Mosquito Creek Watershed

Assessment Report

LAKEHEAD REGION
CONSERVATION AUTHORITY

LAKEHEAD REGION
CONSERVATION AUTHORITY

Mosquito Creek Watershed

Assessment Report

2022

PREPARED BY:

Cody Lane (Environmental Technician)
Ethan Johnston (Environmental Technician)

Acknowledgements

The 2022 Mosquito Creek Watershed Assessment was prepared by Cody Lane and Ethan Johnston, Environmental Technicians of the Lakehead Region Conservation Authority. Scott Drebit, GIS/Water Resources Technologist of the Lakehead Region Conservation Authority, produced the maps for this report and provided input and revisions towards the final copy. Gail Willis, Watershed Manager, also provided guidance, input and revisions towards the completion of this report.

This report has been prepared in-house at the Lakehead Region Conservation Authority for internal purposes to document the condition of the Mosquito Creek watershed in 2022.

Executive Summary

The Mosquito Creek Watershed Assessment Report provides baseline data to track progress and water quality over time and provides the LRCA with a better understanding of the local environment to focus future actions where needed. The results from the collected data were analyzed, and the Mosquito Creek Watershed was given an overall watershed grade rating; thereby, determining the health status of the watershed.

Background

The Mosquito Creek watershed is located within the City of Thunder Bay, Municipality of Oliver Paipoonge, Municipality of Neebing and the Fort William First Nation. The watershed covers a drainage area of approximately 31.1 square kilometres. Mosquito Creek is approximately 15.6 kilometres in length and is a meandering creek which confluences with the Kaministiquia River into Lake Superior. The gradient of the watershed forms an area of low slope within a 2.5 kilometre valley. The valley is contained between mountains to the southeast (Logan Diabase Sills) and smaller outcrops of diabase, or glacial ground Moraine, to the west. The general slope of the watershed is 1.66 percent.

Most of the Mosquito Creek watershed is privately owned land (82 percent), with the remainder being the Fort William First Nation reserved land (18 percent). Land uses in the watershed include private residences, Loch Lomond Ski Area, Thunder Bay Correctional Centre, the Tournament Centre, Nor'Wester View Public School, and the South Neebing Community Centre. The area in the City of Thunder Bay is serviced by municipal water.

Physical and Biological Attributes

The surficial geology of the Mosquito Creek watershed is mainly low relief glaciolacustrine lake plains (53 percent) although alluvial, slope/talus pile, bedrock and moraine plains are also present. The bedrock formation is mostly composed of sedimentary rocks (62 percent), but there are also Mafic and related intrusive rocks (38 percent). The Mosquito Creek watershed is composed of eight different soil types. The most abundant soil type is silt loam, which covers almost half of the watershed (47 percent). Rock is the second most abundant, covering approximately 34 percent of the watershed. The remaining soil is made up of clay, clay loam, fine sandy loam, gravel, medium to moderately fine loam, and moderately coarse sandy loam, which together covers approximately 19 percent.

The Mosquito Creek watershed is located within the boundaries of the Great Lakes and Boreal Forest regions. The most common tree species in the watershed are white spruce, jack pine, black spruce, balsam poplar and trembling aspen. There are a variety of other plants present in the watershed including ferns, shrubs, herbs, mosses, and lichens.

Watershed Site Assessment

For this study, ten sample sites located within the Mosquito Creek watershed were chosen based on a variety of attributes including accessibility, physical features, land use designation, and proximity to man-made features that may alter water quality, as well as headwaters used as a base reference. Site 1 was located near the confluence of the Mosquito Creek and Kaministiquia River. Site 3 was the midpoint on the main channel before it branched off into different tributaries, of which Sites 2, 4, 5, 6 and 7 were located on. Sites 8 and 9 were the closest locations to the head waters of the watershed, with Site 9 being upstream of the Thunder Bay Correctional Centre settling ponds. Lastly, Site 10 was located downstream of most urban development, and north of the confluences of the Site 2 and 3 tributaries.

Surface Water Quality – PWQO Comparison

At each of the ten sample locations, surface water samples and field measurements were collected on June 14th and July 13th, 2022. Surface water samples were analyzed by ALS Laboratory Group for conductivity, total dissolved solids, turbidity, total ammonia, nitrate, nitrite, total phosphorus, *Escherichia coli (E. coli)*, total coliforms and a full metal scan. Field measurements taken with an YSI Multi-Parameter Probe included water temperature, pH, conductivity, oxidation-reduction potential and dissolved oxygen. Field and laboratory results were compared to the Ministry of Environment's *Provincial Water Quality Objectives* (PWQO), 1994. Parameters that exceeded the PWQOs included phosphorous, total coliform, aluminum, iron, copper, cobalt, zinc, and vanadium as described below:

a) Phosphorous Exceedance

Phosphorus exceeded the PWQO criterion (0.03 mg/L) at Sites 4, 5, and 7 during the June sampling period, and at Sites 3, 4, 5, 7, and 9 during the July sampling period. Phosphorus concentrations for all sites ranged from 0.0055 mg/L to 0.54 mg/L.

b) Bacteriological Exceedance – Total Coliform

As there is no current PWQO for total coliform, results were compared to the pre-1994 PWQO criterion (1,000 MPN/100 mL). Every site exceeded the criterion during both the June and July sampling periods. Total coliform concentrations ranged from 1410 MPN/100mL to >2,420 MPN/100 mL for the watershed.

Coliform bacteria are living organisms and can multiply quickly when conditions are favorable for growth or die in large numbers when conditions are not. Bacterial concentrations are dependent on specific conditions such as precipitation, temperature, and stream substrate. The 2022 average temperature during the sampling period was 0.3 degree Celsius higher than the Thunder Bay historical average. The total precipitation

during the sampling period in 2022 was 20.8 millimetres below the Thunder Bay historical average. Higher temperatures and lower precipitation can affect bacteriological counts in watersheds.

c) Metals Exceedance – Aluminum, Iron, Copper, Cobalt, Zinc, and Vanadium

The PWQO criterion for aluminum is 0.075 mg/L. During the June sampling period all sites exceeded the criterion except for Sites 5, 6, and 9. During the July sampling period exceedances occurred at Sites 1, 3, 7, 9, and 10. Aluminum concentrations for all sampling sites ranged from 0.016 mg/L to 4.50 mg/L. These values are typically associated with fine sediments.

The PWQO criterion for iron is 0.30 mg/L. During the June sampling period all sites were above the criterion except for Site 6. During the July sampling period all sites were above the criterion except for Sites 1, and 6. Iron concentrations ranged from 0.146 mg/L to 24.200 mg/L for the watershed. Iron exceedances are common in the region due to natural sources.

The PWQO criterion for copper is 0.005 mg/L. All sites were below the criterion during the June sampling period. Site 9 was the only exceedance during the July sampling period. Copper concentrations ranged from 0.00068 mg/L to 0.00805 mg/L for the watershed.

The PWQO criterion for cobalt is 0.0009 mg/L. All sites were below the criterion during the June sampling period. Site 7 was the only exceedance during the July sampling period. Cobalt concentration ranged 0.00017 mg/L to 0.00822 mg/L for the watershed.

The PWQO criterion for zinc is 0.02 mg/L. All sites were below the criterion during the June sampling period. Site 9 was the only exceedance during the July sampling period. Zinc concentrations range from <0.0030 mg/L to 0.0225 mg/L for the watershed.

The PWQO criterion for vanadium is 0.006 mg/L. All sites were below the criterion during the June sampling period. Site 9 was the only exceedance during the July sampling period. Vanadium concentrations ranged from 0.00072 mg/L to 0.00945 mg/L for the watershed.

Site Observations

The flora and fauna inventory indicated that the Mosquito Creek watershed supports a healthy population of diverse plants and animals. The stream banks were stable and showed little signs of erosion. One bridge exists within the watershed, and it was in good and stable condition. Most culverts were also in good condition, except the culverts at Site 3 (C7) and at Site 6 (C5). These should be monitored in the future as they appear to be deteriorating. All culverts at Site 9 (C8) have debris and sediment blocking water flow, resulting in a large pool forming upstream.

Watershed Report Card Rating

The Mosquito Creek watershed was also assessed using the *Guide to Developing Conservation Authority Watershed Report Cards*, 2017. Using this guideline, surface water quality and forest conditions for the Mosquito Creek watershed were used to determine a grade for the watershed. Surface water quality maintained a good rating with exceedances of phosphorus present within the Mosquito Creek watershed. Forest condition scored a good rating with high forest coverage and a low percentage of riparian forest cover. Overall, the quality of the Mosquito Creek watershed in 2022 was determined to be in good health and graded a B based on the surface water quality and a B based on the forest condition.

Overall, the Mosquito Creek watershed is in good health.

Recommendations

Upon completion of the 2022 Mosquito Creek Watershed Assessment, the following recommendations have been made for consideration:

- Staff and funding permitting it is recommended that an update to the 2022 Mosquito Creek Watershed Assessment be completed in the next five to ten years.
- Benthic analysis indicates water quality over an extended period and should be considered for future watershed assessments.
- Additional sampling should be conducted in the spring to observe the water quality differences between high and low flow seasons.
- If the Provincial Water Quality Monitoring Network program was ever expanded, a monitoring location within the Mosquito Creek watershed should be considered.
- A copy of this report should be provided to the City of Thunder Bay, Municipality of Neebing and the Municipality of Oliver Paipoonge for reference purposes. The Report should be kept on file at the LRCA Administration Office for review by interested parties.

Table of Contents

List of Tables

List of Figures

List of Maps

List of Appendices

1 Introduction

The Mosquito Creek watershed is located within the City of Thunder Bay, the Municipality of Neebing, the Municipality of Oliver Paipoonge, and Fort William First Nation as shown on Map M-1: Key Plan Map. Areas regulated by the Lakehead Region Conservation Authority (LRCA) and Municipal boundaries can be found on Map M-2: Regulated Areas.

A watershed can be defined as all the land and water within the confines of a drainage divide. In essence, the Mosquito Creek watershed consists of all the surrounding land that naturally drains its streams, wetlands, and precipitation runoff into the Kaministiquia River which then flows into Lake Superior.

The drainage network of tributaries comprising the headwaters of Mosquito Creek generally originate within the low, flat plain basin at the base of the Nor'Westers Mountains from mountain runoff and seepage (LRCA, 2008). The watershed covers a drainage area of approximately 31.1 square kilometres. The prevailing soil type throughout the watershed is silt loam over bedrock. Most of the watershed is dominated by white spruce, jack pine, black spruce, balsam poplar and trembling aspen. Mosquito Creek is bounded by the bedrock ridges of Mount McKay (Anemki Wajiw) and Mount McRae. It is 15.6 kilometres in length and meanders through poorly defined and flat drainage courses, to well defined valleys.

The goal of this report is to document the conditions of the watershed, specifically surface water quality, as observed in June and July of 2022. Ten sampling sites were chosen to assess the health of the watershed. This information will ultimately be used to develop and maintain programs to sustain a healthy ecosystem consistent with the Natural Hazards and Natural Heritage Policies of the Province of Ontario.

The main objectives of this assessment report are to:

- Summarize the physical, biological, and socio-economic attributes of the watershed,
- Collect surface water quality data,
- Collect field measurements,
- Conduct an inventory of the forest ecosystem and fauna observed within the watershed,
- Conduct an inventory of soil, streambed substrate and stream bank cover observed within the watershed,
- Document active erosion sites,
- Document the physical condition of all Mosquito Creek water crossings (bridges/culverts), and
- Interpret results to record the health status of the watershed.

2 Background

2.1 Physical Attributes

2.1.1 Topography

Mosquito Creek originates in the area between Loch Lomond and McQuaig Lake, south of Highway 61. It flows in a north easterly direction, joining with the Kaministiquia River approximately nine kilometers upstream from the mouth at Lake Superior. The highest point in the watershed is approximately 460.5 meters above sea level bordering the south-western boundary of the watershed near Sawdust Lake (326616 N, 5352329 E). The lowest point in elevation can be found near the confluence of Kaministiquia River and Mosquito Creek, at 184.8 meters above sea level (328685 N, 5356900 E). The general slope of the watershed is 1.66 percent, having a channel length of 15.6 kilometres. Although the Nor'Wester Mountains form the height of land along the east and south limits of the watershed, the majority of Mosquito Creek consists of a low relief glaciolacustrine lake plain composed of silt and clay deposits (LRCA, 2008). The overall Mosquito Creek watershed topography is shown on Map M-3: Topography.

2.1.2 Geology & Soils

2.1.2.1 Bedrock

Map M-4: Bedrock Geology shows the bedrock geology of the Mosquito Creek watershed. The Mosquito Creek Watershed is in an area of low elevation bounded by the bedrock ridges of Mount McKay (Anemki Wajiw) and Mount McRae to the east. The southeast edge of the watershed has steep gradients and is bounded by mountains. The watershed area is underlain by Paleo-Proterozoic rocks of the Lower Animikie Group consisting of mudstone, greywacke, argillite and siltstone. These rocks are about 1,600 to 2,200 million years in age. All of these sedimentary rocks are soft and permeable and have been deeply eroded and covered by thick deposits of lacustrine (lake) and riverine (river) sediments.

Logan Diabase Sills outcrop on the southeast and northwest sides of the watershed. The diabase rocks are about 1,100 million years old and are both the youngest and hardest (erosion resistant) rocks in the area. They have survived as large flat topped mesas such as Mount McKay (Anemki Wajiw). The diabase rock which forms the mesas was intruded as a flat lying sill or cap rock on the surrounding mesas. The diabase sills are underlain by Animikie Group shales which combine with the diabase to form steep talus on the edge of the mountains. A broken area of shale regolith can be seen on the edges of the mountains; this may form the bedrock interface throughout the watershed. The shale rock and regolith layers are permeable; this means that bedrock source water wells in the area could be affected by groundwater runoff infiltrating into the rock. Figure 3: Rock

Formations South of Thunder Bay shows a cross-section of the rock formations which has led to the development of the mesas and valleys in the area south of Thunder Bay.

2.1.2.2 Surficial Geology

Map M-5: Surficial Geology shows the surficial geology of the Mosquito Creek watershed and the surrounding area. Much of the underlying bedrock in the Mosquito Creek Watershed is deeply eroded; the visible geology consists of Holocene Age sediments except along the margins, which are bedrock. The substrates or sediments were laid down as glacial outwash and lake bottom deposits called glaciolacustrine horizons. The gradient of the Mosquito Creek Watershed forms an area of low slope within a 2.5 kilometre wide valley. The valley is contained between mountains to the southeast (Logan Diabase Sills) and smaller outcrops of diabase, or glacial ground Moraine to the west.

2.1.2.3 Soils

Most of the sediments and soils have been deposited by Mosquito Creek and by historical flooding of the area by Glacial Lake Minong. During the time approximately 8,000 to 10,000 years ago, thick beds of silt, sand and loam material were deposited on the glacial lake bottom. These lacustrine soils now form the Mosquito Creek Watershed. A gradient of 1.66 percent rise occurs over the length of Mosquito Creek. The soil horizons created by the erosion of the fine-grained sedimentary rocks and the glacial deposits has formed fine silty and sand rich soils in the floodplain of Mosquito Creek.

Soil logging was completed using criteria derived from the “Field Guide to the Substrates of Ontario” (MNRF, March 2015). Soil samples were taken using a 1.2 metre soil auger. The depth of the organic layer as well as the depth, composition, and characteristics of the A, B and C soil horizons were recorded at the ten sampling sites along Mosquito Creek (i.e., Site ID MC1 to MC8 were sampled in 2015 and Site ID MC9 and MC10 were sampled in 2022).

Map M-6: Soils illustrates the location of the 10 soil sampling sites. Most soil consist of silty loam with areas of moderately fine loam and sandy loam deposited along the creek bed.

The results of the soil testing are shown in Appendix A: Soil Logging Summary and Photography. The soils usually have a thin organic layer in the Mosquito Creek Watershed. The organic horizon averages 10.0 to 15.0 centimetres in thickness along the creek bed and is 5.0 to 10.0 centimetres thick in the rest of the watershed. The “A” horizon soils are generally less than 1 metre in thickness and often transition directly to the “C” horizon which represents the mineral soils from the last glacial period. The soil testing program indicates that the clay loam layer shown under the creek bed is silty clay loam and sandy clay loam (Sites MC2 to MC10).

Quaternary mapping, located near the intersection of Chippewa Road and Highway 61, indicate that clay layers and sand and gravel deposits lie below the loams and have thicknesses of 7.0 metres near the mouth of Mosquito Creek.

2.1.3 Climate

The climate of the Mosquito Creek watershed is like the Thunder Bay region, in that it is a modified continental climate influenced by Lake Superior. From the months of July to March the westerly winds prevail, whereas the easterly winds prevail the remainder of the year (LRCA, 1985). These winds modify the climate of Thunder Bay and the surrounding regions. The mean daily temperatures and precipitation levels were recorded at the Thunder Bay Airport from 1971 to 2000 (Environment Canada, 2011) as shown in Table 2.1-1. This table also summarizes the extreme daily precipitation in millimetres recorded within a 24-hour period and the date it occurred.

Table 2.1-1: Average Monthly Temperature and Precipitation for Thunder Bay, 1971-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Daily (degrees Celsius)	-14.8	-12	-5.5	2.9	9.5	14	17.6	16.6	11	5	-3	-11.6
Precipitation												
Total Precipitation (millimetres)	31.3	24.9	41.6	41.5	66.5	85.7	89	87.5	88	62.6	55.6	37.5
Extreme Max. Daily Precipitation (millimetres)	51.6	33.5	41.9	69.3	76.2	49.3	53.8	87.1	131.2	47.8	63	42.7
Date (yyyy /dd)	1956 /20	1951 /26	1957 /14	1954 /30	1971 /24	1947 /04	1973 /27	1973 /19	1977 /08	1968 /09	1973 /21	1948 /05

The average monthly temperatures and precipitation levels were recorded at the Thunder Bay Airport for 2022 (Environment Canada, 2022), as shown below.

Table 2.1-2: Average Monthly Temperature and Precipitation for Thunder Bay, January-July 2022

	Jan	Feb	Mar	Apr	May	June	July
Average Temperature							
Daily (degrees Celsius)	-14.7	-19.6	-4.9	2.6	9.1	14.1	18.2
Precipitation							
Total Precipitation (millimetres)	17.7	22.9	55.2	171.9	101.6	83.5	70.4

The average monthly temperature for the June and July sampling periods was 16.1 degrees Celsius and the average monthly precipitation was 61.7 millimetres. In

comparison with the historical data, the 2022 temperature was 0.3 degrees Celsius higher for June and July. The total precipitation for June 2022 was 2.2 millimetres less than the recorded historical average. The total precipitation for July 2022 was 18.6 millimetres less than the recorded historical average. In general temperatures in June and July were near normal while the precipitation in June was also near normal and below average for July.

2.1.4 Hydrology

2.1.4.1 Watershed Characteristics

Mosquito Creek covers an area of approximately 31.1 square kilometres and flows in a general northeasterly direction from the slopes of the Nor'Westers Mountain Range to its confluence with the Kaministiquia River, approximately nine kilometres upstream from Lake Superior. The surface water area has been estimated at 0.2 square kilometres and a wetland area of 2.4 square kilometres. Wetlands make up about 8% of the Mosquito Creek watershed. Mosquito Creek is primarily a runoff dominated system, therefore making high flow conditions closely linked to precipitation events (LRCA, 2008).

2.1.4.2 Hydrogeology

The Thunder Bay Area Regional Aquifer Characterization, Groundwater Management and Protection Report July 2005, illustrated that the Mosquito Creek watershed is in a zone with medium to high intrinsic susceptibility to contamination, in which the groundwater within these zones is more likely to become contaminated. The increased groundwater contamination susceptibility is due to the relatively thin overburden and the proximity of the water table to the ground surface. Site specific contamination controls for this watershed area should be determined as urban development persists.

2.1.4.3 Stormwater Management

At present there is minimal formal stormwater management within the Mosquito Creek Watershed. The area is serviced by municipal water with individual septic systems.

Recommendations from the 1996 Mosquito Creek Post Development Study regarding stormwater included:

- Completing stormwater management studies to determine the effects of the individual developments.
- surface water management best management practices (BMPs) should be assessed for each area to maintain current (pre-development) runoff quality and quantity."

Stormwater Best Management Practices and Low Impact Development (LID) can reduce the effects and likelihood of flood events and groundwater contamination. General techniques recommended for consideration for the Mosquito Creek Watershed include evaluation of existing identified, unevaluated wetlands; maintaining riparian buffers; utilizing grassed swales and infiltration trenches as opposed to piped systems; use of permeable pavement to promote infiltration and other LID techniques as warranted.

2.1.4.4 Evaluated Wetlands

The Mosquito Creek wetlands were delineated and evaluated in 2018 by Northern Bioscience. The watershed has a total of 248.6 hectares of wetlands, consisting of 17 wetland units. Most of the evaluated wetlands are narrow bands along Mosquito Creek and its tributaries, as well as within the Mosquito Creek floodplain. Swamp makes up about half of the wetlands, of which about half is hardwood swamp and the remainder is conifer swamp. Thicket swamp occurs mostly along the creek, and meadow march are common in the floodplain areas. 13 wetland units scored as Provincially Significant following the Ontario Wetland Evaluation System Northern Manual (Ontario Ministry of Natural Resources 2014); however, they lacked a distinct core area, made up less than 10% of the watershed, and there were no areas of patterned fen and no observations of threatened or endangered species. Due to these reasons, those highly scored wetland units were not designated as PSW. Other evaluated wetlands in the watershed include 12.8 hectares of hardwood swamp and marsh, and a 5.8 hectare marsh on the east edge of the watershed. The Mosquito Creek evaluated wetlands are delineated in green on the enclosed maps.

2.1.4.5 Flood and Fill Line Mapping

Floodplain mapping for the Mosquito Creek watershed was updated in 2020 by KGS Group from the previous floodplain study that was completed in 1984. The study update included the collection of topographic data using LiDAR technology and ground surveys, as well as bathymetric data for the creek and tributaries. A hydrologic and hydraulic analysis of the creek system was completed to calculate the conditions during flows estimated for various flood events. Additionally, the floodplain maps were updated that depict the flood hazard limits and regulatory fill lines along the reaches of Mosquito Creek and its tributaries.

The 2020 study update found that the peak flow values estimated for the Regional Storm Flood in the previous 1984 floodplain study and in the 1996 development study were proportionally too large. However, the updated flood and fill line mapping showed good agreement when compared to the previous study.

The 1984 floodplain mapping study concluded that flooding on Mosquito Creek occurs due to rapid runoff of both rainfall and snowmelt flows, and that peak discharges are

affected by the Nor'Wester Mountain Range. In addition, the effect of increased development is not likely to substantially increase regional flood flows. The study also found that the Mosquito Creek valley below Mountain Road can contain the Regional Flood and that the private domestic or commercial structures do not experience flooding in that area. It also concluded that road crossings in the watershed are generally incapable of passing the Regional Flood without road overtopping, but the road overtopping is not usually damaging to watershed access because alternate routes exist to all inhabited areas. Furthermore, that study found that the influence of increased low flows represents a greater potential hazard to the development of the watershed, than do increases in high flows. The more frequent occurrence of flows lower than regional can pose significant threat to the stability of the Mosquito Creek valley. The study suggested that the best way to reduce the impacts of future development on the persistence of low flows is to initiate stormwater management.

2.2 Biological Attributes

2.2.1 Flora

The Mosquito Creek watershed is located within the boundaries of the Great Lakes Forest region and the Boreal Forest region as shown on the Canada's Forest Regions map (Figure 1). The trees which comprise the Great Lakes Forest region are primarily white pine, red pine, and yellow birch. Although the watershed is geographically located in this forest region, the tree species observed are more indicative of a Boreal Forest region, as the trees present are predominantly black spruce, jack pine, white birch, and trembling aspen. This discrepancy is likely since the watershed is relatively close to the Boreal Forest region and mechanisms such as local climate (slope, aspect), site condition (soil characteristics), disturbance regimes and species interaction can affect the species distribution in the area. The coarse scale of the Canada's Forest Regions distribution map is only a basic division of the forest types; there is no discrete line which separates the two zones. Factors such as the ones mentioned above could easily alter forest types which are located between two zones. There are a variety of other plant species present in the Mosquito Creek watershed including ferns, shrubs, herbs, mosses, and lichens. Plant species identified at the sample sites are listed in Appendix B: Common and Scientific Names of Identified Flora and Fauna. There is also a list of identified Flora and Fauna from the Mosquito Creek Post Development Study (1996) in Appendix C.

2.2.2 Fauna

The Mosquito Creek watershed provides breeding grounds for a variety of wildlife. Species of amphibians, reptiles, and butterflies that have been sighted in the watershed and surrounding area historically and recently are listed below in Table 2.2-1. There is also a complete list of the wildlife observed in the watershed in Appendix B: Common and Scientific Names of Identified Flora and Fauna. The Mosquito Creek watershed is part of

the Ministry of Natural Resources and Forestry (MNRF) Wildlife Management Unit 13 and Fisheries Management Zone 6.

Table 2.2-1: Common Reptiles, Amphibians, and Butterflies

Species Name	
Common Name	**Scientific Name**
Amphibians and Reptiles	
Blue-Spotted Salamander	*Ambystoma laterale*
Jefferson Salamander	*Ambystoma jeffersonianum*
Snapping Turtle	*Chelydra serpentine*
Western Painted Turtle	*Chrysemys picta bellii*
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
Eastern Newt	*Notophthalmus viridescens viridescens*
Mudpuppy	*Necturus maculosus*
American Toad	*Anaxyrus americanus*
Boreal Chorus Frog	*Pseudacris maculata*
Gray Tree Frog	*Hyla versicolor*
Green Frog	*Lithobates clamitans*
Mink Frog	*Lithobates septentrionalis*
Northern Leopard Frog	*Lithobates pipiens*
Spring Peeper	*Pseudacris crucifer*
Wood Frog	*Lithobates sylvaticus*
Butterflies	
Juvenal's Duskywing	*Erynnis juvenalis*
European Skipper	*Thymelicus lineola*
Common Branded Skipper	*Hesperia comma*
Long Dash Skipper	*Polites mystic*
Canadian Tiger Swallowtail	*Papilio Canadensis*
Mustard White	*Pieris oleracea*
Cabbage White	*Pieris oleracea*
Clouded Sulphur	*Colias philodice*
Atlantis Fritillary	*Speyeria atlantis*
Northern Crescent	*Phyciodes cocyta*
Satyr Comma	*Polygonia satyrus*
Mourning Cloak	*Nymphalis antiopa*
Milbert's Tortoiseshell	*Algais milberti*
American Lady	*Vanessa virginiensis*
Painted Lady	*Vanessa cardui*
Red Admiral	*Vanessa atalanta*
White Admiral	*Limenitis arthemis*
Northern Pearly-Eye	*Lethe anthedon*
Common Wood-Nymph	*Cercyonis pegala*
Monarch	*Danaus plexippus*

Source: Ontario Butterfly Atlas & Reptile and Amphibian Atlas, 2022

2.2.3 Species at Risk

Ontario has more than 200 species at risk living in its forests and lakes, all at varying degrees of risk. There are approximately 19 species at risk in the Thunder Bay area that have potential to exist within the Mosquito Creek watershed. The surrounding area is considered in addition to the watershed boundary limits, as it is also Boreal Forest region which would allow for movement of individuals in and out of the watershed boundary. Below is a table showing the species at risk, with documented sightings in the Mosquito Creek watershed and immediate surrounding area.

Table 2.2-2: Species at Risk, below, shows the species at risk in the Thunder Bay and Northern Ontario region.

Table 2.2-2: Species at Risk

Species Name		Status of Risk
Common Name	**Scientific Name**	
American Badger *jacksoni* subspecies	*Tixidea taxus jacksoni*	Endangered
American White Pelican	*Pelecanus erythrorhynchos*	Threatened
Bald Eagle	*Haliaeetus leucocephalus*	Special Concern
Bank Swallow	*Riparia riparia*	Threatened
Barn Swallow	*Hirundo rustica*	Threatened
Black Tern	*Chlidonias niger*	Special Concern
Blanding's Turtle	*Emydoidea blandingii*	Threatened
Bobolink	*Dolichonyx oryzivorus*	Threatened
Canada Warbler	*Cardellina canadensis*	Special Concern
Chimney Swift	*Chaetura pelagica*	Threatened
Common Nighthawk	*Chordeiles minor*	Special Concern
Cougar (Mountain Lion)	*Puma concolor*	Endangered
Deepwater Sculpin	*Myoxocephalus thompsonii*	Special Concern
Eastern Meadowlark	*Sturnella magna*	Threatened
Eastern Whip-poor-will	*Antrostomas vociferus*	Threatened
Eastern Wolf	*Canis lupus lycaon*	Special Concern
Eastern Wood-pewee	*Contopus virens*	Special Concern
Golden Eagle	*Aquila chrysaetos*	Endangered
Gray Fox	*Urocyon cinereoargenteus*	Threatened
Horned Grebe	*Podiceps auritus*	Special Concern
Kiyi	*Coregonus kiyi kiyi*	Special Concern
Lake Sturgeon	*Acipenser fulvescens*	Threatened and Special Concern
Least Bittern	*Ixobrychus exilis*	Threatened
Little Brown Bat	*Myotis lucifugus*	Endangered
Loggerhead Shrike	*Lanius ludovicianus*	Endangered
Monarch Butterfly	*Danaus plexippus*	Special Concern
Northern Brook Lamprey	*Ichthyomyzon fossor*	Special Concern
Olive-sided Flycatcher	*Contopus cooperi*	Special Concern
Peregrine Falcon	*Falco peregrinus anatum/tundrius*	Special Concern
Piping Plover	*Charadrius melodus circumcinctus*	Endangered

Table 2.2-2: Species at Risk		
Species Name		Status of Risk
Common Name	Scientific Name	
Pitcher's Thistle	*Cirsium pitcheri*	Threatened
Pygma Snaketail	*Ophiogomphus howei*	Endangered
Rusty Blackbird	*Euphagus carolinus*	Special Concern
Short-eared Owl	*Asio flammeus*	Special Concern
Shortjaw Cisco	*Coregonus zenithicus*	Threatened
Showy Goldenrod	*Solidago speciose*	Threatened and Endangered
Small-flowered Lipocarpha	*Licocarpha micrantha*	Threatened
Snapping Turtle	*Chelydra serpentina*	Special Concern
Wolverine	*Gulo gulo*	Threatened
Woodland Caribou, Boreal population	*Rangifer tarandus caribou*	Threatened
Wood Thrush	*Hylocichla mustelina*	Special Concern
Western Silvery Aster	*Symphyotrichum sericeum*	Endangered

Source: Ontario - Species at Risk in Northern Ontario, 2008

2.2.4 Invasive Species

Invasive species are a threat to native plants and animals and can disturb entire ecosystems. They are introduced and spread as a result of movement of people and goods around the world, increased urbanization, improved transportation routes and through recreational activities. Some of the ways invasive species can enter Ontario include:

- All-terrain vehicles,
- Aquarium, water garden and pet trades,
- Ballast water of ships,
- Canals and changes to waterways,
- Gardening and landscaping,
- Release of live fish and bait,
- Transport of topsoil,
- Recreational and commercial boating,
- Transport of animal carcasses or products made from them, and
- Transport of raw wood and other forest products.

