: 2.5 GPM.
- Use domestic dishwashers that use 10 gallons per cycle or less. Use commercial dishwashers that use 120 gallons per hour (conveyer type) or one gallon or less per rack (door type).
- Use clothes washers that meet EPA ENERGY STAR ® requirements.
- Reference to Bowdoin College's Standard Products and Procedures List.

4. Materials, Resources, and Waste

From a sustainability perspectives, the best building materials are those that are long-lived, least disruptive to harvest, ship, and install, and are also easiest and safest to maintain and reuse. Sustainable design at all stages of building development, including plans to recycle or reuse construction and demolition waste, can help to further alleviate the pressure on our natural resources and our landfills.

GOALS:

- Reduce consumption and depletion of material resources, especially nonrenewable resources.
- Minimize the life-cycle impact of materials on the environment.
- Enhance indoor environmental quality.
- Minimize waste generated from construction, renovation, and demolition of buildings.
- Minimize waste generated during building occupancy.

STRATEGIES:

Raw Material Extraction:

Use Materials with Low Life-Cycle Cost

Choose those materials with the lowest environmental impact when possible.

Production

In order to conserve embodied energy of materials and reduce the consumption of natural resources, consider and use as much as is appropriate of the following:

- Salvaged materials
- Remanufactured materials, such as engineered wood products
- Recycled-content (post-consumer and/or pre-consumer) products and materials
- Materials with post-consumer recycled content are preferred to those with pre-consumer content.
- Reusable, recyclable, and biodegradable materials
- Materials from renewable sources (e.g., wheat, cotton, cork, bamboo)
- Wood certified by the Forest Stewardship Council

Distribution

Use Locally Manufactured Materials

Attempt whenever possible to obtain materials and products from local resources and manufacturers (within 500 miles of the site), thereby minimizing energy use and pollution associated with transporting material from great distances.

Use

Use Durable Materials

Use products or materials (including masonry, steel, glass, and some timber products such as beams, columns, floorboards, etc.) that are durable (with a life cycle of at least 50 years), weather well, and last more than one building lifetime (i.e., through a remodel or reuse in other buildings).

Conserving Resources

Design for Less Material Use

- Reuse existing buildings when appropriate. Employ design strategies to use fewer materials, including reducing the size of the building and spaces; eliminating unnecessary architectural and finish materials; using modular and standard dimensioning; and using strategies that decrease waste during construction.

Design Buildings for Adaptability

Incorporate interior or exterior design options into the project to facilitate building adaptability. Consider and apply the appropriate strategies below:

- Consider site planning and building configuration to accommodate future additions and alterations.

- Plan for maximum standardization or repetition of building elements and details to increase the ease of adapting the interior structure for future alterations or upgrades.
- Where appropriate use raised floor systems for power and telecommunications wiring to accommodate reconfiguration of spaces and information technology support.
- Use modular space planning, partitions, and furnishings.

5. Indoor Environmental Quality

Research has shown that buildings with daylight, fresh air, and occupant control are consistently rated as more comfortable and contribute to occupants' performance and productivity.

GOALS:

- Provide and maintain indoor air quality, which is defined as: "Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people do not express dissatisfaction." (ASHRAE 62-1999).
- Monitor and avoid indoor air quality problems during renovation, demolition, and construction activities.
- Provide occupants with operational control of windows, lighting and HVAC systems whenever possible.
- Produce environments that enhance human comfort, well-being, performance, and productivity by reducing sick-time.

STRATEGIES:

Indoor Air Quality

Provide a Clean and Healthy Environment

- Comply with ASHRAE/OSHA regulations that pertain to the design, operation, inspection and maintenance of ventilation systems.

Control Moisture to Prevent Microbial Contamination

- Where moisture precautions are needed, materials should be specified to discourage microbial growth.
- Address moisture control on the site, within the building envelope and inside the building.

Provide Ample Ventilation for Pollutant Control and Thermal Comfort

Attempt to adhere with the latest consensus standards that pertain to ventilation and thermal comfort by using strategies to provide appropriate ventilation and thermal comfort:

- Recommend adhering with the latest consensus standards that pertain to ventilation and thermal comfort and current ASHRAE Standards.

Use Low VOC-emitting Materials

Use low or no VOC-emitting materials (including paints, coatings, adhesives, carpet, ceiling tiles, and furniture systems) to help ensure good indoor air quality.

