Hunt's Mills Pump House / Re-Use Study

SUSTAINABLE TECHNOLOGY EDUCATION CENTER

East Providence, RI

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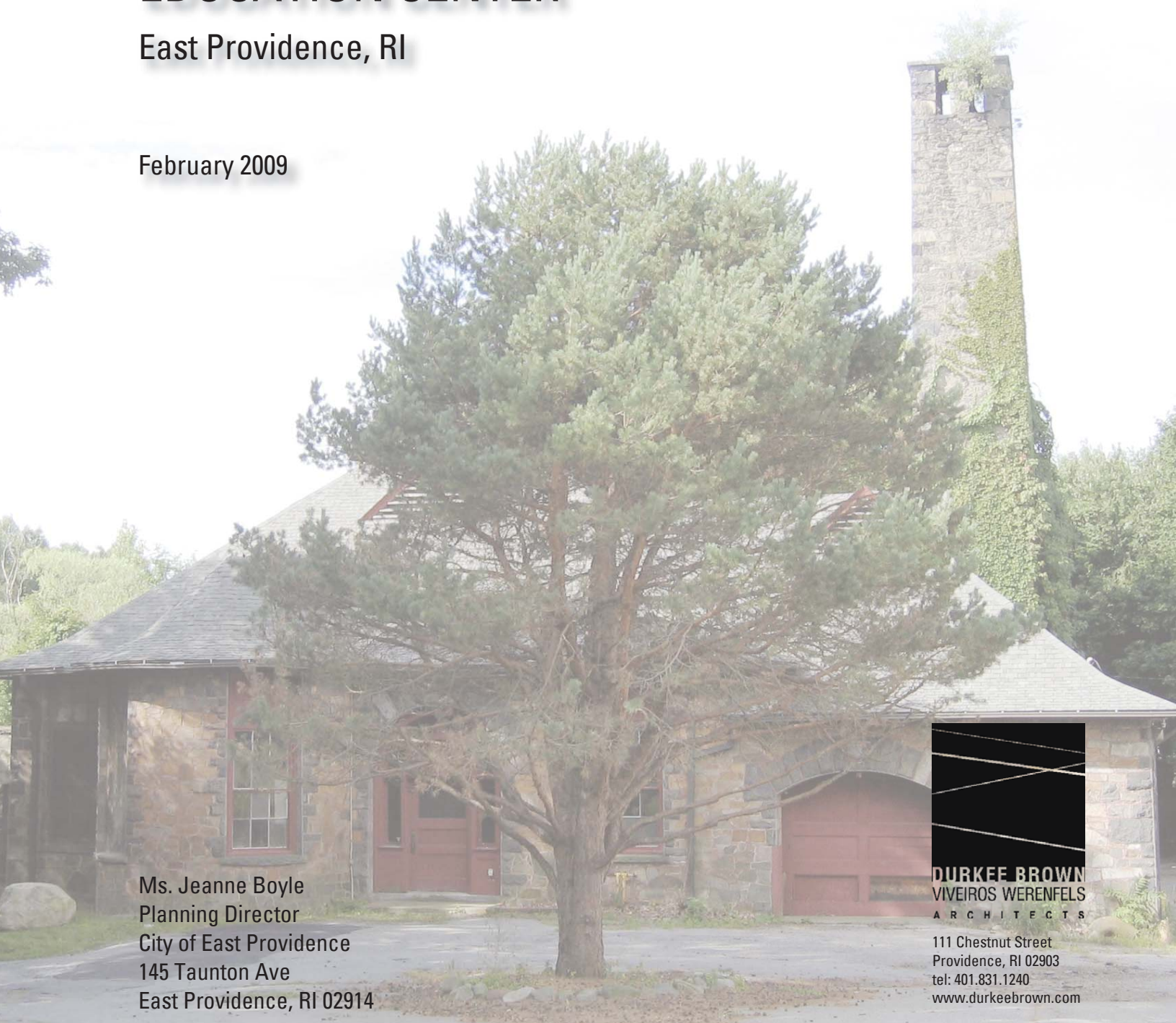

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1. Front Elevation of Pump House

I. PROJECT OVERVIEW

In January 2008 the City of East Providence hired Durkee, Brown, Viveiros and Werenfels Architects to complete a Reuse Study of the historic Hunt's Mills Pump House. Located in a 44 acre park adjacent to the Ten Mile River and owned by the City of East Providence, the Pump House has not been used since 1970.