Invasive species that were observed in Kaministiquia River, Lake Superior or the District of Thunder Bay, Ontario may be present in the Mosquito Creek watershed, according to the Canada/Ontario Invasive Species Centre, MNRF and the Ontario Federation of Anglers and Hunters' Early Detection and Distribution Mapping System. These invasive species are listed below in Table 2.2-3: Invasive Species.

Table 2.2-3: Invasive Species	
Species Name	
Common Name	**Scientific Name**
Bird Vetch	*Vicia cracca*
Bittersweet nightshade	*Solanum dulcamara*
Canada Thistle	*Cirsium arvense*
Chinese Mitten Crab	*Eriocheir sinensis*
Common St. Johnswort	*Hypericum perforatum*
Common Tansy	*Tanacetum vulgare*
Common Valerian	*Valeriana officinalis*
Creeping Bellflower	*Campanula rapunculoides*
Cypress Spurge	*Euphorbia cyparissias*
Dames Rocket	*Hesperis maronalis*
Dog-Strangling Vine	*Cynanchum rossicum & C. nigrum*
Emerald Ash Borer	*Agrilus planipennis*
Eurasian Ruffe	*Gymnocephalus cernuua*
Eurasian Watermilfoil	*Myriophyllum spicatum*
European or Black Alder	*Alnus glutinosa*
European Common Reed	*Phragmites australis ssp. australis*
European Flounder	*Platichthys flesus*
European Spindletree	*Euonymus europaeus*
Flowering-Rush	*Butomus umbellatus*
Garlic Mustard	*Alliaria Petiolata*
Goutweed	*Aegopodium podagraria*
Greater Celandine	*Chelidonium majus*
Himalayan Balsam	*Impatiens glandulifera*
Hybrid Cattail	*Typha x glauca*
Japanese Knotweed	*Polygonum cuspidatum*
Lilly of the Valley	*Convallaria majalis*
Manitoba Maple	*Acer negundo*
Mossy Stonecrop	*Sedum acre*
Narrow-leaved Cattail	*Typha angustifolia*
New Zealand Mud Snail	*Potamopyrgus antipodarum*
Non-native Bush Honeysuckle	*Lonicera spp.*
Norway Maple	*Acer platanoides*
Purple Crown-Vetch	*Securigera varia*
Purple Loosestrife	*Lythrum salicaria*
Rainbow Smelt	*Osmerus mordax*
Redtop	*Agrostis gigantea*
Reed Canarygrass	*Phalaris arundinacea subsp. arundinacea*
Round Goby	*Neogobius melanostomus*
Rusty Crayfish	*Orconectes rusticus*
Scots Pine	*Pinus sylvestris*
Spiny Water Flea	*Bythotrephes longimanus*
Spongy Moth (formerly Gypsy Moth)	*Lymantria dispar*
Squill	*Scilla siberica*
Tatarian honeysuckle	*Lonicera tatarica*
Three Spine Stickleback	*Gasterosteus aculeatus*
Tubenose Goby	*Proterorhinus marmoratus*

Table 2.2-3: Invasive Species	
Species Name	
Common Name	**Scientific Name**
Weeping Alkaligrass	*Puccinellia distans*
White Perch	*Morone Americana*
Wild Chervil	*Anthriscus sylvestris*
Wild Parsnip	*Pastinaca sativa*
Yellow Bedstraw	*Galium verum*
Yellow Sweet-Clover	*Melilotus officinalis*
Yellow Flag Iris	*Iris pseudacorus*
Zebra Mussel	*Dreissena polymorpha*

Source: Early Detection & Distribution Mapping System for Ontario, 2022

2.3 Socio-Economic Attributes

2.3.1 Planning & Development Controls

Land Tenure

Most of the Mosquito Creek watershed is privately owned land (82%). Fort William First Nation reserved land constitutes 18% (Fort William Reserve 52). Land ownership in the watershed is illustrated on Map 7: Land Ownership.

Areas of Jurisdiction

The hydrological boundaries of the Mosquito Creek watershed fall within the City of Thunder Bay, the Municipality of Neebing, the Municipality of Oliver Paipoonge, and the Fort William First Nation. Map 7: Land Ownership, illustrates the location of the Mosquito Creek watershed within these areas. Table 2.3-1 below outlines the watershed area within each boundary.

Table 2.3-1: Areas of Jurisdiction within the Mosquito Creek Watershed			
Geographic Boundaries	**Total Municipal Area (km^2)**	**Municipal Area within Mosquito Creek Watershed (km^2)**	**Municipal Area within Mosquito Creek Watershed (%)**
City of Thunder Bay	334.2	19.5	69.2
Municipality of Neebing	877.6	5.1	16.3
Municipality of Oliver Paipoonge	350.7	0.8	2.6
Fort William First Nation	58.3	5.7	18.2
Total	**1620.8**	**31.1**	**100**

Within the boundaries of the Mosquito Creek watershed the LRCA area of jurisdiction extends within the City of Thunder Bay, the Municipality of Neebing and the Municipality of Oliver Paipoonge. Of the total Mosquito Creek watershed area, 25.4 square kilometers

are within the LRCA area of jurisdiction. The remaining 5.7 square kilometres of the watershed is within the Fort William First Nation.

The Lakehead Region Conservation Authority administers the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses O. Reg 180/06 under the *Conservations Authorities Act.* Areas considered regulated include Provincially Significant Wetlands and 120 metres adjacent, evaluated and unevaluated wetlands plus 30 metres adjacent, all watercourses, all land zoned Hazard Land, Use Limitation or Environmental Protection, steep slopes, and 15 metres landward and one kilometre lakeward from the 100 year flood level on Lake Superior (i.e. 183.9 metres Geodetic Survey of Canada), as shown on Map 2: Regulated Area. Activities within the approximate regulated area may require a permit from the Authority.

2.3.1.1 Land Use Designation/Zoning

Municipal Official Plans contain long term goals and policies that serve as guidelines for future land use and development. The Mosquito Creek watershed is affected by the City of Thunder Bay, the Municipality of Oliver Paipoonge, and the Municipality of Neebing Official Plan and Zoning by-laws. Part of the land is also owned by Fort William First Nation. Land use designations within the Mosquito Creek watershed can be found on Map 9: Zoning.

The policies of the Official Plan and all land use designations are implemented through zoning by-laws. Zoning provides an additional level of detail, particularly with respect to the range of permitted uses and any specific conditions which must be satisfied such as buffering, suitable distances between uses and parking requirements.

City of Thunder Bay

Within the City of Thunder Bay, the Mosquito Creek watershed has been zoned as:

- Community Zone (CM)
- Environmental Protection Zone (EP)
- Future Development Zone (FD)
- Institutional Zone (IN)
- Rural Settlement Zone (RS1)
- Rural Commercial Zone (RS2)
- Rural Zone (RU)
- Rural Commercial Zone (RUC)
- Service Commercial Zone (SC)

The following definitions are taken from the City of Thunder Bay Zoning By-law 1/2022, dated April 11, 2022.

Community Zone (CM)

The purpose of the Community Zone is to permit public or semi-public recreation and cultural facilities.

a) The following uses are permitted as a main use:
- Cemetery and crematorium
- Day care centre
- Indoor recreation use
- Minor institutional use
- Water-related use

b) There is no limit on the number of main uses that may be located within the same building.

Environmental Protection Zone (EP)

The purpose of the Community Zone is to permit public or semi-public recreation and cultural facilities.

a) The following uses are permitted as a main use:
- Cemetery and crematorium
- Day care centre
- Indoor recreation use
- Minor institutional use
- Water-related use

b) There is no limit on the number of main uses that may be located within the same building.

Future Development Zone (FD)

The purpose of the Future Development Zone is to limit development to protect future development options.

a) Only uses, buildings, or structures legally existing on the effective date which may include extensions or additions are permitted as a main use.

Institutional Zone (IN)

The purpose of the Institutional Zone is to permit major institutions. These include hospitals, colleges and universities, secondary schools, and correctional institutions.

a) The following uses are permitted as a main use:
- Correctional centre, penitentiary, or jail
- Educational institution
- Emergency shelter
- Health centre
- Hospital
- Long term care housing

b) There is no limit on the number of main uses that may be located within the same building.

Rural Settlement Zone (RS1)

The purpose of the Rural Settlement Zone is to permit residential uses.

a) The following uses are permitted as a main use:
- Care housing
- Detached house

b) The following uses are permitted as a secondary use to a permitted main use:
- Bed and breakfast
- Home day care

Rural Settlement Commercial Zone (RS2)

The purpose of the Rural Settlement Commercial Zone is to permit a range of non-residential uses to support nearby residential activities.

a) The following uses are permitted as a main use:
- Care housing
- Day care centre
- Detached house
- Minor institutional use
- Rural convenience use
- Rural pet services

b) The following uses are permitted as a secondary use to a permitted main use:
- A home within a building containing a permitted non-residential main use
- Bed and breakfast
- Home day care

Rural Zone (RU)

The purpose of the Rural Zone is to permit agricultural activities with limited residential development.

1.1.1.1 Large rural lots (2 ha or more)

a) The following uses are permitted as a main use on large rural lots:

- Agricultural use
- Care housing
- Detached house
- Rural pet services

b) The following uses are permitted as a secondary use to a permitted main use on large rural lots:

- Bed and breakfast
- Home day care
- Large personal farm
- Limited outdoor storage in association with a home business (Section 12.1.1)
- Outdoor furnace
- Small personal farm

1.1.1.2 Small rural lots (less than 2 ha)

a) The following uses are permitted as a main use on small rural lots:

- Detached house
- Care housing

b) The following uses are permitted as secondary uses to a permitted main use on small rural lots:

- Bed and breakfast
- Small personal farm
- Home day care
- Limited outdoor storage in association with a home business (Section 12.1.1)

Rural Commercial Zone (RUC)

The purpose of the Rural Commercial Zone is to permit a range of non-residential uses to support nearby agricultural and residential activities.

a) The following uses are permitted as a main use:

- Agricultural commercial use
- Care housing

- Day care centre
- Detached house
- Indoor recreation use
- Minor institutional use
- Rural convenience use
- Rural pet services

b) The following uses are permitted as a secondary use to a permitted main use:

- A home within a building containing a permitted non-residential main use
- Bed and breakfast
- Home day care
- Limited outdoor storage in association with a home business (Section 12.1.1)

Service Commercial Zone (SC)

The purpose of the Service Commercial Zone is to permit appropriately scaled shopping and service areas along major streets.

a) The following uses are permitted as a main use:

- Building supply outlet
- Funeral establishment
- Furniture store
- Health centre
- Hotel
- Indoor recreation use
- Indoor self-storage
- Microbrewery
- Motor vehicle sales or rentals
- Motor vehicle service use
- Office
- Restaurant
- Retail commercial use
- Retail warehouse
- Service commercial use

b) There is no limit on the number of main uses that may be located within the same building.

c) The following uses are permitted as a secondary use to a permitted main use:

- Drive-through
- Outdoor display

Municipality of Oliver Paipoonge

Within the Municipality of Oliver Paipoonge, the Mosquito Creek watershed has been zoned as:

- Rural Zone (RU)

The following definitions are taken from the Municipality of Oliver Paipoonge Zoning By-Law JANUARY 01-2019, dated January 1, 2019.

Rural Zone (RU)

No person shall, within any Rural (RU) Zone use any lot or erect, alter or use any building or structure for any purpose except in accordance with Table 6.1.

All of the uses listed are permitted uses in the Rural Zone.

Agricultural use (in accordance with Section 5.3.2)
Agriculture-related use
Conservation uses and watershed management
Single Detached Dwelling
Accessory Dwelling
Accessory Farm Dwelling
Electrical generation (renewable or otherwise) and distribution
Forestry
Home industry
Home occupation
Mining
Stables and riding academies
Storage, Pre-fabricated shipping container
Kennels

Municipality of Neebing

Within the Municipality of Neebing the Mosquito Creek watershed has been zoned as:

- Recreation Commercial Zone (C2)
- Rural Zone (R)
- Watershed Reserve Zone (WR)

The following definitions are taken from the Municipality of Neebing Zoning By-Law No. 2017-030, dated September, 2017.

Recreation Commercial Zone (C2)

No person shall use any lot, building or structure for any use except one of the following uses:

1) a tourist park;
2) a tourist commercial resort;
3) a marina;
4) commercial recreation facilities;
5) ski facilities;
6) a restaurant;
7) a hotel;
8) a convention center; or
9) an accessory dwelling to the uses listed above.

Uses in the list above may be combined on a single lot, however, only one accessory dwelling unit is permitted on any one lot.

Rural Zone (R)

No person shall use any lot, building or structure for any use except one of the following uses:

1) a single dwelling;
2) a modular dwelling;
3) an agricultural use;
4) a forestry use;
5) a stable;
6) watershed management and conservation uses;
7) a home occupation;
8) a home industry;
9) a guest cottage;
10) a bed and breakfast establishment;
11) mineral exploration; or
12) buildings or structures that would be accessory buildings to any of the above uses, had those uses been established prior to the erection of the accessory, provided that the lot on which the buildings or structures are erected is five (5) hectares or larger in area.

Uses in the list above may be combined on a single lot, however, only one dwelling unit is permitted on any one lot.

Watershed Zone (W)

No person shall within any Watershed Reserve (WR) Zone use any lot or erect, alter or use any building or structure for any use or purpose except in accordance with the following: watershed protection; Notwithstanding the previous permitted uses in 3.18.1, no building or structures shall be permitted in the Watershed Reserve (WR) Zone except where such are intended for: management and protection of watershed area.

Use Limitation (UL)

The Use Limitation (UL) Zone is always a dual zone, which is applied together with an underlying main Zone.

The purpose of the Use Limitation (UL) Zone is to control land uses near watercourses, wetlands, areas requiring protection, and other hazards, such as talus slopes. This Zone is under the jurisdiction of the Lakehead Region Conservation Authority. That public authority has the jurisdiction to regulate and/or prohibit development in these areas. Although the areas which are impacted by this rules are shown as "use limitation" zones on the Schedules to this By-law, proximity to watercourses, wetlands and other hazards or areas requiring protection can change based on soil erosion, new data or study results, or other factors. For these reasons, the Corporation will not issue a building permit for certain lands without written approval from the Lakehead Region Conservation Authority. Lands controlled in this regard include the lands falling within the Use Limitation Zone areas on the Schedules to this By-law, and also include:

i) Land within 45 meters of a watercourse;
ii) Land within 45 meters of a wetland; or
iii) Land within 45 meters of other hazards or areas of protection regulated by the Lakehead Region Conservation Authority.

2.3.2 Existing Land Uses

Thunder Bay Correctional Centre

Thunder Bay Correctional Centre, located at 2351 Highway 61, is a Provincial correctional facility for male offenders sentenced to less than two years and a female offender unit for adult females. It serves the Thunder Bay District. The Correctional Centre sewage system uses seasonal lagoons located south of the main facility across Highway 61. A new correctional facility is under construction and is slated to be complete by 2026.

Loch Lomond Ski Area

Loch Lomond Ski Area is located at 1800 Loch Lomond Road and offers skiing, snowboarding, snowshoeing and tubing in the winter as well as mountain biking and hiking in the summer. There are seventeen ski runs and three chair lifts.

Fort William Country Club

The Fort William Country Club is an 18 championship hole golf course located at 1350 Mountain Road. Construction of the course, including the irrigation system for the greens, and grow-in occurred during 1924 and 1925. The course first opened for play in the spring of 1926.

Nor'wester View Public School

Nor'wester View Public School is located at 1946 Mountain Road, just past the Thunder Bay Tournament Centre. There are approximately 330 students registered from Junior Kindergarten through to Grade 8. Opened in September 1996, the semi-rural school area encompasses the South Neebing area, Riverdale area, Vickers Heights area, the Fort William Band Reserve, Totem Trailer Court, Loch Lomond area and the Mount Forest area.

South Neebing Community Centre

South Neebing Community Centre is located at 1841 Mountain Road. It is owned by the City of Thunder Bay and run by volunteers. The Centre offers an array of programs including: Tennis Courts, Basketball Court, Baseball Field, Fitness Classes, Outdoor Skating Rink, Skateboard Park and a Play Group.

Thunder Bay Tournament Centre

The Thunder Bay Tournament Centre is a multi-purpose facility with two ice sheets, lounge and entertainment centre. The Centre can host all levels of hockey, figure skating, ringette and curling. The facility can host trade shows and hockey tournaments. The Thunder Bay Tournament Centre is home to the Northern Hawks. Owned by the City of Thunder Bay but operated by a management team.

2.4 Past Reports

Mosquito Creek Watershed Assessment Report (2015)

In 2015, the LRCA commissioned the Mosquito Creek Watershed Assessment Report on behalf of the City of Thunder Bay. The intent of the report was to document the conditions of the watershed, primarily surface water quality, as observed in June and July of 2015.

The information collected was then used to develop and maintain programs that promoted healthy ecosystem management within the watershed. Upon completion of the assessment, the watershed was graded a B based on the *Guide to Developing Conservation Authority Watershed Report Cards, 2017*.

In 2015, the watershed was in good condition with minimal evident anthropogenic impacts. Surface water quality at the time of the study was good with exceedances attributed to natural sources. Levels were consistent with previous markings and erosion was not a concern as stream banks were stable with bridges and culverts not in need of maintenance.

The report provided water quality data from samples collected on June 15 and July 15, 2015. Exceedances of the PWQO at the time of the study included: Phosphorous 0.2100 mg/L (PWQO criterion 0.03 mg/L); *E. coli* bacteria 102 counts/100 mL (PWQO criterion 100 counts/100 mL); Total coliforms 2,420 MPN/100 mL (pre-1994 PWQO criterion 1,000 MPN/100 mL); Aluminium 0.7300 mg/L (PWQO criterion 0.075 mg/L); Iron 3.770 mg/L (PWQO criterion 0.30 mg/L); Copper 0.00507 mg/L (PWQO criterion 0.005 mg/L); and Cobalt 0.00159 mg/L (PWQO criterion 0.0009 mg/L).

The study recommended that fauna analysis, particularly benthic analysis, should be considered in future assessments; with the next assessment being completed in the next five to ten years. Additional sampling should be conducted in the spring to observe high flow seasons. Lastly, if the Provincial Water Quality Monitoring Network were to be expanded, a monitoring location within the Mosquito Creek watershed should be considered.

Mosquito Creek Post Development Study

In 1996, the LRCA commissioned the Mosquito Creek Post Development Study to assess potential watershed impacts associated with the rapid urbanization and continuing development in the watershed. The study was to assist in minimizing the impacts of future development.

The main conclusions in the report noted that the groundwater quality was naturally poor, a groundwater supply in the watershed with a sustained yield would be difficult to obtain due to low permeability, the natural setting was not highly suitable for disposal of sewage in septic tile fields because of the low permeability of the overburden deposits and occasionally shallow bedrock. The study did recognize that within the watershed, piped municipal water was being provided but not sewage collection and treatment. As a result, a substantial amount of water from outside the watershed is added to the area.

The report provided water quality data from July 24, 1995 that was collected as part of the study. Exceedance of the PWQO at the time of the study included Phosphorous 0.06

mg/L and 0.07 mg/L (PWQO criterion 0.03 mg/L), Iron 0.500 mg/L (PWQO criterion 0.3 mg/L), Zinc 0.038 mg/L (PWQO criterion 0.02 mg/L), and aluminum 0.17 mg/L (PWQO criterion 0.075 mg/L.

The study recommended to consider stormwater management for future development and to maintain current (pre-development) runoff quality and quantity. The study further recommended that a septic system inspection program and a public education program on septic system function and maintenance be implemented. The study concluded that the Thunder Bay Correctional Centre seasonal lagoon discharges were a major source of sediment, nutrient, and bacteriological contamination to the watershed during discharge periods. Road salt was also noted as a concern. Long term water quality monitoring, flow monitoring, wetland assessments, and sediment sampling were recommended.

3 WATERSHED SITE ASSESSMENT

A summary of the sampling techniques used is included in Appendix D: Techniques for Data Collection.

3.1 Site-Selection

Ten sampling sites situated along the Mosquito Creek were used to assess the overall health of the watershed. Each site was chosen based on its accessibility and its proximity to natural or man-made features that may alter water quality. The first eight sites are in the same location as the 2015 watershed assessment study, and two new sites were added for this study (i.e., Site 9 and Site 10).

Sites 8 and 9 represent the most upstream sites sampled within the headwaters of the Mosquito Creek watershed originating from the Municipality of Neebing. Situated on the western tributary to the main creek channel, Site 9 is located on Trendiak Road and serves as an upstream control for the Thunder Bay Correctional Centre settling ponds. Site 8 is also located on Trendiak Road and is situated on the eastern tributary of the main creek channel. Site 7 is also located on the western tributary on Loch Lomond Road representing the sampling point downstream of the Thunder Bay Correctional Centre settling ponds. Site 6 is located on Highway 61 to obtain samples downstream of the Mount Forest Estates subdivision. Site 5 is located on Mountain Road to obtain samples downstream of Nor'Wester View Public School. Site 4 is also located on Mountain Road beside the South Neebing Community Centre and is downstream of the Broad Oaks subdivision. Site 3 is located on 15th Side Road, and it is the midpoint of the main channel downstream of the junction of the west and east tributaries. Site 2 is located on Mountain Road east of Feaver Road and beside the Fort William Country Club. Site 10 is located off Norwester Drive downstream of most of the development area and at the junction to the main channel that drains towards the Kaministiquia River. Site 1 is located on Chippewa Road and represents the most downstream site for the Mosquito Creek watershed. The UTM coordinates and elevation of each site were marked using the Trimble Geo XH GPS unit. Site locations are shown on Map M-8: Site Plan.

3.2 Quantitative Assessment – Surface Water Quality

Several parameters were measured to assess surface water quality of Mosquito Creek. Surface water samples were collected in laboratory supplied bottles by LRCA staff and summer students and transported on ice, to ALS Laboratory Group, 1081 Barton Street, Thunder Bay, Ontario. An analysis was conducted on the samples to determine conductivity, total dissolved solids (TDS), turbidity, nutrients (ammonia-total nitrogen, nitrate, nitrite and phosphorus), bacteria (*E. coli* and total coliforms) and total metals.

Sampling was conducted on two separate occasions for each site, to enable comparisons and reveal discrepancies. The first data set was collected on June 14, 2022. The second set was collected on July 13, 2022.

Methodology for water sample collection was based on the Provincial Water Quality Monitoring Network (PWQMN), Ministry of the Environment, protocol. Grab samples were collected away from the stream bank in the main current by wading or by using a reaching pole. Effort was taken to enter the stream downstream of the sampling location to disturb as little sediment as possible. Additionally, samples were taken upstream from any water crossings and/or outlet culverts and were taken facing upstream into the current. In cases where current was not detectable (stagnant water) or current was flowing in the opposite direction (influenced by wind direction), samples were still collected facing upstream. Samples were collected at a depth of 0.3 metres below the surface of the water to avoid capturing any floating debris.

ALS Laboratory Group provided four collection bottles for each site to conduct the following tests: routine, nutrient, metal, and bacterial analysis. The routine analysis sample bottles and lids were rinsed twice before a true sample was collected. The ALS Laboratory Group pre-charged the nutrient sample bottles with sulfuric acid and the total metals bottles were pre-charged with nitric acid to preserve the samples taken and were not rinsed before filling. Bottles for bacterial analysis were also not rinsed as they were pre-charged with sodium thiosulphate preservative and special care was taken not to open the bottle until the true sample was to be filled. All filled sample bottles were transported on ice for delivery to the laboratory.

Field parameters of water temperature, pH, conductivity, dissolved oxygen, salinity, and oxygen reduction potential were measured using an YSI ProDSS multi-parameter water quality sampler at the same time as water sample collection. The following additional field parameters were also measured: air temperature by mercury thermometer, channel width using a measuring-tape reel, channel depth using a weighted measuring tape reel and velocity was measured using a stick, measuring tape, stopwatch, and appropriate calculations. Velocity was only measured for water running downstream (not in ponds producing only windblown results). A description of the water quality parameters is attached in Appendix G: Water Quality Parameters.

3.3 Applicable Criteria

Surface water quality results from the Mosquito Creek watershed were compared to applicable criteria published in the Provincial Water Quality Objectives (PWQO) by the Ontario Ministry of Environment and Energy (MOEE), July 1994. The goal of the PWQO is to ensure that the surface waters of the province are of the quality which is satisfactory for aquatic life and recreation.

The applicable criteria published in the PWQO water quality guidelines are attached in Appendix E: Water Quality Guidelines. Total Coliform results were compared to the pre-1994 PWQO, as there are no current criteria.

3.4 Qualitative Assessment – Site Observations

Watershed health can also be assessed by qualitative monitoring (i.e., visual inspection). The composition of in-stream substrate, forest soil, stream bank riparian community, shoreline vegetation and condition of the stream bank can all affect water quality. The presence or absence of certain flora and fauna can indicate the status of the watershed to provide suitable habitat. Seven field guides were used to identify terrestrial and aquatic species. Each site was given a Vegetation Type (V-type) allocation based on the *Field Guide to the Forest Ecosystem Classification for Northwestern Ontario* (Sims *et al.* 1997). Sites were assessed based on vegetation that could be seen from the site, with no distinct sample area, using a dichotomous key. It is important to note that these classifications are a general overview of a larger area, and no site was the same as another. Differences or inconsistencies between the V-types should be expected. Vegetation Types for each site are attached in Appendix F: Forest Ecosystem Classification. Common and Latin names of plant species are attached in Appendix B: Common and Scientific Names of Identified Flora and Fauna and in Appendix C: Common and Scientific Names of Mosquito Creek Post Development Study Identified Flora and Fauna. Fauna was assessed by identifying the species and number of individuals observed at each site.

Further, an inventory of Mosquito Creek water crossings (bridges and culverts) was conducted. Physical dimensions were measured, Universal Transverse Mercator (UTM) coordinates and pictures were taken, and general observations were noted including high water marks, stability of fill and any restriction of flow. Culvert and bridge locations can be found on Map M-10: Bridge and Culvert Sites. The bridge and culvert assessments are attached in Appendix I: Bridge Assessments and Appendix H: Culvert Assessments.

3.5 Watershed Report Card Rating

The Conservation Authorities in Ontario have developed the Watershed Report Card (WRC) as a means of reporting and designating watershed health using environmental indicators and to utilize the information to better target programs and measure environmental change. Four resource categories are measured in the Watershed Report Cards which include surface water quality, forest conditions, wetland conditions, and groundwater quality. The grading system for each resource category is recognized as A-Excellent; B-Good; C-Fair; D-Poor; F-Very Poor.

Surface water quality and forest conditions were identified for the Mosquito Creek watershed. The three indicators used to assess surface water quality for the watershed

are total phosphorus, *Escherichia coli (E. coli*), and benthic macroinvertebrates (data not available). The average point score of the surface water indicators is used to determine the overall surface water quality grade. Groundwater data was available for the watershed.

Forest conditions utilize three indicators to determine the grade for the quality of the forest, which include forest coverage, forest interior percentage and percentage of riparian zone forested (see Table 3.5-2: 2017 Forest Conditions Indicator Guidelines). Forest cover is the percentage of the watershed that is forested. Forest interior is the area of forest that lies more than 100 metres from a forest edge. Forest riparian zone measures the amount of forest cover within 30 metres adjacent to all open watercourses. Northern Ontario Forest Cover criteria requires a different scoring system because the targets used for the Watershed Report Card were set by Environment Canada for southern Ontario. The minimum threshold set by Environment Canada for forest cover in Northern Ontario is probably well over 30 percent because it must be able to sustain species such as bear, moose, and boreal birds. A preliminary grading system for percentage forest cover in Northern Ontario has been suggested for the Watershed Report Card.

Percent wetland cover is the percentage of the watershed that is in wetland cover (see Table 3.5-3: 2017 Grading System for Percentage Wetland Cover). Wetlands include swamps (treed and thicket), bogs, fens, and marshes.

