Reconstructing Green
The Williams College Boathouse

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Introduction

As a school with a large endowment and desire for excellence, Williams is always striving to provide its students with the highest amenities for academic and extracurricular work. This trend is manifested in its interest in modern technology, its recruitment of great professors, and especially in its constant physical construction and renovation. In my years here, I have yet to see a lull in such activity, in fact, it seems to be increasing as time goes on. By building new, state-of-the-art facilities, Williams provides its students with the best resources possible, and attracts further hordes of great students. This constant attention toward renovation and new building provides a unique opportunity for making the campus more "green." Although there are many problems with erecting so many large buildings, if every building built on the Williams campus was LEED certified, the college would be making great strides toward reducing carbon emissions.

In the long-range future there are many buildings (especially athletic buildings) that are slated to be renovated or built, and one of these is a new boathouse for the men's and women's rowing teams. The current John A Shaw boathouse was constructed in 1970 from an old house for ice fisherman. This two floor, 4892 sq ft building was designed to accommodate 25 men and their equipment (see Appendix A: Program Growth Diagrams), back when the college was all-male. Now, with over 80 athletes, 4 coaches, and roughly 10 members of the community using the facility, it is violating many city codes (fire, health, etc.) and in need of some renovations. Its single boat bay, 6 racks, 2 bathrooms (with 3 port-o-johns permanently on site), and small lounge are not enough to

handle so many people, and the equipment that these people require (see Appendix B: Boathouse Floorplans).

Because of the already low energy use of the current facility, the construction of a new boathouse presents a great opportunity to reduce carbon emissions. Although it would undoubtedly grow in size, given the proper design, this facility could use innovative sustainable design and technology to avoid a growth in energy use and carbon output. The team really only uses the facility for boat storage and bathrooms, which doesn't create large energy demands over time. The only real uses for energy in the current building are for lighting, a water heater, a small space heater, and to a lesser extent to charge power tools, cox boxes, phones, walkie talkies, and motor boat batteries. These are small enough to allow for energy self-sufficiency, and maybe even carbon neutrality. There are already several other boathouse facilities that have adopted sustainable and carbon neutral design, and given some creativity and an ample budget, the Williams boathouse could be next.

Similar Existing Projects

Boathouse and general athletic construction throughout the country has readily mirrored the movement to go green. As shown in Chip and Adam's presentation, schools such as Bowdoin College, Haverford College and the University of Connecticut have recently built green athletic facilities, and showed, in short, that it can be done! There are also several sustainable boathouse projects that are in progress, such as the Beckwith Boathouse at the University of Iowa, the RiverEast Center in Portland, OR, and the Carbon Challenge Boathouse for use at the upcoming Volvo Ocean Race.

The Beckwith Boathouse will be LEED Certified, with over 50% of construction waste recycled, 40% of materials used recycled or local, a geothermal system, daylight harvesting, lighting controls, and other sustainable elements.[1] The RiverEast Center takes this idea one step further, obtaining a LEED Gold certification for their work. The converted warehouse project (that includes office space as well) uses 51% less energy than the Portland building code requires, and incorporates design elements such as natural light, a white reflective roof, energy efficient fixtures, use of many of the original warehouse materials, and a complex "Green Street" storm water drainage system.[2] Finally, the Carbon Challenge boathouse goes the furthest by being completely carbon neutral. A portable facility designed for use at each of the 11 stopovers on the Volvo Ocean Race, this boathouse includes natural ventilation flows, shading for climate control, photovoltaics, fuel cells, biofuel generators, composting toilets, and much more. It even purchases carbon offsets to compensate transportation emissions![3] It is essentially the pinnacle of sustainable boathouses, and, with the exception of portability, it is the design to which the new Williams boathouse should aspire.

