Proposed Pond Project at Shiloh Quaker Camp

Site Evaluation Report

Prepared for the
Baltimore Yearly Meeting
Camp Property Committee and
Camping Program Committee

By Allen Fetter
January 14, 2011

Table of Contents

Figures

Background and Executive Summary

The Camp Property Committee and Camping Program Committee have been considering the building of a recreational pond at Shiloh Quaker Camp and have started fund raising efforts to that end. This report was prepared to provide a technical evaluation of a proposed site and give recommendations for the committees to consider. Based on the technical evaluation and estimated work effort, cost estimates for the project have been developed, which provides a basis for fundraising goals to realize this project. The alternative option of an in ground swimming pool is also discussed.

The proposed Shiloh Pond Site was initially selected based on its topographic setting (natural drainage) and its proximity to other camp facilities. This site is an open area located between the meeting for worship fire circle and the field above the dining hall. Another identifying feature in this location is the "Narnia Lampost". This site is also shown on Figure 3 within the report.

About a year ago, simple survey of the topography (Figure 1) was done to help conceptualize the pond layout and soil samples were taken to test soil suitability for construction and water retention. Soil engineering analyses show that the soils sampled meet the criteria recommended by the Culpepper Soil and Water Conservation District that also serves Madison County, VA. The conceptual pond layout is of irregular shape about 120 feet across and is shown in Figure 2. The deepest point is expected to be around 12 feet below the pond surface. The total calculated water volume is estimated to be about 1.56 acre feet (67500 ft^3 or 504,900 gallons).

The catchment or drainage area above the pond comprises approximately 6.3 acres (Figure 3), which is more than twice the 3.1 acre size recommended by the USDA Pond Planning, Design and Constriction Manual for the aforementioned water volume in this part of VA. In addition, an adjacent seasonal drainage or well water could provide supplementary water for maintaining water levels if needed. As such, water availability should not be an issue, rather there made be a need to mitigate the catchment size to reduce high inflow rates and attendant sedimentation that occur during storm events.

To calculate soil excavation requirements and dam/berm volume, proposed pond contours were superimposed on the topographic survey map in order to generate an isopach (thickness) map and cross-sections. Both isopach maps and cross-sections (Figures 4 & 5) were used to independently calculate/cross check volumes. For both isopach and cross-section calculation methods, the results are in reasonable agreement, as follows.

	Excavation	Dam/Berm	Extra Soil
Isopach Map Method	3054 yd^3	939 yd^3	2115 yd^3
Cross-Section Method	3100 yd^3	1000yd^3	2100 yd^3

The excess soil could be used beneficially to help level/even out the field above the dining hall, making it more suitable for athletic activities. This field measures approximately 100 x 200 feet and could easily accommodate the ~2100 yd^3 (56,970 ft^3) of extra soil. If distributed evenly, the soil would cover the entire field ~2 feet deep (assuming perfectly planer surface). Alternatively, another location would be needed to move the excess soil.

Soil Suitability and Excavation requirements

Good soil quality is needed for an adequate pond dam. According to the USDA Pond Planning, Design and Constriction Manual, the soil needs 20 percent clay to provide proper compaction and prevent seepage through the dam. Soils with a plasticity index of 10 percent or more and at least 20 percent passing No. 200 sieve is preferred. The three soil samples collected from the proposed pond location all easily passed the preferred 20 percent particle sieve test, with percentages of 45, 67 and 72 percent. Plasticity index values were 7, 11 and 13. Although the plasticity index of one sample was lower than preferred, the dominance of fine particles <200 will help insure proper compaction and prevent seepage through the dam. For extra protection against seepage, the pond bottom and dam can be top-dressed with granular bentonite clay following final contouring. The complete laboratory test results for the soil samples are found in the supplemental PDF attachment.

As mentioned in the Introduction and Executive Summary, soil excavation and dam/berm volume calculations were done by superimposing proposed pond profile contours on the topographic survey map in order to generate an isopach (thickness) map and cross-sections (Figures 4 and 5). Both methods yield estimates of around 3100 yd^3 for the excavation and approximately 1000 yd^3 for the dam/berm - leaving ~2100 yd^3 of excess soil to redistribute.

