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May 26, 2003

Bare Hill Pond Watershed Management Committee
Town Hall
13 Ayer Road
Harvard, MA 01451

Re: Pump Station For Deep Drawdowns

Dear Committee Members:

Bill Johnson asked me to generate an estimate of a pump barge to facilitate a pumped deep drawdown based on my experience as Project Engineer quoting filtration equipment that includes pumps, electrical controls and metal fabrication.

The estimated flow rate required to drawdown the pond was reported to me as 15 cubic feet per second or 6,730 gallons per minute. Of all the alternatives discussed over time, a small barge, anchored in deep water with one or more submersible electric pumps, such as typical sewage ejection pumps discharging via hose or flexible pipe to the downstream side of the dam seems most cost effective. Depending on the timing of the drawdown, such a barge could remain anchored in place over winter or transported from the pond when pumping is no longer required. The use of submersible pumps utilizes commercially available pumps and places both pump and discharge piping below the surface, eliminating freeze concerns.

A steel barge, designed like a roll-on dumpster with well(s) for lowering and supporting the pumps would be a simple arrangement that could be easily transported by existing commercial trucks to and from the launch points. A manual chain capstan could be used to both set and retrieve anchors and lower and position the pump(s). The pumps could be powered by submersible cable from shore. Any power boat or skiff could tow the barge into position.

In the past, estimates of running permanent three phase power to the dam has been a significant sum. It may be worth exploring packaged stand alone generating plants as an interim solution. Rental cost and noise would be principle considerations. The development of small turbine generating plants might offer solution to noise issues.



The controls are a wild card, as the mounting, arrangement and interface with any existing level monitoring devices can change scope of controls significantly. As the pump barge may be inaccessible from shore during drawdown/winter the controls should be shore mounted. The means of controlling pump output in a reduced flow, level maintenance mode will likely require the use of a modulating discharge throttle valve, which if mounted on the barge will require controls.

Since the location of a pumping barge relative to the point of discharge can vary significantly with the local bathymetry, we should assume for budget purposes that testing and certification be conducted at a site where 460 Volt, 3 phase power is readily available and power can be run to the barge without submerged cables.

My estimate of costs, exclusive of design and engineering and based on costs that we obtain as an OEM manufacturer is as follows:

Pumps, such as Barnes Pumps 8SE-HA 8" Submersible Non Clogging Pump, 3500 GPM, 60 HP estimate @ \$12,000 Each. Cost range \$24,000 to \$30,000 with throttling valve.

Barge, 16' L x 8' W x 3' D, fabricated from 1/4" mild steel. With multiple watertight compartments with gasketed deck plates. Pump wells. Pump lift support structure. Painted inside and out with catalyzed water immersion service paint. Steel 5000 lbs @ \$0.40/lb, \$2000. Fabrication and finishing 8 man weeks @ \$65/hour shop rate, \$20,800. Finishing materials \$600. Miscellaneous, \$2,000. Railing and other unforeseen requirements may add cost. Range \$25,000 - \$33,000.

Electrical controls can vary significantly, depending on how elaborate they are. A bare bones control package with disconnect, fusing, AC magnetic motor starters and overloads in NEMA12 enclosure may be \$5,000. If ground fault circuit protection or valve controls and needed that will add cost. A Programmable Logic Controller with software developed to automatically maintain target levels could add tens of thousands the cost. For a bare bones manually operated system, a cost range of \$5,000 - \$15,000 is reasonable.

This yields a construction cost range of \$60,000 to \$78,000.

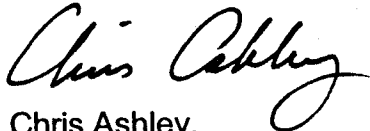
On the design front, I assume that the concept is fairly well developed by the Committee and design does not include evaluation of a full range of

alternatives. I have broken the design phase into tasks that we can put an hourly cost to and estimate design time as follows:

Pump selection	1 week
Control design/specification	1 – 2 weeks
Mechanical design of Barge	
Conceptual	3 – 4 weeks
Drafting for fabrication	3 weeks

Assuming there is some mix of costs among the design talent, for example a mechanical P.E. may be \$260K/person year and a draftsman may be \$80K/person year, a range of \$30,000 - \$40,000 for contracted design work seems reasonable.

Sincerely,



Chris Ashley,
Project Engineer