Construction and Demolition Waste

There are numerous issues to address and ways in which the new facility can become more carbon neutral. One of the preliminary and most important factors is to determine how materials from the current boathouse and from the new construction can be reused and recycled. This C&D (Construction and Demolition) waste includes

[1]Nic Arp, "Regents OK naming of Beckwith Boathouse; Groundbreaking is Wednesday", *University of Iowa News Services,* http://news-releases.uiowa.edu/2008/march/031108boathouse.html.
[2] Peter Guilfoyle, "Key Development" in Transformation of Central Eastside Opens", *Coaxis,* http://www.coaxis.net/about/GeneralRiverEastRelease.doc.
[3] "Cool Actions – Boathouse", *0% Carbon Challenge,* http://www.carbonchallenge.net/cool-actions/boathouse.html.

everything from steel, lumber and concrete to plumbing fixtures and glass. While much of it can be reused in the new facility (boat racks, doors, furniture, etc.), the bulk of the material will need to be recycled. The current building is made largely of concrete and wood, which can both be recycled at numerous locations in the Pittsfield area. After a preliminary search on Earth911, it became clear that there are already 5 recycling centers within a 20 miles of the boathouse that can accommodate these two materials: JH Maxymilliam, Energy Answers Corp., Hancock Drop-off, Daley & Sons, and the Master Garbologist.[4] By locating centers that can take the majority of the matter from the current boathouse, we could cut down on the carbon emissions that would be necessary to bring these materials to separate locations. These centers could collect material from the current structure, as well as old appliances that are too inefficient to be reused. Assuming that it is still safe and useable, much of the concrete can also be used for the new building and parking lot.

Building Materials

Another way in which the new structure can be more environmentally friendly is through the use of local and FSC-certified building materials. Local materials reduce carbon emissions through lower transportation demands, and also help to support small businesses in the area. Middlebury has been leading the way in this effort, recently constructing a library made of almost entirely local materials. Like Middlebury, we could use lumber from the Berkshire region and New York, and get slate from one of several quarries in Vermont. These two sources, and the reuse of concrete from the original structure, could provide for the majority of construction materials needed for the new boathouse, enabling us to easily lower transportation emissions. The new structure should

[4] *Earth911: Making Everyday Earth Day*, http://earth911.org/.

also use FSC-certified lumber, which means that, among other things, it is harvested using sustainable practices and that the trees are replanted.[5] The use of local and FSC-certified lumber, local slate, recycled concrete, and possibly even recycled insulation could less our environmental impact during the building process.

Electricity

Electricity use also presents a challenge in the effort to make the new boathouse totally sustainable. Because the facility is used heavily in the spring and the fall (and virtually never in the winter and summer), the electricity consumption is intense and irregular (see Appendix C: Average year's energy use). While it uses a total of 6333kwh per year (which costs the college roughly $1699), roughly ¾ of that energy is used in a span of 4 months. Thus, it is imperative to come up with an energy solution that combines sustainable production and reduction of consumption in order to provide for this kind of use. The best option for electricity reduction in lighting is to design the building to maximize passive solar gain. Although the current Northeast-Southwest orientation of the structure cannot be changed dues to space restraints, other elements of passive design could be incorporated to reduce energy use. The building is used solely during the day and during sunnier months, so installing skylights and windows could eliminate the need for lighting altogether. The boathouse should also be insulated well, in order to capture this solar energy as heat during the chillier months. By having dimmers and motion sensors on all of the lights, the facility could also reduce energy use during the hours when passive solar gain could be used.