The Pump House was built by the East Providence Fire District in 1893 to provide pressurized water for their own use and for a manufacturing facility in nearby Phillipsdale. Initially, water that fed the hydro-electric turbine inside the Pump House came from just above the nearby horseshoe dam, however, in the 1930's the Pump House began to draw its water power from the Turner Reservoir Dam so that the increased head from upstream could be exploited.

Compiling a Reuse Study for the Pump House included conducting numerous visits to the site to evaluate the building and its context, reviewing historic records and previously prepared reports, and discussing the project with a wide range of existing and potential stakeholders.

Working closely with the East Providence Planning Department and in conjunction with Vanasse Hangen Brustlin, Inc., consulting engineers, and Edward Connors, consulting historian, DBVW Architects determined that creating a Sustainable Technology Education Center at the Hunt's Mills Pump House is a good use for this historic building. Building upon the fact that the Pump House already contains a turbine for the generation of hydro-electric power, the proposed Sustainable Technology Education Center (STEC) would demonstrate several different types of green technology and green building practices. It would be an important component of the larger development of the Hunt's Mills historic site, which is slated to include walking trails and a bike path. The Sustainable Technology Education Center would attract members of the public, school groups, researchers, and businesses that are interested in sustainability.

II. HISTORY OF HUNT'S MILLS PUMP HOUSE AND SITE

Ned Connors

Hunt's Mills, located in a wooded setting on the Ten Mile River, was an active industrial site for 325 years. Industrial exploitation of the falling water at this location has included the operation of a grist mill and other country mills from the 1640s to 1893, a small-scale, mid-19th-century textile mill, and private (later public) water works from the late 19th century to 1970. Significant industrial artifacts of this long period of use survive along with two historic houses and a building associated with an early 20th-century amusement park at the terminus of a Providence trolley line. The natural and built features of this site present a singular opportunity for adaptive reuse utilizing green technologies, education, preservation, recreation and historical interpretation.

A History of Hunt's Mills

Anglo settlement of the area known since the 1850s as Rumford dates to Roger Williams' flight from the Massachusetts Bay Colony in 1636. The falling water of the Mill River, later named the Ten Mile, offered the possibility of a waterpower site that would provide Williams and his fellow exiles with a grist- and sawmill, necessary for the survival of this remote encampment. For almost a year Williams oversaw the establishment of a permanent settlement on the edge of Seekonk Cove, a brackish wetland where the Ten Mile drained into the Seekonk River and Narragansett Bay. That same year, when the group was notified that it still resided within the borders of Plymouth colony, Williams removed to another waterpower site on the Moshassuck River, a few miles to the west in what was to become Providence.

The abandoned site along present-day Roger Williams Avenue was soon occupied in 1643 by a company of fifty-eight settlers from Weymouth, Massachusetts, under the spiritual guidance of Reverend Samuel Newman. As was common at the time, a rude structure was built to serve as a public building and place of worship. Although some historical accounts place the town's first grist mill at Williams' former site near what is now Omega Pond, it is likely that another water privilege was developed around the same time about a mile upstream where rapids and a large granite outcropping in the Ten Mile offered the possibility of a small impoundment of the river and a mill site. This site came to be known in the 18th century as Hunt's Mills.

Stephen Paine and Israel Sabin, two of the original 58 settlers, were the original proprietors of the privilege that included a grist-, saw- and fulling mill until the fires of King Philip's War destroyed most of the Anglo settlements of the area in 1675. By the late 17th century, the privilege had passed to Henry Sweeting, whose daughter Susannah married one John Hunt. Hunt acquired the property from his father-in-law ca 1712 and operated the mills that came to bear his name. The Hunt House, now home to the East Providence Historical Society, was built by Hunt's son John sometime between 1750 and 1790.

Pre-1893 photographs of the site show a small, frame grist mill at the edge of the Ten Mile on the west side of a horseshoe dam dating to 1866.