Table 3.5-1: 2017 Surface Water Quality Indicator Guidelines

					Overall Surface Water Quality Grade	
Total Phosphorus (mg/L)	***E. coli* (#100 mL)**	**Benthic Invertebrates**	**Point Score**	**Grade**	**Final Points**	**Final Grade**
<0.020	0-30	0.00-4.25	5	A	>4.4	A
0.020-0.030	31-100	4.26-5.00	4	B	3.5 - 4.4	B
0.031-0.060	101-300	5.01-5.75	3	C	2.5 - 3.4	C
0.061-0.180	301-1000	5.76-6.50	2	D	1.5 - 2.4	D
>0.180	>1000	6.51-10.00	1	F	<1.5	F

Table 3.5-2: 2017 Forest Conditions Indicator Guidelines

					Overall Forest Conditions	
% Forest Cover	**% Forest Interior**	**% Riparian Zone Forested**	**Point Score**	**Grade**	**Final Points**	**Final Grade**
>35.0	>11.5	>57.5	5	A	>4.4	A
25.1 - 35.0	8.6 - 11.5	42.6- 57.5	4	B	3.5 - 4.4	B
15.1 - 25.0	5.6 - 8.5	27.6 - 42.5	3	C	2.5 - 3.4	C
5.0 – 15.0	2.5 - 5.5	12.5 - 27.5	2	D	1.5 - 2.4	D
<5.0	<2.5	<12.5	1	F	<1.5	F

Table 3.5-3: 2017 Grading System for Percentage Wetland Cover	
Grade	**% Wetland Cover**
A	>11.5
B	8.6-11.5
C	5.6-8.5
D	2.5-5.5
F	<2.5

3.6 Materials

Materials used during the assessment included:

- Auger
- Chest waders
- Cooler and ice packs
- Clipboard and observation chart paper
- Dip net
- Digital camera
- Field guides
- Fluorescent orange vests
- Latex gloves
- Measuring tape reel
- Mercury thermometer
- Metre stick
- Writing utensils
- Reaching pole
- Road map
- Sampling bottles and preservative provided by ALS Laboratory Group
- Scissors
- Stick (to measure velocity)
- Stopwatch
- Trimble Geo XH GPS
- YSI 556 MPS metre
- Ziploc bags

Field Guides:

- Field Guide to the Forest Ecosystem Classification for Northwestern Ontario
- (Sims et al., 1997),
- Wetland Plants of Ontario (Newmaster *et al.*, 1997),
- Forest Plants of Northeastern Ontario (Legasy *et al.*,1995),
- Bugs of Ontario (Acorn, 2003),

- Forest Plants of Central Ontario (Chambers et al.,1996),
- Birds of Ontario (Bezener, 2000), and
- INaturalist app (California Academy of Sciences, 2008).

4 Results

Site photos from each sampling site are attached in Appendix I: Site Photography. The laboratory water quality results and PWQO criteria have been compared and attached in Appendix K: Laboratory Water Quality Results Summary Tables. The original Laboratory Certificates of Analysis and Analytical Reports have been attached in Appendix M: Laboratory Certificates of Analysis and Test Results.

The results for the Mosquito Creek watershed are summarized in the tables below for each sample site. Note that the results from the 2015 Watershed Assessment has been included for comparison purposes.

4.1 Site 1

Site 1 was located near the confluence of Mosquito Creek at the Kaministiquia River and was accessed from Chippewa Road. The substrate at this site included muck, boulders, and cobbles. The banks of the shoreline were stable with abundant vegetation in the riparian zone including balsam fir, trembling aspen, white birch, mountain ash, speckled alder, chokecherry, and willow. Erosion on the banks of the creek downstream of the bridge was apparent. There were no visible aquatic plants near the sample site area. The soil type present at this site in the “A” Horizon was sandy-loam.

The laboratory results from the sampling period showed that total coliforms and aluminum exceeded the PWQO guidelines on both June 14, 2022, and July 13, 2022. Iron exceeded the PWQO guidelines during the June sampling period.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with a value of >2,420 MPN/100mL on June 14, 2022, and 1, 410 MPN/100mL on July 13, 2022. Aluminum results exceeded the PWQO criterion (0.075 mg/L) with a value of 0.513 mg/L on June 14, 2022, and 0.147 mg/L on July 13, 2022.

Iron exceeded the PWQO criterion (0.3 mg/L) with a value of 0.899 mg/L on June 14, 2022.

Table 4.1-1: Location References for Site 1	
Location Description	Chippewa Road, Mosquito Creek confluence at Kaministiquia River
UTM Coordinates	Northing 5356893 Easting 328696
Altitude/Elevation	187.1 metres above sea level

Table 4.1-2: Field Measurements for Site 1					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 10:55	**Date:** 08-Jul-15 **Time:** 13:15	**Date:** 14-Jun-22 **Time:** 13:20	**Date:** 13-Jul-22 **Time:** 9:30
Water Temperature	ºC	15.54	21.18	13.2	14.4
Conductivity	uS/cm	419	578	421.8	655
Dissolved Oxygen	mg/L	11.13	8.13	10.02	9.53
Dissolved Oxygen	%	111.3	92.0	95.7	93.3
pH		8.17	8.60	7.55	8.01
Turbidity	NTU	14.7	10.9	12.34	4.25
Air Temperature	ºC	17.0	23.0	14.0	21.0
Channel Width	m	7.1	7.1	4.8	5.65
Channel Depth	m	0.20	0.30	0.35	0.234
Velocity	m/s	0.26	0.03	0.20	N/A
Salinity		0.20	0.28	-	-
Oxygen Reduction Potential	ORP	99.3	84.2	83.9	87.2

Table 4.1-3: Laboratory Water Quality Results for Site 1						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 10:55	**Date:** 08-Jul-15 **Time:** 13:15	**Date:** 14-Jun-22 **Time:** 13:20	**Date:** 13-Jul-22 **Time:** 9:30
Bacteriological						
Escherichia Coli	MPN/100mL	100	27	39	67	26
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**1,300**	**>2,420**	**>2420**	**1,410**
Physical						
Conductivity (EC)	uS/cm	-	412	557	420	639
pH		6.5-8.5	8.21	8.33	8.1	8.3
Total Dissolved Solids	mg/L	-	237	315	255	384
Turbidity	NTU	-	24.6	14.0	13.4	4.5
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	129	172	145	224
Ammonia-N, Total	mg/L	-	<0.020	0.056	0.0137	0.0066
Un-ionized Ammonia	mg/L	0.02	0.00058	0.0023	0.0003151	0.000165
Chloride (Cl)	mg/L	-	51.7	76.3	45.7	86.6
Nitrate-N (NO3-N)	mg/L	-	0.070	0.072	0.104	0.239
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.020
Phosphorus (P)-Total	mg/L	0.03	0.0283	0.0266	0.0253	0.0198
Sulfate (SO4)	mg/L	-	9.41	9.57	9.90	14.1
Metals						
Aluminum (Al)	mg/L	0.075	**0.730**	**0.435**	**0.513**	**0.147**
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	0.0000329	0.0000425	0.0000268	0.0000206
Cobalt (Co)	mg/L	0.0009	0.00057	0.00051	0.00046	0.00026

Table 4.1-3: Laboratory Water Quality Results for Site 1						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 10:55	**Date:** 08-Jul-15 **Time:** 13:15	**Date:** 14-Jun-22 **Time:** 13:20	**Date:** 13-Jul-22 **Time:** 9:30
Copper (Cu)	mg/L	0.001 (0-20 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00507	0.00490	0.00454	0.00366
Iron (Fe)	mg/L	0.300	**1.210**	**0.959**	**0.899**	0.276
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	0.000311	0.000241	0.000276	0.000066
Sodium (Na)	mg/L	-	28.7	42.6	27.0	43.0
Vanadium (V) – Total	mg/L	0.006	0.00331	0.00369	0.00298	0.00199
Zinc (Zn) - Total	mg/L	0.02 (interim)	0.0036	0.0048	0.0041	<0.0030

Bold indicates exceedance above PWQO guidelines

Table 4.1-4: Flora Observed at Site 1			
FEC V-Type: V14 Balsam Fir Mixedwood			
Forest Density / Stream Cover	20% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Poplar Trembling Aspen White Birch White Spruce Balsam Fir	Chokecherry Willow spp. Speckled Alder Mountain Ash	Dandelion	Meadow Horsetail
Aquatic Macrophytes and Algae			
Emergent	-	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.1-5: Fauna Observed at Site 1	
Fauna Species	
Amphibians	Tadpoles
Birds	Belted Kingfisher
Crustaceans	-
Fish	-
Insects	Black Flies Mosquitoes
Mammals	-
Mollusca	-
Reptiles	Garter Snake

Table 4.1-6: Physical Features Observed at Site 1							
FEC Soil Type: S8 – Moist / Coarse Loamy							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	25%	25%	-	-	-	50%	-
Bank Stability/Erosion	Erosion downstream from the sampling site						

4.2 Site 2

Site 2 was located on north side of Mountain Road, near the White Fox Inn and across from the Fort William Country Club. The substrate at this site included muck, gravel, and cobbles. The banks of the shoreline were stable with abundant vegetation in the riparian zone including white spruce, red pine, jack pine, speckled alder, swamp thistle, and white clover. Broad-leaved arrowhead was also prevalent in the water at the sample site. The soil type present at this side in the "A" Horizon was sand, the "B" Horizon was sandy-clay loam, and the "C" Horizon was silty-clay.

The laboratory results from the June 14, 2022 and July 13, 2022 sampling periods showed that iron and total coliforms exceeded the PWQO guidelines. The June sampling period had an additional aluminum exceedance.

Aluminum exceeded the PWQO criterion of 0.075 mg/L with a value of 0.176 mg/L on June 14, 2022.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with a value of 2,420 MPN/100mL on June 14, 2022 and July 13, 2022.

Iron exceeded the PWQO criterion (0.3 mg/L) with a value of 0.471 mg/L on June 14, 2022 and 0.407 mg/L on July 13, 2022.

Table 4.2-1: Location References for Site 2	
Location Description	North side of Mountain Road - Near White Fox Inn, across from the Fort William Country Club
UTM Coordinates	Northing 5355157 Easting 328148
Altitude/Elevation	205.02 metres above sea level

Table 4.2-2: Field Measurements for Site 2					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 10:20	**Date:** 08-Jul-15 **Time**: 12:40	**Date:** 14-Jul-22 **Time:** 12:38	**Date:** 13-Jul-22 **Time:** 12:41
Water Temperature	ºC	13.95	17.29	12.7	14.8
Conductivity	uS/cm	278	365	226.7	543
Dissolved Oxygen	mg/L	10.22	7.51	8.78	7.92
Dissolved Oxygen	%	99.6	78.6	82.9	78.2
pH		7.66	7.99	7.29	8.36
Turbidity	NTU	2.58	2.27	4.39	2.13
Air Temperature	ºC	16.0	25.0	13.0	23.0
Channel Width	m	0.65	0.8	2.5	2.5
Channel Depth	m	0.20	0.20	1.10	0.66
Velocity	m/s	0.38	0.20	0.18	N/A
Salinity		0.13	0.18	-	-
Oxygen Reduction Potential	ORP	50.0	56.5	68.7	67.7

Table 4.2-3: Laboratory Water Quality Results for Site 2						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 10:20	**Date:** 08-Jul-15 **Time:** 12:40	**Date:** 14-Jun-22 **Time:** 12:38	**Date:** 13-Jul-22 **Time:** 12:41
Bacteriological						
Escherichia Coli	MPN/100mL	100	9	25	36	38
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**2,420**	**1,990**	**>2420**	**>2420**
Physical						
Conductivity (EC)	uS/cm	-	264	337	204	414
pH		6.5-8.5	7.76	7.84	7.8	8.10
Total Dissolved Solids	mg/L	-	174	204	147	249
Turbidity	NTU	-	3.69	2.33	4.25	2.49
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	94.2	130	86.5	184
Ammonia-N, Total	mg/L	-	<0.020	0.074	0.0134	0.0311
Un-ionized Ammonia	mg/L	0.02	0.0005	0.00229	0.00003	0.00084
Chloride (Cl)	mg/L	-	20.70	33.80	12.1	39.7
Nitrate-N (NO3-N)	mg/L	-	0.024	0.044	<0.020	0.085
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.010
Phosphorus (P)-Total	mg/L	0.03	0.0145	0.0205	0.0211	0.0233
Sulfate (SO4)	mg/L	-	9.22	6.83	6.20	3.72
Metals						
Aluminum (Al)	mg/L	0.075	**0.142**	0.061	**0.176**	0.053
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	0.0000177	-	0.0000188	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	-	0.0000139	-	0.0000072
Cobalt (Co)	mg/L	0.0009	0.00023	0.00023	0.00020	0.00017

Table 4.2-3: Laboratory Water Quality Results for Site 2						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 10:20	**Date:** 08-Jul-15 **Time:** 12:40	**Date:** 14-Jun-22 **Time:** 12:38	**Date:** 13-Jul-22 **Time:** 12:41
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00371	0.00285	0.00365	0.00192
Iron (Fe)	mg/L	0.300	**0.539**	**0.657**	**0.471**	**0.407**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	0.000072	0.000051	0.000128	<0.000050
Sodium (Na)	mg/L	-	14.8	21.4	9.5	24.6
Vanadium (V) – Total	mg/L	0.006	0.00119	0.00106	0.00133	0.00073
Zinc (Zn) - Total	mg/L	0.02 (interim)	0.0031	<0.0030	0.0083	<0.0030

Bold indicates exceedance above PWQO guidelines

Table 4.2-4: Flora Observed at Site 2			
FEC V-Type: V24 White Spruce – Balsam Fir / Shrub Rich			
Forest Density / Stream Cover	20% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Poplar Jack Pine Red Pine White Spruce	Speckled Alder Prickly Wild Rose	Canada Anemone Cow Vetch Dandelion White Clover Red Clover Swamp Thistle Tall Buttercup Ox-Eye Daisy	
Aquatic Macrophytes and Algae			
Emergent	Broad-Leaved- Arrowhead Small Yellow Water- Crowfoot	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.2-5: Fauna Observed at Site 2	
Fauna Species	
Amphibians	Tadpoles
Birds	Song sparrow
Crustaceans	-
Fish	-
Insects	Black Flies Mosquitoes Water Striders Bumblebees
Mammals	-
Mollusca	-
Reptiles	-

Table 4.2-6: Physical Features Observed at Site 2							
FEC Soil Type: S10 – Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	25%	25%	-	-	75%	-
Bank Stability/ Erosion	Stable / abundant vegetation						

4.3 Site 3

Site 3 was located on the east side of 15th Side Road, halfway between Highway 61 and Mountain Road. The substrate at this site included sand, gravel and boulders. The banks of the shoreline were stable with abundant vegetation in the riparian zone including white spruce, balsam poplar, slender willow, pincherry, serviceberry, sweet coltsfoot and rough-stemmed goldenrod. Broad-leaved arrowhead was also prevalent in the water at the sample site. The soil type present at this site in the "A" Horizon was loamy-sand; the "B" Horizon was silty-clay loam.

Monitor site culvert as condition continues to deteriorate.

The laboratory results from the June 14, 2022 and July 13, 2022 sampling period determined that total coliforms, iron and aluminum exceeded the PWQO guidelines. The June sampling period had an additional exceedance of phosphorus.

Phosphorus exceeded the PWQO criterion of 0.030 mg/L with a value of 0.0319 mg/L on July 13, 2022.

Total coliforms exceeded the PWQO criterion of 1,000 MPN/100mL with a value of 2, 420 MPN/100mL on June 14, 2022 and >2, 420 MPN/100mL on July 13, 2022.

Aluminum exceeded the PWQO criterion of 0.075 mg/L with a value of 0.144 mg/L on June 14, 2022 and 0.414 on July 13, 2022.

Iron was in exceedance of the PWQO criterion of 0.3 mg/L with values of 0.543 mg/L on June 14, 2022 and 0.748 mg/L on July 13, 2022.

Table 4.3-1: Location References for Site 3	
Location Description	East side of 15th Side Road, between Highway 61 and Mountain Road
UTM Coordinates	Northing 5355175 Easting 327036
Altitude/Elevation	203.59 metres above sea level

Table 4.3-2: Field Measurements for Site 3					
Parameter	**Unit**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jul-22	**Date:** 13-Jul-22
		Time: 9:30	**Time**: 11:20	**Time:** 11:48	**Time:** 11:30
Water Temperature	ºC	16.37	17.39	12.9	15.2
Conductivity	uS/cm	414	614	506	646
Dissolved Oxygen	mg/L	9.75	7.78	9.01	8.05
Dissolved Oxygen	%	99.8	81.3	84.3	80.3
pH		7.80	8.24	7.28	7.82
Turbidity	NTU	3.23	6.58	4.46	9.01
Air Temperature	ºC	18.0	25.0	14.0	23.0
Channel Width	m	4.3	4.3	1.10	0.95
Channel Depth	m	0.29	0.28	0.25	0.12
Velocity	m/s	0.44	N/A	0.44	0.12
Salinity		0.20	0.30	-	-
Oxygen Reduction Potential	ORP	92.2	112.5	67.2	80.2

Table 4.3-3: Laboratory Water Quality Results for Site 3						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jun-22	**Date:** 13-Jul-22
			Time: 9:30	**Time:** 11:20	**Time:** 11:48	**Time:** 11:30
Bacteriological						
Escherichia Coli	MPN/100mL	100	102	50	15	66
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**1990**	**1990**	**>2420**	**2420**
Physical						
Conductivity (EC)	uS/cm	-	408	590	500	626
pH		6.5-8.5	7.90	8.07	8.12	8.20
Total Dissolved Solids	mg/L	-	238	348	292	343
Turbidity	NTU	-	4.65	7.13	5.79	11.0
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	128	188	166	207
Ammonia-N, Total	mg/L	-	<0.020	0.050	0.0167	0.0247
Un-ionized Ammonia	mg/L	0.02	0.00058	0.00155	0.00004	0.00067
Chloride (Cl)	mg/L	-	46.2	83.9	61.4	91.5

Table 4.3-3: Laboratory Water Quality Results for Site 3						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jun-22	**Date:** 13-Jul-22
			Time: 9:30	**Time:** 11:20	**Time:** 11:48	**Time:** 11:30
Nitrate-N (NO3-N)	mg/L	-	0.051	0.043	0.171	0.064
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.020
Phosphorus (P)-Total	mg/L	0.03	0.0208	**0.0330**	0.0226	**0.0319**
Sulfate (SO4)	mg/L	-	6.15	6.30	9.39	11.6
Metals						
Aluminum (Al)	mg/L	0.075	**0.207**	**0.285**	**0.144**	**0.414**
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	0.0000182	0.0000241	0.0000327	0.0000214
Cobalt (Co)	mg/L	0.0009	0.00029	0.00045	0.00031	0.00049
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00327	0.00300	0.00317	0.00321
Iron (Fe)	mg/L	0.300	**0.689**	**0.912**	**0.543**	**0.748**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	0.000090	0.000158	0.000105	0.000212
Sodium (Na)	mg/L	-	30.2	48.9	39.4	54.9
Vanadium (V) – Total	mg/L	0.006	0.00182	0.00266	0.00181	0.00271
Zinc (Zn) - Total	mg/L	0.02 (interim)	<0.0030	0.0039	0.0034	0.0034

Bold indicates exceedance above PWQO guidelines

Table 4.3-4: Flora Observed at Site 3			
FEC V-Type: V15 White Spruce Mixedwood			
Forest Density / Stream Cover	5% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Poplar Trembling Aspen White Pine White Spruce	Pincherry Serviceberry Slender Willow Speckled Alder	Cow Vetch Dandelion Rough-Stemmed-Goldenrod Swamp Thistle Sweet Coltsfoot	Meadow Horsetail Sphagnum Moss
Aquatic Macrophytes and Algae			
Emergent	-	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.3-5: Fauna Observed at Site 3	
Fauna Species	
Amphibians	Tadpoles
Birds	American Goldfinch
Crustaceans	-
Fish	-
Insects	Black Flies House Flies Mosquitoes
Mammals	-
Mollusca	-
Reptiles	-

Table 4.3-6: Physical Features Observed at Site 3							
FEC Soil Type: S10 – Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	10%	-	40%	50%	-	-	-
Bank Stability/ Erosion	Stable/ abundant vegetation						

4.4 Site 4

Site 4 was located on the north side of Mountain Road beside the South Neebing Community Center. The substrate at this site was muck. The banks of the shoreline were stable with abundant vegetation in the riparian zone including balsam fir, jack pine, trembling aspen, common reed, Canada blue joint, common thistle and red clover. Aquatic vegetation was visible during both visits. There was a beaver dam observed further downstream, which could be causing the water to back up. The soil type present at this site in the "A" and "B" Horizon was sand; the "C" Horizon was silty-clay/clay.

The laboratory results from both the June and July sampling periods showed that total coliforms and iron exceeded the PWQO guidelines. The June sampling period had additional exceedances of phosphorus and iron.

Phosphorus exceeded the PWQO criterion of 0.030 mg/L with a value of 0.0336 mg/L on June 14, 2022.

Total coliforms and iron exceeded the PWQO guidelines on both June 14, 2022 and July 13, 2022 sampling periods.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with a value of >2, 420 MPN/100mL on June 14, 2022 and July 13, 2022.

Iron exceeded the PWQO criterion (0.3 mg/L) with a value of 0.805 mg/L on June 14, 2022 and 1.4 mg/L on July 13, 2022.

Aluminum results exceeded the PWQO criterion (0.075 mg/L) with a value of 0.13 mg/L on June 14, 2022.

Table 4.4-1: Location References for Site 4	
Location Description	North side of Mountain Road beside the South Neebing Community Centre
UTM Coordinates	Northing 5354184 Easting 326100
Altitude/Elevation	212.74 metres above sea level

Table 4.4-2: Field Measurements for Site 4					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 14:50	**Date:** 08-Jul-15 **Time**: 10:40	**Date:** 14-Jul-22 **Time:** 11:35	**Date:** 13-Jul-22 **Time:** 11:00
Water Temperature	ºC	19.02	17.28	13.4	15.5
Conductivity	uS/cm	223	291	242	562
Dissolved Oxygen	mg/L	10.0	5.56	5.86	4.79
Dissolved Oxygen	%	108.1	58.4	56.2	48.1
pH		7.64	7.90	7.13	7.41
Turbidity	NTU	2.36	3.29	2.84	2.32
Air Temperature	ºC	25.0	27.0	13.0	23.0
Channel Width	m	8.4	8.4	N/A	N/A
Channel Depth	m	0.70	0.70	0.70	0.42
Velocity	m/s	N/A	N/A	N/A	N/A
Salinity		0.11	0.14	-	-
Oxygen Reduction Potential	ORP	106.9	98.2	74.3	77.5

Table 4.4-3: Laboratory Water Quality Results for Site 4						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 14:50	**Date:** 08-Jul-15 **Time:** 10:40	**Date:** 14-Jun-22 **Time:** 11:35	**Date:** 13-Jul-22 **Time:** 11:00
Bacteriological						
Escherichia Coli	MPN/100mL	100	88	40	58	50
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**1300**	**1990**	**>2420**	**>2420**
Physical						
Conductivity (EC)	uS/cm	-	217	281	237	404
pH		6.5-8.5	7.72	7.55	7.87	7.87
Total Dissolved Solids	mg/L	-	151	204	151	247
Turbidity	NTU	-	2.83	3.85	3.88	3.89
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	83.3	121	100	168
Ammonia-N, Total	mg/L	-	<0.020	0.068	0.0079	0.0098
Un-ionized Ammonia	mg/L	0.02	0.00024	0.00068	0.00002	0.00003
Chloride (Cl)	mg/L	-	17.9	23.1	17.3	45.6

Table 4.4-3: Laboratory Water Quality Results for Site 4						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jun-22	**Date:** 13-Jul-22
			Time: 14:50	**Time:** 10:40	**Time:** 11:35	**Time:** 11:00
Nitrate-N (NO3-N)	mg/L	-	0.032	<0.020	<0.020	<0.020
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.010
Phosphorus (P)-Total	mg/L	0.03	0.0190	**0.0449**	**0.0336**	0.0063
Sulfate (SO4)	mg/L	-	2.60	0.77	1.97	1.72
Metals						
Aluminum (Al)	mg/L	0.075	**0.141**	**0.137**	**0.130**	0.050
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	0.0000167	-	0.0000208	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	-	0.0000115	-	<0.0000050
Cobalt (Co)	mg/L	0.0009	0.00023	0.00038	0.00030	0.00046
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00314	0.00183	0.00265	0.00122
Iron (Fe)	mg/L	0.300	**0.663**	**1.38**	**0.805**	**1.40**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	0.000088	0.000146	0.000095	0.000064
Sodium (Na)	mg/L	-	11.6	15.3	12.8	28.0
Vanadium (V) – Total	mg/L	0.006	0.00153	0.00173	0.00164	0.00106
Zinc (Zn) - Total	mg/L	0.02 (interim)	<0.0030	<0.0030	<0.0030	<0.0030

Bold indicates exceedance above PWQO guidelines

Table 4.4-4: Flora Observed at Site 4			
FEC V-Type: V14 Balsam Fir Mixedwood			
Forest Density / Stream Cover	10% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Fir Trembling Aspen Jack Pine Red Pine Balsam Poplar	Willow spp. Choke Cherry Manitoba Maple	Tall Buttercup Red Clover White Clover Dandelion Swamp Thistle Cow Vetch Ox-Eye Daisy	Common Reed Canada Blue Joint
Aquatic Macrophytes and Algae			
Emergent	Broad-Leaved Arrowhead	**Floating Algae**	-
Rooted Floating	Waterlily	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.4-5: Fauna Observed at Site 4	
Fauna Species	
Amphibians	-
Birds	-
Crustaceans	-
Fish	Minnows
Insects	Black Flies Dragonflies Mosquitoes Red Ants
Mammals	
Mollusca	-
Reptiles	-

Table 4.4-6: Physical Features Observed at Site 4							
FEC Soil Type: S10 – Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	-	-	-	-	100%	-
Bank Stability/ Erosion	Stable/ abundant vegetation						

4.5 Site 5

Site 5 was located on the north side of Mountain Road, between 1947 and 1953 Mountain Road, across from Nor'Wester View Public School. The substrate was composed of muck. The banks of the shoreline were stable with abundant vegetation in the riparian zone including balsam poplar, trembling aspen, white spruce, pincherry, lupines and swamp thistle. Aquatic vegetation was visible during both visits including broad-leaved arrowhead and common cattail. The soil type present at this site was silty-clay in exclusively an "A" Horizon.

The laboratory results from both the June 14, 2022 and July 13, 2022 sampling periods showed that phosphorus, total coliforms, and iron exceeded the PWQO guidelines.

Phosphorus exceeded the PWQO criterion of 0.030 mg/L with a value of 0.041 mg/L on June 14, 2022 and 0.0452 mg/L on July 13, 2022.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with a value of 2, 420 MPN/100mL on June 14, 2022 and >2, 420 MPN/100mL on July 13, 2022.

Iron exceeded the PWQO criterion (0.3 mg/L) with a value of 0.678 mg/L on June 14, 2022 and 0.935 mg/L on July 13, 2022.