[5] "Principles and Criteria," *Forest Stewardship Council of the United States,* http://www.fscus.org/standards_criteria/

In addition to the light and heat provided by passive solar, the building will need some way of generating energy to charge appliances such as power tools, phones, motor boat batteries, walkie talkies, cox boxes and emergency lighting. Although small wind turbines, fuel cells and biofuel generators all have the potential to fill this role, the most effective way of generating this power would be through the use of photovoltaic solar panels. Such panels have already been set up in several locations around Williamstown, and have been found to produce, on average, between 20 and 30% of their maximum efficiency per year. The 7.2 kW array on the top of Morley Science Center is a prime example of the type of array that would be effective at the new boathouse. Costing the College $70,000 to buy and install (roughly $10 per watt, minus government subsidies totaling roughly 30%), this array produces more than enough energy per year to cover the boathouse's annual energy consumption. Thus, an array of a similar size (or maybe even smaller) would be optimal. The only problem caused by this type of energy production is that it is constant and steady, whereas the energy use of the boathouse is intense and irregular. This could be solved, though, by selling the energy produced by the photovoltaics to the Pittsfield grid, and buying our energy from the grid in return. This solution would be economically beneficial to the College, and make the boathouse technically self-sufficient while still allowing for our varied energy use.

Heating and Hot Water

The new boathouse could also use solar energy to provide a limited amount of hot water and space heating. Currently, the only heat comes from a small hot water tank (to comply with health code) and a small space heater on the second floor. In the new structure, however, the coaches are hoping to install a larger hot water tank, and heating

in one of the boat-bays to enable boat repairs that are temperature-dependant. These objectives can both be accomplished through the installation of an evacuated tube solar system. Such a system uses an array of tubes filled with water (see Appendix D: Attached photo) to collect solar heat, and then circulates this hot water around the building to provide space heating. Estimated to have as high as 50% efficiency, this system can further be complemented by the installation of conductive walls and other surfaces, which will disperse the heat of the water tubes throughout the building. This system would be perfect for the new boathouse because it uses solar energy to not only provide the adequate amount of heating for boat repairs performed, but also the adequate amount of hot water to comply with health code standards. The system also keeps the facility at a constant temperature, which is preferable for the maintenance of equipment and the structure in general.

Water Use and Waste

Another challenge in designing a completely sustainable boathouse is water use and waste disposal. The current building has access to the Pittsfield sewage line, making it most cost-effective to take advantage of that amenity for the new structure. However, it is still important that the building cut down on water use, in order to preserve this resource and produce less waste generally. Currently, water is used for the toilets and sinks, and to clean the boats. Like electricity, the water is rarely used in the summer months, and cut off completely during the winter. The pipes are drained between the months of November and April, as there is no one there to use the facility. In order to address the water use for toilets, the best option is to install low-flow toilets and waterless urinals in the new boathouse, similar to the ones in Kellogg House and the new building

projects. These appliances would use little water (waterless urinals use none, low-flow toilets use roughly 75% less than those in current building), and thus produce less waste. The new building should also use improved, no-leak hoses and sinks with aerators, in order to reduce water that is leaked, lost, and otherwise wasted.

Landscaping and Drainage

Another aspect of water management in new facility is the way in which storm water is captured and used. Currently, there is little to no drainage on site, causing serious amounts of mud and even flooding on occasion. This must be improved for the future project, so as to increase not only the sustainability, but also the efficiency of the site. Similar to that used in the Beckwith Boathouse and RiverEast Center, absorbent landscaping, parking lots and drainage systems could be installed to adequately handle the full storm runoff. Also, it may be possible to collect the storm water, and reuse it in toilets and to wash boats, which could alleviate the water use problem. In order to absorb stormwater, we could install a green roof on the facility, which would also provide insulation, and even provide additional space for athlete use! This tact has been successful in numerous facilities globally, including the Atwater Commons Dining Hall at Middlebury. Although there would limited space on the roof of the new boathouse (especially with the installation of PV panels and an evacuated tube system), such a roof might be beneficial in order to alleviate the storm water runoff problems associated with new construction and this site in general.

