TOWNSHIP OF WENTWORTH

:

# CONSOLIDATION
# OF THE OUTLET FOR LAKE LOUISA

# TOWNSHIP OF WENTWORTH

Excerpt from the plans
prepared by Miroslav
Chum, Inc.

*May 3, 2021*

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# 1. SITUATION

This document was produced at the request of the Township of Wentworth to preparetechnical documentation for the consolidation of the outlet for Lake Louisa.

The outflow area is composed of a pile of rocks of varying, but relatively coarse, grain size. In particular, during periods of moderate and low flow, the water percolates through the rocks and the flow becomes highly anastomosing. Under these conditions, free movement of fish is not possible. In addition, the water level of the lake decreases, while at the same time exposing shallow areas of its shoreline.

In order to stabilize the flow conditions and preserve the quality of the water environment of Lake Louisa, it is proposed to consolidate the section of the outlet with rocks of a spread granulometry. A notch will be built in the spillway to concentrate the flow associated with the low-water regime and to facilitate the free movement of the fish species present.

After the structure is put in place, the average water rating for Lake Louisa will not be changed.

Photographs in support of this document were taken during site visits in 2018 and 2019.

## 2. LOCATION

The response area is located at the outlet of Lake Louisa, in the southwestern part of the territory occupied by the Township of Wentworth. Plans presented in the appendix provide an overview of the location of the target area. The site is accessible by Lake Louisa South Road and by a private road about 130 m long. Specifically, the geographic coordinates of the outlet are No. 45-45' 16' and O 74-25' 02". Photo 1 shows a glimpse of the water from the outlet.

*Photo 1 View of Lake Louisa from the outlet.*

# 3. DESCRIPTION OF THE CURRENT SITUATION

The lake outlet is mainly composed of high-caliber granular material (photos 2, 3 and 4). The difference between the lake and its emissary (unnamed water courses) is relatively small, not exceeding 0.80 m. Since the length of the outlet is more than 25 m long, the longitudinal slope is relatively small, reaching an average inclination of about 1: 30.

Usually, in the natural environment, a longitudinal slope of this order does not represent a particular difficulty for the free movement of fish. However, in this case, high granulometry is responsible for a significant percolation of water through the rocks. Indeed, during periods of stretching, almost all the flow is transited through interstices. Naturally, this type of flow is not compatible with fish migration. In addition, the high percolation over the entire width of the outlet (about 20m wide) is responsible for the significant lowering of the lake's water level, while degrading the water environment and adjacent wetlands.

The emissary of Lake Louisa is relatively narrow and flows into Mud Lake, located about 150 m further downstream (photo 5). It should be noted that no other obstacles to free movement have been observed between the two bodies of water.

The entire outlet area (approximately $500^{m2)}$ is stable, and no active erosion zone has been observed. The banks are also stable and covered with shrub and herbaceous vegetation. According to superficial surveys, the soil is composed of sandy and gravelly till, covered by granular material.

Given the recent periods of prolonged drought, the deterioration of the situation appears to have worsened recently.

Finally, it should be noted that during site visits, the outlet was generally clear and clean. It is clear, however, that floating objects can partially clog the spillway, reducing its transient capacity.

*Photo 2 View from the lake on the outlet.*

*Photo 3 The outlet is made up of large stones. During periods of low water, the extensive percolation through the rocks makes the free movement of fish impossible.*

*Photo 4 In the downstream part of the outlet, it appears that the flow was channeled by anthropogenic interventions. During periods of low water, these interventions contribute to the lowering of the water level of Lake Louisa.*

*Photo 5 Between the outlet of Lake Louisa and the south Lake Louisa road, the stream is relatively narrow and straight.*

## 3.1 HYDROLOGY AND HYDRAULICS

## 3.2 HYDROGRAPHY

Lake Louisa is a natural body of water with an area of $4.4^{km2.}$ Regionally, this considerable area ranks it among the major bodies of water with high recreational tourism potential. This body of water is fed by several small streams that originate in the outer part of the watershed. Most of the watershed area is occupied by foreststands at different stages of maturity. In general, the slopes of the watershed are moderate. The waters of Lake Louisa are drained by an unnamed stream to Mud Lake, about 150 m downstream. Subsequently, the stream is renamed Reardon and flows into the West and North rivers.

## 3.3 HYDROLOGY

The hydrological behavior of the Lake Louisa watershed was analyzed using the rational method. To our knowledge, no gauge stations with a statistically usable set of data are installed in the study of the basin.

The behavior of the basin is considered to have a natural diet, not influenced by water management or by major anthropogenic interventions. Hydrological analyses have been developed for the outlet, at the profile of the outlet.

