

**Summary of Engineer's DRAFT Conceptual Summary Report  
Shamineau Lake Outlet Investigation  
By Houston Engineering, Inc.  
August 9, 2017**

**INTRODUCTION**

**Project Description**

The purpose of this project is to establish a maximum operating level of Shamineau Lake for economic and natural resource benefits. This can be accomplished by managing the high-water levels of Lake Shamineau at an elevation that protects adjacent property owners and sustains a healthy wildlife environment. The need for the project is to significantly reduce future property damages, shoreline damages, reduce property owner costs, and provide more efficient strategic planning abilities for the LID, County and State.

The proposed project concept involves the construction of a permanent outlet for Shamineau Lake. Shamineau Lake is located in a closed watershed basin and during the recent wet hydrologic cycle, has been subject to rising water levels. An increase in lake level has negatively affected properties around the lake with many property owners reporting shoreline and structural damages due to high water levels. In response to a recent survey, lake owners reported an estimated \$1.230 million in expenses due to high water level.

The proposed project concept establishes a permanent outlet for Shamineau Lake and was initiated by the Shamineau Lake Improvement District (LID). Details for the improvement project including project costs and needs will be itemized and displayed in the final report that will be available on the Lake Shamineau website prior to the August 26<sup>th</sup> Annual Meeting.

**Benefits**

The proposed drainage system improvements to Shamineau Lake will provide the following benefits:

- 1) Increase the capacity of the outlet for Shamineau Lake (Alt 2 & 3),
- 2) Increase the capacity of existing original drainage upstream and downstream of US 10 (Alt 3),
- 3) Reduce lake bounce duration and magnitude (Alt 2 & 3),
- 4) Significantly reduce the frequency of high lake stages exceeding the Ordinary High Water (OHW) elevation of Shamineau Lake causing damages to adjacent landowners (Alt 2 & 3),
- 5) Improve lake shore land use management and planning (Alt 2 & 3),
- 6) Reduce lake shore erosion (Alt 2 & 3),
- 7) Increase the predictability of US 10 hydraulic operations (Alt 3),
- 8) Improve the general management efforts, operation and maintenance of the system (Alt 2 & 3).

**Hydrologic Conditions**

The normal precipitation annual (1981-2010) for the Shamineau Lake drainage area is 27.24" provided by the DNR State Climatology Office. The measured average annual precipitation from the Brainerd Crow Wing County Airport for the same timeframe is 28.24". Since the early 1990s, notably the last 5 to 19 years, higher than normal precipitation has occurred and based on measurements from the Brainerd Crow Wing County Airport, the average annual precipitation since 1991 has been just over 30".

1991-2016	2007-2016	2011-2016	2012-2016
30.05	32.49	33.49	34.31

The drainage patterns south of CR 203 and east of Shamineau Lake have been taken into consideration for this report.

Crookneck Lake is located just to the south of Shamineau Lake. A correlation between the Water Surface Elevation's (WSE's) of the two lakes has been observed through the comparison of lake elevation data. The data ranges from 1999 -2017 and shows that Crookneck Lake's WSE ranges from 0.81 ft to 1.60 ft above Shamineau Lake's WSE with an average of 1.12 ft higher. As of August 1, there was a water surface elevation difference of 1.1 ft between the two lakes.

Altered hydrologic patterns immediately south of Shamineau and Crookneck Lakes were identified which appear to conflict with understood drainage area boundaries. The unnatural runoff contribution to these lakes inflows has an impact on lake levels and should be addressed. The altered hydrology appears to be ditching, road/trail grades without culverts, existing culverts set at high grades, and blocked drainage ways due to historic standing water with limited flows. It is understood that addressing these altered hydrology issues will reduce the total volume of water required to be discharged from Shamineau Lake; however, will likely have a minor impact on sustained high lake levels.

