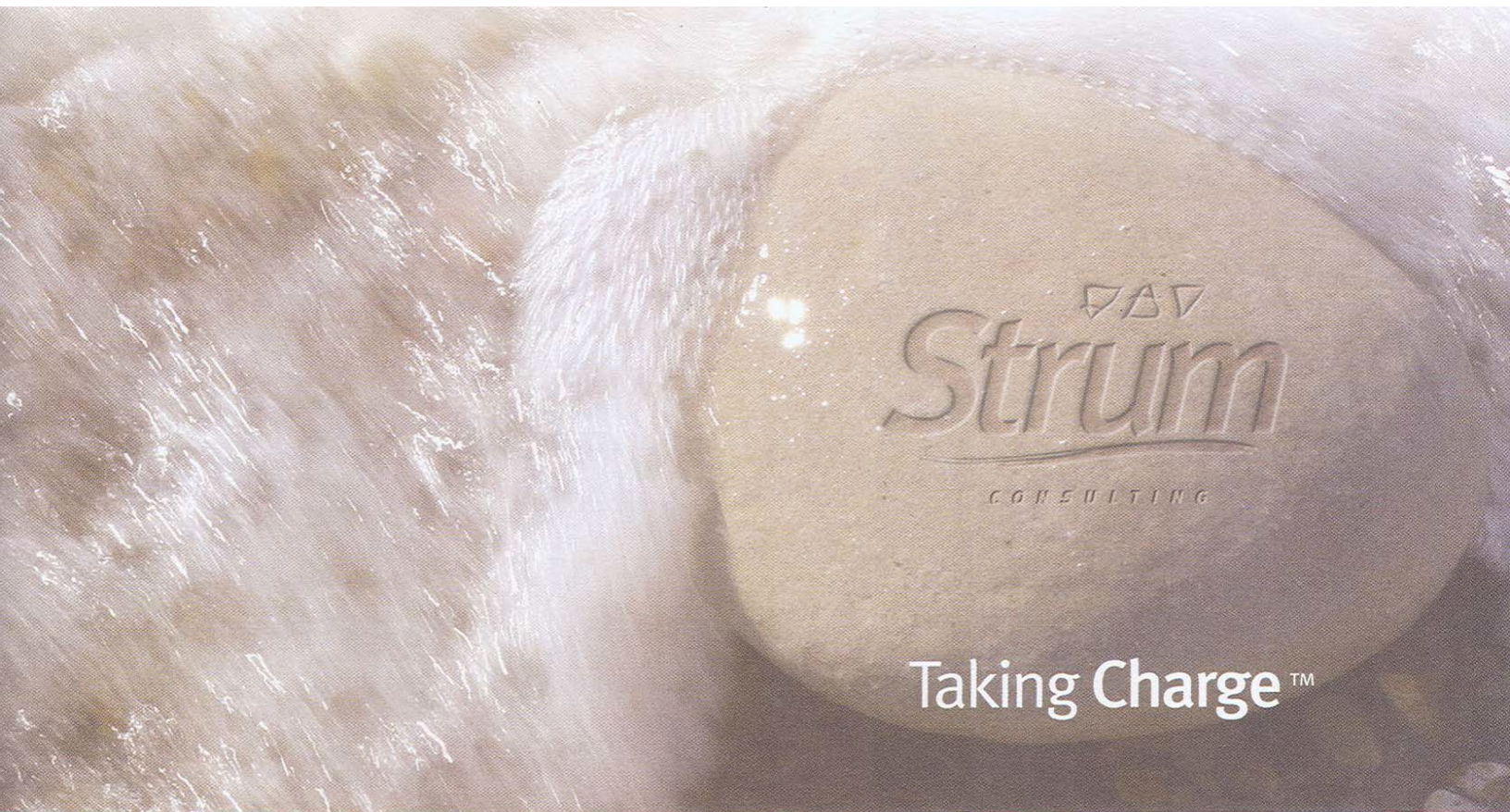




**Desktop Hydrogeological Assessment
Proposed Tacora Impoundment Area Expansion
FINAL REPORT**

January 25, 2023





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Ms. Sharlene Baird
Environment Superintendent
Tacora Resources Inc.
1 Wabush Mines Road
P.O. Box 3000
Wabush, NL A0R 1B0