- Reference to Bowdoin College's Standard Products and Procedures List.
- The section instructs contractors to:
 - Ensure that all construction materials, interior finishes and major furnishings installed at Bowdoin College comply with most recent industry standards or regulatory agency Volatile Organic Compound (VOC) emission standards, including specific requirements for carpet systems and paint products.
 - Follow material conditioning procedures.
 - Follow project sequencing procedures (e.g., allow wet products to dry before installing porous products).
 - Reduce dust emissions in occupied buildings through the use of wet methods, etc.
 - Submit Material Safety Data Sheets (MSDS) for EH&S review and approval prior to construction for projects that require:
 - (a) The large scale use of potentially toxic or odor producing products (e.g., roofing material, paint, epoxy), or
 - (b) Projects conducted in close proximity to sensitive areas.

Human Factors

Provide Appropriate Thermal Conditions

Address environmental and seasonal considerations for dry bulb temperature and radiant temperature profile, relative humidity, and occupants' activities and modes of dress.

Provide Effective Lighting

Illuminance Levels: Use design strategies and features to ensure that the illuminance levels and Luminance Ratios are appropriate for the users, activities, and tasks.

Color Temperature: Use design strategies and features to ensure that color temperature, color rendering, and modeling of light are appropriate for the users, activities, and tasks.

Glare: Use design strategies and features (e.g., selection of lighting fixtures, installations, and controls) to avoid glare in ways that support the program, user purposes, and preferences.

Provide Appropriate Building Acoustical and Vibration Conditions

Vibrations: Use design features and strategies to control sources of externally and internally induced vibrations from wind loads, passing traffic, interior foot traffic, building HVAC systems, and interior machinery.

Noise Control: Use design features and strategies to control sources of noise from mechanical and electrical equipment and from sources exterior to the building. Select wall assemblies with appropriately designed ducts, piping, and electrical systems.

Soundscapes: Use design features and strategies to create appropriate sound reverberation levels, background sound levels, sound rendition, and speech interference levels.

Provide Views, Viewspace, and Connection to Natural Environment

Exterior and Interior Views: Use design strategies to provide windows, skylights, and/or clerestories for outside view access from all work areas or regularly occupied spaces or to provide contact with patterns and textures of the natural world through interior recreations (e.g., atria, plazas, courtyards, plantings, and similarly restorative interior design treatments).

Viewspaces: use design features and strategies to create connected interior and exterior viewspaces which provide the proper combinations of spaciousness, privacy, personal security, visual relief, and visual access to routes and settings with and to the outside of the building.

Appendix A

History of Sustainable Building Design at Bowdoin College

Since 2000 Bowdoin has been incorporating many LEED™ type features into new building projects,

- ❖ In 2000 a major renovation of **Thorne Dining Hall** was completed which incorporated several energy conservation and indoor environmental quality features. The 650 seat dining hall was built to operate without air conditioning by including several passive design concepts.
 - The large facility has very high ceilings, operable windows and large operable shades that can be lowered over the windows during the hot summer days - reducing solar gain in the summer months and providing the flexibility to use the solar gain during the heating season.
 - During the heating season the large windows allow sunlight to reach a heat absorbing slate floor, which then radiates thermal energy.
 - Other energy conservation measures, including natural day lighting, variable speed drives on pumping loads, and premium efficiency motors on all equipment were incorporated in the building's Electro/Mechanical design.

- ❖ In the fall of 2001, renovations began in **Adams Hall**, within the College's Environmental Studies Department. Green design was a fundamental feature to the building, as well as the inclusion of student input and research.
 - The majority of the demolition and construction waste was recycled - sent to the Riverside Recycle Facility in Portland where they process and recycle bulky waste. Other ways we recycled the waste included having wastewood recovered as heat and having doors from the old offices set aside to be reused in other areas throughout campus.
 - VOC free paints were used on the walls and trim.
 - T8 bulbs with electronic ballasts were used that allow for switching on/off two of the outside lamps in cross section separately from center lamp. These light fixtures are designed to shine light down, as well as up, which in turn allows the light to reflect off the ceiling tiles to provide even more lighting.
 - FSC certified birch lumber was purchased by the Maine company A.E. Sampson & Son. The birch wood flooring is of the tongue and groove style therefore requiring no adhesive in its installment, and thus no VOCs.
 - Plants have been shown in NASA studies to remove formaldehyde and other VOCs from the air. Therefore, and in accordance with our "green" theme, a planter was designed for the main room of the Environmental Studies Center. The planter itself was made from the same birch wood as the floors and the top was lined with a slate trim. This slate was recycled from the old chalkboards that were in Adams Hall prior to the renovation!