2. Historic Image of Hunt House and Horseshoe Dam

This mill was powered by a breast wheel protected by an enclosure on the east side of the building. It is likely that this 19th-century mill varied little in scale from those built at the privilege since the mid-17th century. By the early 19th century, entrepreneurs seeking to replicate the success of Samuel Slater's cotton spinning factory in Pawtucket established waterpower sites on rivers and streams throughout New England. The old industrial settlement at Hunt's Mills found itself one in a series of new textile operations erected at privileges along the Ten Mile. These factories included nearby Dodgeville and Central Mill (upstream) and the Omega Mill (downstream). Another significant development in the settlement of this part of East Providence was the Rumford Chemical Works' relocation in 1858 from Providence to a large tract of land that came to be called Rumford.

The laying out of the Providence and Worcester Railroad along the Seekonk River in 1874 made Rumford Chemical Company's riverfront property an attractive site for large-scale industrial development. The first company to take advantage of the manufacturing and transportation potential of this area bounded by the Seekonk River and the railroad line was Richmond Paper Company. In 1882 this company erected a large, steam powered pulping and finishing plant, damming the Ten Mile below the old Omega Mill privilege and creating a new impoundment known as Paper Mill Pond, later renamed Omega Pond. Richmond failed in 1887, leaving behind a plant that sat vacant for six years until it was purchased by another Providence company seeking room to expand, Eugene Philips' American Electrical Works. The emerging industrial village around the mill was rechristened Phillipsdale.

3. Historic Image of Grist Mill at Horseshoe Dam

Rumford Chemical Works had purchased the Hunt's Mills privilege, buildings and land in the 1870s to draw water from the Ten Mile River. Rumford was the principal owner of the East Providence Fire District, a private water company that built the pumping station at Hunt's Mills in 1893 to provide an adequate supply of pressurized water for their own use along with the needs of the newly-adapted former Richmond plant in Phillipsdale. The company built a penstock immediately above the existing horseshoe dam, feeding this column of water underground to a mixed-flow turbine in the cellar of a new masonry pumping station built on the site of the former fulling mill. The excavation for the penstock as well as the construction of water control structures required the demolition of the grist mill.

The assets of the East Providence Fire District were purchased by the newly-formed East Providence Water Company in 1895. It is likely that at the time of construction the original pumps within the station were directly coupled to the turbine. At some point, probably before 1900, a dynamo was installed to convert waterpower to direct current. The current thus generated was routed to electrical pumps. The Town of East Providence purchased the East Providence Water Company in 1928, roughly coincidental with the sale of the American Electrical Works plant to Kennecott Wire and Cable. The need for an ample supply of water in Phillipsdale had been compounded by the growing number of manufacturing firms along the Seekonk. The Sayles textile interests had established a bleachery and dye works there in 1899. Eugene Philips and George Washburn made a joint investment in the establishment of Washburn Wire in 1901 (later Ocean State Steel). By 1910 a thriving company village complete with a church, school, stores and scores of company-built houses sought water along with these industries.

4. Historic Postcard of Pump House

Suburbanization of Rumford occurred along with the industrial development of the town. The Ten Mile not only provided water for the fire district, it also became East Providence's drinking water supply. Within the first decade of East Providence ownership, the town announced an ambitious plan to create a new dam roughly 1/3 of a mile upstream of the Civil War-era dam. This new impoundment in 1936 would flood the old Central Mill privilege (on the north side of Route 152) and create the James V. Turner Reservoir (the body of water on the south side of Route 152). A 2200-foot long, 66" diameter penstock ran from the west end of the dam to the turbine in the now-enlarged pumping station. The turbine shaft powered an alternator that provided electricity to a bank of water pumps. East Providence maintained the pumping station and its electromechanical works until October of 1970, when the city switched from local water to the growing network of towns drawing water from the Scituate Reservoir. Although the penstock from the Turner Dam to the pumping station has failed, the turbine, alternator, pumps and switching equipment remain in situ. An open tailrace extends southerly from the turbine to a point where it rejoins the Ten Mile River roughly 1000' downstream.