Water Availability and Considerations

The catchment or drainage area above the pond comprises approximately 6.3 acres (Figure 3), which is more than twice the 3.1 acre size recommended by the USDA Pond Planning, Design and Constriction Manual for a pond of this size in this part of VA. In addition, an adjacent seasonal drainage or well water could provide supplementary water for maintaining water levels if needed. As such, water availability should not be an issue, rather there made be a need to mitigate the catchment size to reduce high inflow rates and attendant influx of bacteria and sediments during storm events, which sometimes plague this area. A diversion ditch about 200 feet up in the draw is recommended to divert high-energy and high flow to the pond.

The need for regular circulation or flow through is unnecessary other than to maintain water levels. While a previous consultant for the Catoctin pond project asserted that the pond would "turn to thick pea soup" without regular flow through, this is simply untrue. Based on his logic, Crater Lake in Oregon, which has no creek inflow and no outflow, should be choked with algae -

this is not the case, rather it is azure blue (Other examples abound). It is nutrient levels and high energy rainfall events that affect pond water quality (specifically, algae growth, bacteria levels and turbidity levels). Consequently, the pond design and operation at this site should aim for the exclusion of storm water inflow and water level maintenance through natural groundwater inflow and diversion of occasional base flow from the nearby drainage valley.

Pond Drainage and Hydrant System

For pond drainage and a dry hydrant a system a schematic drawing is shown in Figure 6. Such a design would obviate the need for a central standpipe and does not rely on a large expensive valve that would be subject to corrosion. Also, not putting a pipe through the lower part of the dam allows better compaction of the berm (no need to worry about gingerly avoiding the PVC with heavy equipment) and it avoids the common "piping" phenomenon that often plagues earthen structures penetrated by dam plumbing. "Piping" is seepage and preferential removal of fine-grained material that often around penetrations due to inadequate compaction. Over time, this leads to excessive leakage and the need for later corrective actions (more time and money).

For normal operation, the drain pipe's open T-coupling on the dam berm acts as a vacuum break, which prevents accidental drainage of the pond through siphoning. Complete drainage of the pond for maintenance, however, can be accomplished easily through siphoning. This is done by plugging the lower outlet, filling the pipe with water and plugging the T-coupling. Once this is completed, the lower outlet plug is removed to commence siphoning. This method was successfully used to help drain the pond at Catoctin. Based on gravity flow rates through 6" PVC (550 gpm), the entire pond volume (504,900 gallons) could be drained in about 15 ½ hours. Alternatively, 4" PVC can handle 240 gpm, which would take about two days to drain. For regular pond overflow the siphon system would be able to handle expected flow discharges. An overflow spillway on the northeast corner of the pond (Figure 2) would accommodate excess overflow during major storm events.

The dry hydrant piping would also share the same wet well as the siphon drain and with the hydrant daylighting in the northeast corner of the playing field. This dry hydrant will provide easy access to water by the fire department if necessary.

Cost Estimates

Cost estimates shown below were made allowing for the encountering of adverse site conditions, which would result in more time and labor. Under expected conditions (observed thus far), the total project costs are expected to be lower.

Site clearing of ~ ¾ acre (tree removal, and scraping and stockpiling of organic matter and "A Horizon" soils): $10,000

Excavation of pond and construction of dam/berm: $37,000

4’ diameter concrete manhole/wet well w/ 6” drain & hydrant ports (and installation): $7,000

Installation of 200 foot drain (siphon system) and 100 foot dry hydrant, 6” PVC: $8,000

Diversion ditch: $1,300

24’ dock, 8’ wide: $11,000

50 tons of sand @ $50/ton: $2,500

Final pond grading, Hydroseed or seed and mulch: $2,500

Grading and seeding of excess soil (playing field): $2,500

Grand Total: $81,800 + 10% profit = $89,980

Alternative option

An alternative option to a new pond could include the building of a swimming pool. Below ground swimming pool construction costs run on the order of $50 per square foot. Additional costs would include utilities to run pump/filtration equipment, chemicals, routine maintenance, and could include fencing (if required). Construction of a pool similar to the size at Opequon (~25’ x 50’) might cost around $62,500. A person with first-hand experience regarding long-term pool maintenance costs might be able to provide some insights on this matter. For this alternative programmatic considerations should include the following:

- Would a pool of this size would be adequate to meet the needs of the summer camp?

- Would pursuing a “non-rustic” swimming option have a negative impact on the Shiloh Camp experience?

Other considerations may arise during respective committee deliberations.