Table 4.5-1: Location References for Site 5	
Location Description	North side of Mountain Road, between 1947 and 1953 Mountain Road, across from Nor'Wester View Public School
UTM Coordinates	Northing 5354188 Easting 325570
Altitude/Elevation	219.41 metres above sea level

Table 4.5-2: Field Measurements for Site 5					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 14:20	**Date:** 08-Jul-15 **Time**: 10:10	**Date:** 14-Jul-22 **Time:** 11:25	**Date:** 13-Jul-22 **Time:** 10:30
Water Temperature	ºC	18.58	15.77	13.1	13.7
Conductivity	uS/cm	476	533	554	767
Dissolved Oxygen	mg/L	8.51	3.57	5.36	3.63
Dissolved Oxygen	%	91.6	37.2	51.2	35.1
pH		7.58	7.84	7.02	7.53
Turbidity	NTU	0.58	1.35	1.67	0.69
Air Temperature	ºC	26.0	23.0	14.0	21.0
Channel Width	m	1.25	1.10	0.53	0.69
Channel Depth	m	0.30	0.39	0.30	0.293
Velocity	m/s	0.45	0.009	N/A	N/A
Salinity		0.23	0.26	-	-
Oxygen Reduction Potential	ORP	95.4	58.5	66.4	28.2

Table 4.5-3: Laboratory Water Quality Results for Site 5						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 14:20	**Date:** 08-Jul-15 **Time:** 10:10	**Date:** 14-Jun-22 **Time:** 11:25	**Date:** 13-Jul-22 **Time:** 10:30
Bacteriological						
Escherichia Coli	MPN/100mL	100	10	11	33	15
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**1050**	**2420**	**2420**	**>2420**
Physical						
Conductivity (EC)	uS/cm	-	469	529	538	741
pH		6.5-8.5	7.73	7.61	8.23	7.98
Total Dissolved Solids	mg/L	-	278	302	320	452
Turbidity	NTU	-	0.96	1.52	2.10	2.48
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	151	196	181	233
Ammonia-N, Total	mg/L	-	0.032	0.031	0.0103	0.0172
Un-ionized Ammonia	mg/L	0.02	0.00038	0.00029	0.00002	0.00043
Chloride (Cl)	mg/L	-	53.8	59.6	67.2	122
Nitrate-N (NO3-N)	mg/L	-	<0.020	<0.020	<0.020	<0.040
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.020
Phosphorus (P)-Total	mg/L	0.03	0.0261	**0.0504**	**0.0410**	**0.0452**
Sulfate (SO4)	mg/L	-	8.62	0.96	8.32	6.52
Metals						

Table 4.5-3: Laboratory Water Quality Results for Site 5						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jun-22	**Date:** 13-Jul-22
			Time: 14:20	**Time:** 10:10	**Time:** 11:25	**Time:** 10:30
Aluminum (Al)	mg/L	0.075	0.0204	0.0146	0.0367	0.0161
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	-	-	0.0000208	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	0.0000087	0.0000103	-	<0.0000050
Cobalt (Co)	mg/L	0.0009	0.00016	0.00059	0.00031	0.00041
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00177	0.00075	0.00149	0.00068
Iron (Fe)	mg/L	0.300	**0.377**	**0.961**	**0.678**	**0.935**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	0.000088	<0.000050	<0.000050	<0.000050
Sodium (Na)	mg/L	-	30.8	32.5	37.8	60.3
Vanadium (V) – Total	mg/L	0.006	0.00087	0.00113	0.00121	0.00085
Zinc (Zn) - Total	mg/L	0.02 (interim)	<0.0030	0.0031	<0.0030	<0.0030

Bold indicates exceedance above PWQO guidelines

Table 4.5-4: Flora Observed at Site 5			
FEC V-Type: V14 Balsam Fir Mixedwood			
Forest Density / Stream Cover	75% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Poplar Balsam Fir Jack Pine Trembling Aspen White Spruce	Choke Cherry Currant spp. Pin Cherry Willow spp.	Common Cattail Canada Anemone Dandelion Lupine Swamp Thistle Wood Lily	
Aquatic Macrophytes and Algae			
Emergent	Broad-Leaved Arrowhead	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.5-5: Fauna Observed at Site 5	
Fauna Species	
Amphibians	-
Birds	-
Crustaceans	-
Fish	-
Insects	Black Flies Bumblebee Water Striders
Mammals	-
Mollusca	-
Reptiles	-

Table 4.5-6: Physical Features Observed at Site 5							
FEC Soil Type: S10 – Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	-	-	-	-	100%	-
Bank Stability/ Erosion	Stable/ abundant vegetation						

4.6 Site 6

Site 6 was located on the south side of Highway 61, adjacent to 1956 Highway 61, approximately 700 metres from Mountain Road. The substrate was composed of silt, sand and cobbles. The banks of the shoreline were stable with abundant vegetation in the riparian zone including white spruce, balsam poplar, trembling aspen, speckled alder, pincherry and willow. Aquatic vegetation was not present during both site visits. The soil type present at this site was sandy-clay loam in the “A” Horizon and loamy-sand in the “C” Horizon.

The laboratory results from the June and July 2022 sampling periods showed that total coliforms exceeded the PWQO guidelines.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with a value of >2,420 MPN/100mL on June 14, 2022 and July 13, 2022.

Table 4.6-1: Location References for Site 6	
Location Description	South side of Highway 61, adjacent to 1956 Highway 61, approximately 700 metres from Mountain Road
UTM Coordinates	Northing 5354748 Easting 325572
Altitude/Elevation	216.01 metres above sea level

Table 4.6-2: Field Measurements for Site 6					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 13:20	**Date:** 08-Jul-15 **Time:** 9:25	**Date:** 14-Jul-22 **Time:** 11:05	**Date:** 13-Jul-22 **Time:** 10:15
Water Temperature	ºC	14.64	12.0	10.6	11.5
Conductivity	uS/cm	1123	1332	992	271
Dissolved Oxygen	mg/L	11.10	8.17	8.69	9.82
Dissolved Oxygen	%	109.6	75.7	78.2	90.3
pH		7.95	8.42	7.16	7.89
Turbidity	NTU	0.73	1.60	0.89	1.87
Air Temperature	ºC	25.0	18.0	14.0	22.0
Channel Width	m	1.10	1.10	0.87	0.8
Channel Depth	m	0.30	0.25	0.10	0.104
Velocity	m/s	0.71	0.13	0.15	0.17
Salinity		0.56	0.67	-	-
Oxygen Reduction Potential	ORP	114.5	107.1	101.4	101.9

Table 4.6-3: Laboratory Water Quality Results for Site 6						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 13:20	**Date:** 08-Jul-15 **Time:** 9:25	**Date:** 14-Jun-22 **Time:** 11:05	**Date:** 13-Jul-22 **Time:** 10:15
Bacteriological						
Escherichia Coli	MPN/100mL	100	3	76	8	18
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**1300**	**>2420**	**>2420**	**>2420**
Physical						
Conductivity (EC)	uS/cm	-	1110	1250	950	620
pH		6.5-8.5	8.02	8.12	8.42	8.22
Total Dissolved Solids	mg/L	-	606	757	554	340
Turbidity	NTU	-	1.17	1.51	1.43	2.59
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	273	357	297	200
Ammonia-N, Total	mg/L	-	<0.020	0.170	0.0246	0.0082
Un-ionized Ammonia	mg/L	0.02	0.00054	0.00357	0.00005	0.00017
Chloride (Cl)	mg/L	-	180	212	140	87.6
Nitrate-N (NO3-N)	mg/L	-	0.845	1.14	0.68	0.423
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.050	<0.050	<0.020
Phosphorus (P)-Total	mg/L	0.03	0.0071	0.0081	0.0086	0.0090
Sulfate (SO4)	mg/L	-	23.8	31.0	24.9	16.0
Metals						
Aluminum (Al)	mg/L	0.075	0.0396	0.0441	0.0328	**0.075**
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	-	-	0.0000545	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	0.0000275	0.0000394	-	0.0000122
Cobalt (Co)	mg/L	0.0009	0.00033	0.00048	0.00053	0.00027

Table 4.6-3: Laboratory Water Quality Results for Site 6						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jun-22	**Date:** 13-Jul-22
			Time: 13:20	**Time:** 9:25	**Time:** 11:05	**Time:** 10:15
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00383	0.00330	0.00373	0.00223
Iron (Fe)	mg/L	0.300	0.161	0.250	0.146	0.194
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	<0.000050	<0.000050	<0.000050	0.000056
Sodium (Na)	mg/L	-	111	130	94.1	58.6
Vanadium (V) – Total	mg/L	0.006	0.00072	0.00085	0.00099	0.00072
Zinc (Zn) - Total	mg/L	0.02 (interim)	0.0038	0.0048	0.0057	<0.0030

Bold indicates exceedance above PWQO guidelines

Table 4.6-4: Flora Observed at Site 6			
FEC V-Type: V15 White Spruce Mixedwood			
Forest Density /Stream Cover	65% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Poplar Trembling Aspen White Spruce Tamarack	Pincherry Willow spp. Speckled Alder	Dandelion Rough-Stemmed- Goldenrod White Clover Common Cattail Ox-Eye Daisy Red Clover Swamp Thistle	Fringed Brome Grass Lady Fern
Aquatic Macrophytes and Algae			
Emergent	-	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.6-5: Fauna Observed at Site 6	
Fauna Species	
Amphibians	-
Birds	Pileated woodpecker
Crustaceans	-
Fish	-

Table 4.6-5: Fauna Observed at Site 6	
Insects	Black Flies Mosquitoes Water Striders Asian Ladybug Grasshoppers Butterflies Black Ants White Admiral
Mammals	-
Mollusca	-
Reptiles	-

Table 4.6-6: Physical Features Observed at Site 6							
FEC Soil Type: S10 – Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	30%	-	35%	35%	-	-
Bank Stability/Erosion	Stable/ abundant vegetation						

4.7 Site 7

Site 7 was located on the east side Loch Lomond Road, 400 meters from Gregor Road. There was a beaver dam upstream which could be causing some water blockage. The substrate was composed of muck. The banks of the shoreline were stable with abundant vegetation in the riparian zone including black spruce, balsam poplar, tamarack, trembling aspen, willow, cow vetch, orange jewelweed and ox-eye daisies. Aquatic vegetation was not present during both site visits. The soil type present at this site was silty-loam in the "A" Horizon, silty-clay loam in the "B" Horizon and sandy-loam with gravel in the "C" Horizon.

The low water condition at the site during the July sampling period was believed to have been created by an upstream blockage at Site 9. As a result, field and laboratory water quality results may have been affected.

The laboratory results from both the June 14, 2022 and July 13, 2022 sampling periods showed that phosphorus, total coliforms, iron and aluminum exceeded the PWQO guidelines. The July sampling period had an additional exceedance of cobalt.

Phosphorus exceeded the PWQO criterion of 0.030 mg/L with a value of 0.0631 mg/L on June 14, 2022 and 0.54 mg/L on July 13, 2022.

Total coliforms exceeded the PWQO criterion of 1,000 MPN/100mL with values of >2, 420 MPN/100mL on June 14, 2022 and 1, 960 on July 13, 2022.

Aluminum exceeded the PWQO criterion of 0.075 mg/L with values of 0.132 on June 14, 2022 and 0.15 on July 13, 2022.

Iron exceeded the PWQO criterion of 0.3 mg/L with values of 0.666 on June 14, 2022 and 24.2 on July 13, 2022.

Cobalt exceeded the PWQO criterion of 0.0009 mg/L with a value of 0.00822 mg/L on July 13, 2022.

Table 4.7-1: Location References for Site 7	
Location Description	East side of Loch Lomond Road, 400 meters from Gregor Road
UTM Coordinates	Northing 5353576 Easting 324939
Altitude/Elevation	222.60 metres above sea level

Table 4.7-2: Field Measurements for Site 7					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 10:40	**Date:** 08-Jul-15 **Time**: 14:30	**Date:** 14-Jul-22 **Time:** 10:30	**Date:** 13-Jul-22 **Time:** 13:20
Water Temperature	ºC	N/A	19.35	12.4	13.5
Conductivity	uS/cm	390	520	444.8	3667
Dissolved Oxygen	mg/L	5.87	2.26	6.42	5.33
Dissolved Oxygen	%	61.9	23.1	60.2	51.8
pH		7.43	7.48	6.87	7.24
Turbidity	NTU	1.22	3.86	3.35	14.31
Air Temperature	ºC	20.0	25.0	14.0	24.0
Channel Width	m	2.10	0.90	1.0	1.30
Channel Depth	m	0.40	0.20	0.10	0.18
Velocity	m/s	0.26	0.08	0.13	N/A
Salinity		0.19	0.25	-	-
Oxygen Reduction Potential	ORP	58.7	N/A	94.6	-102.7

Bold indicates exceedance above PWQO guidelines

Table 4.7-3: Laboratory Water Quality Results for Site 7						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 10:40	**Date:** 08-Jul-15 **Time:** 14:30	**Date:** 14-Jun-22 **Time:** 10:30	**Date:** 13-Jul-22 **Time:** 13:20
Bacteriological						
Escherichia Coli	MPN/100mL	100	30	9	96	<10
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**2420**	435	**>2420**	**1960**
Physical						
Conductivity (EC)	uS/cm	-	108	482	432	3090
pH		6.5-8.5	7.39	7.33	8.14	7.63
Total Dissolved Solids	mg/L	-	97	295	276	2050
Turbidity	NTU	-	5.99	6.30	4.30	90.5
Nutrients and Anions						

Table 4.7-3: Laboratory Water Quality Results for Site 7						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 10:40	**Date:** 08-Jul-15 **Time:** 14:30	**Date:** 14-Jun-22 **Time:** 10:30	**Date:** 13-Jul-22 **Time:** 13:20
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	**58.8**	**187**	**165**	**453**
Ammonia-N, Total	mg/L	-	<0.020	0.123	0.0220	0.304
Un-ionized Ammonia	mg/L	0.02	N/A	0.00148	0.00005	0.00076
Chloride (Cl)	mg/L	-	0.32	46.2	43.8	892
Nitrate-N (NO3-N)	mg/L	-	0.021	<0.020	0.030	<0.40
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.20
Phosphorus (P)-Total	mg/L	0.03	0.0177	**0.210**	**0.063**	**0.540**
Sulfate (SO4)	mg/L	-	1.39	<0.30	**6.48**	<6.0
Metals						
Aluminum (Al)	mg/L	0.075	**0.337**	0.0313	**0.132**	**0.150**
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	0.0000225	-	0.0000297	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	-	0.0000087	-	0.0000786
Cobalt (Co)	mg/L	0.0009	0.00027	**0.00159**	0.00039	**0.00822**
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00349	0.00060	0.00198	0.00229
Iron (Fe)	mg/L	0.300	**0.643**	**3.77**	**0.666**	**24.2**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	0.000108	-	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	-	0.000063	0.000065	0.000058
Sodium (Na)	mg/L	-	1.99	24.1	25.9	497
Vanadium (V) – Total	mg/L	0.006	0.00163	0.00220	0.00176	0.00286
Zinc (Zn) - Total	mg/L	0.02 (interim)	<0.0030	<0.0030	<0.0030	0.0095

Table 4.7-4: Flora Observed at Site 7			
FEC V-Type: V14 Balsam Fir Mixedwood			
Forest Density / Stream Cover	80% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Fir White Spruce Balsam Poplar Black Ash Black Spruce Tamarack Trembling Aspen	Willow Spp. Speckled Alder	Common Cattail Tall Buttercup Cow Vetch Ox-Eye Daisy Dandelion Orange Jewelweed	

Table 4.7-4: Flora Observed at Site 7			
Aquatic Macrophytes and Algae			
Emergent	-	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.7-5: Fauna Observed at Site 7	
Fauna Species	
Amphibians	-
Birds	-
Crustaceans	-
Fish	-
Insects	Black Flies Bumblebees Eastern Tiger Swallowtail Mosquitoes Spring Azure White Admiral
Mammals	-
Mollusca	-
Reptiles	-

Table 4.7-6: Physical Features Observed at Site 7							
FEC Soil Type: S10 – Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	-	-	-	-	100%	-
Bank Stability/ Erosion	Stable/ abundant vegetation						

4.8 Site 8

Site 8 was located on the privately owned property of 2176 Trendiak Road, 150 metres west from Loch Lomond Road. The substrate was composed of muck. The banks of the shoreline were stable with abundant vegetation in the riparian zone including jack pine, white birch, black spruce, tall yellow aster, water parsnip, cow vetch and swamp thistle. Aquatic vegetation was visible during both visits including broad-leaved arrowhead and common cattail. The soil type present at this site was silty-loam in both the “A” and “B” Horizons.

The laboratory results from the June 14, 2022 and July 13, 2022 sampling periods showed that total coliforms and iron exceeded the PWQO guidelines. The June sampling period had an additional exceedance of aluminum.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with a value of 2,420 MPN/100mL on June 14, 2022 and 1,990 MPN/100mL on July 13, 2022.

Iron exceeded the PWQO criterion (0.3 mg/L) with a value of 0.663 mg/L on June 14, 2022 and 0.827 mg/L on July 13, 2022.

Aluminum results exceeded the PWQO criterion (0.075 mg/L) with a value of 0.122 mg/L on June 14, 2022.

Table 4.8-1: Location References for Site 8	
Location Description	2176 Trendiak Road, about 150 meters west from Loch Lomond Road
UTM Coordinates	Northing 5352181 Easting 324761
Altitude/Elevation	235.89 metres above sea level

Table 4.8-2: Field Measurements for Site 8					
Parameter	**Unit**	**Date:** 10-Jun-15 **Time:** 9:45	**Date:** 08-Jul-15 **Time**: 13:35	**Date:** 14-Jul-22 **Time:** 10:10	**Date:** 13-Jul-22 **Time:** 13:50
Water Temperature	ºC	16.09	21.17	14.0	15.2
Conductivity	uS/cm	114	166	130.0	149
Dissolved Oxygen	mg/L	9.01	7.14	7.11	7.93
Dissolved Oxygen	%	92.2	38.0	69.0	83.4
pH		7.54	7.88	6.98	8.12
Turbidity	NTU	3.45	2.83	2.01	2.34
Air Temperature	ºC	19.0	23.0	13.0	23.0
Channel Width	m	2.70	2.70	5.40	8.21
Channel Depth	m	0.29	0.30	0.40	0.63
Velocity	m/s	0.12	N/A	N/A	0.06
Salinity		0.05	0.08	-	-
Oxygen Reduction Potential	ORP	106.9	17.8	66.0	73.2

Table 4.8-3: Laboratory Water Quality Results for Site 8						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15 **Time:** 9:45	**Date:** 08-Jul-15 **Time:** 13:35	**Date:** 14-Jun-22 **Time:** 10:10	**Date:** 13-Jul-22 **Time:** 13:50
Bacteriological						
Escherichia Coli	MPN/100mL	100	30	20	14	29
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**2420**	**1990**	**2420**	**1990**
Physical						
Conductivity (EC)	uS/cm	-	108	162	128	155
pH		6.5-8.5	7.39	7.65	7.69	7.83
Total Dissolved Solids	mg/L	-	97	133	107	132
Turbidity	NTU	-	5.99	3.74	2.86	2.10
Nutrients and Anions						
Alkalinity	mg/L	61.4 (June);	58.8	95.4	69.5	90.7

Table 4.8-3: Laboratory Water Quality Results for Site 8						
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 10-Jun-15	**Date:** 08-Jul-15	**Date:** 14-Jun-22	**Date:** 13-Jul-22
			Time: 9:45	**Time:** 13:35	**Time:** 10:10	**Time:** 13:50
		94.1 (July) 2022				
Ammonia-N, Total	mg/L	-	<0.020	0.031	0.0442	0.0156
Un-ionized Ammonia	mg/L	0.02	0.00019	0.0004	0.000011	0.00051
Chloride (Cl)	mg/L	-	0.32	0.41	1.60	0.59
Nitrate-N (NO3-N)	mg/L	-	0.021	<0.020	<0.020	<0.020
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010	<0.010	<0.010
Phosphorus (P)-Total	mg/L	0.03	0.0177	0.0217	0.0268	0.0254
Sulfate (SO4)	mg/L	-	1.39	0.75	0.66	<0.30
Metals						
Aluminum (Al)	mg/L	0.075	**0.337**	**0.148**	**0.122**	0.0309
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	0.0000157	0.0000204	-	0.0000051
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	-	-	0.0000198	-
Cobalt (Co)	mg/L	0.0009	0.00043	0.00031	0.00019	0.00024
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00145	0.00204	0.00301	0.00123
Iron (Fe)	mg/L	0.300	**0.904**	**0.805**	**0.663**	**0.827**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	<0.000050	-	0.000068	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	-	0.000089	-	<0.000050
Sodium (Na)	mg/L	-	22.1	2.20	2.66	2.37
Vanadium (V) – Total	mg/L	0.006	0.00135	0.00160	0.00156	0.00090
Zinc (Zn) - Total	mg/L	0.02 (interim)	<0.0030	0.0034	<0.0030	<0.0030

Bold indicates exceedance above PWQO guidelines

Table 4.8-4: Flora Observed at Site 8			
FEC V-Type: V17 Jack Pine Mixedwood/Shrub Rich			
Forest Density / Stream Cover	0% stream cover		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Black Spruce Green Ash Jack Pine White Birch White Spruce	Beaked Hazel Speckled Alder	Common Cattail Dandelion Swamp Thistle Cow Vetch Tall Yellow Aster Water Parsnip Square-Stemmed Monkey Flower	
Aquatic Macrophytes and Algae			
Emergent	Broad-Leaved Arrowhead	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.8-5: Fauna Observed at Site 8	
Fauna Species	
Amphibians	-
Birds	Belted kingfisher Blue Jay
Crustaceans	-
Fish	Minnows
Insects	Black Flies Common Baskettail Mosquitoes Water Striders
Mammals	-
Mollusca	-
Reptiles	Garter Snake

Table 4.8-6: Physical Features Observed at Site 8							
FEC Soil Type: S9 – Moist / Silty - Silt Loamy							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	-	-	-	-	100%	-
Bank Stability/ Erosion	Stable/ abundant vegetation						

4.9 Site 9

Site 9 is located on Trendiak Road, 670 metres east of Little Norway Road. The substrate was composed of muck. The banks of the shoreline were stable with abundant vegetation in the riparian zone including Black Ash, Balsam Fir, Trembling Aspen, White Spruce, Tall Yellow Aster, Swamp Thistle and Cow Vetch. The common aquatic flora species was the common cattail. The soil type present at this site was silty-loam in both the "A" and "B" Horizons.

During the July sampling period the upstream culverts were blocked by woody debris and sediment creating a large pool of stagnant water which is believed to have influenced the field and laboratory water quality results.

The laboratory results from the June 14, 2022 and July 13, 2022 sampling periods showed that total coliforms and iron exceeded the PWQO guidelines. The July sampling period had additional exceedances of aluminum, vanadium and zinc.

Phosphorus exceeded the PWQO guidelines (0.03 mg/L) with a value of 0.174 during the July sampling period.

Total coliforms were above the pre-1994 PWQO criterion of 1,000 MPN/100mL with values of 2, 420 MPN/100mL on June 14, 2022 and 9800 MPN/100mL on July 13, 2022. Iron exceeded the PWQO criterion (0.3 mg/L) with a value of 0.595 mg/L on June 14, 2022 and 7.82 mg/L on July 13, 2022.

Aluminum exceeded the PWQO criterion of 0.075 mg/L with a value of 4.50 mg/L on July 13, 2022.

Vanadium exceeded the PWQO criterion of 0.006 mg/L with a value of 0.00945 mg/L on July 13, 2022.

Zinc exceeded the PWQO criterion of 0.02 mg/L with a value of 0.0225 mg/L on July 13, 2022.

Table 4.9-1: Location References for Site 9	
Location Description	Trendiak Road, 670 meters east from Little Norway Road.
UTM Coordinates	Northing 5352231 Easting 323512
Altitude/Elevation	241 metres above sea level

Table 4.9-2: Field Measurements for Site 9			
Parameter	**Unit**	**Date:** 14-Jul-22 **Time:** 9:30	**Date:** 13-Jul-22 **Time:** 13:50
Water Temperature	ºC	13.0	15.6
Conductivity	uS/cm	215.8	289
Dissolved Oxygen	mg/L	5.67	0.76
Dissolved Oxygen	%	53.9	7.6
pH		7.20	7.63
Turbidity	NTU	1.32	85.17
Air Temperature	ºC	11.0	24.0
Channel Width	m	7.40	7.60
Channel Depth	m	0.46	0.35
Velocity	m/s	N/A	N/A
Salinity		-	-
Oxygen Reduction Potential	ORP	86.1	26.1

Table 4.9-3: Laboratory Water Quality Results for Site 9				
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 14-Jun-22 **Time:** 9:30	**Date:** 13-Jul-22 **Time:** 15:30
Bacteriological				
Escherichia Coli	MPN/100mL	100	99	50
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**2420**	**9800**
Physical				
Conductivity (EC)	uS/cm	-	206	272
pH		6.5-8.5	7.93	7.60
Total Dissolved Solids	mg/L	-	147	209
Turbidity	NTU	-	2.00	115
Nutrients and Anions				
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	94.2	160
Ammonia-N, Total	mg/L	-	<0.0050	0.103
Un-ionized Ammonia	mg/L	0.02	**<**0.000012	0.00299
Chloride (Cl)	mg/L	-	10.8	5.06
Nitrate-N (NO3-N)	mg/L	-	<0.020	<0.020
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.010
Phosphorus (P)-Total	mg/L	0.03	0.0224	**0.174**
Sulfate (SO4)	mg/L	-	4.42	0.66
Metals				
Aluminum (Al)	mg/L	0.075	0.0717	**4.50**
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	0.0000208	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	-	0.000110
Cobalt (Co)	mg/L	0.0009	0.00020	**0.00343**
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00221	0.00805
Iron (Fe)	mg/L	0.300	**0.595**	**7.82**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-

Table 4.9-3: Laboratory Water Quality Results for Site 9				
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 14-Jun-22 **Time:** 9:30	**Date:** 13-Jul-22 **Time:** 15:30
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	<0.000050	0.00158
Sodium (Na)	mg/L	-	6.63	7.02
Vanadium (V) – Total	mg/L	0.006	0.00127	**0.00945**
Zinc (Zn) - Total	mg/L	0.02 (interim)	<0.0030	**0.0225**

Bold indicates exceedance above PWQO guidelines

Table 4.9-4: Flora Observed at Site 9			
FEC V-Type: V2 Black Ash Hardwood and Mixedwood			
Forest Density / Stream Cover	10%		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Poplar Black Ash Black Spruce Willow spp. White Birch Trembling Aspen	Choke Cherry Dwarf Raspberry Highbush Cranberry Pin Cherry Red Osier Dogwood Tatarian Honeysuckle White Meadowsweet	Canada Anemone Cow Parsley Buttercup spp.	Marsh Horsetail Woodland Horsetail
Aquatic Macrophytes and Algae			
Emergent	-	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.9-5: Fauna Observed at Site 9	
Fauna Species	
Amphibians	-
Birds	American Crow Common Yellowthroat American Goldfinch
Crustaceans	-
Fish	Minnows
Insects	Common Baskettail Blackflies Mosquitoes Spring Azure Eastern Tiger Swallowtail
Mammals	Snowshoe Hare
Mollusca	-
Reptiles	-

Table 4.9-6: Physical Features Observed at Site 9							
FEC Soil Type: S9 – Moist / Silty - Silt Loamy							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	20%	40%	-	-	40%	-
Bank Stability/ Erosion	Stable/ abundant vegetation						

4.10 Site 10

Site 10 is located East of Norwester Drive at the confluence from Site 2 and 3 tributaries. It is downstream of most major urban developments within the Mosquito Creek watershed. The substrate was composed of muck. The banks of the shoreline were stable with abundant vegetation in the riparian zone including balsam fir, jack pine, trembling aspen, common reed, Canada blue joint, common thistle and speckled alder. Aquatic vegetation was not present during both site visits. The soil type present at this site was clay in both the "A" and "B" Horizons

The laboratory results from the June 14, 2022 and July 13, 2022 sampling periods showed that total coliforms, aluminum, and iron all exceeded the PWQO guidelines.

Total coliforms exceeded the PWQO criterion of 1,000 MPN/100mL with a value of 2, 420 MPN/100mL on June 14, 2022 and >2, 420 MPN/100mL on July 13, 2022.

Aluminum exceeded the PWQO criterion of 0.075 mg/L with a value of 0.264 mg/L on June 14, 2022 and 0.576 on July 13, 2022.

Iron was in exceedance of the PWQO criterion of 0.3 mg/L with values of 0.657 mg/L on June 14, 2022 and 0.843 mg/L on July 13, 2022.

Table 4.10-1: Location References for Site 10	
Location Description	East of Norwester Drive at the confluence from Site 2 and 3 tributaries
UTM Coordinates	Northing 5355705 Easting 327723
Altitude/Elevation	198 metres above sea level

Table 4.10-2: Field Measurements for Site 10			
Parameter	**Unit**	**Date:** 14-Jul-22	**Date:** 13-Jul-22
		Time: 12:15	**Time:** 11:50
Water Temperature	ºC	12.6	17.9
Conductivity	uS/cm	463.4	714
Dissolved Oxygen	mg/L	9.39	7.48
Dissolved Oxygen	%	88.6	79.0
pH		7.29	7.84
Turbidity	NTU	14.16	18.56

Table 4.10-2: Field Measurements for Site 10			
Air Temperature	ºC	14.0	24.0
Channel Width	m	3.0	3.77
Channel Depth	m	0.31	0.157
Velocity	m/s	N/A	N/A
Salinity		-	-
Oxygen Reduction Potential	ORP	41.4	56.4

Table 4.10-3: Laboratory Water Quality Results for Site 10				
Parameter	**Unit**	**PWQO Guidelines**	**Date:** 14-Jun-22 **Time:** 12:15	**Date:** 13-Jul-22 **Time:** 11:50
Bacteriological				
Escherichia Coli	MPN/100mL	100	91	36
Total Coliforms	MPN/100mL	1,000 (prior to 1994)	**2420**	**>2420**
Physical				
Conductivity (EC)	uS/cm	-	454	688
pH		6.5-8.5	8.14	8.19
Total Dissolved Solids	mg/L	-	274	375
Turbidity	NTU	-	11.2	16.8
Nutrients and Anions				
Alkalinity	mg/L	61.4 (June); 94.1 (July) 2022	157	219
Ammonia-N, Total	mg/L	-	0.0129	0.0087
Un-ionized Ammonia	mg/L	0.02	0.00031	0.00029
Chloride (Cl)	mg/L	-	52.9	105
Nitrate-N (NO3-N)	mg/L	-	0.159	<0.040
Nitrite-N (NO2-N)	mg/L	-	<0.010	<0.020
Phosphorus (P)-Total	mg/L	0.03	0.0272	0.0055
Sulfate (SO4)	mg/L	-	9.78	11.2
Metals				
Aluminum (Al)	mg/L	0.075	**0.264**	**0.576**
Cadmium (Cd)	mg/L	0.0001 (0-100 mg/L $CaCO_3$)	0.0000347	-
	mg/L	0.0005 (>100 mg/L $CaCO_3$)	-	0.0000347
Cobalt (Co)	mg/L	0.0009	0.00040	0.00060
Copper (Cu)	mg/L	0.001 (0-20 mg $CaCO_3$)	-	-
	mg/L	0.005 (>20 mg/L $CaCO_3$)	0.00386	0.00415
Iron (Fe)	mg/L	0.300	**0.657**	**0.843**
Lead (Pb)	mg/L	0.001 (<30 mg/L $CaCO_3$)	-	-
	mg/L	0.003 (30- 80 mg/L $CaCO_3$)	-	-
	mg/L	0.005 (>80 mg/L $CaCO_3$)	0.000193	0.000247
Sodium (Na)	mg/L	-	32.2	56.8
Vanadium (V) – Total	mg/L	0.006	0.00241	0.00348
Zinc (Zn) - Total	mg/L	0.02 (interim)	0.0049	0.0037

Bold indicates exceedance above PWQO guidelines

Table 4.10-4: Flora Observed at Site 10			
FEC V-Type: V14 Balsam Fir Mixedwood			
Forest Density / Stream Cover	0%		
Terrestrial Species			
Trees	**Shrubs**	**Herbs**	**Ferns / Horsetails / Mosses / Grasses**
Balsam Fir Trembling Aspen Tamarack White Birch Jack Pine Balsam Poplar White Spruce	Chokecherry Willow spp. Speckled Alder Mountain Ash Manitoba Maple	Tall Buttercup Red Clover White Clover Dandelion Swamp Thistle Cow Vetch Ox-Eye Daisy Cow Parsnip	Common Reed Canada Blue Joint Coral Root
Aquatic Macrophytes and Algae			
Emergent	-	**Floating Algae**	-
Rooted Floating	-	**Filaments**	-
Submergent	-	**Attached Algae**	-
Free Floating	-	**Slimes or Crusts**	-

Table 4.10-5: Fauna Observed at Site 10	
Fauna Species	
Amphibians	-
Birds	Common Raven Blue Jay
Crustaceans	-
Fish	-
Insects	Mosquito Black fly European Skipper Eastern tiger Swallowtail
Mammals	-
Mollusca	-
Reptiles	-

Table 4.10-6: Physical Features Observed at Site 10							
FEC Soil Type: Moist / Fine Loamy - Clayey							
In-stream Substrate							
Bedrock	**Boulder**	**Cobbles**	**Gravel**	**Sand**	**Silt**	**Muck**	**Clay**
-	-	-	-	-	-	100%	-
Bank Stability/ Erosion	Erosion present at sampling site stream bank/poor stability						

4.11 Watershed Report Card Results

The overall surface water quality for the Mosquito Creek Watershed maintained a total averaged point score of 4. With minimal exceedances for phosphorus and no exceedances for *E.coli*, the rating of the surface water quality for the Mosquito Creek watershed was determined to have a grade of B.