5. Existing Alternator in Pump House (circa 1930)

III. SUSTAINABLE TECHNOLOGY EDUCATION CENTER

A. Why create a Sustainable Technology Education Center at Hunt's Mill?

The Hunt's Mills Pump House was originally constructed for the purpose of housing aparatus for the hydro-elctric power that was being generated by the nearby falls in the Ten Mile River. The building currently contains a turbine, an alternator, and the switch gears and meters that ran when the building pumped water for the City of East Providence. Since hydro-electric power is the reason this building was originally construced, it makes sense to consider hydro-electric power as a key component of its reuse. Combining hydro-electric power with other sustainable technologies as a demonstration project seems like a valuable proposition at a point in time when people are clamoring to learn more about sustainability and "green" architecture. The infrastructure exists; it makes sense to build on it.

B. What is a Sustainable Technology Education Center?

A Sustainable Technology Education Center (STEC) would be a venue for demonstrating different forms of sustainable technology and green building practices. With the generation of hydro-electric power as the centerpiece, other sustainable features such as a photo voltaic array (solar panels), a green roof, a wind turbine, geo-thermal heating and cooling, and composting toilets could be added. The design of the building renovation could also feature natural daylighting, low consumption plumbing fixtures, recycled building products, and low VOC paints. The metering of energy could be set up so that the creation of energy from on-site sources is visible.

C. Who might participate in creating and supporting a Sustainable Technology Education Center?

In order to gauge the level of support for the creation of a Sustainable Technology Education Center, two presentations were made by DBVW Architects to discuss the viability of such an undertaking. The first meeting, held at East Providence City Hall, was attended by the City Manager, several City Council members, planning department staff and other interested stakeholders. The second meeting, held at DBVW Architects, also included several representatives from educational institutions (Brown University, New England Institute of Technology), several non-profit organizations (Ten Mile River Watershed Council, Apeiron Institute, Center for Ecosystem Restoration) and other interested parties such as Woodard & Curran, Hinkley Allen, Struever Bros. Eccles & Rouse, and Conserve by Design.

The consensus at these two meetings was that creating a STEC at the Hunt's Mills Pump House was a good idea and a worthwhile venture, but one that needs a business plan to determine how it will happen and who will participate financially.

IV. SUSTAINABLE TECHNOLOGIES

There are many sustainable elements that could, and should, be incorporated into the design of the proposed Sustainable Technology Education Center. Below are some of the elements that may be included. As the design progresses, it may be decided that some of these elements are not feasible. At the same time, additional sustainable elements are likely to be added to the mix.

A. Hydropower Generation

Hydro-electric generation has existed at the Hunt's Mill site since 1893 when the existing Pump House was constructed. Prior to that time, the power of the Ten Mile River was used to operate a grist mill at this site.

Within the basement of the existing building is a Vertical Francis Unit Turbine made by Leffel Co. in 1924 (144 KW, 225 RPM, 180 KVA). On the first floor is an alternator that was installed circa 1930. While the alternator appears to be in excellent condition, the turbine will probably require rebuilding (or replacement with a new unit) before it can be re-activated.

In 1980, C.E. Maguire Inc. completed a study of the feasibility of creating small-scale hydro-electric generation at Hunt's Mills. The study was

6. Turner Reservoir Dam

based on utilizing the head from both the horseshoe dam at Hunt's Mills and the dam upstream at the Turner Reservoir for a total of 34 feet of net head. This study considered two options: replacing the existing turbine with two new turbines; or refurbishing the exisitng turbine and adding a new one. With two new turbines, the study concluded that the capacity (based on 86% efficiency) would be 285 KW and the average yearly energy generated would be 1,248,300 KWh. (See Maquire study in Appendix.) In addition to the work necessary on the turbines, the 2200 foot long, 66" diameter, penstock that is connected to the Turner Dam would have to be replaced or a new pipe would have to be inserted within it.

The potential to generate hydro-electric power and sell it back to the grid is an exciting one. The amount of income that could be generated from such a venture has yet to be determined and the costs to create an operable sytem are significant. There are also considerable permitting issues that must be investigated and resolved with regard to utilizing the water of the Ten Mile River.

In summary, re-creating hydro-electric power at Hunt's Mills appears to be entirely possible, either by refurbishing the existing turbine or by installing new turbines. However, more information is needed to determine costs, the exact amount of power that can be generated, and what permitting obstacles might exist.