Another point to consider is that the pool option would likely preclude the installation of a dry hydrant system.

Preliminary Recommendations

Because this report's focus is that of pond development, the recommendations below are based on the original goal. Since the nature of the pond project does not require detailed engineering and significant work could commence without all funding in place, the need to hire a general contractor is not necessary and would save on estimated project costs (e.g., no contractor profit). As a member of the Camp Property Committee, with a keen interest in a good outcome for this project at a reasonable cost, I am be willing to provide substantial technical guidance and oversight in the execution of this project. My background education, training and experience in hydrology, geology and soils, along with significant experience directing heavy equipment work, are germane for this task. I have made local equipment contractors with experience in pond construction to obtain pricing information, and the caretaker also has a tracked loader that could be used for the project. The use of local resources would minimize or eliminate equipment mobilization fees.

As per guidance from Culpepper Soil and Water Conservation District that also serves Madison County, the only regulatory requirements for this action would be the submission of an "Erosion and Sediment Control Plan" to Madison County as the construction would disturb more than 10,000 ft^2. The Army Corps of Engineers, Norfolk District needs to make a jurisdictional determination regarding wetlands (presence/absence) at the pond site. The outcome of this Corps evaluation will be an official letter regarding the presence/absence of any wetlands at the proposed pond site. The Virginia Department of Environmental Quality follows the same wetlands criteria as the Army Corps of Engineers; hence the letter from the Corps will suffice to satisfy VA DEQ requirements.