The forest coverage for the Mosquito Creek watershed was 19.5 square kilometres (61.4 percent), interior forest coverage was 11.8 square kilometres (37.2 percent) and the riparian forest cover was 1.1 square kilometres (3.5 percent). These percentages generated a total point score of eleven (average of 3.7) for the forest conditions, which determined a grade of B.

Table 4.9-1: Mosquito Creek Watershed Surface Water Indicators and Overall Grade Calculation

Site Number	Average Total Phosphorus (mg/L)	Average *E. coli* (MPN/100mL)	Average of Benthic Invertebrates	Overall Surface Water Quality Grade	
				Final Points	Grade
1	0.0226	46.5	N/A	4	B
2	0.0222	37	N/A	4	B
3	0.0273	40.5	N/A	4	B
4	0.0200	54	N/A	4	B
5	0.0431	24	N/A	4	B
6	0.0088	13	N/A	5	A
7	0.3016	53	N/A	2.5	C
8	0.0261	21.5	N/A	4.5	A
9	0.0982	74.5	N/A	3	C
10	0.0164	63.5	N/A	4.5	A
Overall Average	**0.0586**	**42.8**	**N/A**	**4**	**B**

Table 4.9-2: Mosquito Creek Watershed Forest Conditions and Overall Grade Calculation

% Forest Cover	% Forest Interior	% Riparian Zone Forested	Total Point Score	Grade	Overall Forest Conditions	
					Final Points	Final Grade
61.4	37.2	3.5	11	B	3.7	B

Table 4.9-3: Mosquito Creek Watershed Percent Wetland Cover

% Wetland Cover	Grade
7.32	C

5 Discussion

The Mosquito Creek watershed was sampled at ten different locations, chosen based on accessibility and possible contamination sources, as well as attempting to reach all areas of the watershed. Two visits were completed for each site. The first sampling date was on June 14, 2022 and the second sampling date was on July 13, 2022.

The average air temperature for the June 2022 sampling period was 12.9 degrees Celsius which was below the monthly average temperature of 14.7 degrees Celsius as well as the historical average of 14.0 degrees Celsius for June 1971-2000 in Thunder Bay. The average air temperature for the July 2022 sampling period was 23.6 degrees Celsius which exceeded the monthly average temperature of 17.5 degrees Celsius and the historical average of 17.6 degrees Celsius for July 1971-2000. Precipitation for the month of June totaled 44.7 millimetres which was below the historical monthly average of 85.7 millimetres for Thunder Bay from June 1971-2000. In July, precipitation totaled 65.9 millimetres which was also below the historical monthly average of 89.0 millimetres for July 1971-2000.

There was no Low Water Condition declared by the Lakehead Region Conservation Authority during 2022.

Water temperature ranged from 10.6 degrees Celsius to 14 degrees Celsius in June and 11.5 degrees Celsius to 17.9 degrees Celsius in July which can be seen on Figure 13: Water Temperature at Mosquito Creek Sample Sites.

From the ten sample locations, nine of them were at water crossings which required either a bridge or culvert to support the road. The only bridge present was at Site 1 which was made of reinforced concrete and steel beams and did not appear to alter flow in a significant way or change the natural stream course. The fill used for the footing on either bank, consisted of boulders, cobble and gravel. The fill used was similar to the natural stream bank substrate and aided in bridge support as well as erosion and sedimentation control from road run-off. Culverts were present at Sites 2 through 9. The culverts at these sites were in relatively good condition except for Site 3 and were large enough to withstand increased velocity and water levels from heavy rainfall. The culvert at Site 3 had corroded along the bottom and appeared to have deteriorated since 2015. The culvert at site 6 in the early stages of corrosion with holes forming along the rust line. All culverts at site 9 have substantial blockages of debris with very little water flow downstream of the culverts.

A vegetation assessment was carried out at each site, recording species present within view of each site. A summary of each site is included in Appendix F: Forest Ecosystem Classification. Forest Ecosystem Classification Type V-14 White Spruce Mixedwood, was

the most common and occurred at Sites 1, 4, 5 and 7. The remaining sites still had a similar mixedwood forest type, sometimes favouring coniferous species as opposed to hardwood. The dominant tree species within the Mosquito Creek watershed included white spruce, balsam poplar, trembling aspen, jack pine and black spruce. The shrub layer was very diverse throughout the watershed, with many species present. Some commonly observed species in the shrub layer were chokecherry, pin cherry, beaked hazel, serviceberry, and willow species. The ground cover and herb layer included wildflowers typical of disturbed sites, most likely due to the habitat provided by roadsides. The most observed herb and wildflower species included dandelion, ox-eyed daisy, swamp thistle, buttercup, common bulrush, cow vetch, red and white clover. Birdsfoot trefoil and cow vetch was present at every sampling site and no species at risk were seen at the sample sites within the Mosquito Creek watershed. Some of the aquatic vegetation identified was broad-leaved arrowhead, small yellow water crowfoot, and waterlily.

Overall, the stream banks documented within the Mosquito Creek watershed were stable. The main soil type was silty-loam with some clay content, which tends to be a compacting type soil and aids in river stability. Some of the sites were mainly muck but had vegetation right up to the edge of the water, while some had more boulder and cobble. Both types of substrate aid the banks by helping with slope stability and keeping erosion to a minimum.

High values and exceedances for metals and physical parameters at Sites 7 and 9 during the July sampling period were attributed to a lack of water flow through Site 9 due to a natural disturbance. A build-up of woody debris and sediment on the upstream culverts, presumably placed by a beaver, had restricted flow on the downstream side. The accumulation of water upstream of Site 9 is likely responsible for the high values and exceedances at the site. Consequently, the low water condition created downstream at Site 7 likely caused the higher values and exceedances.

The PWQO acceptable pH range is 6.5-8.5. The range within the Mosquito Creek watershed was 6.87 to 8.36 as illustrated on Figure 12: pH Level at Mosquito Creek Sample Sites. The average pH lies within a good water quality range, being slightly more basic in some areas of the watershed. The average pH of the watershed was 8.02, which is within an acceptable water quality range.

Total Dissolved Solids (TDS) can be related to conductivity since the dissolved solids are what conduct an electric current through the water. The more dissolved solids present in a solution, the greater the conductive potential as there are more ions present to carry the charge. The relationship can be seen in the watershed data when comparing between Figure 15: Conductivity at Mosquito Creek Sample Sites and Figure 14: Total Dissolved Solids (TDS) at Mosquito Creek Sample Sites. The highest reading for TDS and conductivity were at Site 7, and the lowest readings for both parameters were at Site 8. The highest

TDS reading was 2050 mg/L at Site 7 on July 13, 2022. The lowest TDS reading found was 107 mg/L at Site 8 on June 14, 2022.

High physical water quality parameters can be attributed to lack of water flow at site 7. Lack of water flow can be traced to blockages at the tributary located at site 9.

Monitoring of bacterial levels in surface water is often limited to *E. coli*, as this is the most common water-borne pathogen that can cause illness and death. During both the June and July sampling periods no sites were in exceedance of the PWQO of 100 MPN/100mL. The highest level of *E. Coli* present was 99 MPN/100mL at Site 9, during the June sampling period. *E. Coli* levels for all sampling results ranged from 8 MPN/100mL to 99 MPN/100mL. The *E. Coli* results are illustrated on Figure 17: *Escherichia coli* Bacteria Counts at Mosquito Creek River Sample Sites

Presence of *E. coli* generally indicates a fecal contamination source nearby and many studies have shown that the presence of farm animals near a stream can significantly influence bacteria counts. *E. coli* could also enter the watershed from leaking residential septic tanks and/or from manure.

Total coliforms are among the flora present in the intestinal tract of animals and are often present in much greater numbers than potential pathogens, such as *E. coli*. Therefore, coliforms are easier to isolate and identify within a water sample. In order to better determine the possibility of contamination, total coliforms are measured in surface water as indicators of pathogenic bacteria contamination. No current PWQO exists for total coliforms. Total coliforms exceeded the pre-1994 PWQO of 1,000 MPN/100mL at all the sites during both the June and July sampling periods. The highest level of total coliform present was 9800 MPN/100mL at Site 9 on July 13, 2022. Total coliforms ranged from 1410 to 9800 MPN/100mL.

There is currently no PWQO for conductivity. The highest recorded level was 3,367 microSiemens per centimetre (uS/cm) at Site 7 on July 13, 2022. The lowest recorded level was 130 uS/cm on June 14, 2022 at Site 8. The conductivity levels are illustrated on Figure 15: Conductivity at Mosquito Creek Sample Sites.

Turbidity in the Mosquito Creek watershed ranged from 1.43 NTU to 115.0 NTU, as seen in Figure 16: Turbidity at Mosquito Creek Sample Sites. All sites during the June sampling period were below the *Canadian Recreational Water Quality* drinking guidelines of 50 NTU (Health Canada, 1992). Sites 7 and 9 were above the water quality drinking guidelines of 50 NTU. The lowest recorded turbidity value was 1.43 NTU at Site 6 on June 14, 2022. The highest recorded turbidity value was 115.0 NTU at Site 9 on July 13, 2022.

As a limiting nutrient to aquatic vegetation, phosphorus is important to monitor in watersheds to avoid excessive vegetation growth, which can lead to lowered dissolved

oxygen. Phosphorus exceeded the PWQO of 0.03 mg/L at Sites 5, and 7 during the June sampling period, and Sites 4, 5, 7, 9, and 10 during the July sampling period. Phosphorous concentrations for all sampling results ranged from 0.031 mg/L to 0.704 mg/L. The average concentration of phosphorous for all sites during the June sampling period was 0.018 mg/L, and 0.110 mg/L during the July sampling period.

The PWQO criterion of 0.075 mg/L for aluminum was exceeded during the June sampling period at all sites except for Sites 5, 6, and 9. Exceedances occurred during the July sampling period at Sites 1, 3, 7, 9, and 10. Aluminum concentrations for all sampling results ranged from 0.016 mg/L to 4.50 mg/L. The average concentration of aluminum for all sites was 0.162 mg/L during the June sampling period and 0.601 mg/L during the July sampling period, which are both above the PWQO criterion.

The PWQO criterion of 0.30 mg/L for iron was exceeded at all sites except for Site 6 during the June sampling period. Exceedances occurred at every site except for Sites 1, and 6 during the July sampling period. Iron concentrations for all sampling results ranged from 0.146 mg/L to 24.200 mg/L. The average concentration of iron was calculated to be 0.612 mg/L for the June sampling period and 3.765 mg/L for the July sampling period, which are both above the PWQO criterion.

High aluminum and iron levels may be caused by the underlying geology. These metals may naturally dissociate from mineral-rich rocks. The exceedances are likely a result of natural sources and are commonly high within the region.

Copper was below the PWQO criterion of 0.005 mg/L at all sites during the June sampling period. Only one exceedance occurred at Site 9 during the July sampling period. Copper concentrations for all sampling results ranged from 0.00068 mg/L to 0.00805 mg/L. The average concentration of copper was 0.00300 mg/L for all sites during the June sampling period and 0.00286 mg/L during the July sampling period.

The PWQO criterion of 0.0009 mg/L for cobalt was not exceeded during the June sampling period. Only one exceedance occurred at Site 7 during the July sampling period. Cobalt concentrations ranged from 0.00017 mg/L to 0.00822 mg/L. The average concentration of cobalt was 0.00033 mg/L for all sites during the June sampling period and 0.00146 mg/L during the July sampling period.

The PWQO criterion of 0.02 mg/L for zinc was not exceeded during the June sampling period. Only one exceedance occurred at Site 9 during the July sampling period. Zinc concentrations ranged from <0.0030 mg/L to 0.0225 mg/L. The average concentration of zinc was 0.00528 mg/L for all sites during the June sampling period and 0.00978 mg/L during the July sampling period.

The PWQO criterion of 0.006 mg/L for vanadium was not exceeded during the June sampling period. Only one exceedance occurred at Site 9 during the July sampling period. Vanadium concentrations ranged from 0.00072 mg/L to 0.00945 mg/L. The average concentration of zinc was 0.00169 mg/L for all sites during the June sampling period and 0.002475 mg/L during the July sampling period.

The overall health of the Mosquito Creek watershed was determined using the ratings from surface water quality and forest conditions, which were combined to give a grade for the Watershed Report Card. Given the number of exceedances for phosphorus, the overall health of the Mosquito Creek watershed surface water quality has maintained a rating (B) for its Watershed Report Card rating. The Mosquito Creek Forest conditions based on forest coverage, forest interior, and riparian zone forested, were determined to also result in a rating of (B). Based on this rating and other observed conditions, the Mosquito Creek watershed has been determined to have good overall health.

6 Conclusion

The Mosquito Creek watershed was determined to be in good condition with minimal evident anthropogenic impacts. Surface water quality at the time of the study was good, with the exceedances of the Provincial Water Quality Objectives being mostly attributed to natural sources. Plant species composition seems characteristic of the boreal forest, with diversity at each site among the overstory, understory and herb layer. A more comprehensive fauna study would give a clear indication of the species and populations present, but at the time of the study, multiple species were observed giving a good representation of a typical boreal forest area. Water levels seemed consistent with previous water markings. Erosion was not typically a concern as the stream banks were stable. Stream cover was often provided by shrubs and trees growing along the creek banks which also helped prevent erosion. Bridges were in stable condition with no immediate concern for maintenance. Culverts at Site 3 and 6 should be monitored as corrosion persists, and blockage should be removed from Site 9 culverts, relieving possible backflow.

7 Recommendations

Upon completion of the 2022 Mosquito Creek Watershed Assessment, the following recommendations have been made for considerations:

- Staff and funding permitting it is recommended that an update to the 2022 Mosquito Creek Watershed Assessment be completed in the next five to ten years
- Benthic analysis indicates water quality over an extended period of time and should be considered for future watershed assessments.
- Additional sampling should be conducted in the spring to observe the water quality differences between high and low flow seasons
- If the Provincial Water Quality Monitoring Network program was ever expanded, a monitoring location within the Mosquito Creek watershed should be considered.
- A copy of this report should be provided to the City of Thunder Bay, Municipality of Neebing and Municipality of Oliver Paipoonge for reference purposes. The report should be kept on file at the LRCA Administration Office for review by interested parties.

8 References

City of Thunder Bay. Golf Courses/Facilities. Fort William Country Club. Online. Accessed: December 6, 2022. Available: <https://directory.visitthunderbay.com/Home/View/fort-william-golf-and-country-club>

City of Thunder Bay. Arenas. Thunder Bay Tournament Centre. Online. Accessed: December 6, 2022. Available: < http://tbtournamentcentre.com/>

City of Thunder Bay. "City of Thunder Bay Zoning By-Law 100-2010". Online. Accessed: December 6, 2022. Available: <https://www.thunderbay.ca/en/business/resources/Documents/Zoning/Zoning-By-law-100-2010---Updated-Sept-2019.pdf >

Conservation Ontario. "2011 Guide to Developing Conservation Authority Watershed Report Cards". 2011. Print.

Cudmore, Becky and Nicholas E. Mandrak. "The Baitfish Primer". Fisheries and Oceans Canada. Winnipeg, Manitoba. 2011. Print.

Dickinson, T., Metsger, D., Bull, J., & R. Dickinson. "The ROM Field Guide to Wildflowers of Ontario". Royal Ontario Museum and McClelland and Stewart Ltd., Toronto, Ontario. 2004. Print.

EDDMapS Ontario. 2022. Early Detection & Distribution Mapping System. The University of Georgia – Center for Invasive Species and Ecosystem Health. Online. Accessed December 6, 2022. Available: <https://www.eddmaps.org/ontario/distribution/>

Environment Canada. Canadian Climate Normals 1971-2000 Station Data. Online. Accessed: December 9, 2022. Available: <https://climate.weather.gc.ca/climate_normals/results_e.html?searchType=stnName&txtStationName=thunder&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=4055&dispBack=0>

Environment Canada. "Daily Data Report - Thunder Bay". Online. Accessed: December 9, 2022. Available: <https://climate.weather.gc.ca/climate_data/daily_data_e.html?StationID=30682>

Fenco MacLaren Inc. “Mosquito Creek Post Development Study”. Report to Lakehead Region Conservation Authority. March 1996. Print.

Fort William Country Club Limited. “Home”. Online. Accessed: December 6, 2022. Available: <https://www.fwcc.ca/>

Harris, Allan G., S.C. McMurray, P.W.C. Uhlig, J.K. Jeglum, R.F. Foster and G.D. Racey. “Field Guide to Wetland Ecosystem Classification for Northwestern Ontario”. Queen’s Printer for Ontario, Ontario, Canada. 1996. Print.

Health Canada. “Guidelines for Canadian Recreational Water Quality, Third Edition”. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Online. Accessed: December 6, 2022. Available: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-recreational-water-quality-third-edition.html >

Lakehead Region Conservation Authority. “Thunder Bay Aquifer Characterization, Groundwater Management and Protection Study”. July 2005. Print.

Lakehead Region Conservation Authority. “Lakehead Source Protection Area Watershed Characterization Report”. March 2008. Print.

Lakehead Region Conservation Authority. “Mosquito Creek Watershed Assessment Report”. July 2015. Print.

Legasy, Karen, Shayna LaBelle-Beadman, and Brenda Chambers. “Forest Plants of Northeastern Ontario”. Canada. Lone Pine Publishing & Queen’s Printer for Ontario. 1995. Print.

Lenntech B.V. “Aluminum and water: reaction mechanisms, environmental impact and health effects”. Online. Accessed: December 6, 2022. Available: <http://www.lenntech.com/periodic/water/aluminium/aluminum-and-water.htm#ixzz2bJ86RbwN>

Ministry of the Environment and Energy (MOEE). “Policies, Guidelines, Provincial Water Quality Objectives”. Toronto, Ontario. Queen’s Printer. July 1994. Online. Accessed: December 6, 2022. Available: <https://www.ontario.ca/document/water-management-policies-guidelines-provincial-water-quality-objectives>

Municipality of Neebing. “Municipality of Neebing Zoning By-Law No. 2017-030”. Online. Accessed: December 6, 2022. Available: <https://www.neebing.org/en/business-and-development/resources/Documents/Zoning_By-Law-2017-030_FINAL.pdf>

Municipality of Oliver Paipoonge. “Zoning By-law of the corporation of The Municipality of Oliver Paipoonge. January 01-2019”. Online. Accessed: December 6, 2022. Available: <https://oliverpaipoonge.ca/application/files/7116/0701/8596/Zoning_By-law_01-2019_FINAL.pdf>

Natural Resources Canada. Forest Classification. Online. Accessed: December 6, 2022. Available: <https://www.nrcan.gc.ca/our-natural-resources/forests/sustainable-forest-management/measuring-and-reporting/forest-classification/13179>

Newmaster, Steven G., Allen G. Harris, and Linda J. Kershaw. “Wetland Plants of Ontario”. Toronto, Ontario. Queen’s Printer. 1997. Print.

Nor'wester View Public School. “Home”. Online. Accessed: December 6, 2022. Available: <http://norwesterview.lakeheadschools.ca/>

Northern Bioscience Ecological Consulting. “Mosquito Creek Watershed Wetland Evaluation”. November 2018. Print.

Ontario Geological Survey. “Map 2545 Bedrock geology of Ontario, explanatory notes and legend”. Ontario. Queen’s Printer. 1991. Print.

Ontario Ministry of Natural Resources and Forestry. “Invasive Species Strategic Plan (2012).” Queen’s Printer for Ontario, 2021. Online. Accessed: December 6, 2022. Available: < https://www.ontario.ca/page/invasive-species-strategic-plan-2012>

Ontario Nature. Species at Risk in Northern Ontario. 2008. Online. Accessed: December 6, 2022. Available: < https://onnaturemagazine.com/species-at-risk-in-northern-ontario.html?unapproved=66374&moderation-hash=b472163b0d7f6a564952a85296ce3c5c#comment-66374>

Ontario Nature. 2015. Ontario Reptile and Amphibian Atlas. Online. Accessed: December 6, 2022. Available: <https://www.ontarioinsects.org/herp/>

R. J. Burnside and Associates Limited, AMEC Earth and Environmental, and Lakehead Region Conservation Authority. “The Lakehead Region Conservation Authority Thunder Bay Area Aquifer Characterization Groundwater Management and Protection Study Final Report”. July 2005. Print.

Sims, Richard A., William D. Towill, Kenneth A. Baldwin, and Gregory M. Wickware. "Field Guide to Forest Ecosystem Classification for Northwestern Ontario". Twin Offset Ltd., Ontario, Canada. 1997. Print.

The Lathem Group Inc. Consulting Engineers. "Mosquito Creek Hydrology Study". November 23, 1983. Print.

Toronto Entomologists' Association. Ontario Butterfly Atlas Online. Online. Accessed: December 6, 2022. Available: <https://www.ontarioinsects.org/atlas/>

United States Geographical Survey (USGS). Hem, John D. "Study and interpretation of the chemical characteristics of natural water". 3rd ed. U.S. Geological Survey Water-supply Paper 2254. Department of the Interior. United States Government Printing Office. 1985. Print.

211 Ontario North. "South Neebing Community Centre". Online. Accessed: December 6, 2022. Available: < https://www.southneebingcc.ca/>

Figures

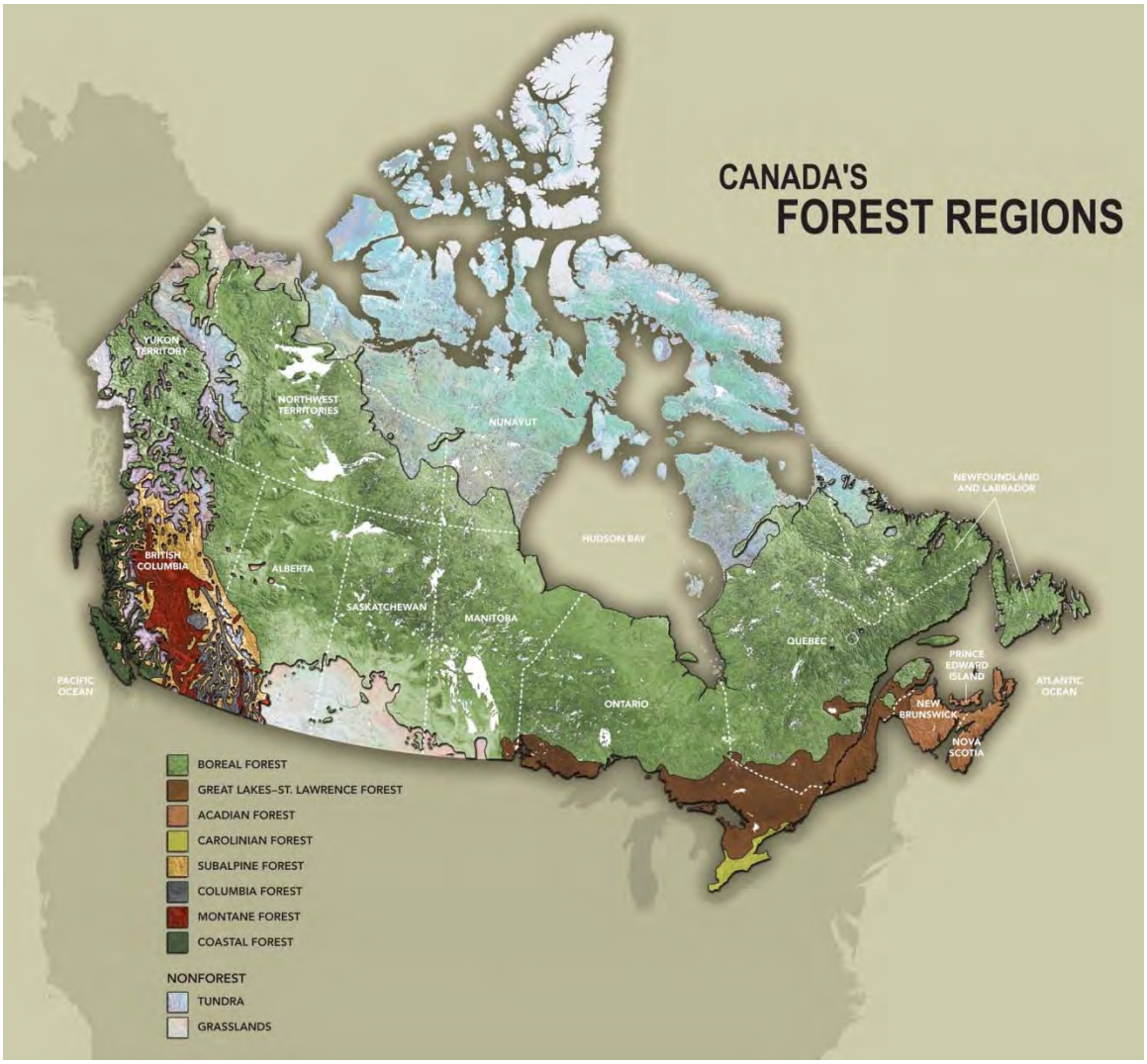


Figure 1: Canada's Forest Regions (Canadian Forest Service, 2013)

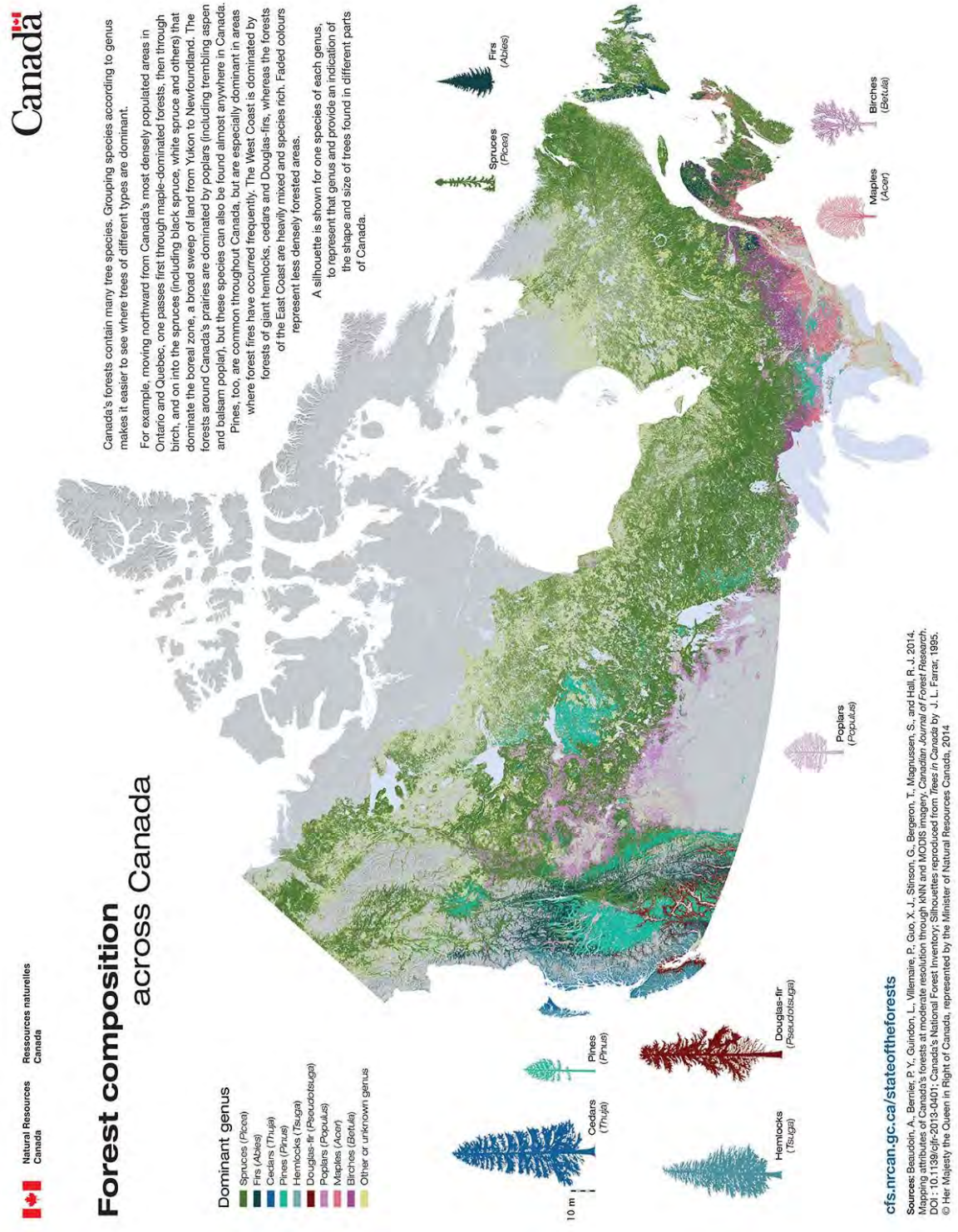
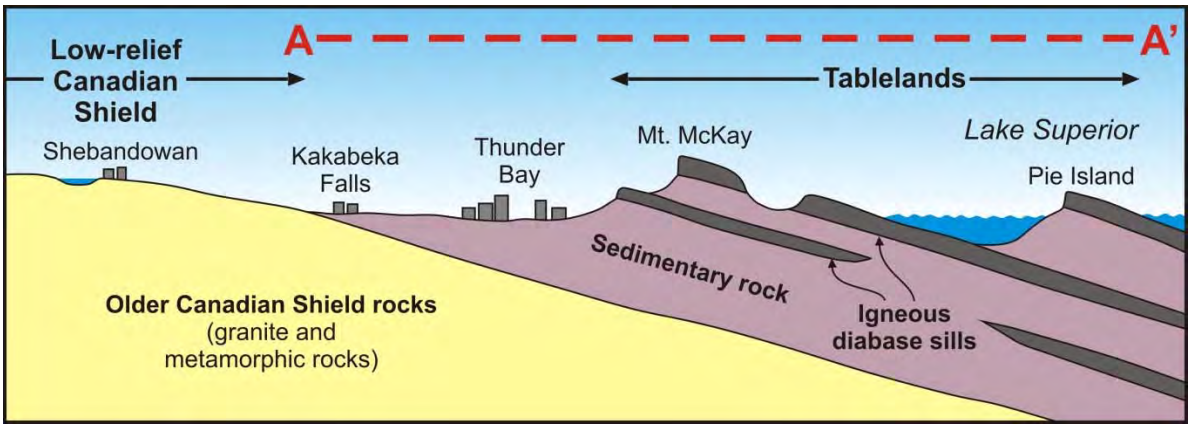


Figure 2: Forest Composition across Canada (Natural Resources Canada, 2014)

N
S



The Mosquito Creek Watershed forms in an erosional valley of soft Animikie Shales bounded to the south by mesas and cuestas of hard Igneous diabase sills.