A feasibility study has already been completed by GZA GeoEnvironmental, Inc. for constructing a hydro-electric project at the Dodgeville Dam, which is approximately ten miles upstream from Hunt's Mills on the Ten Mile River. This study concluded that a hydro-electric project quite similar to the one proposed for Hunt's Mills is feasible.

Information gathered for that study might prove useful in further evaluating the feasibility of hydro-electric power at Hunt's Mills.

7. New Horizontal Turbine (blue section) recently installed at Royal Mill, West Warwick

B. Solar Power

Installing one or more photo-voltaic arrays at Hunt's Mills is very viable and, while it would probably not produce excess power that could be sold back to the grid, it could generate power to be used on-site. Photo voltaic solar cells work by directly converting sunlight to electricity. Photo voltaic panels could be mounted directly on the Pump House on south-facing roof slopes (which are limited at this building) or they could be located remotely.

In the site plan in the appendix of this report, a photo-voltaic array is shown to the southwest of the Pump House on top of an existing clearwell tank. The clearwell tank is a remnant of former Pump House operations and consists of a mostly underground tank that is capped with an asphalt-covered "lid". The area of asphalt is approximately 11,000 sqaure feet, thus providing a large clear area that could be covered with photo voltaic panels. More information about the condition of the clearwell tank is necessary to determine the viability of such an installation.

8. Example of Photo-Voltaic Array

C. Wind Power

While a wind survey has not been conducted at the Hunt's Mills site to determine if there is enough wind to support the operation of one or more wind turbines, wind-generated power is worth exploring at this location. Because the site is not coastal and is not elevated, the wind power that could be generated may be limited, however, as a demonstration project, it would be great to include at least one small-scale wind turbine. The amount of energy that is generated relative to the other sources of power on the site could then be monitored and displayed within the Pump House.

9. Example of Small Scale Wind Turbine

D. Green Roof Technology

The flat-roofed addition on the east side of the Pump House provides an ideal location for green roof technology. Green roofs can be installed either as a layered system of components, or as a series of self-contained trays that support plant growth.

Layered green roofing systems typically consist of a waterproof membrane over the existing roof deck and insulation, followed by a layer of drainage material and filter fabric, followed by a layer of growing medium (lightweight "soil") and plant material. Alternatively, self-contained trays that contain drainage material, filter fabric, growing medium, and plants can be installed on top of membrane roofs.

In terms of sustainability, green roofs offer several advantages over conventional roofing systems, including improved thermal performance, protection of underlying roof system (increased longevity), decreased heat island effect due to low reflectivity, and filtration of rainwater.

10. Green Roof, Barcelona, Spain

E. Geo-thermal Heating and Cooling

A geo-thermal system could be installed to provide heating and cooling for the Pump House. Geo-thermal systems are environmentally friendly and represent significant operating savings over conventional heating and cooling systems. Geo-thermal systems work by circulating a water-based solution through a loop system that is buried deep in the ground (usually about 1500 feet deep). Burying the loop takes advantage of the fact that subsurface temperatures are relatively constant. In winter, the liquid in the loop is heated by the relatively higher temperature found under the earth's surface, while in summer, the temperature in the ground is cooler and heat from the liquid is discharged. Initial installation costs of geo-thermal systems are higher, however, significant savings can be realized over time through more efficient operations.

11. Geo-thermal well being dug in front of downtown Providence building

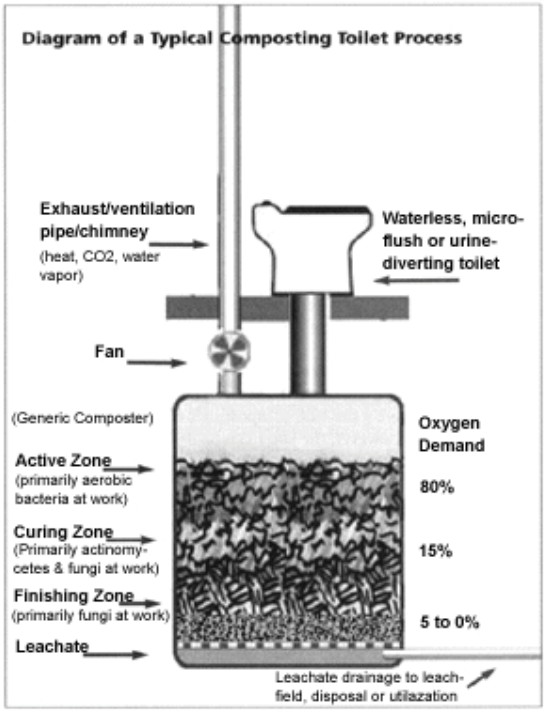
F. Sustainable Water Management

There are several ways in which water can be managed on site to significantly reduce overall water consumption.