Team Transportation

Lastly, in order to make the sport and facility more carbon-neutral, it is important to address the carbon emissions created by the team's travel needs. Each day in the fall

and spring, roughly 80 rowers travel between the Williams campus and the boathouse, using 2 school busses and occasionally personal cars. This creates enormous carbon emissions, and supports the US dependence on oil and other fossil fuels. In order to cut down on emissions and gas use, the college should look into vehicles that run on other fuels, such as strait biodeisel (refined vegetable oil) and waste vegetable oil. Waste vegetable oil busses present an interesting solution, especially because they run on a fuel that is already a waste product of the college. Although the college does not currently own any of its own, school busses could be purchased used and then retrofitted to accommodate such fuel use. They could collect waste vegetable oil and grease from the dining halls, and in conjunction with a little diesel, fuel their busses with a cost of two to five cents per mile! Dartmouth engineering students have already proven this type of retrofit to be cost effective and green, almost completely eliminating the carbon emissions of the bus that they purchased. By following suit, Williams can continue to provide transportation for the crew teams, while increasing environmental awareness and greatly cutting down on their carbon emissions.

Challenges and Potential for Success

Despite these proposed possibilities and the potential for sustainable building, there are still several challenges that face this project. One of the most serious ones is that of space. The current boathouse sits on an incredibly small plot of land, surrounded by occupied houses, apartments, and a marina (see Appendix E: Zoning map). Because of the amenities offered at the current site (access to sewage and the electricity grid, proximity to campus, etc.), it would also make little sense to move completely. And, although the college has looked into buying adjacent pieces of land, for the sake of

planning, it seems likely that the new building will be restricted to the current plot. These spatial and location restrictions present problems with providing the design features discussed above, while still complying with the Pittsfield building code. Building code for Zone R-6 (the location of the boathouse) states that buildings may not be higher than 35 ft, cover more than 50% of their property, or be within 10ft of the property line.[6] Seeing as the current boathouse is already 22 ft high and very close to property lines, this leaves little room for further construction. It will be thus be difficult to adequately incorporate elements such as passive solar, green roofing, and innovative drainage unless the property is expanded.

It will also be important to look at the budget needs of constructing the new boathouse in a sustainable fashion. This project has already proven to be attractive to donors, with over a million dollars being allocated to the cause. However, because the boathouse is not a facility that many people use, something that will generate good PR, or even a facility on campus, it is unlikely that the College will encourage the use of these donations on green technology. Thus, it is important to alert donors to the sustainability potential of this facility, and ensure that they support constructing the new boathouse to be a carbon-efficient building. It is also notable that a good portion of this budget must go toward Safety and Building Code measures to which the John A Shaw boathouse was never subject. According to Stephanie Boyd, the new building would need everything from safety lights to ventilation to an elevator, which would take a toll on any donations collected. These requirements would increase the needed budget for the project, and thus

[6] "Code of the City of Pittsfield, MA," *City of Pittsfield,* http://gcp.esub.net/cgi-bin/om_isapi.dll?clientID=116644&infobase=pi1888.nfo&softpage=Browse_Frame_Pg42.

necessarily increase the amount of money collected from donors and the amount of time before the facility is built.