- ❖ In the spring of 2002 the college completed construction of the **Schwartz Outdoor Leadership Center (OLC)**. The strongest environmental aspects of the building are site use, lack of air conditioning, natural ventilation, use of day lighting, and solar radiant-floor heating.
 - The original design for the Schwartz was 15,000 to 18,000 square feet, but was cut down to a little over 5000 square feet. As the architect for the building told us - "The greenest thing is what you don't build!" The site was also chosen very carefully to preserve trees and the natural surroundings by constructing the building close to the road and over an old faculty parking lot.
 - Both the high windows and heat exchange ventilation system, in which the warm air inside the building helps to heat the cold air as it enters, are energy efficient designs that help to reduce heat loss.
 - The kitchen, offices, meeting rooms, and storerooms have little need for artificial lighting, as 90% of the spaces in the building are lit with natural daylight. Solar radiant-floor heating also offers energy savings as well as improving indoor air quality. It works by turning the floor into a large-area, low-temperature radiator.
 - One of the sustainable materials being used for the building is Trex, a recycled plastic that replaces lumber normally used for decks.

- ❖ In the fall of 2004 **Kanbar Hall**, opened on the corner of Bath Road and Sills Drive. The building has many sustainable features integrated into the design.
 - Placing the building on the western portion of the building envelope saved the Bowdoin Pines clustered on the eastern portion of the parcel.
 - Regionally appropriate landscaping design as well as water conserving restroom fixtures reduces the overall water use for the building.
 - The HVAC has variable speed fans and pumping systems to reduce inefficiency. Offices have individual controls for the HVAC as well as operable windows.
 - During construction the College is working with the Institutional Recycling Network to recycle construction debris and keep construction waste to a minimum.
 - Recycled content is included in the steel and ceiling tiles, and Fly Ash is recycled into the concrete mix.
 - The building will be built with Bowdoin Blend red brick, made in Auburn, Maine, showing the College's commitment to using local material whenever possible.

- ❖ In the fall of 2005, the **Osher and West Residence Halls** opened on the corner of South Street and Coffin Street. Many features of the new dorms, including the materials, heating system and rainwater system all contribute to the overall sustainability of the buildings. Features include:
 - Indoor bike rooms and outdoor racks. These easily accessible rooms and racks encourage students to bike to class and into town, rather than drive a few blocks. This allows more parking for visitors, faculty and staff, and cuts down on gas emissions in the Brunswick area.
 - Large windows and skylights that allow light to filter through the building. The impressive amount of natural daylight filtering through the building gave the project LEED™ credits and reduces the need for electricity during daylight hours.
 - The roofs on both buildings are EnergyStar© rated, which means they are white instead of black. White roofs trap less heat, which mean the buildings do not require as much cooling as a typical dorm in hot weather.
 - The rainwater system traps rain in a large tank, where it is purified by ultraviolet radiation and pumped to the toilets. This practice eliminates the use of treated potable water for toilet flushing.
 - The geothermal heating system takes heat out of groundwater, reducing Bowdoin's need for fossil fuels.
 - Individual thermostats are present in each dorm suite, and all windows can be opened to promote maximum student comfort.
 - Many of the materials used in construction are locally manufactured, and are composed of a certain percentage of recycled content (See complete list below). By using recycled materials, Bowdoin helps to create a market for recycled goods, and helps to diminish the need to cut down more trees, build more factories, etc.
 - During the construction process waste was carefully separated so much of it could be recycled, thus reducing the overall amount of waste dumped in the landfill.

Each of the above components garners a certain number of LEED™ credits, which cumulatively allowed the buildings to become LEED™ Silver Certified.

- ❖ In the spring of 2007 the transformation of the Curtis Pool building into **Studzinski Recital Hall** was completed. This project preserved an important campus landmark and enhanced the core of Bowdoin's campus. Key aspects of the approach to sustainable design include:
 - A re-use of the existing building with a new building type that is ideally suited to its open span interior and heavy masonry walls.
 - Reinvention of the previous hardscape of Hyde Plaza into a landscaped quad, increasing the green space of campus and enhancing the cohesiveness of the campus landscape fabric.
 - Advanced mechanical systems designed for energy conservation and acoustical excellence. A geothermal system provides a renewable source of heating and cooling and eliminates the need for a noisy chiller and cooling tower.