Based on lake level information between April and August of this year, and considering the limited rainfall during that time, the lake is less than 0.1 ft lower in elevation. Considering the dry summer, if 4" of rain fell in the last 3 months over the Shamineau watershed, approximately 3/4" would be direct runoff to the lake. That would total just over 7" of water lake level rise in Shamineau from runoff over that 3 month period. Evaporation through the same period (May to August) is the highest rate of evaporation during the year and generally amounts to an average of 6" per month or 18" for 3 months. There should be a measurable reduction in Shamineau water levels (almost a foot) over this timeframe relative to this scenario, but there is actually less than 1".

Interests regarding redirecting inflows to Shamineau Lake in the SE corner of the lake have been expressed to reduce inflows to the lake and reduce a contributing source of the high water levels on the lake. This issue will be addressed during the permitting process through state and federal wetland and waters interests, as well as Morrison County Planning. However, it is our experience that diverting the natural flow watercourses, is a difficult project type to get permitting. Therefore, the calculations used to estimate the outlet discharge includes the identified natural drainage area boundaries exhibited on current and available contour and planning maps.

## **RECOMMENDED SOLUTIONS AND EVALUATION OF ALTERNATIVE SOLUTIONS**

### **Recommended Solutions**

A review of the historic and recent problems being experienced with Shamineau Lake indicate that a majority of the reported and documented problems appear due to the wet hydrologic cycle and the lake not having an outlet. The problems appear related to an increase in WSE above those desired by the property owners around Shamineau Lake. A new outlet structure and pumping station is proposed to drawdown and maintain the lake at a lower maximum WSE. The proposed new outlet structure and drainage piping will provide for improved and adequate hydraulic capacity and improved economic value to the lake.

Three alternatives were considered for this project. The below descriptions are intended to provide the information related to the alternatives considered. They are as follows:

- 1) Do Nothing
- 2) Northeast Bound Outlet
- 3) Southwest Bound Outlet

**Alternative No. 1: Do Nothing**

This alternative involves the completion of no work. The problems with high WSE's on Shamineau Lake and the damaging effects it has on the adjacent shoreline would remain. There would continue to be a lack of freeboard provided for significant rainfall events. This could cause significant damages to lower lying properties. The problems appear to be related to a lack of outlet capacity causing excessive lake level bounce and excessive high lake levels durations. The natural outlet to Shamineau Lake is to the southwest through Lena Lake. The natural outlet would have at one time had flows at elevation 1280.0 but due to the construction of roads, now occurs around elevation 1285.0. Significant damages would be expected should Shamineau Lake reach the original natural runout elevation of 1280.0.

**Alternative No. 2: Northeast Bound Outlet**

Alternative 2 proposes the construction of an outlet to the northeast of Shamineau Lake. The proposed project limits extend from a point near the shoreline of the NE part of Shamineau Lake and proceeds northeasterly into Stanchfield Lake. From there it flows north and then northeasterly before outletting into Lake Placid (Rosing Township).

The proposed project includes the installation of a new lake outlet structure and pumping station near Shamineau Lake immediately adjacent to the shoreline at the northeast part of the lake. From the pumping station, installation of drainage piping will take water to the northeast through a ridge to the location of a pipe outfall structure. A natural tributary to Stanchfield Lake will convey flows to Stanchfield Lake and ultimately to Lake Placid.

Alternative 2 requires a significant amount of pipe boring through the natural ridge that has a top elevation of 1356.0. It also proposes to convey flows through a corridor which has not historically existed. This alternative will provide freeboard for flooding rainfall events. Alternative 2 is currently considered to be the most expensive alternative and further analysis will not be carried forward at this time.

**Alternative No. 3: Southwest Bound Outlet**

Alternative 3 proposes the construction of an outlet to the southwest of Shamineau Lake. The proposed project limits extend from a point near the shoreline of the SW part of Shamineau Lake and proceeds southwesterly into Lena Lake. From there it flows west through US 10 into the SE 1/4 Section 13, T132N, R32W (Fawn Lake Township) in Todd County and continues to flow to the southwest into Section 24, T132N, R32W (Fawn Lake Township) where it joins Fish Trap Creek, a tributary to the Long Prairie River. Fish Trap Creek is the outlet for Fish Trap Lake and has adequate flow capacity to accommodate design outflows from the proposed project.