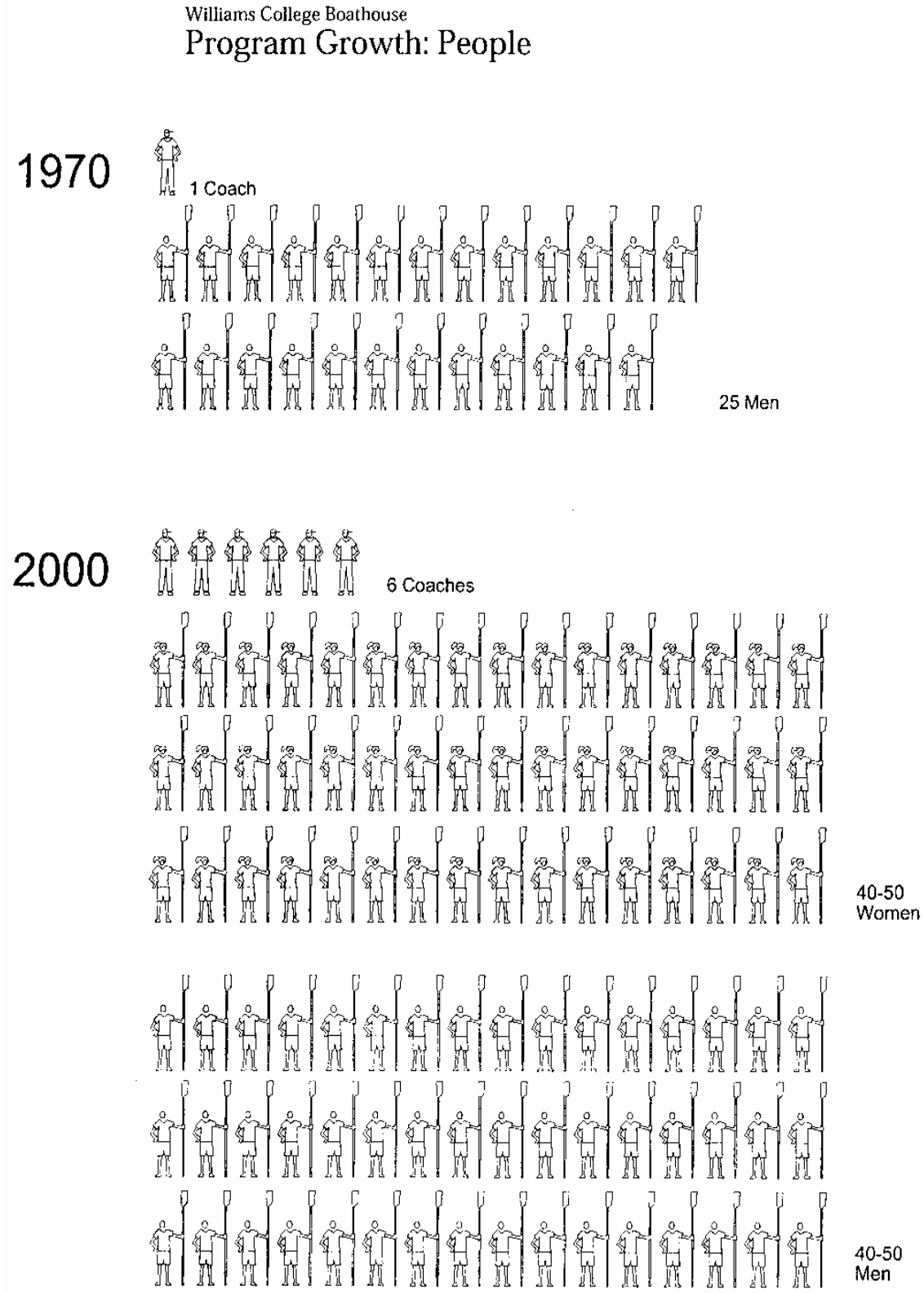
Conclusion

Building a new sustainable boathouse to house the Williams Crew Team on Lake Onota is a challenging, but not impossible task. While there are many factors to take into account, so far Williams has done a fabulous job in making sustainability a priority, and ensuring that their construction projects are environmentally and socially responsible. After looking at other successful green boathouses and the paths that they have taken, it seems that C&D waste, green and local materials, electricity use, heating and hot water, water use, team transportation, and drainage present not only challenges, but opportunities for innovative design. If a completely portable, carbon-neutral boathouse can be designed and constructed, there is no reason that the new Williams College boathouse can't at least be LEED Certified![7]