Dear Ms. Baird,

Re: Desktop Hydrogeological Assessment
Proposed Tacora Impoundment Area Expansion

Further to your request Strum Consulting (Strum) has conducted a desktop hydrogeological assessment of the proposed Tacora Resources Inc. (Tacora) Impoundment Area Expansion (TIA). The hydrogeological assessment was a requirement of the conditions of release of the proposed project from further environmental assessment under the Newfoundland and Labrador Environmental Protection Act. The assessment was conducted using a variety of currently available information provided by Tacora and Sikumiut Environmental Management Ltd. (SEM), online sources, and from the Strum Consulting (Strum) in-house technical library. The study area is as shown on the attached Drawing 1.

The assessment provides background information on the proposed TIA study area regarding surface soils, bedrock geology, hydrogeology, and topography while developing inferences on site groundwater movement, flow orientation, and depth to groundwater. The assessment also provides comments on the potential impacts of the proposed expansion of the TIA on groundwater resources in the area and recommendations for possible further groundwater monitoring.

PHYSIOGRAPHIC SETTING

Setting

The study area forms part of the Smallwood Reservoir/Michikamau eco region that consists primarily of rich coniferous forests and tundra. The eco region is described as having short cool summers and long severe cold winters and the growing season lasts from 100 to 120

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days. The topography is generally flat to rolling with abundant lakes. Elevations vary from 330 metres (m) to 500 m above sea level (asl) with isolated rugged hills. Eskers and drumlins are common surficial landforms and permafrost occurs throughout the region.

Surficial Soils

Surficial soils in the study area are generally variable in thickness and composition. Aside from eskers and drumlins, a thin veneer of soil is common throughout this region. Soil veneers typically consist of till overlying bedrock with a thicknesses of less than 1.5 m. The till consists of a mixture of grain sizes, from clay to boulders deposited by glacial action.

Mapping of the Surficial Hydrostratigraphic Units of Labrador suggests that the bulk of surficial deposits in the study area are those of a Unit B classified as till and ribbed moraine deposits. Hydraulic conductivity of the surficial soils reportedly ranges substantially in these deposits, varying from 10 to 10^{-7} m/day. Well yields from aquifer testing (air lift or constant rate pumping tests) in wells placed in surficial deposits vary somewhat. The highest yields are reported in screened wells placed in silty sand surficial deposits, while the lowest are from screened wells placed in sands or fine textured deposits.

Bedrock Geology

Bedrock in the proposed TIA area, which is present beneath and toward the south end of the Flora Lake basin is underlain by late proterozoic rock and are represented by several rock groups. Gagnon Group rocks, specifically Kakao Formation rocks are located toward the north end of Flora Lake. These include quartz-feldspar-biotite bearing schists and gneisses. Associated with the schist and gneiss rocks are magmatic rocks including migmatites with a granitic component of 30% or more. Migmatites with 60% granitic composition are mapped as underlying the south end of the Flora Lake basin.

Dudley Formation marbles are also dispersed through the Kakao Formation, and underly the southwest perimeter of the study area. To the east of the study area limits are gabbros of the Shabogamo Group including metagabbro, diorites, pyroxenite, amphibolite, and biotite schists. Minor runs of Gagnon Group Wabush Iron Formation bedrock exist just northeast of the study area characterized by iron rich oxide containing iron formation rock.

Bedrock Hydrogeology

There are two primary bedrock hydrostratigraphic units present in the study area. They are known as Unit 2, granitic and gneissic rocks and Unit 4, sedimentary and volcanic rocks of the Labrador Trough along with metamorphosed equivalents of the Labrador Trough and Seal Lake group.

Unit 2 rocks consists primarily of granitic and gneissic rocks with low to moderate well yield. Records for wells placed in these rock types indicated depths ranging from 13 m to 177 m with a mean depth of 62 m. Yields of wells drilled in Unit 2 are typically moderate with a median sustainable pumping rate of 21.5 litres per minute (L/min) and 28.7 L/min based on air lift and constant rate pumping tests respectively.