Figure 1 - Existing Site Contour Map

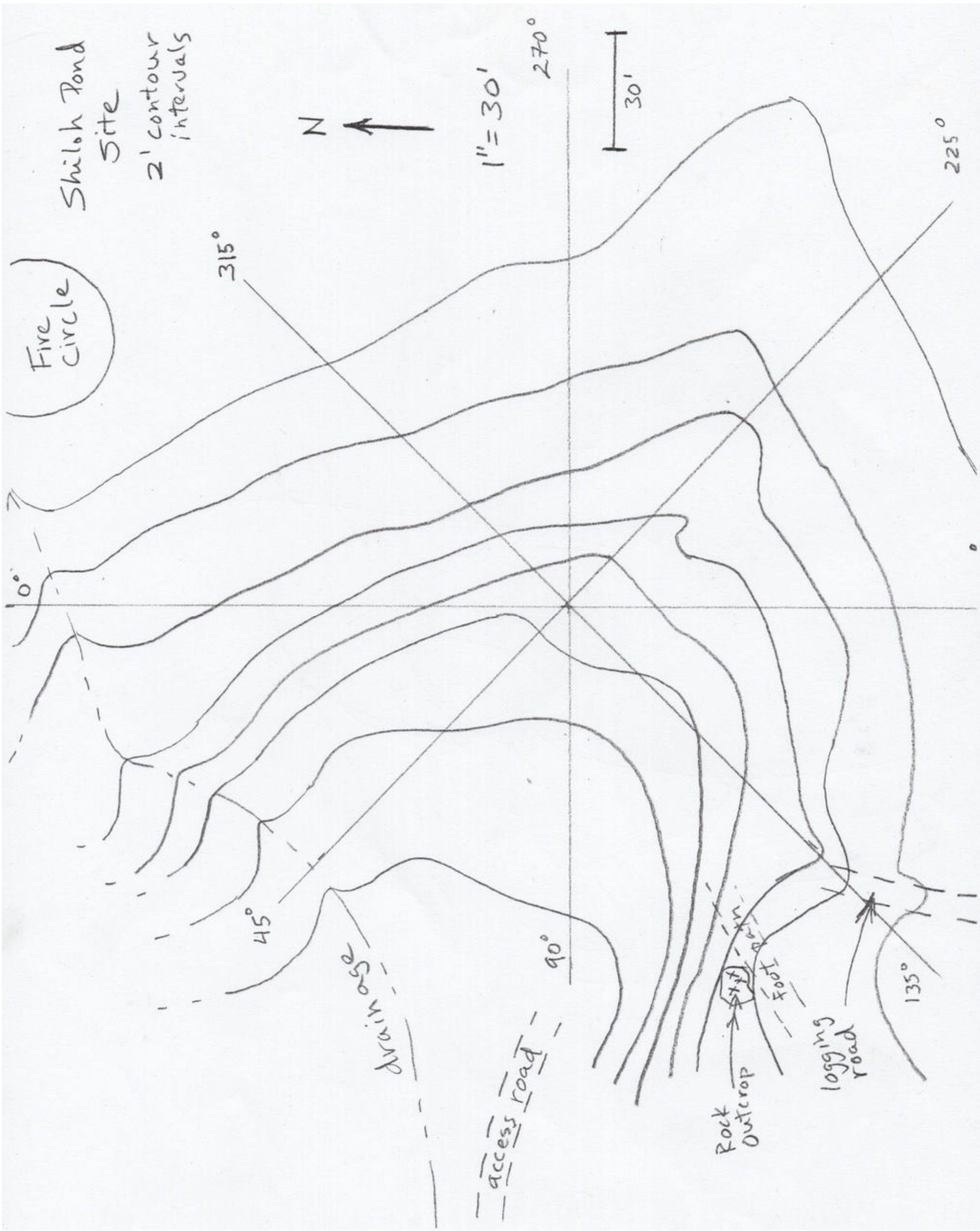
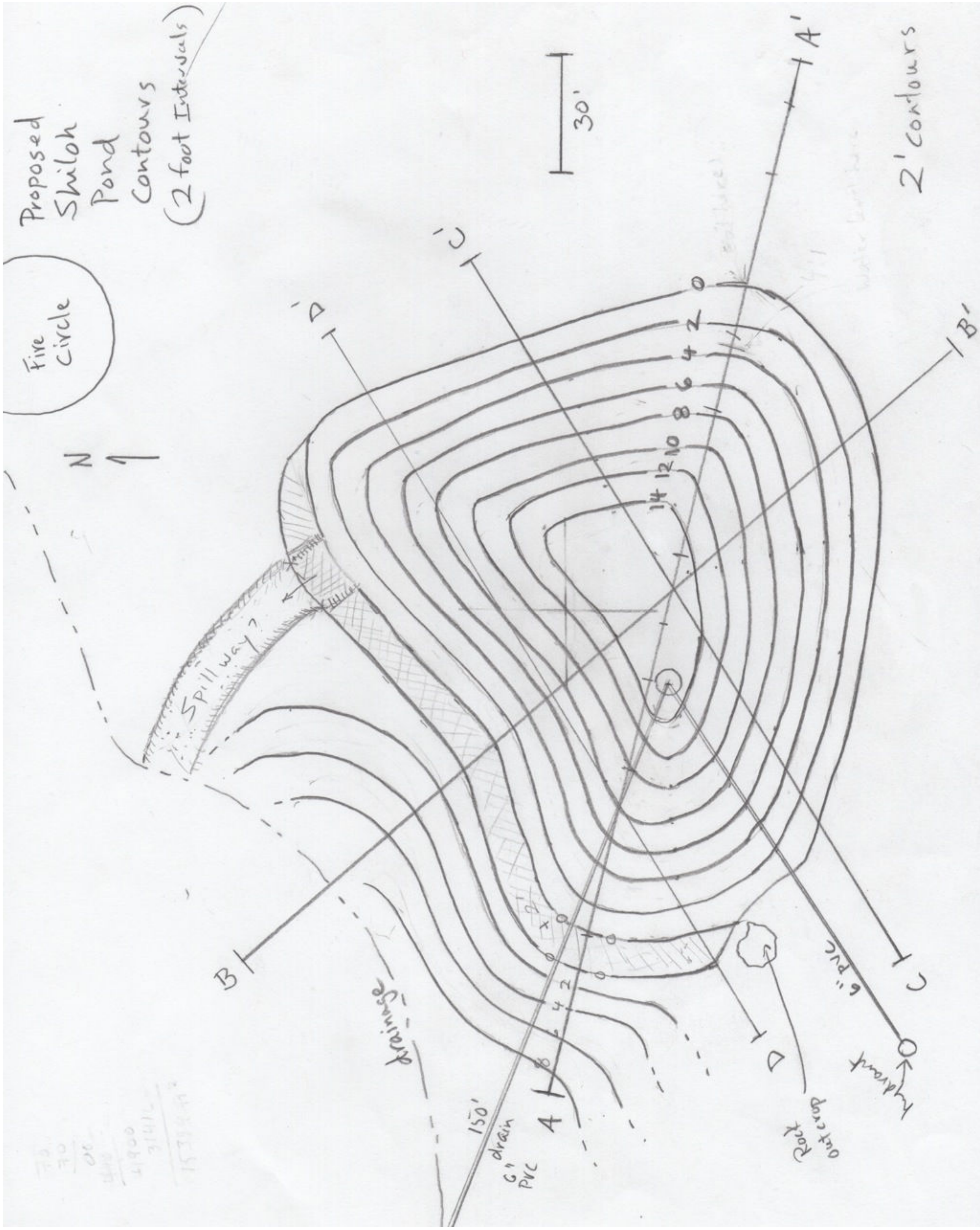