The rational method usually shows relatively conservative results. We estimate that the actual flows of the watershed are slightly lower than the values presented.

The soil runoff coefficient was estimated from visual observations of surface deposits in the basin. It should be noted, however, that this coefficient can vary considerably depending on soil conditions (presence of frost, condition of vegetation, construction of communication routes, etc.).

To determine the high-water line, we consider the flow of the biannual flood ($Q_2$) as a representative flood.

Considering the results, we note that the lake's rolling capacity (ability to mitigate flooding) is relatively significant. Naturally, the relatively high ratio between the area of the basin 'water bodies' (5.1 km2) and that of the watershed (21 km2) is mainly responsible for this behavior.

To complete the hydrological portrait of the basin, the average interannual flow ($Q_{moy)}$ reaches 0.40 $m^{3/s}$ and the flow rate of seven consecutive days of a two-year recurrence ($Q_{2.7}$) is in the order of 0.040 $m^{3/s.}$

## 3.4 HYDRAULIC OUTLET

Since the current configuration will be preserved, the anticipated behavior will be substantially similar to current conditions. Naturally, this statement is valid for average and flood flows. For low flows, with reduced percolation through rocks, the lake's water level is expected to stabilize further.

Note that the large width of the outlet (about 20 m) is responsible for the small variation in water level associated with the passage of floods compared to average conditions.

# 4. CONCEPT OF THE PROPOSED INTERVENTION

The concept of the intervention was developed by considering the following:

1) The proposed intervention should be aligned with the aquatic ecosystem.

2) The average water level of Lake Louisa would not be changed from the current situation.

3) The proposed intervention should allow the free movement of fish during most water conditions prevailing at the outlet.

4) The very gentle slope downstream should allow the free movement of fish without any additional devices.

5) The periodic lowering of the lake's water level during low water periods should be reduced.

6) A rock structure (natural materials) should be integrated into the current aquatic ecosystem (possibility of re-vegetation).

7) The establishment of such a structure should be relatively easy and achievable by local and non-specialized resources.

8) Any repairs and maintenance work should be relatively easy to carry out.

9) The possibility of obstruction by floating bodies (tree trunk, ice) should be greatly reduced.

# 5. ENVIRONMENTAL AND WILDLIFE ASPECTS

Currently, during medium to low flows, the outlet is an impassable obstacle to the free movement of fish. Following the installation of the compacted rock with watertight elements, free movement will be made possible between the lake and its outlet. A cut-out will be formed in the weir structure to concentrate the flow of the spill and maintain a sufficientwater slide for the fish species present. Photos 6 and 7 show similar structures. It is noted thatalmost all of the flow is transited through the free flow regime and that the proportion of water infiltrated by the structure is relatively small.

Compared to the current environmental situation, no adverse changes to the aquatic and shoreline ecosystem of Lake Louisa are anticipated. Indeed, after the work, the level of the water body would remain the same. In addition, the released debit regime would remain virtually unchanged.

Naturally, during construction, all measures will have to be taken to reduce the environmental impact. The riparian vegetation already present in the vicinity of the proposed dam should be preserved. The management of sediments that could eventually be generated by construction would be the subject of particular attention. At the same time, disturbance of the Earth's surface would be minimized.

*Photo 6 Example of a rock outlet. Roger Lake, Wentworth.*

*Photo 7 Example of a rock outlet. Drolet Lake.*

# 6. TECHNICAL FEATURES

## 6.1 PERIOD OF COMPLETION

Work must be carried out during the low water flow period. However, it is preferable to carry out the work in the first half of the summer period to facilitate the resumption of herbaceous vegetation and to reduce the risk of surface erosion of the newly established embankments.

The completion periods prescribed by the authorities must be respected.

## 6.2 PATH

The dam is accessible by the network of local and provincial roads. There is no need to build new paths. However, the use of the path must be approved by the owners of the premises.