Unit 4 rocks consists primarily of siltstone, and shale with turbidite sequences formed within deep water rock environments. These rocks include schists, along with dolomites, marble, shale, and shallow to deep marine sandstone. This group of rocks also includes red beds, described as iron rich sedimentary rock. Wells placed in these rock types range in depth from 22.8 m to 91.4 m, with a mean of 45 m. Mean air lift yields are commonly 20 L/min with constant rate pumping test yields ranging from 23 L/min to 600 L/min.

The study area is largely underlain by Unit 2 granites interspersed with gneiss. Unit 4 rocks defined in mapped contacts lie to the west and northwest of the study area, to the north, and toward the southern tip of the study area. Faulting dominates the contact throughout the southern tip of the study area where the Unit 2 rock meets Unit 4 siltstones and turbidite formations.

HYDROGEOLOGICAL ASSESSMENT

As part of the hydrogeological assessment, a review of data provided by Tacora for nine piezometers was conducted. The nine piezometers are located in close proximity near the South Dike location of the current tailings deposition area, immediately east of the northeast tip of Wahnahnish Lake. It is understood that the piezometers were installed to assist with geotechnical considerations regarding tailings pile stability and were not designed or installed specifically for groundwater quality monitoring purposes. Groundwater elevations in the piezometers range from 561 m to 575 m asl. It is assumed that all piezometers assess shallow groundwater conditions in the area of tailing deposition near the South Dike.

Groundwater levels measured in the piezometers over time were provided by Tacora's geotechnical consultants charted in graphical format. The charts indicate that water levels in the piezometers were continuously monitored using automated transducers between 2012 and 2014, with occasional data monitored between 2014 to 2018 (i.e., two sets). The chart of piezometric data shows the rise and fall of groundwater levels in tailings as they fluctuate over a period of one or more years.

Water levels were observed to vary between 2 m and 6 m over the span of the monitoring period results. In some cases, fluctuations of 2 m to 2.5 m occur over a three to four month period. This fluctuation in water levels over time appears to be related to seasonal fluctuations, but could also be indicative of the influence of successive tailings depositional events through the same time frame, significant precipitation periods, etc.

Some piezometers such as PZ-12-05, indicate a rise in water levels in excess of 5 m, maintained over a period of 16 months, before dropping to pre rise levels. This observation of water table level rise and maintenance over a 16-month timeframe is unlikely due to seasonal influence. More likely, this sustained 16-month rise in groundwater levels is related to sustained precipitation events or other events which might result from tailings deposition near the piezometers over that timeframe. This extended influence of water level increases occurs in several of the piezometers, suggesting an anthropogenic source such as tailings deposition, versus seasonal related fluctuation. This suggests that tailings deposition may

impact water table levels over time, either through direct ongoing deposition of the tailings, or by saturated levels caused indirectly by tailings deposition.

A review of the Tacora Environmental Registration document provides detailed information on the proposed TIA. In it, the report details the recent development of the current impoundment works within the Flora Lake basin, and expands on that project beyond phases 1 through 4 and onto proposed successive phases of Impoundment Expansion up to phase 9 and onto the closure phase, estimated to be completed in 2047. These phases are presented in a series of drawings provided in the Registration Document, ranging from Drawing 2.2 (current day) to Closure as portrayed in Drawing 3.11. Additional drawings show various phases of proposed TIA expansion during Phases 5 through 9.

The successive phases show the order of tailings deposition in the Flora Lake basin, extending in successive fill fronts, moving from the north end of the Flora Lake basin, toward the south east. The phases describe the added layers and increases in elevation planned for the divide between Flora Lake basin and Wahnahnish Lake watersheds. Additionally, deposition will occur along the east periphery of the Flora Lake basin. An important aspect of the tailings deposition process is the requirement to raise the elevation of the new Saddle Dike crest over time as the project continues with tailings deposition.