Figure 3: Rock Formations South of Thunder Bay

Figure 4: Fort William Country Club

Figure 5: Nor'Wester View Public School

Figure 6: South Neebing Community Centre

Figure 7: Thunder Bay Tournament Centre

Figure 8: Loch Lomond Ski Area

Figure 9: Thunder Bay Correctional Centre

Figure 10: Thunder Bay Correctional Centre Lagoons

Figure 11: Whiskey Jack Estates

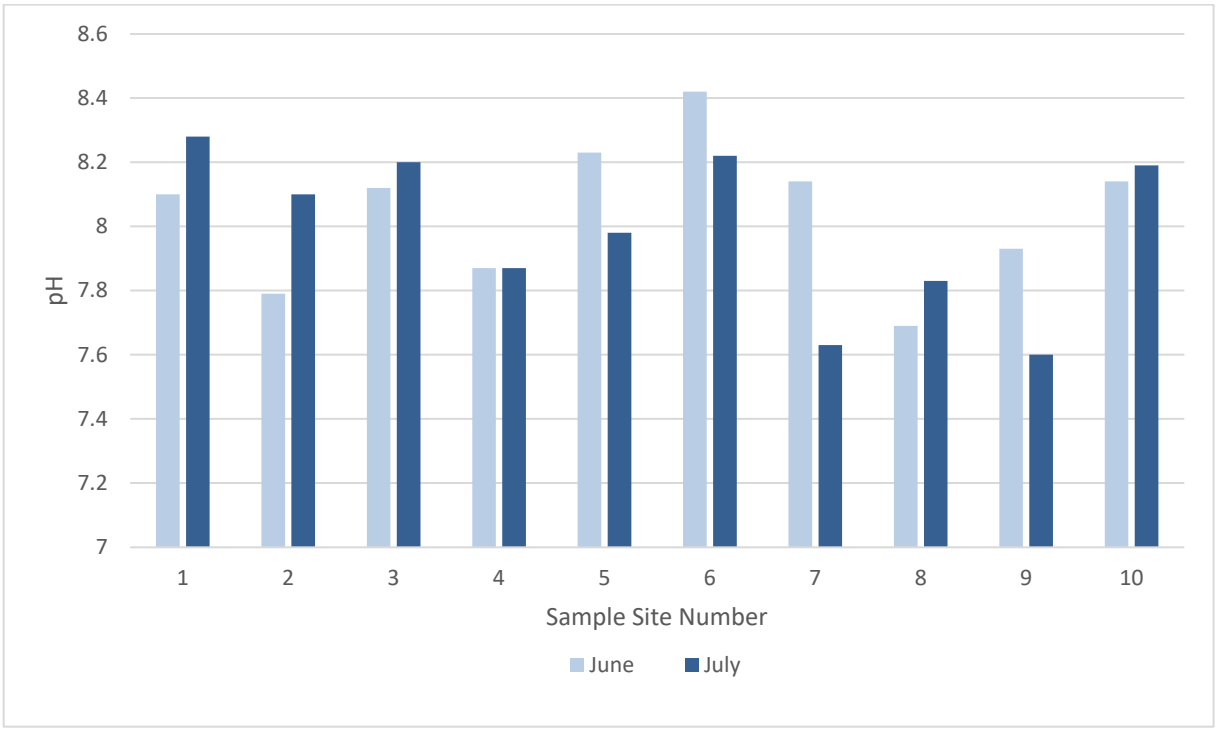


Figure 12: pH Level at Mosquito Creek Sample Sites

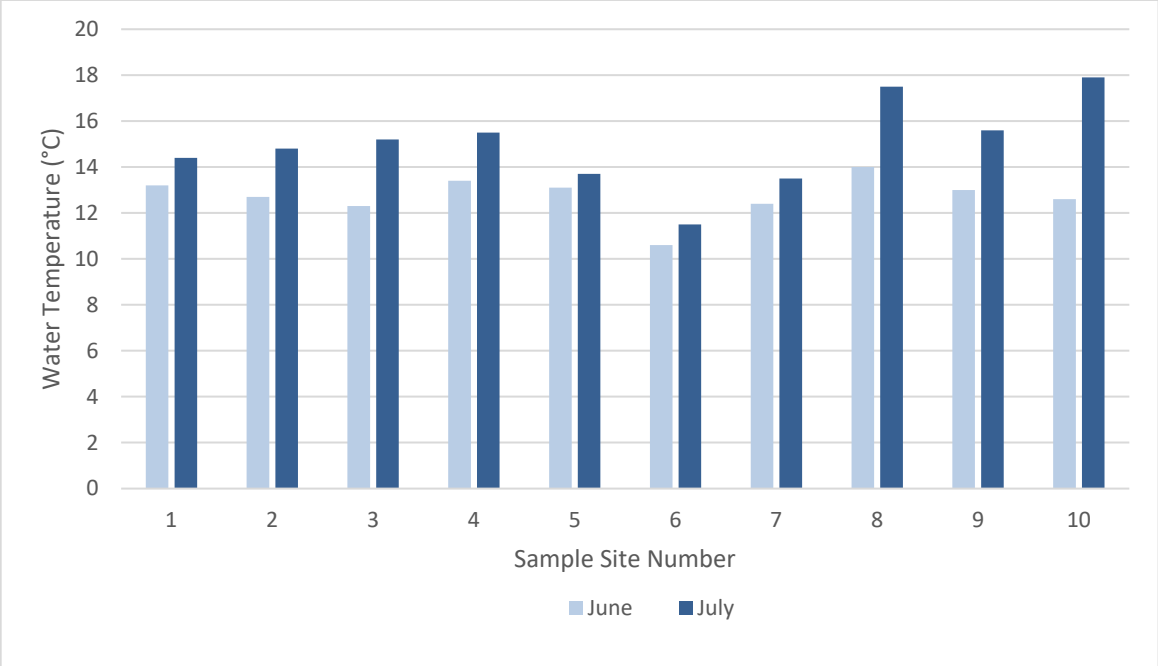


Figure 13: Water Temperature at Mosquito Creek Sample Sites

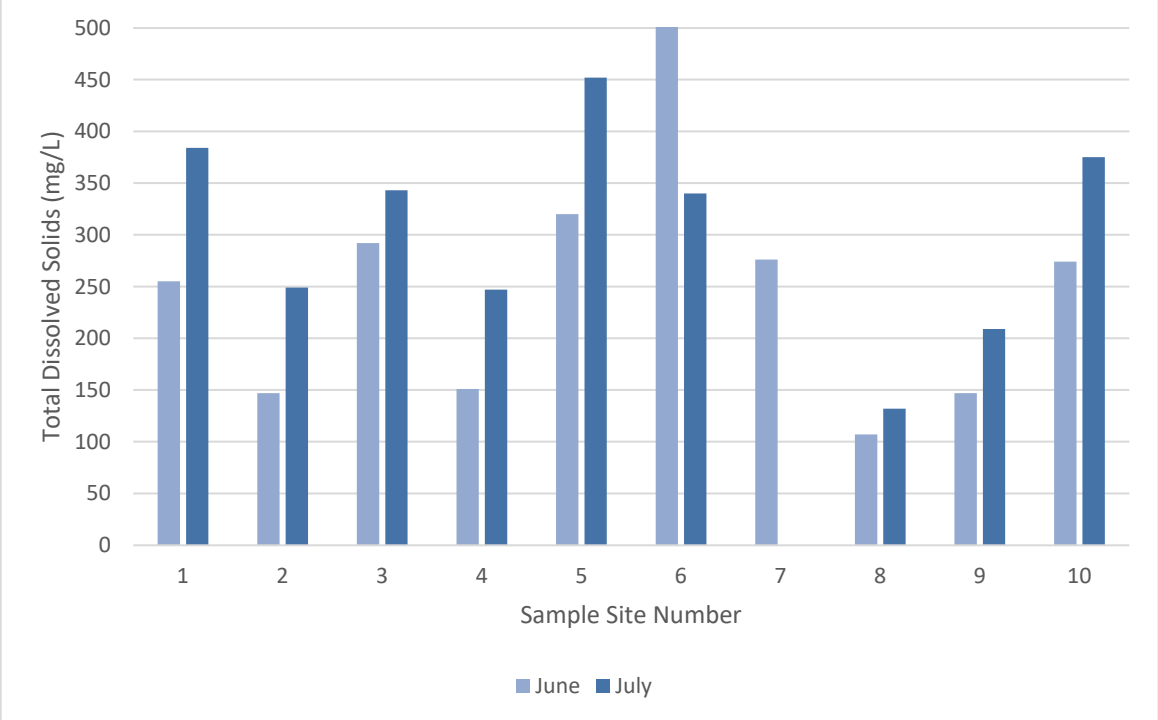


Figure 14: Total Dissolved Solids at Mosquito Creek Sample Sites

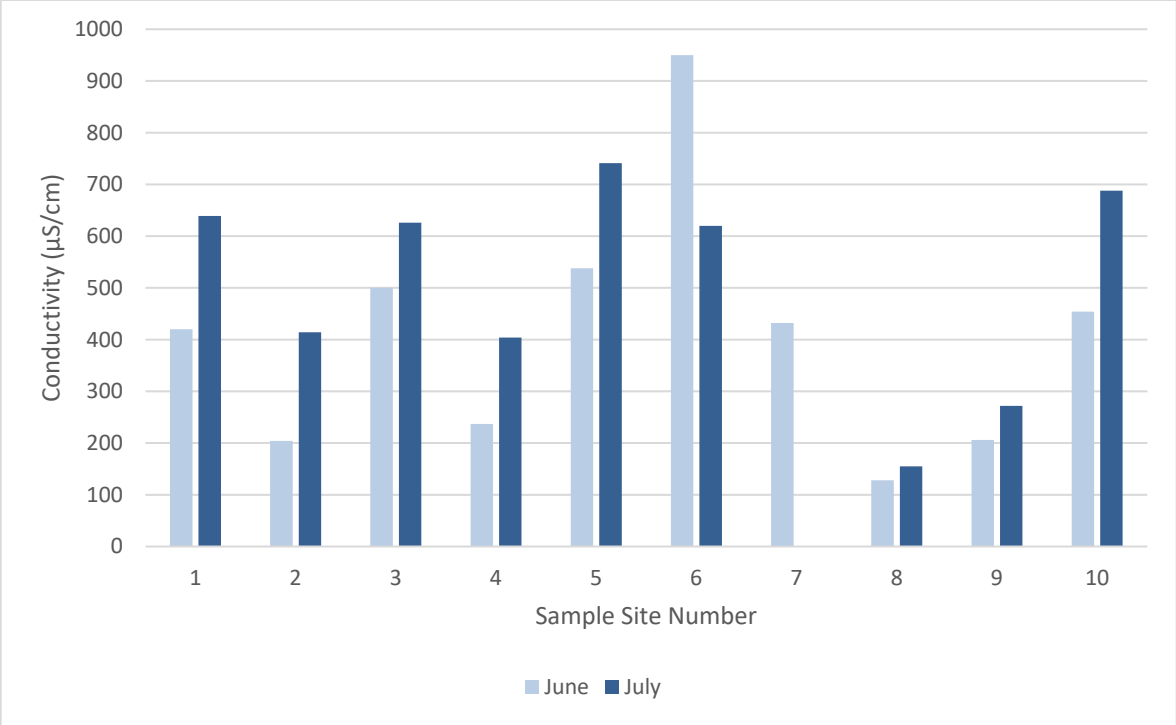


Figure 15: Conductivity at Mosquito Creek Sample Sites

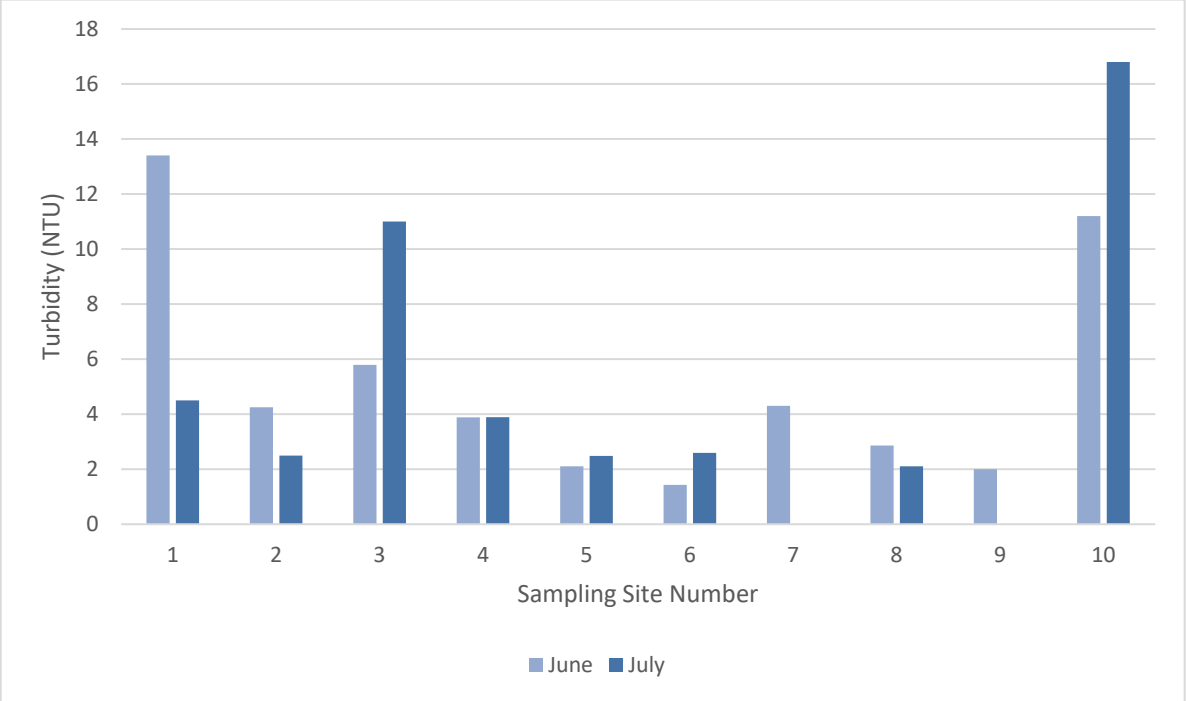


Figure 16: Turbidity at Mosquito Creek Sample Sites

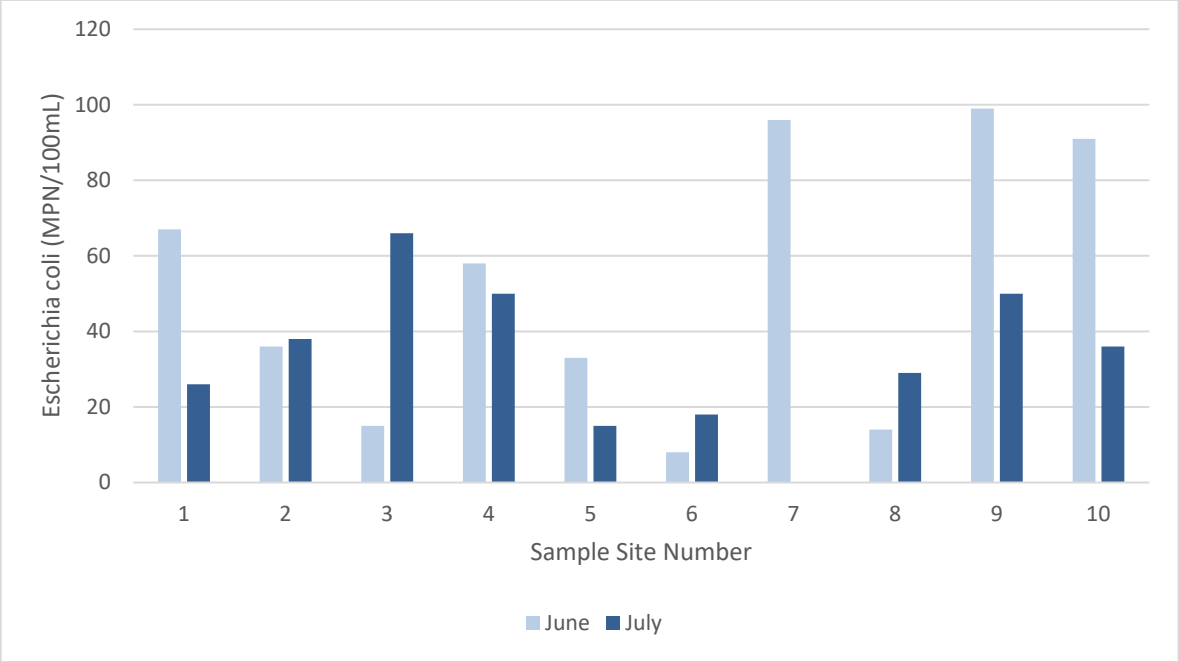


Figure 17: *Escherichia Coli* Bacteria Counts at Mosquito Creek Sample Sites

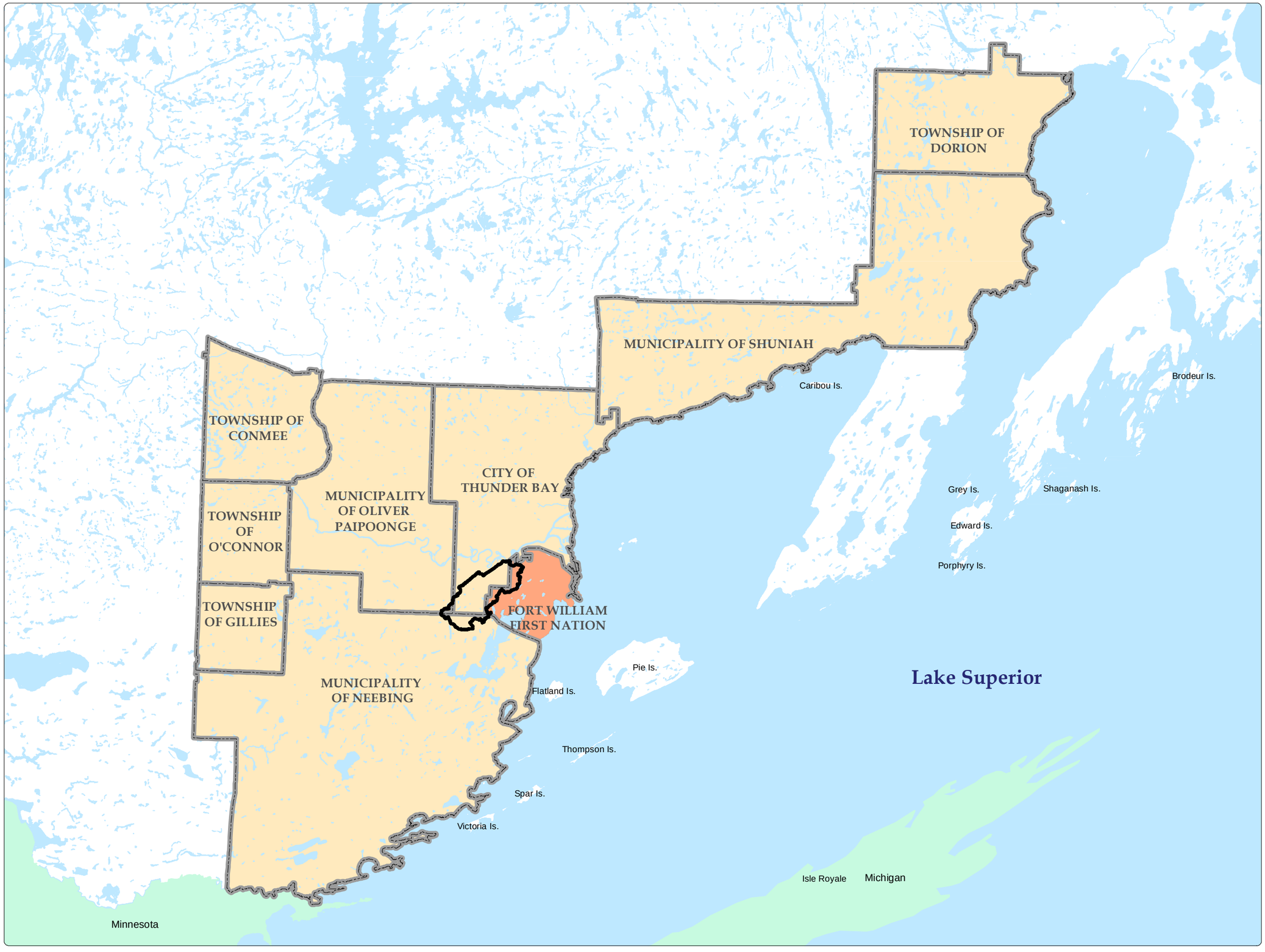
MAPS

MAPS

LAKEHEAD REGION
CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-1: Key Plan



N

Legend

- Mosquito Creek Watershed
- Municipal Boundary
- Fort William First Nation
- LRCA Jurisdiction Boundary
- Water Body

0 10 20 km

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

Base data used under license through the members of the Ontario Geospatial Data Exchange.

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-2: Regulated Area

N

Legend

- Mosquito Creek Watershed
- LRCA Owned Lands
- Municipal Boundary
- First Nations Land
- LRCA Jurisdiction Boundary
- Approximate Regulated Area

Regulated Features:

- Regional Floodline
- 100 Year Floodline
- Fill Line
- Floodplain
- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-3: Topography

N

Legend

- Mosquito Creek Watershed
- Highest Point in Watershed
- Municipal Boundary

Drainage

- Water Body
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland
- Stream
- River

Contour Lines

- 10m Contour Intervals

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-4: Bedrock Geology

N

Legend

- Mosquito Creek Watershed
- Municipal Boundary

Bedrock Formation

MESOPROTEROZOIC

- 31a, Mafic and related intrusive rocks

PALEOPROTEROZOIC

- 22a, Sedimentary rocks

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-5: Surficial Geology

N

Legend

- Mosquito Creek Watershed
- Municipal Boundary

Surficial Geology

- Alluvial
- Bedrock
- Esker/Kame/Outwash plain
- Glaciolacustrine plain
- Moraine
- Organics
- Slope/Talus pile

Surficial Points Features

- QUARRY/MINE WORKINGS
- SAND/GRAVEL PIT
- TALUS

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-6: Soils

N

Legend

- Mosquito Creek Watershed
- Municipal Boundary
- Soil/Water Sampling Sites

OMAFRA Soils

- Organic (O)
- Clay (c)
- Clay Loam (cl)
- Fine Sandy Loam (fsl)
- Gravel (g)
- Gravelly Sand (gs)
- Gravelly Sand Loam (gsl)
- Medium to Moderately Fine Loam (l)
- Loamy Sand (ls)
- Peaty Phase (pp)
- Rock (r)
- Coarse Sand and Loamy Sand (s)
- Silty Clay Loam (sicl)
- Silt Loam (sil)
- Moderately Coarse Sandy Loam (sl)
- Very Fine Sandy Loam (vfsl)

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

Base data used under license through the members of the Ontario Geospatial Data Exchange.

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

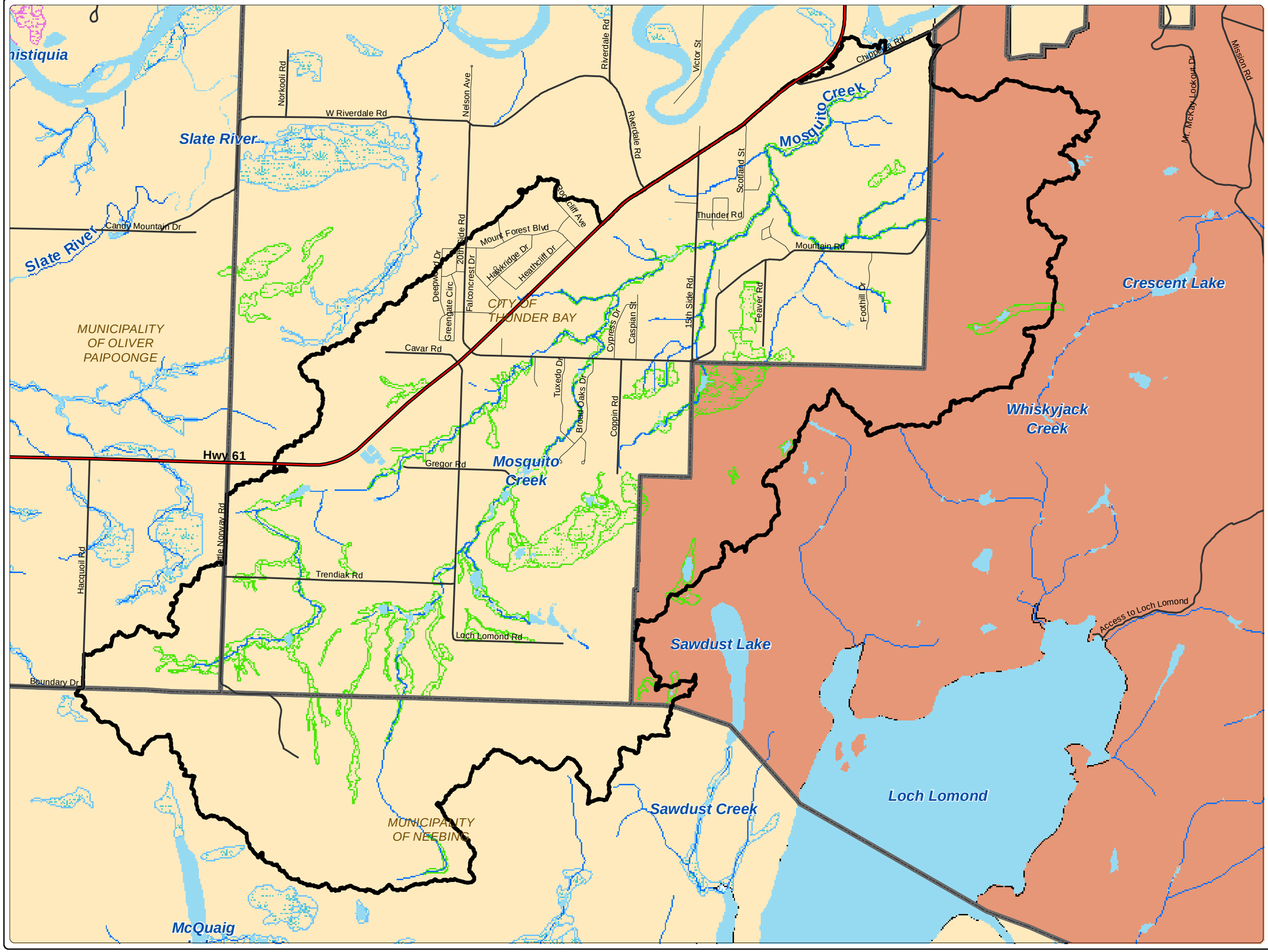
Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-7: Land Ownership

N



Legend

- Mosquito Creek Watershed
- Municipal Boundary

Land Ownership

- Federal Land Indian Reserve
- Private Land

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

Base data used under license through the members of the Ontario Geospatial Data Exchange.