Figure 2 - Pond Contour Map



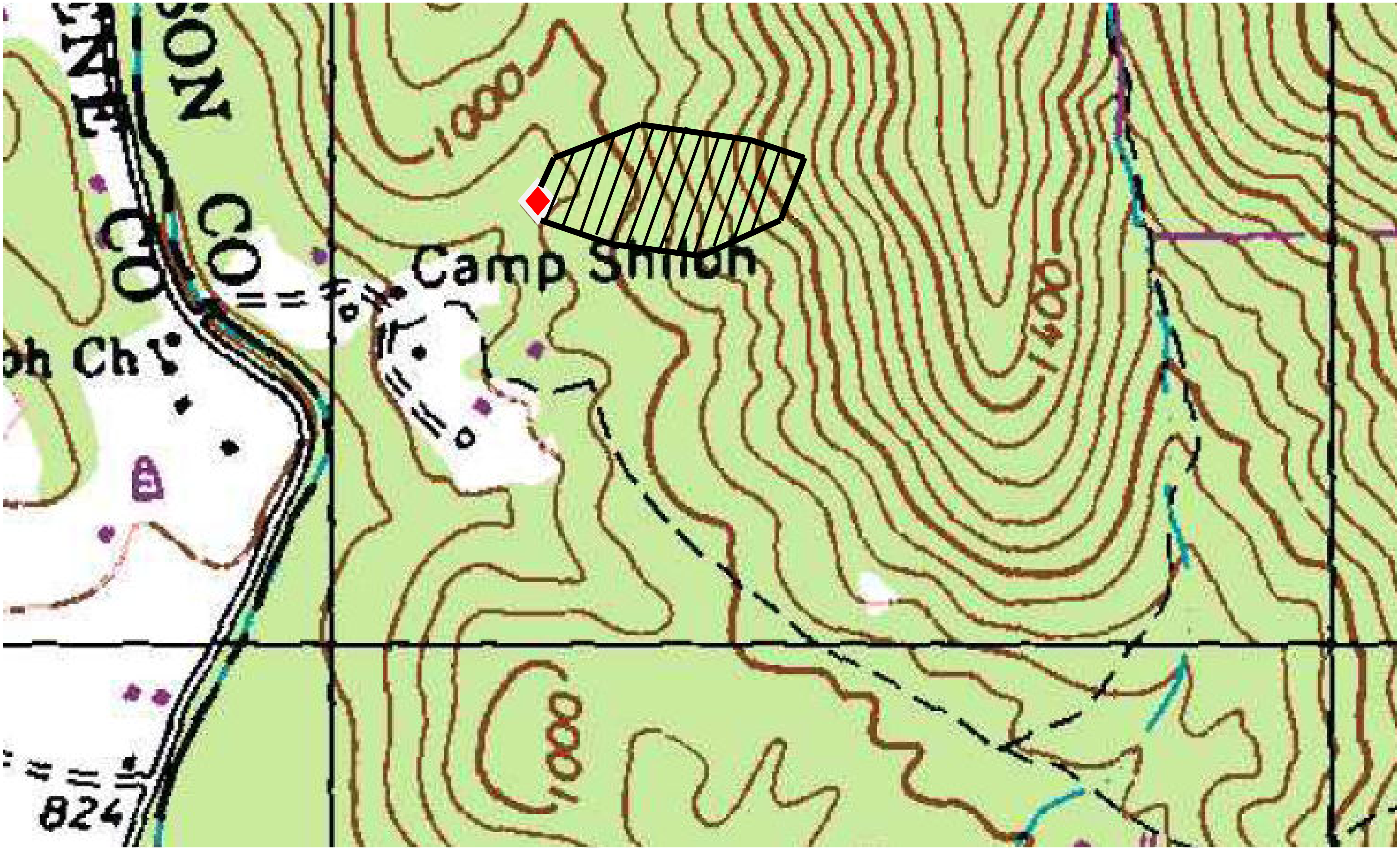


Figure 3 – Watershed catchment area for proposed pond location at Shiloh Quaker Camp. Pond location denoted by red diamond. Reference: 1999 USGS 7.5' quadrangle map (Fletcher, VA). Note that gridlines are on 1 kilometer spacing (3280 feet). Calculated catchment area = 273,800 ft2 (~6.3 acres). The USDA Pond Planning, Design and Constriction Manual