- Interior storm windows with high performance insulating glass enhance the thermal performance of the existing exterior shell.
 - Abundant natural light is provided into all major spaces, including the Recital Hall. Special detailing of the laminated glass installed on an angle is employed to allow natural light while preserving the acoustical isolation of the Hall.
- ❖ In the summer of 2007 a major renovation and expansion of **Walker Art Building** was completed. Bowdoin's Building Design Standards for Renovation Projects were utilized to allow the project to include such features as:
- Energy efficient windows and skylights, intended to optimize effective use of natural light.
 - New energy efficient mechanical and electrical systems which utilize geothermal wells for heating and cooling supplemented by the existing steam plant.
 - The spaces are efficiently managed using Bowdoin's Energy Management System (EMS). The EMS provides a very high level of oversight and control of building systems. This is critical to maintain constant temperature and humidity for the art but also significantly reduces the chance that energy will be wasted by poorly performing equipment.
 - A building-wide lighting management system assures proper monitoring and control, saving energy.
 - Low flow plumbing fixtures with motion sensor flushometers and faucets, non-CFC refrigerants, full commissioning of building systems
 - Heat recovery units were installed to utilize recycled heat which will keep attic spaces warm and reduces the risk of condensation.
 - An indoor air quality (IAQ) program was used throughout construction to protect duct work and absorptive materials to guard against mold growth and future IAQ issues.
- ❖ In the fall of 2007 a three-phase renovation of six first year dormitories known as "**The Bricks**" was completed. This major project incorporated several energy conservation and indoor environmental quality features including:
- Re-Use of existing buildings which allowed the construction to divert 38% of the construction waste from landfills.
 - 116 tons of wood, 51 tons of metal and 182 tons of concrete were recycled during the renovations.
 - Indoor bike rooms and outdoor racks. These easily accessible rooms and racks encourage students to bike to class and into town, rather than drive a few blocks. This allows more parking for visitors, faculty and staff, and cuts down on gas emissions in the Brunswick area.
 - Utilized building products which were low VOC, incorporate recycled and post-consumer content, locally manufactured building products and, waste fly ash was used in concrete mix.
- ❖ In the summer of 2008 a major renovation of **Adams Hall** was completed which incorporated several energy conservation and indoor environmental quality features such as:
- Capitalizing on the most sustainable construction strategy of reusing what is currently there. By renovating the existing building instead of building new at an alternate location the College saved natural resources and extended the lifecycle of the building.
 - Following the USGBC guidelines of installing landscaping that does not require irrigation
 - New mechanical and electrical systems which utilize low flow plumbing fixtures, digital monitoring and controls, high efficiency motors, fans with variable speed drives, lighting fixtures with energy efficient lamps with occupancy sensors.
 - The installation of increased building insulation, new skylights and an addition which reduces the need for artificial lighting and replacement of the windows with new low E insulated windows that were designed to match the historic size, shape and character of those being removed.
 - All offices and classrooms are arranged to have operable windows, affording natural light and views to the outdoors and opportunities for natural ventilation.

- ❖ In January 2009 **Sidney J. Watson Arena** hosted its first hockey game. In July of 2009 the project became the first newly constructed ice arena in the United States to earn the coveted LEED™ certification. Sustainable features include:
 - A storm water management system which includes two infiltration systems that divert clean rainwater from the roof into the aquifer, and two retention ponds to remove sedimentation and debris from storm water runoff while minimizing peak flow rates into the watershed.
 - Low-flow showers, faucets, toilets and urinals result in a 38% reduction in water use over that of typical fixtures.
 - 82% of generated construction waste (515 tons) was diverted from landfill to recycling
 - 30% of the building products include pre and post consumer recycled material
 - 40% of building materials came from within 500 miles of the site, reducing emissions from transportation while supporting the local economy.

- ❖ In September 2009 **The Peter Buck Center for Health & Fitness** opened to the campus community. The new facility consists of new Athletic Department offices and associated meeting spaces, free weight, cardio training and wellness areas for use by the faculty, staff, and students. The building also contains the Bowdoin Health Services Center which is predominantly used by students. This project would be the Colleges third LEED™ certified project. Some of the many sustainable features integrated into the design are:
 - Lighting control system which offers cost effective energy savings, and highly efficient lighting fixtures and controls were selected in order to allow the lighting levels to match the needs for specific functions in the various areas.
 - High efficient HVAC equipment offers cost effective energy savings and was selected in order to that exceeds the requirements of ASHRAE.
 - Environmental controls of office and meeting areas is individually controlled to provide a high level of comfort.
 - Installing regionally appropriate landscaping which eliminates the need for irrigation of landscaping.
 - Utilized building products and finishes which were low VOC, incorporate recycled and post-consumer content, and locally manufactured building products.
 - Energy conservation measures including natural day lighting, variable speed drives and premium efficiency motors on all equipment were incorporated in the building's HVAC and electrical system designs.