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

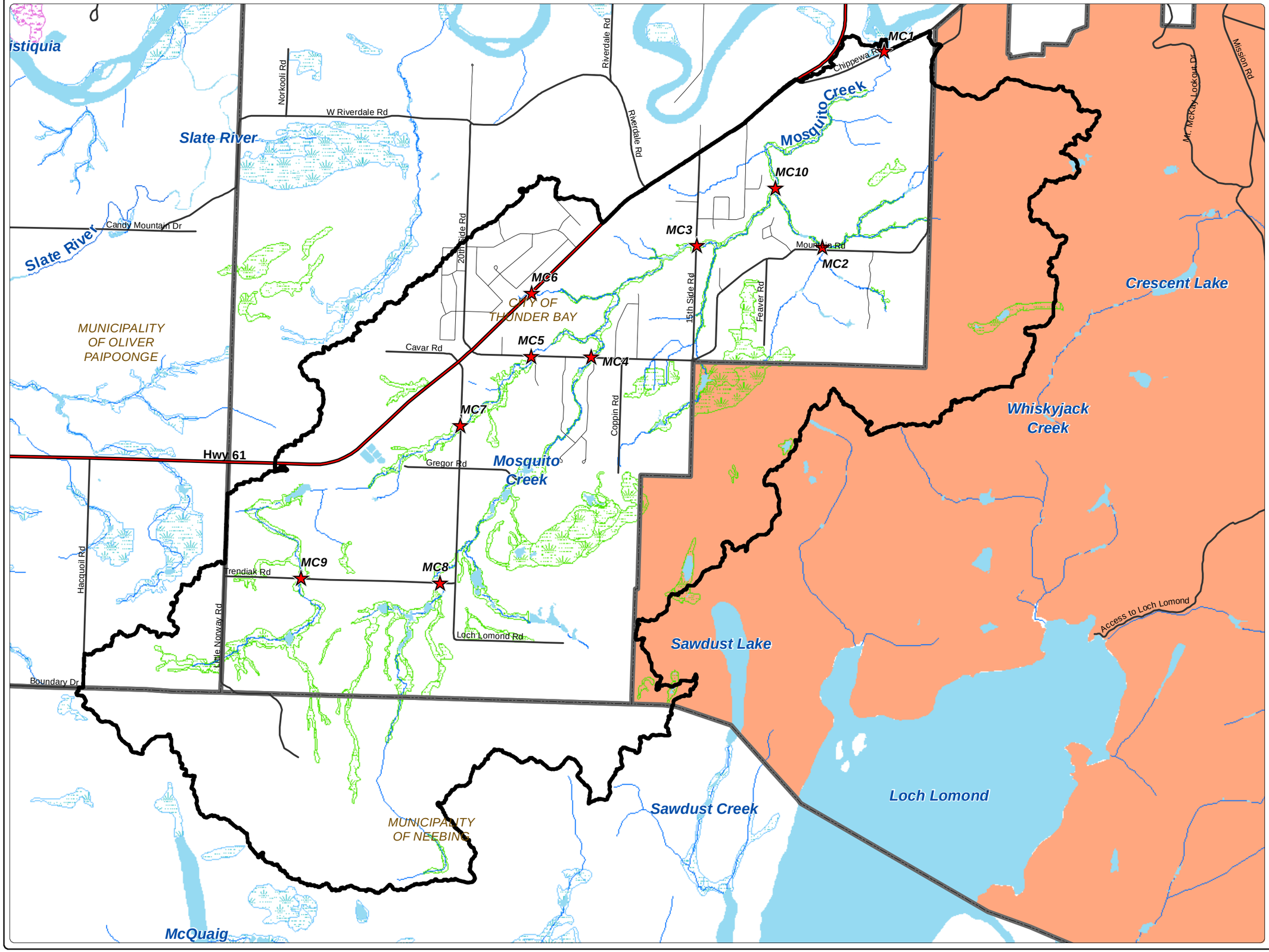
Datum: NAD 83
Projection: UTM Zone 16N
Date: August, 2022

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-8: Site Plan

N



Legend

- Sampling Sites
- Mosquito Creek Watershed
- Municipal Boundary
- First Nations Land

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

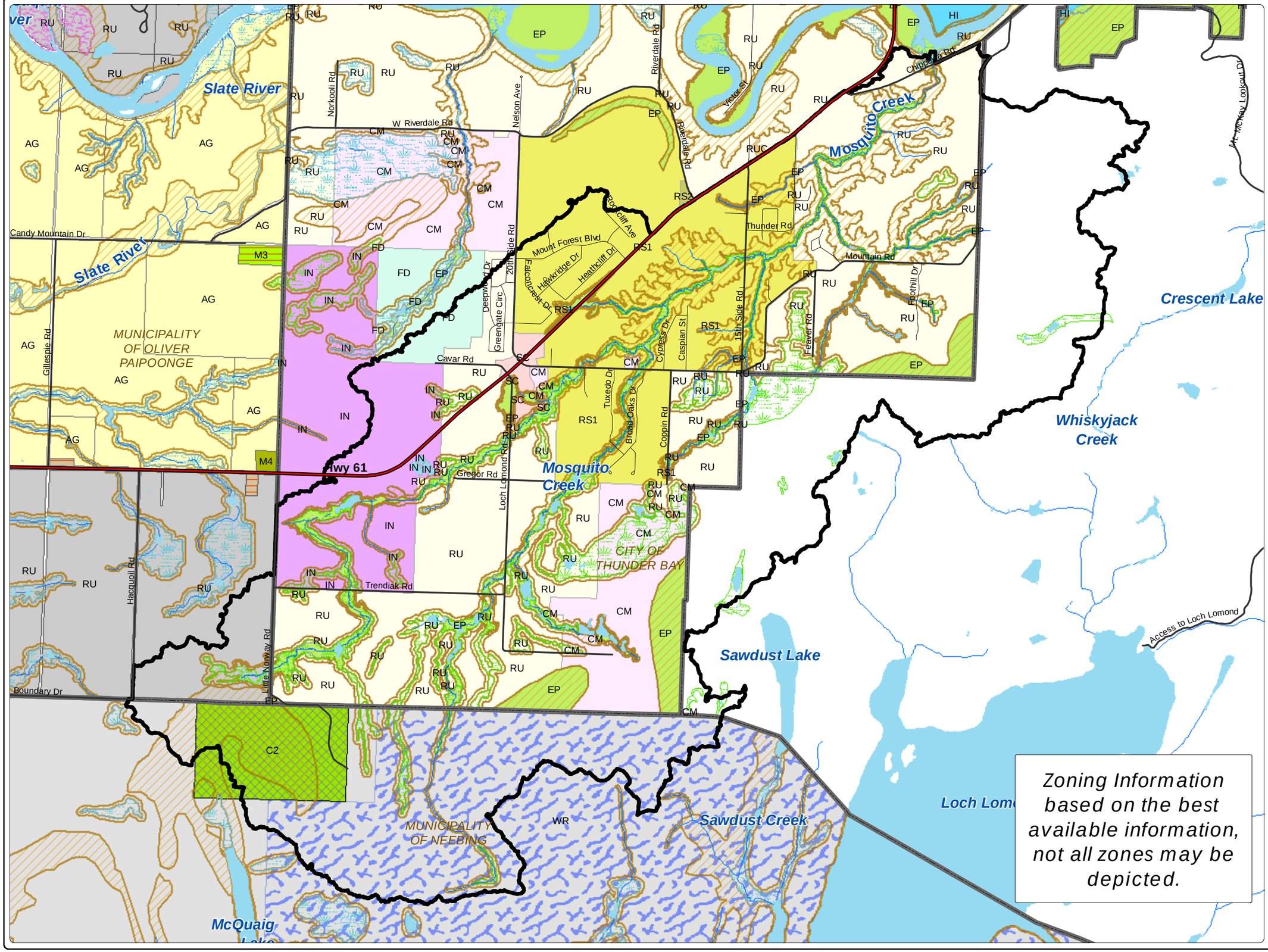
Created by: scott

LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-9: Zoning

N



Legend

- Mosquito Creek Watershed
- Municipal Boundary

City of Thunder Bay Zoning

- CM, Community Zone
- EP, Environmental Protection Zone
- FD, Future Development Zone
- HI, Heavy Industrial Zone
- IN, Institutional Zone
- RS1, Rural Settlement Zone
- RS2, Rural Settlement Commercial Zone
- RU, Rural Zone
- RUC, Rural Commercial Zone
- SC, Service Commercial Zone
- Environmental Overlay

Municipality of Oliver-Paipoonge Zoning

- AG, GENERAL AGRICULTURE
- C1, GENERAL COMMERCIAL
- M3, EXTRACTIVE INDUSTRIAL
- M4, LIGHT INDUSTRIAL
- RU, RURAL
- UL, Use Limitation Zone

Municipality of Neebing Zoning

- C2, Recreation Commercial Zone
- WR, Watershed Reserve Zone
- UL, Use Limitation Zone
- Rural Zone

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

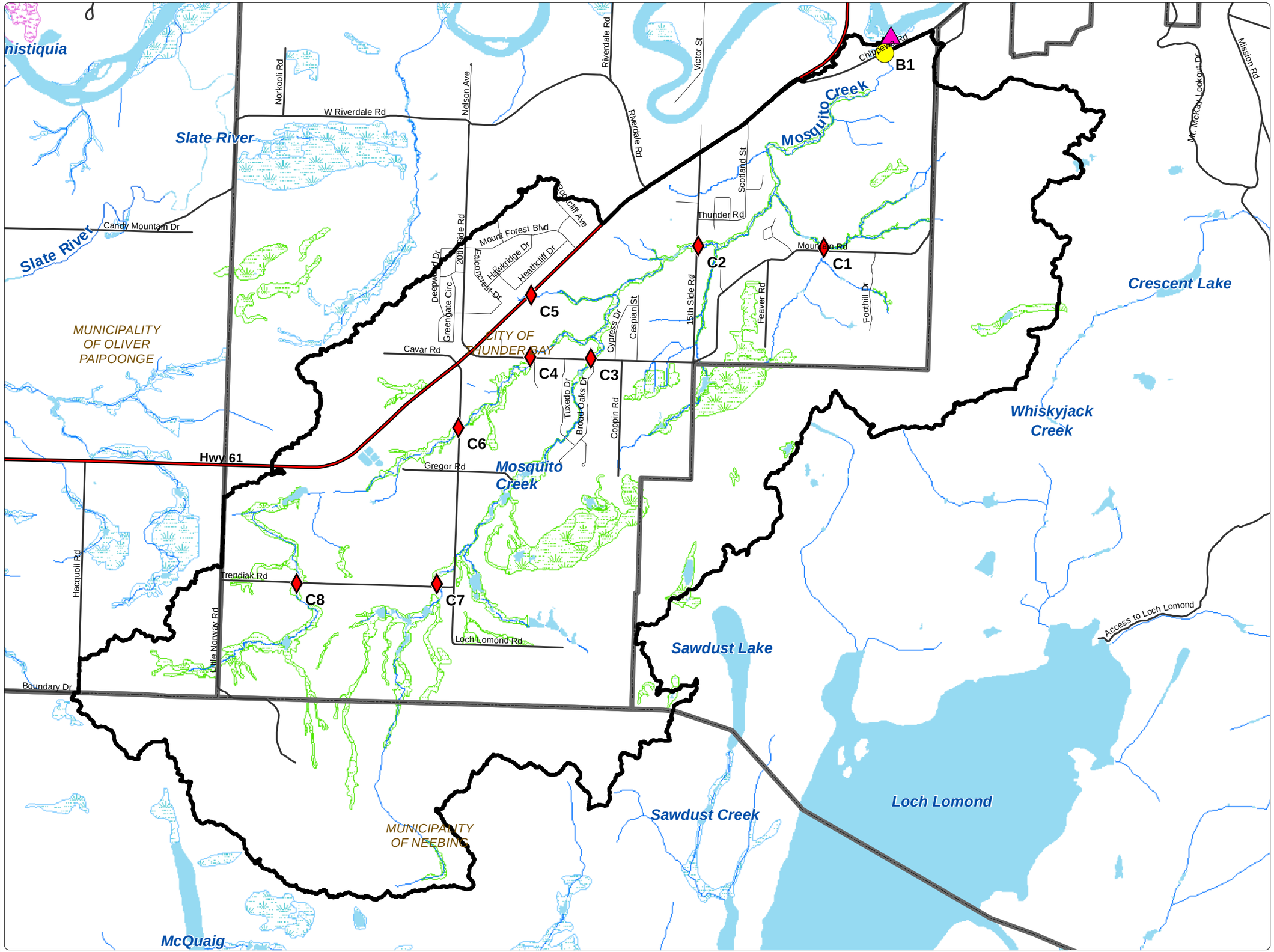
Zoning Information based on the best available information, not all zones may be depicted.

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott



LAKEHEAD REGION CONSERVATION AUTHORITY

Mosquito Creek Watershed

M-10: Bridge & Culvert Sites

N

Legend

- Confluence
- Bridge
- Culvert
- Mosquito Creek Watershed
- Municipal Boundary

Drainage

- Water Body
- Stream
- River
- Provincially Significant Wetland
- Evaluated Wetland
- Unevaluated Wetland

Roads

- Highway
- Road
- Street

0 500 1,000 1,500 m

This publication was produced by:
Lakehead Region Conservation Authority
130 Conservation Rd.
Thunder Bay, ON
P7B 6T8

This map is illustrative only. Do not rely on it as being a precise indicator of routes or features, nor as a guide to navigation.

Coordinate System: NAD 1983 CSRS UTM Zone 16N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

Created by: scott

Appendix A:

Soil Logging Summary and Photography

Appendix A: Soil Logging Summary and Photography

Soil Logging Summary

SITE ID	Organic Layer "O"	"A" Horizon	"B" Horizon	"C" Horizon
MC1	0-6cm , brown	6-50cm sandy loam		50cm – cobbles / rock. No sample
MC2	0-16cm grey	16-50cm sand	50-90cm sandy clay- loam	90-120cm silty-clay
MC3	0-5cm brown-grey peaty	5-30cm loamy sand	30-78cm silty clay loam	78cm cobbles / rock. No sample
MC4	0-15cm dark brown, peaty	15-38cm sand and minor organics	38-65cm sand	65-100cm + silty clay turning into clay at 1m
MC5	0-20cm brown peaty	20-100cm silty clay		100cm_> cobbles / rock. No sample
MC6	0-18cm folic organics	18-36cm sandy clay loam		36cm-120cm loamy sand
MC7	0-10cm	10-21cm silty loam	21-65cm silty clay loam	65-120cm sandy loam with gravel
MC8	0-12cm	12-18cm silty loam minor organic	18—120cm silty loam	
MC9		0-45cm silty loam		45-80cm silty loam with till
MC10		0-10cm silty loam		50-90cm silty clay loam

Soil Photography

(Note: Photos not taken at Sites 4 and 7)

MC1

MC2

MC3

MC5

MC6

MC8

MC9

MC10

Appendix B:

Common and Scientific Names of Identified Flora and Fauna

Appendix B: Common and Scientific Names of Identified Flora and Fauna

Flora	
Common Name	**Scientific (Latin) Name**
Trees	
Balsam poplar	*Populus balsamifera*
Black spruce	*Picea mariana*
Tamarack	*Larix laricina*
Trembling aspen	*Populus tremuloides*
White birch	*Betula papyrifera*
White spruce	*Picea glauca*
Balsam Fir	*Abies balsamea*
Black Ash	*Fraxinus nigra*
Green Ash	*Fraxinus pennsylvanica*
Jack Pine	*Pinus banksiana*
Red Pine	*Pinus resinosa*
White Pine	*Pinus strobus*
Shrubs	
American mountain ash	*Sorbus americana*
Beaked hazel	*Corylus cornuta*
Bush honeysuckle	*Diervilla lonicera*
Green alder	*Alnus viridis*
Mountain maple	*Acer spicatum*
Pin cherry	*Prunus pensylvanica*
Prickly wild rose	*Rosa acicularis* ssp. *sayi*
Red-osier dogwood	*Cornus stolonifera*
Showy mountain ash	*Sorbus decora*
Smooth gooseberry	*Ribes hirtellum*
Smooth serviceberry	*Amelanchier laevis*
Speckled alder	*Alnus rugosa*
Twinflower	*Mitchella repens*
Wild red raspberry	*Rubus idaeus ssp. melanolasius*
Willow spp.	*Salix spp.*
Herbs	
Canada Goldenrod	*Solidago canadensis*
Coltsfoot	*Tussilago farfara*
Swamp Thistle	*Cirsium sp.*
Corn Sow-Thistle	*Sonchus arvensis*
Cow Vetch	*Vivia cracca*
Dandelion	*Taraxacum officinale*
Lupines	*Lupinus albus*

Flora	
Orange Jewelweed	*Impatiens capensis*
Ox-Eye Daisy	*Leucanthemum vulgare*
Red Clover	*Trifolium pratense*
Rhubarb	*Rheum rhabarbarum*
Rough-Stemmed Goldenrod	*Solidago rugosa*
Square-Stemmed Monkeyflower	*Mimulus ringens*
Tall Buttercup	*Ranunculus acris*
Wood Lily	*Lilium sp.*
Water Parsnip	*Sium suave*
White Clover	*Trifolium repens*
Yarrow	*Achillea millefolium*
Yellow Hawkweed	*Hieracium pratense*
Spotted Coral Root	
Ferns/Mosses/Graminoids/Lichens	
Canada Blue Joint	*Calamagrostis canadensis*
Common Reed	*Phragmites australis*
Dark-Green Bulrush	*Scirpus atrovirens*
Fringed Brome Grass	*Bromus ciliatus*
Horsetail - Field	*Equisetum arvense*
Horsetail - Meadow	*Equisetum pratense*
Horsetail - Swamp	*Equisetum fluviatile*
Lady Fern	*Athyrium filix-femina*
Sedge	*Carex spp.*
Sphagnum Moss	*Sphagnum spp.*
Aquatic Plants	
Broad-Leaved Arrowhead	*Sagittaria latifolia*
Common Cattail	*Typha latifolia*
Small Yellow Water Crowfoot	*Ranunculus gmelinii*
Waterlily	*Nymphaeaceae* spp.

Fauna	
Common Name	**Scientific (Latin) Name**
Amphibians	
American toad	*Anaxyrus americanus*
Frog spp.	*Rana spp.*
Common Garter Snake	*Thamnophis sirtalis*
Birds	
Common Merganser	*Mergus merganser*
Hawk spp.	*Accipiter* spp.
Ovenbird	*Seiurus aurocapilla*

Fauna	
Belted Kingfisher	*Megaceryle alcyon*
Finch spp.	*Carduelis* spp. *Haemorhous* spp.
Veery	*Catharus fuscescens*
Pileated Woodpecker	*Dryocopus pileatus*
Fish	
Minnow spp.	*Phoxinus spp.*
Invertebrates	
Black fly	*Simuliidae spp.*
Common Black Ant	*Lasius niger*
Black Fly	*Simuliidae spp.*
Bumblebee	*Bombus spp.*
Butterfly	*Rhopalocera* spp.
Cricket	*Gryllidae* spp.
Dragonfly spp.	*Anisoptera* spp.
Eastern Tiger Swallowtail	*Papilio glaucus*
Grasshopper	*Caelifera* spp.
Ladybug	*Coccinellidae* sp.
Midge	*Pseudochironomus spp.*
Mosquito	*Culicidae spp.*
Red Ant	*Solenopsis spp.*
Spring Azure	*Celastrina ladon*
Water Spider	*Papilio glaucus*
Water Strider	*Gerridae spp.*
White Admiral	*Limenitis camilla*
Mammals	
Snowshoe hare	*Lepus americanus*
Bear	*Ursidae spp.*
Eastern Gray Squirrel	*Sciurus carolinensis*
Grey Wolf	*Canis lupus*
North-American Beaver	*Castor canadensis*
Raccoon	*Procyon lotor*
White-Tailed Deer	*Odocoileus virginianus*
Annelids	
Leech spp.	*Clitellata spp.*

Appendix C:

Common and Scientific Names of Mosquito Creek Post Development Study Identified Flora and Fauna

Appendix C: Common and Scientific Names of Mosquito Creek Post Development Study Identified Flora and Fauna

Source: Fenco MacLaren Inc., 1996

Flora	
Common Name	**Scientific (Latin) Name**
Trees	
Aspen	*Populus* sp.
Balsam Fir	*Abies balsamea*
Black Ash	*Fraxinus nigra*
Black Spruce	*Picea mariana*
Cedar	*Thuja* sp.
Elm	*Ulmus* sp.
Jack Pine	*Pinus banksiana*
Larch	*Larix laricina*
Manitoba Maple	*Acer negundo*
Poplar	*Populus* sp.
Red Maple	*Acer rubrum*
Silver Maple	*Acer saccharinum*
White Birch	*Betula papyrifera*
White Spruce	*Picea glauca*
Shrubs	
Beaked Hazel	*Corylus cornuta*
Bulrush	*Scirpus* spp.
Choke Cherry	*Prunus virginiana*
Red-Osier Dogwood	*Cornus stolonifera*
Willow	*Salix* spp.
Herbs	
Canada Blue Joint	*Calamagrostis canadensis*
Eastern Skunk Cabbage	*Symplocarpus foetidus*
Fireweed	*Epilobium angustifolium*
Scouring Rush	*Equisetum hyemale*
Water Parsnip	*Sium suave*
White Sweet Clover	*Melilotus alba*
Ferns/Mosses/Graminoids/Lichens	
Sedges	*Cyperaceae* spp.
Aquatic Plants	
Common Cattail	*Typha latifolia*
Duckweed	*Lemna* sp.
Pondweed	*Potamogeton* sp.
Reed Canary Grass	*Phalaris arundinacea*

Fauna	
Common Name	**Scientific (Latin) Name**
Reptiles and Amphibians	
Leopard Frog	*Rana* sp.
Fish	
Brook Stickleback	*Culaea Inconstans*
Common Shiner	*Notropis cornutus*
Creek Chub	*Semotilus atromaculatus*
Cyprinid	*Cyprinidae* sp.
Darter	*Percidae* sp.
Fathead Minnow	*Pimephales promelas*
Finescale Dace	*Phoxinus neogaeus*
Freshwater Smelt	*Osmeridae* sp.
Johnny Darter	*Etheostoma nigrum*
Lake Chub	*Couesius plumbeus*
Longnose Dace	*Rhinichthys cataractae*
Minnow	*Cyprinidae* sp.
Mottled Sculpin	*Cottus bairdi*
Mudpuppy	*Necturus* sp.
Northern Redbelly Dace	*Phoxinus eos*
Pearl Dace	*Semotilus margarita*
Rock Bass	*Ambloplites rupestris*
Sculpin	*Cottoidea* sp.
Shorthead Redhorse	*Moxostoma macrolepidotum*
Smallmouth Bass	*Micropterus dolomieu*
Sturgeon	*Acipenseridae* sp.
Trout-Perch	*Percopsis omiscomaycus*
Walleye	*Sander vitreus*
White Sucker	*Catostomus commersonii*
Invertebrates	
Caddisfly	*Trichoptera* sp.
Crayfish	*Decapoda* sp.
Freshwater Leech	*Macrobdella decora*
Freshwater Shrimp	*Amphipoda* sp.
Freshwater Worm	*Oligochaeta* sp.
Giant Crane Fly	*Tipula* sp.
Midge/Chironomid	*Chironomidae* sp.
Mollusks	*Mollusca* sp.
Net-Spinning Caddisfly	*Hydropsyche* sp.
Stonefly	*Plecoptera* sp.

Water Strider	*Gerridae* sp.
Aves	
Canada Goose	*Branta canadensis*
Duck	*Anatidae* sp.
Great Blue Heron	*Ardea herodias*
Mammals	
American Mink	*Neovison vison*
Bear	*Ursus* sp.
Cougar	*Puma concolor*
Moose	*Alces alces*
North American Beaver	*Castor canadensis*
Red Fox	*Vulpes vulpes*
Striped Skunk	*Mephitis mephitis*
White Tailed Deer	*Odocoileus virginianus*

Appendix D:

Techniques for Data Collection

Appendix D: Techniques for Data Collection

Air Temperature
The air temperature was measured with a basic mercury thermometer.

Channel Width & Depth
The width of the stream was measured using a nylon measuring-tape reel. Channel depth was measured by using a stainless steel meter stick.

Conductivity
Conductivity was measured with the YSI Pro DSS. The accuracy of the reading was ±0.001 mS/cm or ±1.0%; whichever was greater. The readings were recorded once the probe was completely submerged and all readings stabilized. In addition to conductivity readings taken in the field, laboratory analysis of the samples provided a second reading of conductivity which is included within the results.

Dissolved Oxygen
The YSI Pro DSS measured dissolved oxygen for the samples. The readings were recorded once the probe was submerged in the water and all variables were stabilized.

Flora and Fauna Identification
Identification was made in the vicinity of the sample sites, no transects were made. Observations were made approximately 50 metres from either stream edge. Field guides and the INaturalist app were used to accurately identify species.

Flow
The velocity of river flow at sites was measured using a stick and nylon measuring-tape reel. Distances measured varied depending upon stream obstructions and variable depth. The flow was then calculated using the equation **Q=V*A**, where **Q** is flow/ discharge, **V** is velocity (distance divided by time), and **A** is the cross sectional area of the stream.

Latitude, Longitude, and Elevation
The Universal Transverse Mercator (UTM) coordinates for each site were measured with a Trimble Geo XH 2008 hand held GPS unit.

Location
The sample sites were chosen using a 1:50,000 scale topographic map. The sample sites were also described in terms of road access and road crossings.

pH
The YSI Pro DSS measured pH for the water sample sites. The readings were recorded once the probe was submerged in the water and all the variables were stabilized. A pH reading was also taken during the analysis at the laboratory.

Photographs
Photographs were taken at each site using the Canon EOS DSLR, Olympus Tough TG-5 shock and water proof camera. Upstream, downstream, soil, and vegetation photographs as well as culvert and outstanding litter or erosion photographs were all taken at each site. Substrate photographs were attempted at each site with the waterproof camera.

Surface Water Sampling
Samples were taken at the same position at each site wherever possible. Grab sampling technique was used when conducting surface water sampling. Sample bottles were pre-charged with preservatives, so this did not have to be done in the field. Sample bottles were submerged 15 to 30 centimetres below the surface of the water body and positioned towards the flow of the water source. Samples were kept cool and delivered to ALS Laboratory for analyzing.

Total Dissolved Solids
The total dissolved solids (TDS) were measured in laboratory.

Turbidity
Turbidity of the water was measured with the YSI Pro DSS. The readings were taken after the probe was submerged and all variables on the meter were stabilized.

Water Temperature
Water temperature was measured with the YSI Pro DSS. The readings were taken after the probe was submerged and all variables on the meter were stabilized.

OBBN In-Stream Materials Key

Soil Type
Like stream bed description, soil type on land will impact vegetation and erosion potential. Soil type was categorized based on its grain size using the FEC Manual for North Western Ontario.

Stream Bed Description

The bed description was described by means of a visual scan of the sample site area, with percentages assigned to the appropriate categories of varying grain sizes:

Grain Size	Description
Boulder	> 25.6 cm in diameter
Cobbles	6.4 - 25.6 cm in diameter
Gravel	0.2 – 6.4 cm in diameter
Sand	< 0.2 cm in diameter
Silt	Finer inorganic material than sand
Organic	Mainly organic combination of silt and clay
Clay	Inorganic origin with no apparent structure

Stream Cover

Stream cover describes the vegetation density along the river bank no more than 5 metres from the water's edge. Stream cover was divided into three categories of density:

Description	% Cover
Dense	75-100% shaded by canopy
Partly Open	25-75% shaded by canopy
Open	0-25% shaded by canopy

Appendix E:

Water Quality Guidelines

Appendix E: Water Quality Guidelines

The following are taken from the Ministry of the Environment, Provincial Water Quality Objectives (PWQO), July 1994 and was updated August 16, 2021.

Physical

Alkalinity
Alkalinity should not be decreased by more than 25% of the natural concentration.

Dissolved Oxygen
Dissolved oxygen concentrations should not be less than the values specified below for cold water biota (e.g. salmonid fish communities) and warm water biota (e.g. centrarchid fish communities):

Dissolved Oxygen Concentration				
Temperature	Cold Water Biota		Warm Water Biota	
°C	% Saturation	mg/L	% Saturation	mg/L
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

In waters inhabited by sensitive biological communities, or in situations where additional physical or chemical stressors are operating, more stringent criteria may be required. For example, a sensitive species such as lake trout may require more specific water quality objectives.

In some hypolimnetic waters, dissolved oxygen is naturally lower than the concentrations specified in the above table. Such a condition should not be altered by adding oxygen-demanding materials causing a depletion of oxygen.

pH
The pH should be in the range of 6.5 – 8.5

- to protect aquatic life
- both alkaline and acidic waters may cause irritation to anyone using the water for recreational purposes

Temperature
The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment. In particular, the diversity, distribution and abundance of plant and animal life shall not be significantly changed.