Based on a review of topographic maps, the current elevation of the two lakes is estimated at 542 masl and 545 masl for Wahnahnish Lake and Flora Lakes respectively. The current elevation of the natural divide between the two lakes is 585 masl, or 40 m above the two lakes.

As provided in Table 3.3 of the Tacora Registration Document, Summary of the Tailings Deposition Phases for the Scully Mine to 2047, the deposition of tailings will result in an increase in elevation along the watershed divide between Lake Wahnahnish and Flora Lake from its current elevation of approximately 585 masl to an estimated elevation of 617 masl, by the year 2047. This suggests that the elevation of the divide will increase by an additional 32 m from tailings deposition.

The western edge of the Flora Lake tailings impoundment, marked by the Saddle Dike lies along much of the divide between the two watersheds. Presently, it is assumed that surface water that falls along the west side of the ridge drains west and that precipitation that falls along the east side of the ridge drains east. It is understood that maintenance of a proposed 100 m buffer between tailings and the edge of watershed boundaries is required.

A review of the Tacora Registration Document indicates that monitoring of water quality from tailings drainage suggests a relatively benign impact on groundwater quality. As a result, and given that the impact is anticipated to be slight, the impact on groundwater quality should be minimal. However, it may be detectable and accordingly could result in concerns over time. Concerns may be heightened in the absence of a long term monitoring plan.

Assessment of variations in water levels and direction of groundwater flow in the shallow groundwater regime due to increasing thickness and elevation of tailings deposition over time is recommended. Monitoring of changes in groundwater levels and flow direction will facilitate assessment of trends over the life of the project.

In addition, monitoring of groundwater quality trends should also be conducted to determine any potential impact the expanded tailing impoundment would have on groundwater in the surrounding area. Groundwater quality data can be used to assess current conditions and determine whether migration of tailings discharge water into soil and shallow bedrock occurs and the extent to which it may impact quality of existing groundwater.

The installation of a series of groundwater wells is recommended to evaluate this potential impact of the TIA in groundwater. The wells should be nested (i.e., shallow and deep well at each location) and would be used to assess several baseline factors including depth to groundwater, vertical groundwater gradients, and groundwater flow direction prior to and after tailings are deposited. Monitoring wells could be placed independently or as part of ongoing geotechnical assessment carried out at the site in relation to tailings placement.

In addition to water level monitoring, it is suggested that initial sampling be conducted to develop an accurate picture of pre-deposition groundwater quality as well as bi-annual sampling to assess for trends associated with changes in groundwater over time that might be caused by tailings deposition.

A set of six nested pairs are suggested, four approximately equally spaced near crest dike high points along the western edge of the Flora South basin divide and two along the eastern basin perimeter.

Nested pair installation can be placed to match the pace of tailings deposition, or all at once depending on access to proposed sites, but wells should be placed at least a year in advance of tailings deposition as the project advances in a particular tailings front. All sites should be geolocated and a long-term database of elevations and water quality data developed and assessed for trends.

Recommendations

As indicated above, the potential exists that tailings deposition could possibly impact shallow groundwater flow along the periphery of the proposed TIA, particularly with regard to groundwater flow and groundwater quality along the western and eastern flank. The western flank in particular is situated adjacent to a sensitive watershed containing the Wahnahnish Lake. Accordingly, it is recommended that groundwater monitoring wells be installed to collect information that can be used to develop a plan to mitigate any potential impacts to groundwater monitoring purposes and act as a safeguard to address any concerns associated with this potential. Groundwater levels can be monitored through the use of transducers placed in wells. In addition, water quality can be sampled to address any shallow groundwater impacts.

We trust this report to be satisfactory at this time. Please contact us with any questions you may have.