Beginning with rainwater, water that falls on the roofs of the Pump House (and perhaps the Hunt House next door) could be harvested for use in plumbing fixtures or for irrigation. Rainwater that is used in plumbing fixtures must first be treated and must reach the fixtures through a dedicated piping system. Water that is used for on-site irrigation can simply be stored for later use.

There are also many options for reducing water consumption by treating waste on site. "Living machines" use plant growth to filter waste products from the effluent generated by plumbing fixtures, much the same way that wetlands filter pollutants from run-off. The filtered water that is produced can be re-used for irrigation, toilet flushing or wash water. Typically, "living machines" occupy greenhouse-type structures where the plants grow and where the filtration processes occur.

Composting toilets, which do not require a water supply, can also be used to reduce water consumption. Based on the process of aerobic decomposition, composting toilets typically feature tanks beneath the fixtures that store and decompose human waste to create an end product that is aerated fertile organic humus. This product must be periodically removed from the tank and is typically disposed of off site.



12. Composting toilet diagram

Composting toilets have been successfully used at Matunuck State Beach in Rhode Island.

If constructing a "living machine" or installing composting toilets are not feasible, then, at a minimum, low-consumption plumbing fixtures should be installed to reduce overall water consumption.

G. Sustainable Building Renovations

When the Pump House is renovated to accommodate the exihibit and educational functions of the Sustainable Technology Education Center, it should be done in as sustainable a way as possible. Whether the project qualifyies for LEED Certification or not (see Section V), it is possible to design the renovations in a way that maximizes the use of environmentally friendly materials and systems and minimizes reliance on fossil fuels. The following is a brief list of elements that can and should be incorporated into the renovation:

- Maximize efficiency of HVAC equipment
- Improve energy performance of windows
  (by refurbishing existing and additing storm windows
  or replacing with appropriately designed new units)
- Optimize energy performance of roofs and walls
- Provide increased ventilation
- Maximize day-lighting and views
- Utilize low-emitting materials
- Utilize recyled and regional materials and certified woods
- Install daylight and occupancy sensors

13. Low partitions allow for natural daylighting and views from all workstations at DBVW Architects' offices

H. Sustainable Site Design Strategies

In addition to the sustainable technologies that will occupy the site (hydro-electric turbines, photo-voltaic arrays, etc.), the design of site improvements can also be done in an environmentally friendly way. The following should be taken into consideration:

- Use pervious materials wherever hardscaping is required.
- Capture and treat stormwater runoff
- Use paving and roofing materials with high refelctivity to reduce heat island effect
- Minimize light pollution from building and site
- Use native species and drought-tolerant plants

I. Sustainable Practices

The following sustainable practices should be followed during construction and once the building is operational:

- Minimize and then recyle demolished building components
- Control site run-off during and after construction
- Commission building energy systems to verify performance
- Store and collect recylables
- Clean and maintain building using environmentally friendly products
- Prohibit smoking
- Encourage the use of public transit, walking and biking

14. Providing bike racks encourages alternative means of transportation

V. LEED CERTIFICATION POTENTIAL

The USGBC (United States Green Building Council) has established a rating system for evaluating the energy performance and overall sustainability of new and existing building projects. By following the LEED (Leadership in Energy and Environmental Design) rating systems, projects can obtain varying levels of certification, with platinum being the highest level and simple certificaiton being the lowest.

Applying for LEED certification is a fairly complex process and is usually done by a LEED Acredited Professional (LEED AP). DBVW Architects has several LEED APs and is able to complete the LEED application process. The engineering consultants and the contractor involved in a project also play important roles in the submission of information for LEED certification. Once a project is LEED certified, it has this performance-based stamp of approval, which is widely recognized as a legitimate threshold for "green" design.