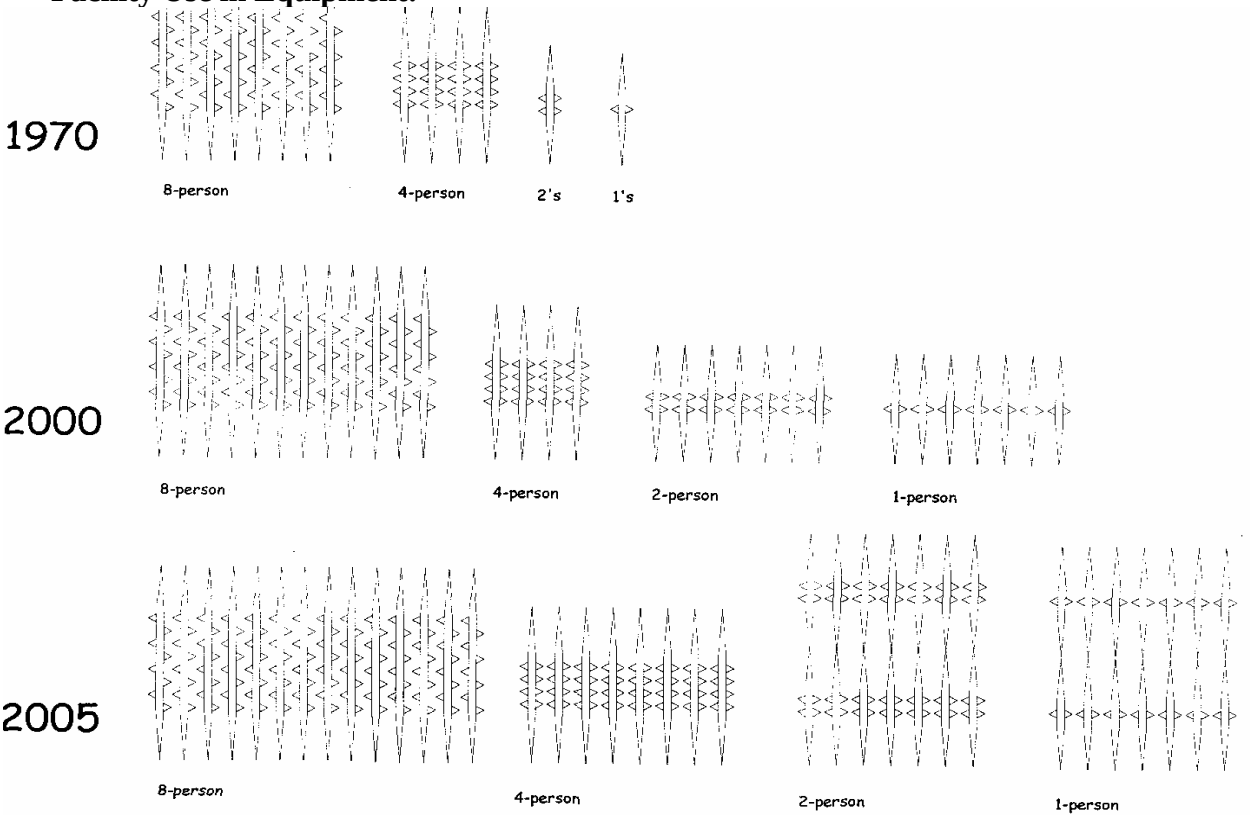
[7] General facts on the building and rowing program obtained from David Dethier, Stephanie Boyd and head Women's Coach Justin Moore.