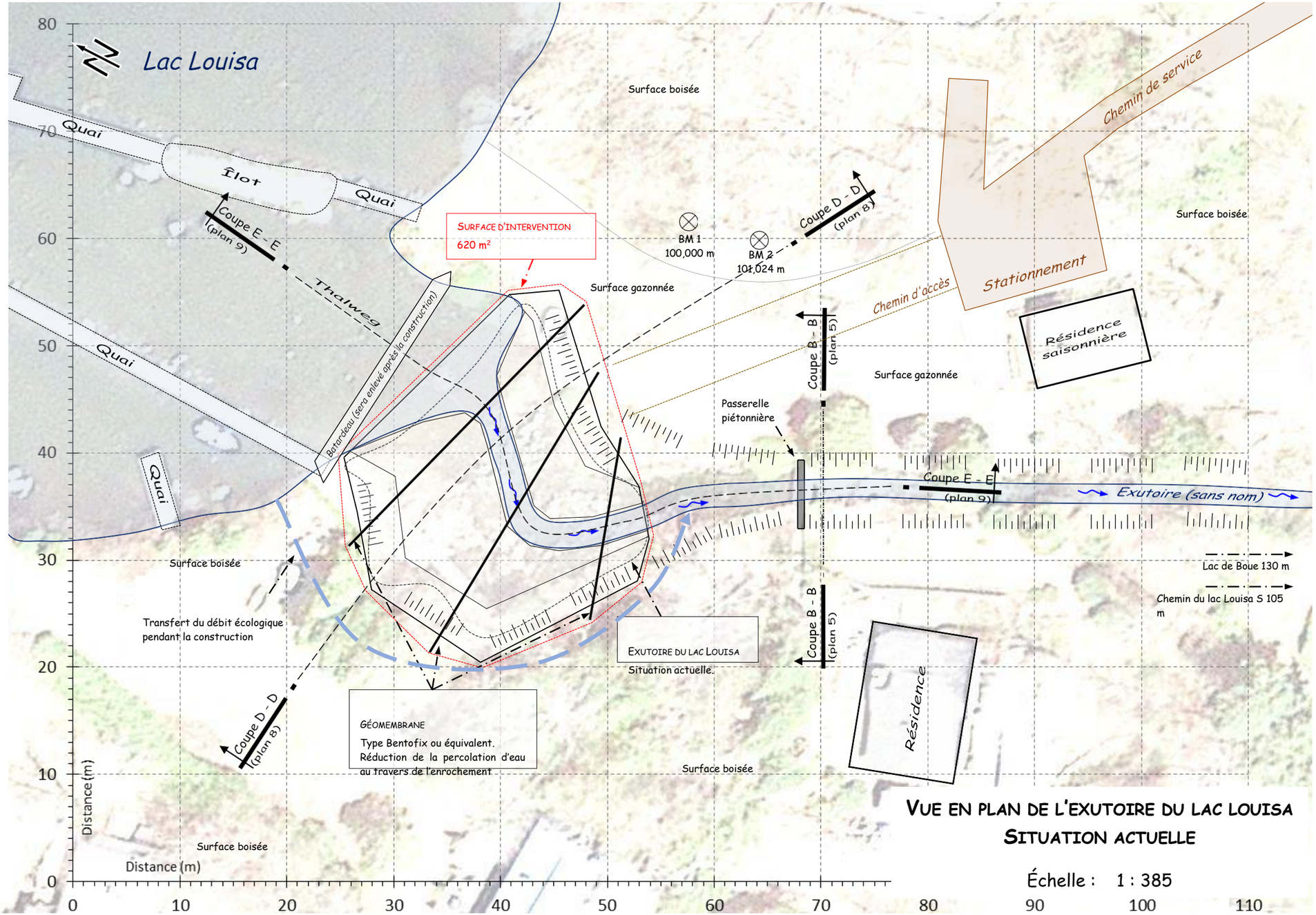
## 6.3 DEFORESTATION

In general, the work does not require deforestation.

## 6.4 REHABILITATION

After construction, it is necessary to carry out the rehabilitation of the premises. Wood debris will be collected and disposed of in an environmentally friendly manner. The exposed surfaces will be consolidated. All recoverable materials and construction debris will have to be collected and transported off-site. Sections of road that are broken or severely damaged will be repaired.

# ANNEXE Plans




## VUE EN PLAN DE L'EXUTOIRE DU LAC LOUISA
## SITUATION ACTUELLE

Échelle : 1 : 385

| | |
|---|---|
| *Projet* | Consolidation de l'exutoire du lac Louisa |
| *Municipalité* | Canton de Wentworth |
| *No du projet* | 2019-05-06 |
| *Référence du client* | |
| *Plan d'eau* | Lac Louisa |
| *Plan* | Vue en plan de l'exutoire du lac Louisa<br>Situation projetée |
| *Localisation* | N 45° 45' 16"<br>W 74° 25' 02" |
| *Échelle* | 1 : 385 |
| *Projeté par* | Miroslav Chum, ing., M.Sc. |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|---|---|
| *Dessiné par* | Miroslav Chum |
| *Sceau* | INGÉNIEUR - ENGINEER<br>Miroslav Chum<br>108442<br>QUÉBEC<br>*20 octobre 2019*<br>Miroslav Chum |
| *Unités* | Système métrique SI<br>Distances en mm<br>Élévations en m |
| *Date* | 20 octobre 2019 |

**Plan 7**