The proposed project includes the installation of a new lake outlet structure and pumping station near Shamineau Lake immediately adjacent to the shoreline at the southwest part of the lake. From the pumping station, installation of drainage piping will take water westerly and then southerly through Aztec Road or W. Shamineau Drive to the location of a pipe outfall structure. A segment of existing natural swale will convey flows from the outfall structure to Lena Lake.

Alternative 3 currently has the least known opposition from the public and agencies affected by the outlet investigation. This alternative will also provide freeboard for flooding rainfall events. Considering the items presented, Alternative 3 provides the best known alternative serving the needs identified. Upon review of the known practical alternatives and consideration of the problems identified by the LID Board associated with the high water levels on Shamineau Lake it was determined by the Engineer that Alternative 3 best serves the overall interests identified by the Shamineau Lake LID and best serves the natural resource interests within the drainage area.

**EVALUATION OF SOCIAL, ECONOMIC AND ENVIRONMENT IMPACT OF THE PROJECT**

**Shamineau**

Lakeshore owners and recreational users will be provided improved shoreline management benefits. Improved planning efforts will be realized by establishing a maximum operating lake level. This will help reduce damages from flooding and shore erosion and help stabilize and manage the shoreline of the lake which will be a direct benefit from the proposed improvements. Private benefits would be experienced through an increase in the system’s outlet capacity.

**Project and Operation Costs**

The conceptual opinion of probable project costs for the improvement project described in this report is as follows:

<b>Proposed Improvements</b>	<b>Construction Cost</b>	<b>*Other Costs</b>	<b>Total Cost**</b>
Shamineau Lake Outlet Improvement Project	\$1,100,000	\$400,000	\$1,500,000

Other costs include design and construction engineering, permitting, surveying, soils investigation, administration, legal, right of way acquisition proceedings, funding processing and other miscellaneous costs

**Cursory Environmental Review**

Various environmental concerns were taken into consideration while developing the proposed project. The main concern is the invasive species Eurasian Water-Milfoil that has invaded Shamineau Lake. To prevent the spread of invasive species, a screen filter will be utilized in the pumping station to ensure no transfer of invasive species to downstream receiving waterbodies.

**Effects of the Project on Water Quality**

The occurrence of an extreme runoff condition during project construction should not cause an increased sediment load into downstream channels or Shamineau Lake. Minimal changes to land use and cover type will result from the project. When the project is completed, the sediment load to receiving waterbodies from the project will not likely be increased from pre-project conditions. Erosion reduction techniques have also been incorporated into the project design, including riprap at the outfall structure and stabilize overflow structures at various waterbodies downstream. Erosion problems caused by high lake levels and overland flows will be reduced.

**Effects on Fish and Wildlife Resources**

The Improvement project proposes to incorporate a filter screen on the pumping station to prevent invasive species and fish passage from traveling downstream. It is assumed that fish passage prevention will benefit the fishery interests of Shamineau Lake.

**Overall Environmental Impact**

It appears, based on a cursory review of existing data, that this project will likely impart no long-term adverse effects on the environment. While construction operations have an inherent adverse effect on the environment, these effects are temporary in comparison to the long-term net benefits anticipated from the project operation.

## **DETAILED DESCRIPTION OF THE PROJECT**

### **Project Operations and Maintenance (O&M) Plan**

An O&M plan will be developed during the preliminary design and permitting phase to establish operating lake levels, pump run time restrictions and opportunities, seasonal restrictions, and other identified discharge operating criteria to most efficiently establish optimal times to activate the lake outlet. Primary intention of the operating plan is to minimize hydraulic impacts to adjacent and downstream property owners, and to minimize stress on channel, water bodies, and natural resource interests. Trigger elevations on Shamineau Lake and downstream receiving waterbodies will be established for operating the pumping station. As a result of the conceptual planning phase, it is proposed to maintain Shamineau Lake's maximum WSE between 1274.1 and 1275.1. However, a note in the plan will be included to describe a process to modify the operating plan if the system is not functioning as anticipated. The intention here is to allow for adjusting the lower limits of the drawdown elevation on Shamineau, to review operating times during the year, or change downstream trigger elevations for operation of the pumping system.