recommends 2 acres of drainage to support 1 acre-foot of pond volume in this part of VA. The area needed for proposed pond volume of 2500yds^3 (1.56 acre feet) is 3.1 acres; hence the site is in the appropriate location from a water budget standpoint.

Figure 4 - Isopach Map of Excavation and Dam/Berm Volumes

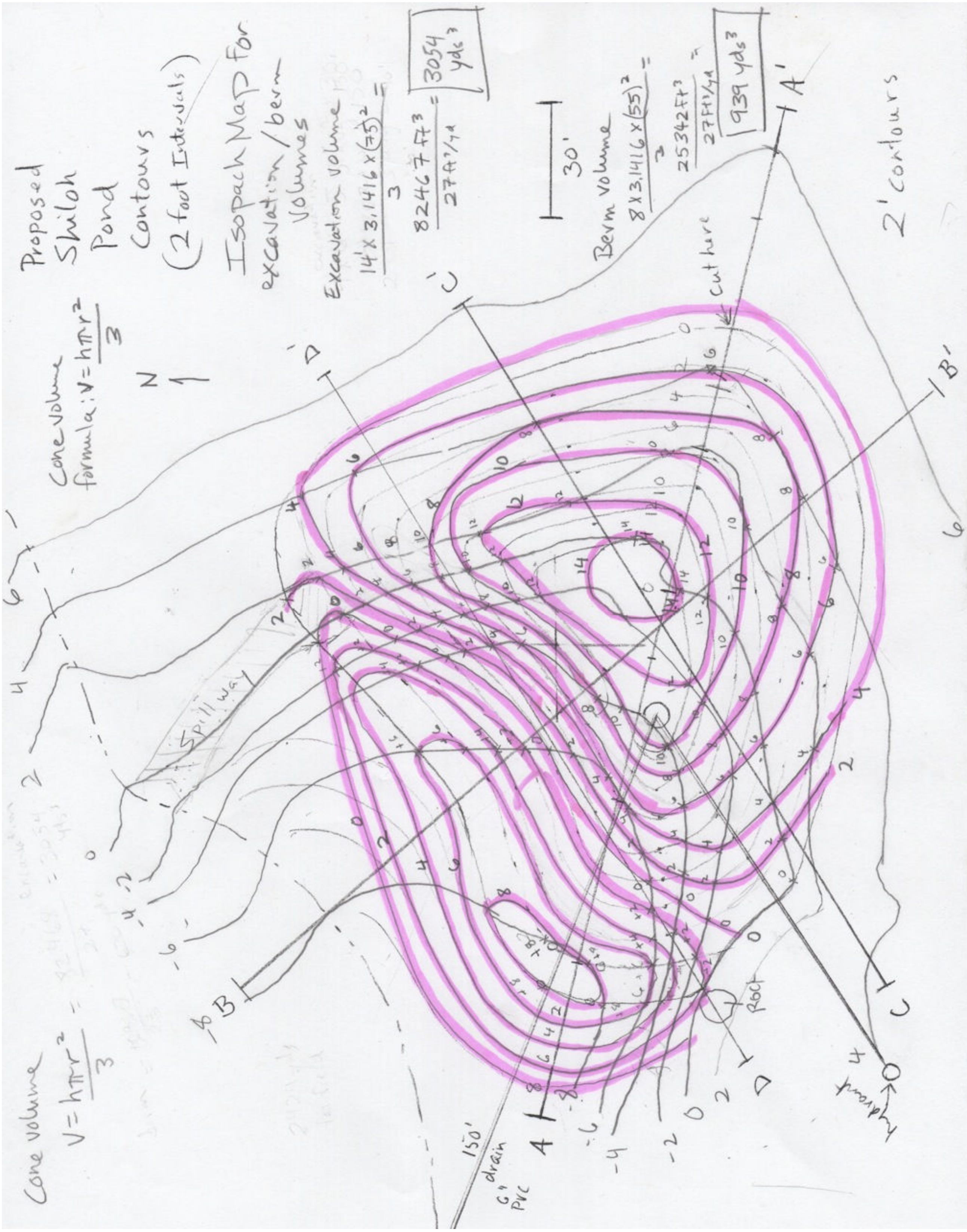


Figure 5 - Cross Sections (ground surface and pond excavation)