Thank you,



A. Bruce Strum, P.Geo.
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Attachment: TIA Study Area, Drawing No. 1

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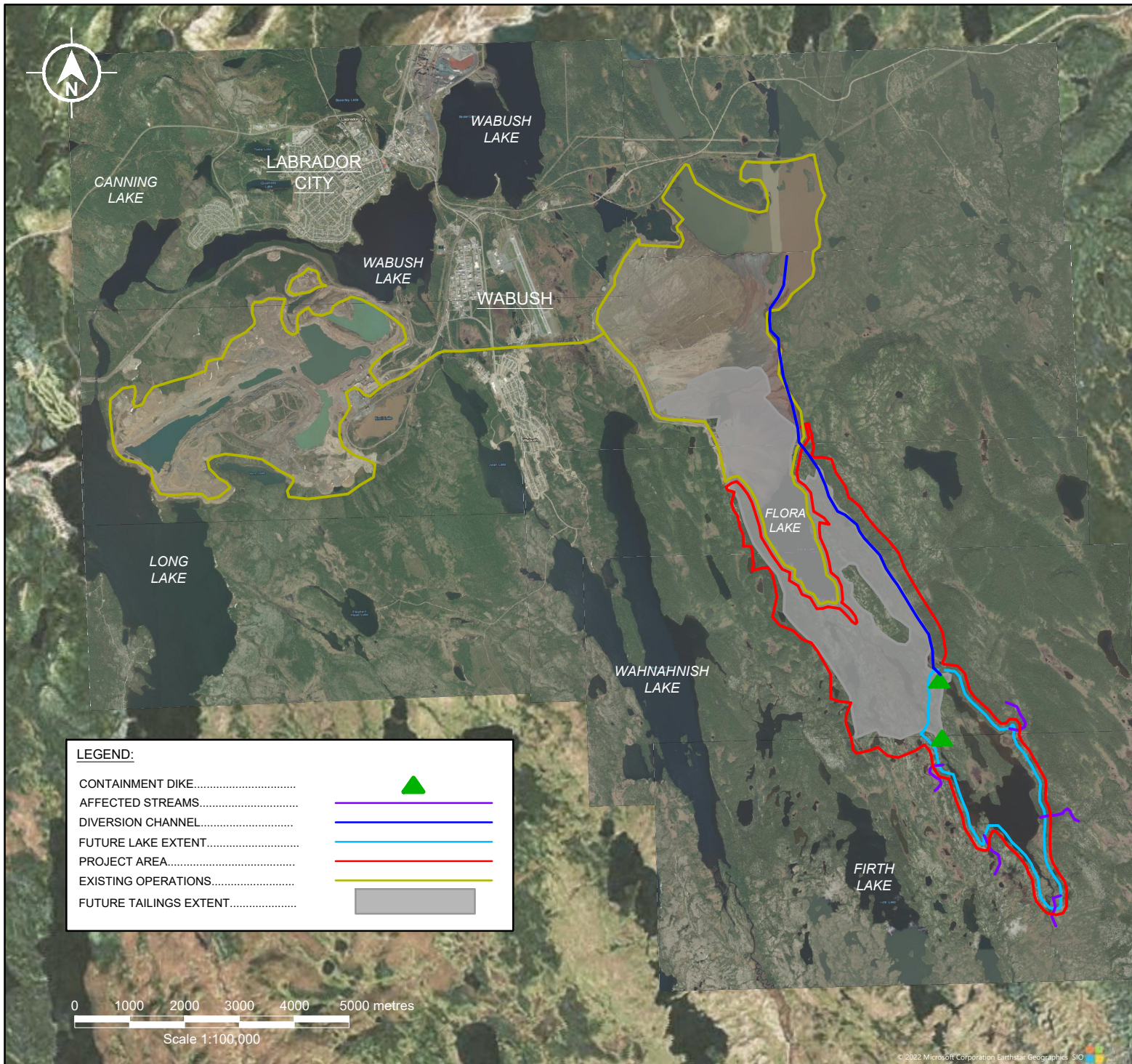
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CLIENT:		
TACORA RESOURCES		
PROJECT:		
TACORA IMPOUNDMENT REVIEW		
SITE LOCATION:		
FLORA WATERSHED LABRADOR CITY, NL		
DRAWING TITLE:		
STUDY AREA		
CONSULTANT:		
		
SCALE:		
1:100,000		
DATE:		DRAWN:
AUGUST 2022		L. PEMBERTON
DESIGNED:	CHECKED:	APPR'D:
	B. STRUM	B. STRUM
PROJECT No.:		
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