Converting the Hunt's Mills Pump House to a Sustainable Technology Education Center can be done as a LEED project. Since this rehabilitation will highlight green practices and technologies, obtaining LEED certification, particularly at one of the higher levels, will be a good way to have the project officially recognized as sustainable. While studies have indicated that obtaining LEED certification increases the construction cost by only a small percentage, there are additional professional fees involved with submitting all of the application materials.

Whether this project obtains LEED certification or not, it should be done in a way that demonstrates sustainable building technologies and practices and results in a truly green building.

VI. SITE DEVELOPMENT AT HUNT'S MILLS

Creating a Sustainable Technology Education Center at Hunt's Mills is part of a much larger project encompassing the park around the Pump House and creating linkages to other important sites and networks. In the Appendix to this report is a site map indicating the many site features to which the Pump House will be linked.

A. Walking Trails: To the north of the Hunt's Mills site, on the north side of Pleasant Street, is the beginiing of the Turner Reservoir Loop Trail. This scenic walking trail circumnavigates the reservoir and could be connected to walking trails within the Hunt's Mills site.

B. Raised Walkway / River Observatory: The City of East Providence is planning to construct a raised walkway on the east side of the Ten Mile River between Pleasant Street and the Turner Reservoir. This walkway will provide an opportunity for visitors to observe the river and wetlands and could be linked with similar activities at the Hunt's Mills site.

C. Bike Path: There are currently plans to extend an existing bike path along the west side of the Turner Reservoir and into the Hunt's Mills site. Because Hunt's Mills will be the terminus of this bike path, it will bring a considerable amount of activity to the site.

D. Hunt House Museum: Adjacent to the Pump House is the circa 1750 John Hunt House. This Georgian style, wood framed house is owned by the City of East Providence and operated by the East Providence Historical Society as a house musuem. Visitation to the Hunt House and the Sustainable Technology Education Center would offer visitors a glimpse into two earlier centuries and two distinct styles of architecture.

15. Hunt House, circa 1750

E. Caleb Williams Cottage: To the north of the Hunt House and the Pump House is the Caleb Williams Cottage, an early 19th century wood framed building. While it is in need of restoration, the Caleb Williams cottage could provides an opportunity to view yet another historic architectural style and perhaps to accommodate a use that will benefit the park, such as a caretakers' residence or a home for a related non-profit organization.

F. Kayak / Canoe Launch: The Hunt's Mills site is surrounded on three sides by the Ten Mile River. In additiont to providing hydro-power and a terrific scenic amenity, the river offers an opportunity for kayaking and canoeing. A kayak/canoe launch could provide additional recreational opportunities to visitors to the park.

G. Farmers' Market: The northern portion of the Hunt's Mills site borders Pleasant Street, which has a fairly high rate of traffic. Adjacent to Pleasant Street is an open field that could potentially provide an attractive location for a weekly farmers' market.

H. Passive Recreational Opportunities: In addition to the active educational and recreational opportunities described above, the site also provides an opportunity for more passive recreation. It is already well-used by dog walkers and nature enthusiasts. Picnic tables and benches provide scenic views of the river and the site and offer a chance to relax and contemplate nature.

16. Caleb Williams Cottage
circa 1840

VII. CONCLUSION

Creating a Sustainable Technology Education Center at the Hunt's Mills Pump House presents a tremendous opportunity to reuse a significant historic structure and to create a resource for the future. By using this building as a place to showcase new, environmentally friendly technologies, products and practices, a Center can be created that will benefit many sectors of the population, from school children to homeowners to researchers. People want to learn more about sustainability and what better way to provide that opportunity than to create a demonstration project in a building that was constructed in the nineteenth century to generate hydro-electric power?

The STEC will also play a significant role in the larger context of the 44-acre park in which it is located. By connecting to walking trails, bike paths, canoe/kayak launches and other nearby historic structures, it will provide an important focal point within the park.

VIII. NEXT STEPS

This report is the beginning of a process, not the culmination of one. It attempts to lay out an idea for creating a Sustainable Technology Education Center at the Hunt's Mills Pump House and to provide information to consider in moving forward with making this project a reality. There are several steps that should be taken to further evaluate the feasibility of this project.