### **Analysis Outlet Conditions and Adequacy**

The proposed Alternative 3 outlets into Lena Lake which will be maintained by a weir outlet structure. From there, a constructed channel will take outflows southwesterly, crossing US 10 and outletting into Cass County Lake. From Cass County Lake, a natural stream continues southwesterly and connects to Fish Trap Creek. Fish Trap Creek is a tributary to Fish Trap Lake and has adequate flow capacity to accommodate outflows from the proposed project.

### **Hydraulic Design of Proposed Drainage Improvements**

The proposed Shamineau Lake Outlet improvement project will increase the hydraulic capacity of the culverts through US 10. The existing two lines of 30" drainage pipes will be cleaned out and a 36" pipe will be jack and bored through US 10 at a lower elevation to convey flows resulting from the pumping operations on Shamineau Lake. The proposed project design provides Shamineau Lake drawdown rates from stage elev. 1276.1' to 1274.1' within 180 days from the start of the pumping operations. Once the initial drawdown is completed, the conceptual operating plan would generally require pumps to operate on 3-month pump operating intervals to maintain these levels. To draw down Shamineau Lake from elevation 1275.1 to elevation 1274.1 would take 90 days of operating pumps, assuming average hydrologic conditions during operation.

## **PROJECT ECONOMIC ANALYSIS AND FINANCING**

The total preliminary opinion of probable project cost (OPC) for the Shamineau Lake Outlet Investigation, including the new Shamineau Lake outlet structure, the 30" drainage pipe, the Lena Lake outlet structure, culvert through US 10 and the construction of ditches is \$1,500,000. Of this amount, \$400,000 is for design and construction engineering, permitting, surveying, soils investigation, administration, legal, right of way acquisition proceedings, funding processing and other miscellaneous costs.

There are 407 parcels in the Shamineau Lake LID Assessment area and the average cost per parcel of the project would be between \$3,000 and \$3,500, and the average cost per commercial unit would be between \$1,100 and \$1,300. If the improvement project is bonded for 10 years and assuming an annual interest rate to be 4%, the average monthly payment per parcel for the 10-year period would be \$35 - \$40, and the average monthly payment per commercial unit would be \$10 - \$15. It should be noted that these estimated costs is intended for general information purposes only.

Based on cursory information and similar past projects, the operating cost of the pump station is approximately \$5,000/month of operation. The pump station will likely require climate control which is estimated at \$300 to \$500 per month; contingent on elements housed within the station. Lastly, an escrowed maintenance account is recommended which could be set at \$15,000 minimum balance to cover maintenance and repairs of the outlet system.

**Potential funding sources are as follows:**

- 1) Hazard Mitigation Grant Program through the Minnesota Department of Natural Resources (MnDNR). This grant is a flood damage reduction grant and could provide 50% of the project funding with a 50% local match required. This grant has the highest potential for funding.
- 2) Clean Water Fund Grant Program through the Minnesota Board of Water and Soil Resources (BWSR). This grant could be used for erosion control, shoreline erosion control and protection. 75% of the project could be funded through this grant with a required 25% of the funding being local. This is a very competitive grant.
- 3) Local Bonding (Loan Process) – MN 429 process. To be executed upon determination of LID to proceed from the conceptual report.

State funding sources generally fall within budget years for the various agencies, and currently would appear most state funding sources would be eligible for expenditures after July of 2018. Therefore, if we receive any funds from state sources, we could coordinate various project cost elements to be eligible for these grant funds. It would be difficult to coordinate, but is possible. With that said, the LID will need to prioritize outside funding sources with schedule for completion of work.

*Note: The full report produced by Houston Engineering, Inc., including graphs and maps, will be available on the Lake Shamaineau website ([minnesotawaters.org/lakeshamaineau](http://minnesotawaters.org/lakeshamaineau) ) prior to the August 26th Annual Meeting.*