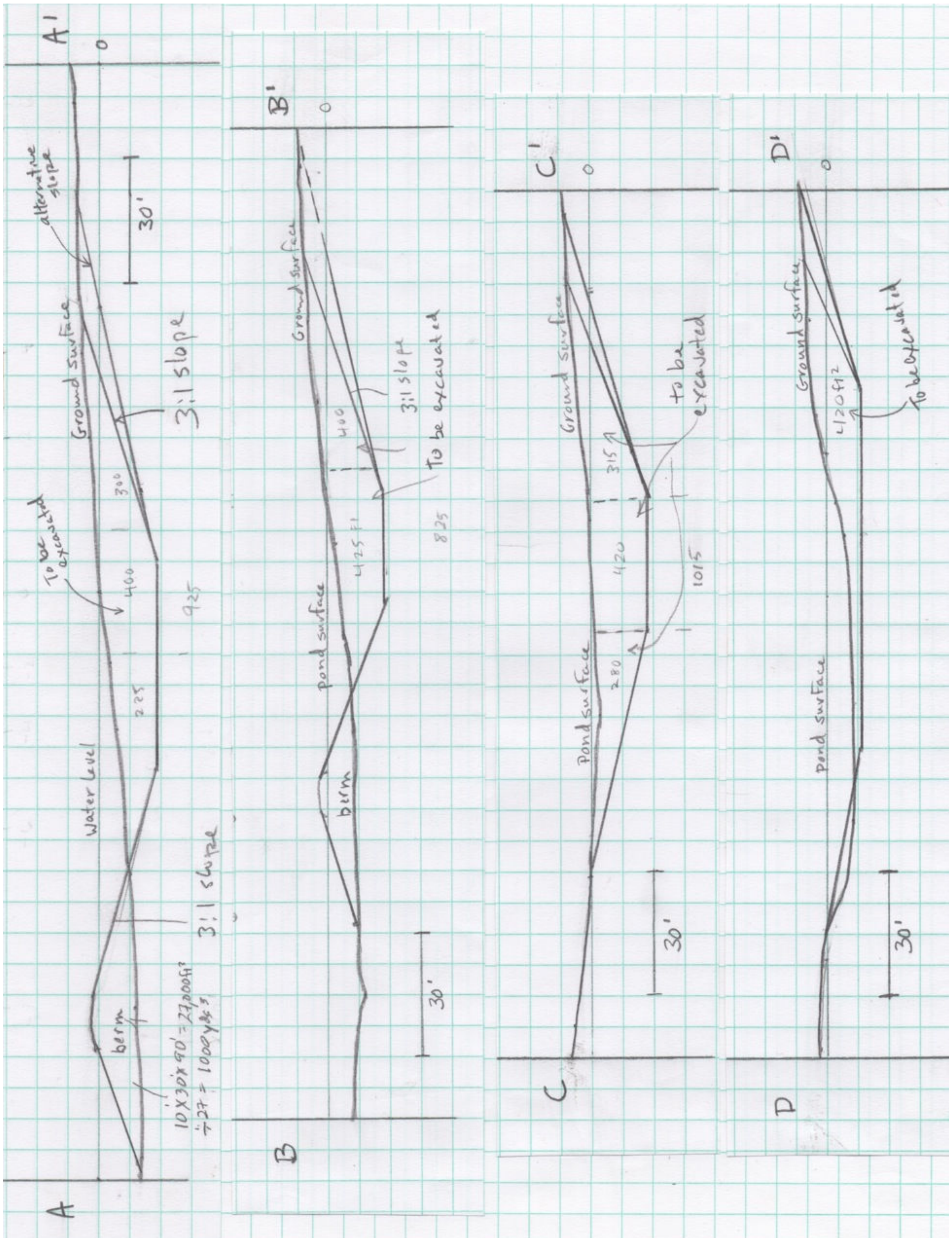


Figure 6 – Pond Drain and hydrant system