A. Study of hydro-electric potential: In 1980, C. E. Maguire completed a reconnaissance study of small scale hydro development at Hunt's Mills. This study determined that there was the potential to generate 285 KW of power annually. This study now needs to be updated to take into account current constraints, conditions, and construction costs. A similar study has recently been completed for the Dodgeville Dam in Attelboro, Massachusetts. This study may provide useful information for Hunt's Mills.

B Development of a Business Plan: Before the creation of the STEC can proceed, there needs to be a business plan that outlines how the building will be renovated, how funds to incorporate sustainable technologies will be raised, and how the Center will be operated once it is up and running. Will it continue to be owned by the City of East Providence or will it be transferred to a non-profit entity. Will it be fully staffed or open on a limited basis? There are many questions that need to be carefully considered to ensure this project's success.

C. Phased Renovations to the Pump House: With some minor exceptions, the existing Pump House building is in very good condition. The masonry is generally sound, with the exception of a portion of the south ell; the roofs are in good repair; and the interior is in excellent condition, albeit rather dated. A phased project that addressed the most critical items first should be undertaken. Phase I should include restoration of the exterior of the building as well as installation of basic infrastructure (mechanical, electrical and plumbing systems). In the appendix of this study are drawings of the work that warrants immediate attention.

D. Fundraising: Once a business plan and a strategy for renovating the building are in place, funds will need to be raised to make sure that the project happens in a timely fashion and that as many sustainable elements as possible are included.

1. Pump House: Front (North) Elevation

2. Pump House: Front (North) Elevation Looking East

3. Pump House: East Elevation

4. Pump House: Southwest Corner

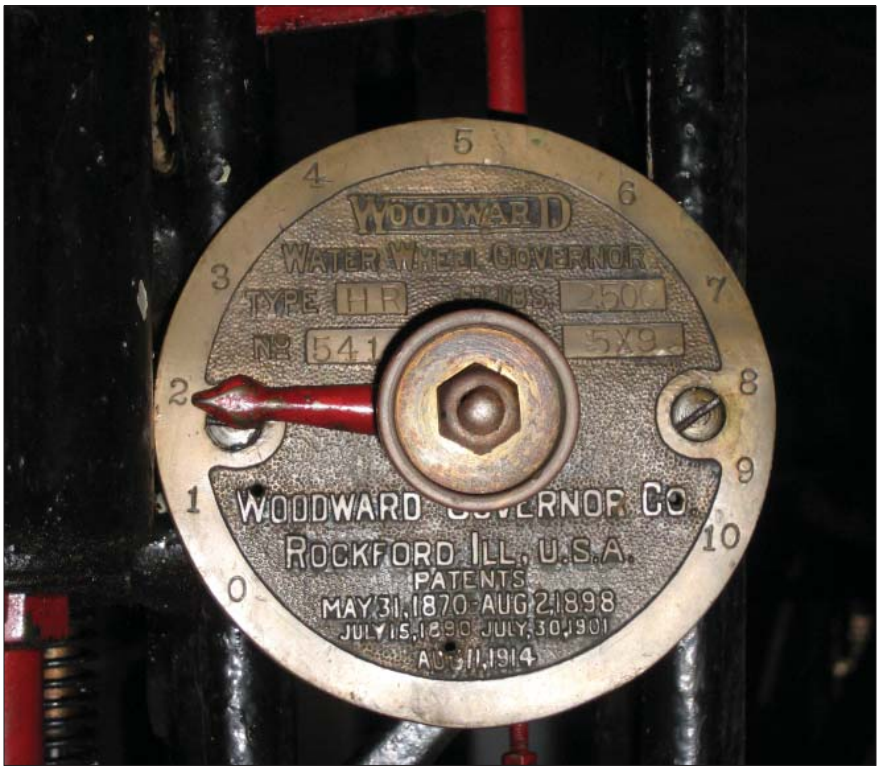
5. Pump House: Interior, Looking North

6. Pump House: Interior, Looking South

7. Pump House: Electrical Switching Gear

8. Pump House: Meters for Measuring Flow Rate

9. Pump House: Alternator (c. 1930)



10. Pump House: Water Wheel Governor

11. Pump House: Penstock Entering North Foundation Wall

12.. Pump House: Access Cover at Leffel Turbine

13. Elevated Settling Tank

14. Top of Clearwell Tank