Appendices

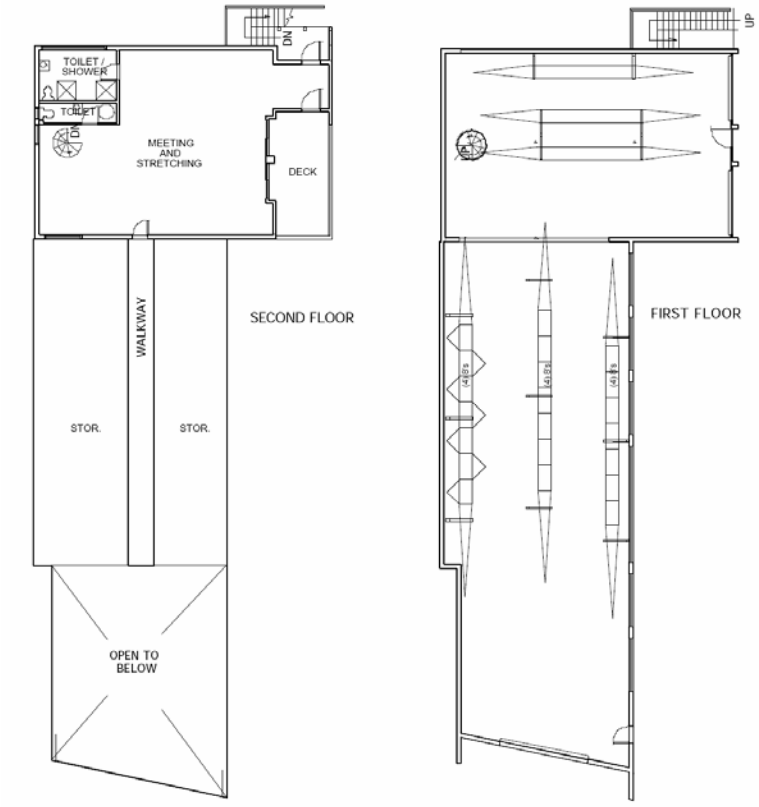
A. Facility Use in People:



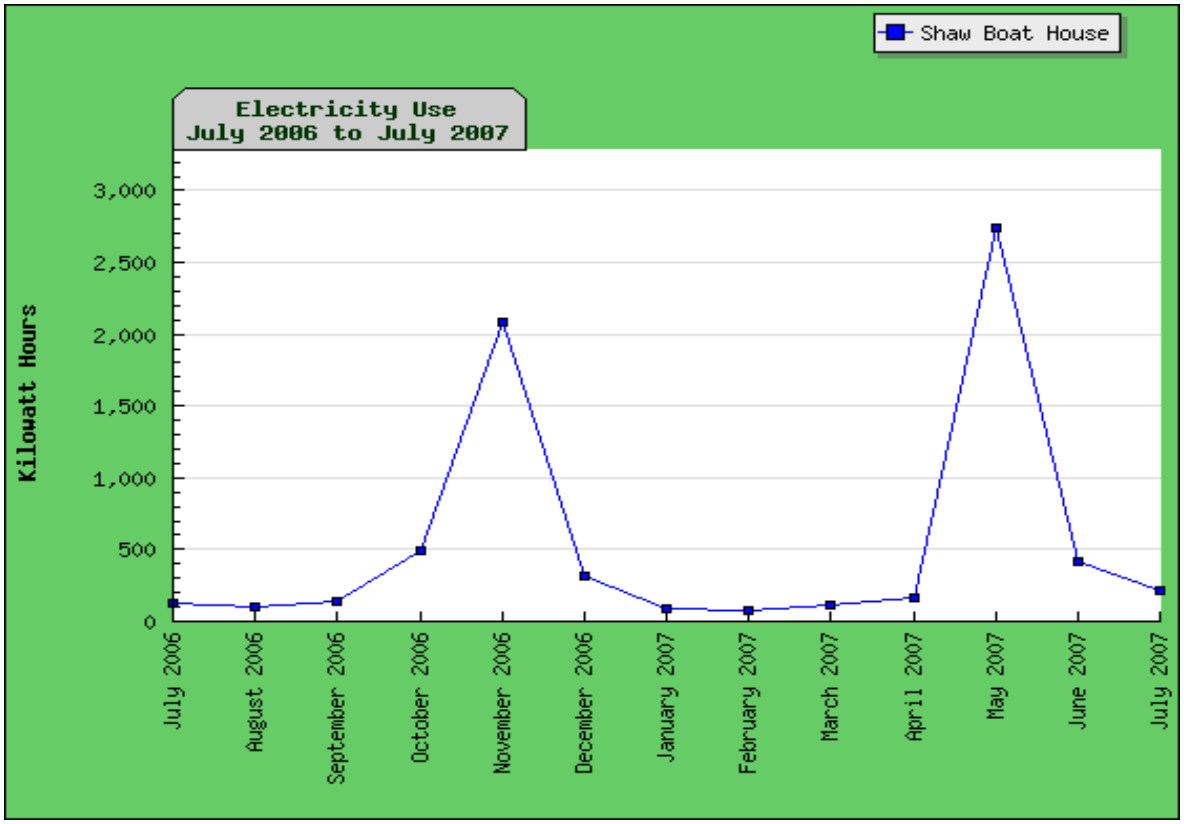
Facility Use in Equipment:



B. Current Boathouse Layout:

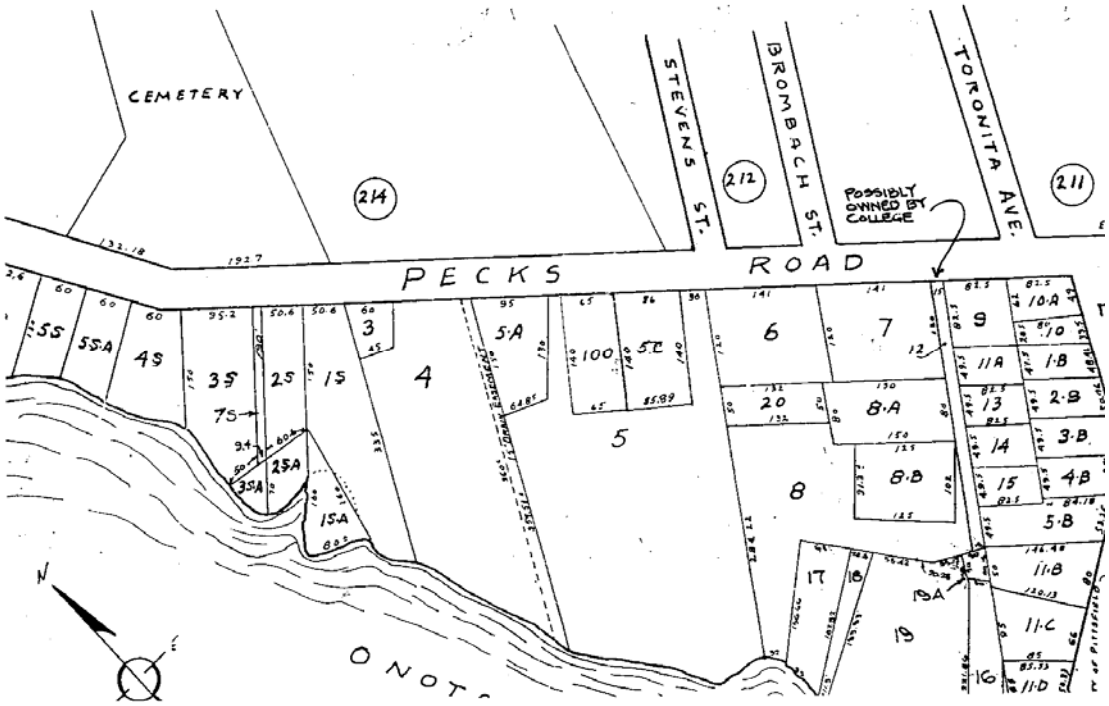


C. Electricity Use Over the Course of a Year:



D. Example of an Evacuated Tube Array:

E. Zoning Map of the Boathouse Property (shown as #8):



Sources Cited

Arp, Nic. "Regents OK naming of Beckwith Boathouse; Groundbreaking is Wednesday", *University of Iowa News Services,* http://news-releases.uiowa.edu/2008/march/031108boathouse.html.

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"Principles and Criteria," *Forest Stewardship Council of the United States,* http://www.fscus.org/standards_criteria/

Earth911: Making Everyday Earth Day, http://earth911.org/.

Additional information on the existing boathouse and rowing program was obtained from David Dethier, Stephanie Boyd, and Head Womens Coach Justin Moore.