Waste Heat Discharge

1. Ambient Temperature Changes

   The temperature at the edge of a mixing zone shall not exceed the natural ambient water temperature at a representative control location by more than 10°C (18°F). However, in special circumstances, local conditions may require a significantly lower temperature difference than 10°C (18°F). Potential dischargers are to apply to the MOECC for guidance as to the allowable temperature rise for each thermal discharge. This ministry will also specify the nature of the mixing zone and the procedure for the establishment of a representative control location for temperature recording on a case-by-case basis.

2. Discharge Temperature Permitted

   The maximum temperature of the receiving body of water, at any point in the thermal plume outside a mixing zone, shall not exceed 30°C (86°F) or the temperature of a representative control location plus 10°C (18°F) or the allowed temperature difference, whichever is the lesser temperature. These maximum temperatures are to be measured on a mean daily basis from continuous records.

3. Taking and Discharging of Cooling Water

   Users of cooling water shall meet both the Objectives for temperature outlined above and the "Procedures for the Taking and Discharge of Cooling Water" as outlined in the MOEE publication *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters (1994).*

Nutrients

Ammonia (un-ionized)
The amount of un-ionized ammonia should not exceed 20 µg/L.

The percentages of un-ionized ammonia (NH_3) in aqueous ammonia solution for different temperature and pH conditions are listed in the table below. For example, at 20°C and pH of 8.0, a total ammonia concentration of 500 µg/L would give an un-ionized ammonia concentration of 500 x 3.8/100 = 19 µg/L which is less than the un-ionized ammonia Objective of 20 µg/L.

The table below is taken from the PWQO; percentages are rounded to two significant figures. The equations given by may be used to interpolate values between those given in the table:

$f = 1/(10^{pKa-pH} +1)$, where **f is the fraction of NH_3**

pKa = 0.09018 + 2729.92/T, where T = ambient water temperature in Kelvin (K = °C + 273.16)

Results should be converted to percent and rounded to two significant figures. Extrapolations should not be made beyond the ranges of the table.

Note: Under certain temperature and pH conditions, the total ammonia criteria for the protection of aquatic life may be less stringent than the criteria for other beneficial uses (e.g. public water supply).

Percent NH3 in aqueous ammonia solutions for 0-30 °C and pH 6-10

Temp.	**pH**								
°C	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
0	.0083	.026	.083	.26	.82	2.6	7.6	21.	45.
1	.0090	.028	.090	.28	.89	2.8	8.3	22.	47.
2	.0098	.031	.098	.31	.97	3.0	8.9	24.	49.
3	.011	.034	.11	.34	1.1	3.3	9.6	25.	52.
4	.012	.036	.12	.36	1.1	3.5	10.	27.	54.
5	.013	.040	.13	.39	1.2	3.8	11.	28.	56.
6	.014	.043	.14	.43	1.3	4.1	12.	30.	58.
7	.015	.046	.15	.46	1.5	4.4	13.	32.	60.
8	.016	.050	.16	.50	1.6	4.8	14.	34.	61.
9	.017	.054	.17	.54	1.7	5.2	15.	35.	63.
10	.019	.059	.19	.59	1.8	5.6	16.	37.	65.
11	.020	.064	.20	.63	2.0	6.0	17.	39.	67.
12	.022	.069	.22	.68	2.1	6.4	18.	41.	69.
13	.024	.074	.24	.74	2.3	6.9	19.	43.	70.
14	.025	.080	.25	.80	2.5	7.4	20.	45.	72.

Temp.	pH								
°C	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
15	.027	.087	.27	.86	2.7	8.0	22.	46.	73.
16	.030	.093	.29	.93	2.9	8.5	23.	48.	75.
17	.032	.10	.32	1.0	3.1	9.1	24.	50.	76.
18	.034	.11	.34	1.1	3.3	9.8	26.	52.	77.
19	.037	.11	.37	1.2	3.6	11.	27.	54.	79.
20	.040	.13	.40	1.2	3.8	11.	28.	56.	80.
21	.043	.14	.43	1.3	4.1	12.	30.	58.	81.
22	.046	.15	.46	1.4	4.4	13.	32.	59.	82.
23	.049	.16	.49	1.5	4.7	14.	33.	61.	83.
24	.053	.17	.53	1.7	5.0	14.	35.	63.	84.
25	.057	.18	.57	1.8	5.4	15.	36.	64.	85.
26	.061	.19	.61	1.9	5.8	16.	38.	66.	86.
27	.065	.21	.65	2.0	6.2	17.	40.	67.	87.
28	.070	.22	.70	2.2	6.6	18.	41.	69.	88.
29	.075	.24	.75	2.3	7.0	19.	43.	70.	88.
30	.081	.25	.80	2.5	7.5	20.	45.	72.	89.

Phosphorus

Current scientific evidence is insufficient to develop a firm objective at this time. Accordingly, the following phosphorus concentrations should be considered as general guidelines, which should be supplemented by site-specific studies:

- To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L;
- A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less. This should apply to all lakes naturally below this value;
- Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 µg/L.

Bacteriological

Escherichia coli

The amount of *Escherichia coli* should not exceed 100 counts per 100 mL of water (based on a geometric mean of at least 5 samples).

Based on a recreational water quality guideline published by the Ontario Ministry of Health in 1992, this Ministry of Health guideline was specifically intended for application by the local Medical Officer of Health to swimming and bathing beaches. It is based upon a geometric mean

of levels of *E. coli* determined from a minimum of 5 samples per site taken within a given swimming area and collected within a one month period. If the geometric mean *E. coli* level for the sample series at a given site exceeds 100 per 100 mL, the site should be considered unsuitable for swimming and bathing. *E. coli* was selected for the guideline because studies have determined that, among bacteria of the coliform group, *E. coli* is the most suitable and specific indicator of fecal contamination.

An analytical test with a high degree of specificity for *E. coli* regardless of water sample source, requiring no confirmation procedures, and which produces results in 21 hours has been developed and adopted by both the Ministry of Health, and Ministry of Environment and Energy laboratories.

Where testing indicates sewage or fecal contamination, a site-specific judgment must be made as to the severity of the problem and the appropriate course of action.

As of May 1, 1994, MOEE staff has been advised to base all **new** compliance, enforcement and monitoring activities on the *E. coli* test. Some water managers may find it necessary to continue testing for fecal coliforms or total coliforms. For example, where testing at a long term water quality monitoring station requires a continuous record of results using either the fecal or total coliform test to monitor trends in water quality. As a benchmark for the long term monitoring results, the former objectives for fecal coliforms and total coliforms are referenced for your information. For fecal coliforms the objective was 100 counts per 100 ml (based on a geometric mean density for a series of water samples). For total coliforms the objective was 1000 counts per 100 ml (based on a geometric mean density for a series of water samples).

Metals

Aluminum

Aluminum amounts should not exceed the following:

PH values	Interim PWQO (µg/L)
4.5 to 5.5	15
>5.5 to 6.5	No more than 10 % of natural background
> 6.5 to 9.0	75

Antimony

The amount of Antimony should not exceed 20 µg/L.

Arsenic

The amount of Arsenic should not exceed 5 µg/L.

Barium

There are currently no PWQO guidelines for Barium.

Beryllium
Beryllium amounts should not exceed the following:

Hardness as $CaCO_3$ (mg/L)	Interim PWQO (µg/L)
< 75	11
>75	1100

Bismuth
There are currently no PWQO guidelines for Bismuth.

Boron
The amount of Boron should not exceed 200 µg/L.

Cadmium
Cadmium amounts should not exceed the following:

Hardness as $CaCO_3$ (mg/L)	Interim PWQO (µg/L)
0 – 100	0.1
>100	0.5

Calcium
There are currently no PWQO guidelines for Calcium.

Chromium
Chromium amounts should not exceed the following:

	Interim PWQO (µg/L)
Hexavalent Chromium (Cr VI)	1
Trivalent Chromium (Cr III)	8.9

Cobalt
The amount of Cobalt should not exceed 0.9 µg/L.

Copper
The amount of Copper should not exceed the following:

Hardness as $CaCO_3$ (mg/L)	Interim PWQO (µg/L)
0-20	1
>20	5

Iron
The amount of Iron should not exceed 300 µg/L.

Lead
Lead amounts should not exceed the following:

Hardness as $CaCO_3$ (mg/L)	Interim PWQO (µg/L)
< 30	1
30 to 80	3
> 80	5

Lithium
There are currently no PWQO guidelines for Lithium.

Magnesium
There are currently no PWQO guidelines limiting the intake of Magnesium.

Manganese
There are currently no PWQO guidelines for Manganese.

Molybdenum
The amount of Molybdenum should not exceed 40 µg/L.

Nickel
The amount of Nickel should not exceed 25 µg/L.

Potassium
There are currently no PWQO guidelines for Potassium.

Selenium
The amount of Selenium should not exceed 100 µg/L.

Silicon
There are currently no PWQO guidelines for Silicon.

Silver
The amount of Silver should not exceed 0.1 µg/L.

Sodium
There are currently no PWQO guidelines for Sodium.

Strontium
There are currently no PWQO guidelines for Strontium.

Tellurium

There are currently no PWQO guidelines for Tellurium

Thallium

The amount of Thallium should not exceed 0.3 μg/L.

Tin

There are currently no PWQO guidelines for Tin.

Titanium

There are currently no PWQO guidelines for Titanium.

Tungsten

The amount of Tungsten should not exceed 30 μg/L.

Uranium

The amount of Uranium should not exceed 5 μg/L.

Vanadium

The amount of Vanadium should not exceed 6 μg/L.

Zinc

The amount of Zinc should not exceed 20 μg/L.

Zirconium

The amount of Zirconium should not exceed 4 μg/L.

Appendix F:

Forest Ecosystem Classification

Appendix F: Forest Ecosystem Classification

Site 2: V24 White Spruce – Balsam Fir / Shrub Rich

Description: A conifer type with white spruce and/or balsam fir as the main canopy species. The understory tends to be shrub rich with balsam fir, *Acer spicatum*, *Corylus cornuta* and, on the wetter sites, *Alnus rugosa* potentially abundant. The herb layer varies from rich to poor. Occurring on deep, fresh to moist, mineral soils across a range of texture classes.

Common Overstory Species:
Picea glauca, Abies balsamea, Picea mariana, Pinus banksiana, Betula papyrifera

Common Understory Species:

Shrubs:	*Abies balsamea, Rubus pubescens, Amelanchier spp., Sorbus decora, Acer spicatum, Corylus cornuta, Diervilla lonicera, Linnaea borealis, Rosa acicularis*
Herbs:	*Clintonia borealis, Aralia nudicaulis, Cornus canadensis, Galium triflorum, Maianthemum canadense, Streptopus roseus, Aster macrophyllus, Trientalis borealis, Mitella nuda, Anemone quinquefolia, Viola renifolia, Petasites palmatus, Fragaria virginiana*
Mosses:	*Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Dicranum polysetum*

Forest Floor Cover:

Cover Type	Broadleaf Litter	Moss	Conifer Litter	Wood
Forest Floor Cover (%)	23	32	34	7

Site 3 and 6: V15 White Spruce Mixedwood

Description: A variable mixedwood type with white spruce as the main canopy species. The understory ranges from herb and shrub rich to poor, with balsam fir commonly abundant in the shrub layer. Occurring over a broad range of soil and site conditions but primarily on deep, fresh to moist, mineral soils.

Site 3

Site 6

Common Overstory Species:
Picea glauca, Abies balsamea, Populus tremuloides, Betula papyrifera, Picea mariana, Populus balsamifera, Acer rubrum, Pinus banksiana

Common Understory Species:

Shrubs:	*Abies balsamea, Acer spicatum, Rubus pubescens, Corylus cornuta, Sorbus decora, Linnaea borealis, Diervilla lonicera, Rosa acicularis, Amelanchier* spp., *Populus tremuloides*
Herbs:	*Aralia nudicaulis, Cornus canadensis, Clintonia borealis, Maianthemum canadense, Streptopus roseus, Trientalis borealis, Galium triflorum, Aster macrophyllus, Mitella nuda, Viola renifolia, Anemone quinquefolia, Petasites palmatus*
Mosses:	*Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Plagiomnium, cuspidatum*

Forest Floor Cover:

Cover Type	Broadleaf Litter	Moss	Conifer Litter	Wood
Forest Floor Cover (%)	61	16	13	5

Site 1, 4, 5, 7 and 10: V14 Balsam Fir Mixedwood

Description: An extremely variable mixedwood type. The canopy, comprising mainly balsam fir, may contain a mixture of several species. The understory varies from shrub rich to moderately herb and shrub poor. Usually on deep, fresh to moist, mineral soils but encompassing a wide range of soil and site conditions.

Site 1

Site 4

Site 5

Site 7

Site 10

Common Overstory Species:
Abies balsamea, Populus tremuloides, Betula papyrifera, Picea glauca, Picea mariana, Pinus banksiana, Populus balsamifera, Thuja occidentalis

Common Understory Species:

Shrubs:	*Abies balsamea, Acer spicatum, Rubus pubescens, Linnaea borealis, Diervilla lonicera, Sorbus decora, Populus tremuloides, Corylus cornuta, Amelanchier* spp., *Rosa acicularis*
Herbs:	*Maianthemum canadense, Aralia nudicaulis, Clintonia borealis, Streptopus roseus, Cornus canadensis, Trientalis borealis, Viola renifolia, Mitella nuda, Aster macrophyllus, Galium triflorum, Coptis trifolia, Petasites palmatus*
Mosses:	*Pleurozium schreberi, Ptilium crista-castrensis, Hylocomium splendens, Plagiomnium cuspidatum*

Forest Floor Cover:

Species	Broadleaf Litter	Moss	Conifer Litter	Wood
Forest Floor Cover (%)	66	12	14	6

Site 8: V17 Jack Pine Mixedwood/Shrub Rich

Description: Jack Pine mixedwoods with spruce and fir occasional in the canopy. The understory is typically rich in herb and low shrub species, often with abundances of *Diervilla lonicera, Aralia nudicaulis, Aster macrophyllus* and *Cornus canadensis*. Occuring on upland, fresh to dry, coarse-textured mineral soils.

Common Overstory Species:
Pinus banksiana, Populus tremuloides, Betula papyrifera, Picea mariana, Abies balsamea, Picea glauca

Common Understory Species:

Shrubs:	*Diervilla lonicera, Linnaea borealis, Abies balsamea, Vaccinium angustifolium, Corylus cornuta, Vaccinium myrtilloides, Populus tremuloides, Rubus pubescens, Amelanchier* spp., *Alnus crispa, Picea mariana, Rosa acicularis*
Herbs:	*Aralia nudicaulis, Maianthemum canadense, Clintonia borealis, Cornus canadensis, Aster macrophyllus, Trientalis borealis, Streptopus roseus, Viola* spp.
Mosses:	*Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis*

Forest Floor Cover:

Species	Broadleaf Litter	Moss	Conifer Litter	Wood
Forest Floor Cover (%)	36	27	32	0

Site 9: V2 Black Ash Hardwood and Mixedwood

Description: Hardwood and mixedwood stands containing black ash in the overstory. The understory is typically dense and floristically diverse. Of limited areal extent; occurring in low-lying locations on deep, moist to wet, usually non-calcareous substrates.

Common Overstory Species: *Fraxinus nigra, Abies balsamea, Populus tremuloides, Betula papyrifera, Picea glauca, Thuja occidentalis, Fraxinus pennsylvanica, Ulma americana, populus balsamifera*

Common Understory Species:

Shrubs:	*Rubus pubescens, Acer spicatum,* balsam fir*, Ribes triste, Prunus virginiana, Cornus stolonifera, Alnus rugosa, Corylus cornuta, Rubus idaeus*
Herbs:	*Viola* spp., *Mitella nuda, Athyrium filix-femina, Galiu8m triflorum, Mainthemum canadense, Dryopteris austriaca, Circaea alpina, Streptopus roseus, Aralia nudicaulis, Aster macrophyllus, Trientalis borealis, Equisetum sylvaticum*
Mosses:	*Plagiomnium cuspidatum, Climacium dendroides*

Forest Floor Cover:

Species	Broadleaf Litter	Moss	Humus	Water	Graminoid Litter	Wood
Forest Floor Cover (%)	36	20	12	11	11	6

Appendix G:

Water Quality Parameters

Appendix G: Summary of Water Quality Parameters

Physical Properties

The abiotic factors of water quality are very influential on aquatic plants and animals and can have a significant impact on the ecosystem. The following physical parameters were measured either in the field or in the laboratory.

Conductivity
Conductivity is the measure of the ability of water to carry an electrical current expressed in micro seimens per centimetre (µS/cm). The reading is used to determine the total dissolved solids (TDS) in the water sample. There is no PWQO for conductivity.

Dissolved Oxygen
Like terrestrial animals, fish and other aquatic species require oxygen to breathe. It is not the mere presence of dissolved oxygen that is important; the gas has to be above a certain concentration in order to sustain life. As well, oxygen is required to decompose organic matter in the stream. Dissolved oxygen levels will be highest if the water is colder, turbulent (a lot of mixing at the air-water interface) and during the day when aquatic plants have had time to produce oxygen during photosynthesis. PWQO's have an acceptable range for dissolved oxygen in water dependent upon temperature. At 15 degrees Celsius the minimum amount of dissolved oxygen is 5 milligrams per litre (mg/L) and at 20 degrees Celsius the minimum amount of dissolved oxygen is 4 mg/L for cold water biota.

pH
The pH measures the concentration of hydrogen ions in the water based on a logarithmic scale of 0 to 14. Lower pH is acidic (many free hydrogen ions) and higher pH is alkaline (few free hydrogen ions). The pH of water determines the solubility and biological availability of chemicals constituents such as nutrients (eg. nitrogen, phosphorus) and heavy metals (eg. lead, copper). Extreme pH levels can increase the solubility of elements and compounds and it can make potentially toxic chemicals more mobile and increase the risk of absorption by aquatic life (Frondriest Environmental Inc.). The natural factors that can affect pH are interactions with surrounding rocks and other materials, precipitation (especially acid rain), and CO_2 concentrations. The anthropogenic factors that influence pH include wastewater and mining discharges, acid rain as a result of emissions from mining or fossil fuel combustion, and point source pollution from agricultural runoff (Frondriest Environmental Inc.). Geology of the watershed can give the river some buffering capacity to resist changes in pH but overall the range should stay between 6.5 and 8.5 to protect aquatic life, and avoid irritation to anyone using the water for recreational purposes.

Temperature

Water temperature is important because it dictates the kind of aquatic life that can live in a stream. Fish, insects, plankton and other aquatic species all have a preferred temperature range. If the temperature goes too far above or below their preferred range, then the number of species will decrease until there is none. Temperature also influences water chemistry which in turn affects biological activity. Chemical reactions generally speed up with warmer temperatures. Temperature is important, as warmer water holds less dissolved oxygen and warmer water will allow bacteria to reproduce and grow more quickly. Temperature can vary depending on the source of the water, depth and velocity of the stream, sunlight intensity and the amount of shade by the shoreline vegetation. There is no PWQO for temperature.

Total Dissolved Solids

Total dissolved solids (TDS) measure the amount of inorganic salts and small amounts of organic matter that is dissolved in water. The principal constituents are usually calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, sulphate, and nitrate (from agricultural use). Most of these originate from natural geological sources yet high levels may indicate runoff from of road salts, runoff from agricultural and erosion from exposed soil/no stream bank vegetation. There is no PWQO for TDS.

Turbidity

Turbidity is the measure of the relative clarity of water. Turbidity in water is caused by suspended matter such as silt, clay and algae that scatter the sunlight. The diversity of species will be affected by how far the sunlight can penetrate the water column. Fish gills will become clogged with a lot of suspended material, as well the material can settle on top of fish spawning grounds (and their eggs). Highly turbid water will appear murky or dirty. Turbidity will be higher after heavy rainfall, but high levels may also indicate soil erosion.

Nutrients

Like terrestrial plants, aquatic plants and algae require nutrients for growth and productivity. The main nutrients of concern are nitrogen and phosphorus.

Nitrogen

Nitrogen (N) is one of the most common gases in our atmosphere. It makes up approximately 78% of the earth's atmosphere. Like phosphorus, these nutrients are often applied to agricultural crops as fertilizers and having too much in the river can increase plant growth and productivity to unhealthy levels. Nitrogen is constantly being recycled through the environment through decomposition, etc. The most important forms that plants can readily use are ammonia, nitrate (NO_3) and nitrite (NO_2). There are

many different ways to report nitrogen so it is necessary to note that the results from ALS Laboratory Group were given in Total ammonia-nitrogen (mg/L), Nitrate-nitrogen (NO_3-N mg/L), and Nitrite-nitrogen (NO_2-N mg/L).

Phosphorus

Total phosphorus gives a measurement of all forms of phosphorus found in the watershed, but the most important form within this measurement is soluble inorganic phosphate (PO_4) or orthophosphate ion (PO_4^{-3}). These two forms are of utmost importance because they are utilized by aquatic plants. While phosphorus is essential to life, too much can increase algae growth within the watershed. Excessive growths or build ups of algae on abiotic features (like rocks) can use up all the dissolved oxygen leaving other species, like fish, with anoxic (no oxygen) conditions. Nutrient loading may cause a decrease in biodiversity and a decrease in ecologically sensitive species. Natural decomposition of organic matter such as leaves, twigs, and grass that is washed into the stream during the winter does constitute an important source of nutrients. However, high levels of phosphorus may indicate unnatural sources such as detergent, pesticide, and fertilizer runoff or waste from farms contaminating the watershed. The PWQO criteria for phosphorus is 0.03 mg/L.

Bacteria

Escherichia coli

Escherichia coli (*E. coli*) are naturally found in the intestines of humans and warm-blooded animals. Unlike other bacteria in this family, *E. coli* does not usually occur naturally on plants or in soil and water. The inability of *E. coli* to grow in water combined with its short survival time in water environments means that the detection of *E. coli* in a water system is a good indicator of recent fecal contamination. Potential sources of *E. coli* include: leaking septic systems, runoff from manure storage facilities or wild animal waste (i.e. beavers and Canadian Geese). These bacteria can cause irritation of the skin and eyes when contact is made and can cause gastro-intestinal disorders.

Total Coliforms

Total coliforms are a group of bacteria that are naturally found on plants, in soils, water, and the intestines of humans and warm-blooded animals. Due to the fact that total coliforms are widespread in the environment, they can be used as one of the many operational tools to determine the efficiency of a drinking water treatment system. The total coliform group contains various species of the genera *Escherichia, Klebsiella, Enterobacte, Citrobacter, Serratia,* and many others. There is no current PWQO for total coliforms; however, the previous guideline from prior to 1994 was 1000 MPN per 100 mL.

Metals

Most of the metals listed below are found naturally within the earth's crust and weathering of rock can transport them into surface water. The following is a complete list of the metals analysis performed on the water samples and their qualities.

Aluminum
Aluminum is the most abundant metal on Earth, comprising about 8% of the Earth's crust. It is found in a variety of minerals, such as feldspars and micas, which, with time, weather to clays. Aluminum in the aquatic environment comes from both natural and anthropogenic sources but the amount of aluminum found naturally in the environment exceeds aluminum from anthropogenic sources. Soil derived dusts from activities like farming, mining, and coal combustion can directly release aluminum into aquatic environments. Wind and water erosion from agricultural lands also release aluminum into the aquatic environment. Acid rain can also lower environmental pH and make aluminum more soluble in the environment (Environment and Climate Change, 2017). High levels of aluminum will put strain on the kidneys of animals when they attempt to excrete it but it is not normally fatal. Aluminum and its compounds are often used in food as additives, in drugs, consumer products, and in the treatment of drinking water. Aluminum poisoning has been linked to neurological dementia in kidney dialysis patients and, in recent years, Alzheimer's disease, Parkinson's disease, and Lou Gehrig's disease. The intake of large amounts of aluminum can also cause anaemia, osteomalacia (brittle or soft bones), glucose intolerance, and cardiac arrest in humans. The PWQO guideline for aluminum varies with pH, the maximum concentration being 75 μg/L at pH >6.5.

Antimony
Antimony is a metallic element that is a blue-white colour in its stable form. Antimony is present in the aquatic environment as a result of rock weathering, soil runoff, and anthropogenic activities (Filella, M., Belzile, N., & Chen, Y., 2001). Acute intoxication is characterized by abdominal pain, vomiting, diarrhea, dehydration, muscular pain, shock, haemoglobinuria, anuria, and uraemia. In addition, severe myocardial symptoms and convulsions have been observed with acute doses of antimonials, as well some deaths were attributed to liver necrosis. Concentrations of antimony in freshwater systems typically range from a few ng/l to a few μg/l (Filella, M., Belzile, N., & Chen, Y., 2001). The maximum concentration of antimony under PWQO guidelines is 20 μg/L.

Arsenic
Arsenic is a natural element abundantly found within the earth's crust. It may be found in some drinking water supplies, including wells. Long-term exposure (over many years or decades) to high levels of arsenic in drinking water may cause thickening and discoloration of the skin; nausea and diarrhea; decreased production of blood cells; abnormal heart rhythm and blood vessel damage, or numbness in the hands and feet.

Short term exposure (days/weeks) to very high levels of arsenic can result in abdominal pain, vomiting and diarrhea, muscular cramping or pain, weakness and flushing of skin, skin rash, numbness, burning or tingling sensation on the palms of the hands and soles of the feet, or loss of movement and sensory response. The maximum concentration of arsenic under PWQO guidelines is 5 μg/L.

Barium

Barium is present as a trace element in both igneous and sedimentary rocks. Although it is not found free in nature, barium occurs in a number of compounds. Barium compounds have a wide variety of industrial applications. They are used in the plastic, rubber, electronic, and textile industries. Barium can anthropogenically enter surface water during coal processing as the effluent from a coal conversion plant contains high concentrations of barium, also through barium ore processing and subsequent industrial chemical processes involving barium. Barium can enter freshwater systems naturally through leaching and eroding of sedimentary rocks (CCME, 2013). At high concentrations, barium causes strong vasoconstriction (increase in blood pressure) by its direct stimulation of arterial muscle, peristalsis (radial contraction and relaxation of muscles) due to the violent stimulation of smooth muscle, and convulsions and paralysis following stimulation of the central nervous system. Depending on the dose and solubility of the barium salt, death may occur in a few hours or a few days. There are currently no PWQO guidelines for barium.

Beryllium

Beryllium is a hard grey metal that is extracted from the earth, refined and reduced to a very fine powder. It occurs as a chemical component of certain rocks, coal and oil, soil, and volcanic dust. People exposed to beryllium are at risk of developing serious debilitating diseases. Chronic beryllium disease (CBD or berylliosis) is a painful scarring of the lung tissue. Less common than CBD, acute (short—term) beryllium disease, causes lung inflammation resembling pneumonia. In severe cases, both diseases may be fatal. The maximum concentration of beryllium under PWQO guidelines depends on hardness. If $CaCO_3$ is >75 mg/L the maximum concentration of beryllium is 1100 μg/L and if the $CaCO_3$ is <75 mg/L the maximum concentration of Beryllium is 11 μg/L.

Bismuth

Bismuth is a brittle metal with a pinkish colour, often found in its native form. Exposure to bismuth at low doses may cause gastrointestinal disorders, low stomach acid, heartburn, bloating, calcification, warts, diarrhea, and gastric ulcers. At large doses it may cause mental confusion, memory problems, tremors, staggering gait, muscle twitching, slurring speech, joint problems, hypoadrenalism, hearing and visual disturbances, hallucinations and coma. There are currently no PWQO guidelines limiting the intake of bismuth.

Boron

Boron is a non-metallic element that is not found in nature in its elemental form but can be found in over 80 compounds. High concentrations of boron are found in sediments and sedimentary rocks, especially in clay rich marine sediments. (Canadian Council of Ministers of the Environment, 2009). Natural sources of boron to the aquatic environment is through atmospheric deposition, natural weathering processes, volcanic emissions, soil dust, and plant aerosols. Anthropogenic sources of boron include fossil fuel combustion, biomass burning, municipal sewage, waste waters from coal-burning power plants, irrigation, copper smelters, and industries that use boron. Natural weathering of boron releases more boron into the environment than industrial sources due to the high occurrence of clay-rich sedimentary rocks on the Earth's surface. Boron concentrations in freshwater are more likely dependent on the leaching of boron from the surrounding geology than from waste water or pollution (Canadian Council of Ministers of the Environment, 2009). Exposure to boron in small doses may cause irritation to the nose, throat, and eyes. In larger doses, boron can affect the stomach, liver, kidneys, brain, and may eventually lead to death. The maximum level of boron under PWQO guidelines is 200 μg/L.

Cadmium

Cadmium is a relatively rare element and an extremely toxic metal even in low concentrations. It is used commercially as a stabilizer in plastic, in fungicides for golf courses, in televisions, in nickel–cadmium batteries, in motor oils, and in curing agents for rubber. Anthropogenic sources of cadmium are industrial wastes from metallurgical plants, plating works, plants manufacturing cadmium pigments, textile operations, cadmium-stabilized plastics, or nickel-cadmium batteries, or by effluents from sewage treatment plants (Health Canada). Natural sources of cadmium include dissolution of sediment containing cadmium, especially in more acidic waters (Health Canada). Cadmium poisoning can lead to itai-itai disease, which initiates bone softening, joint pain, and kidney failure. The interim PWQO guideline states if hardness as $CaCO_3$ is 0-100 mg/L, the maximum cadmium concentration is 0.1 μg/L, and if hardness is >100 mg/L, the maximum cadmium concentration is 0.5 μg/L.

Calcium

Calcium is the third most abundant metal in the Earth's crust. Calcium is also the most abundant metal in the human body and is the main constituent of bones. Calcium is a dietary requirement and there are no adverse health effects from intake of large doses of calcium. There are currently no PWQO guidelines for calcium.

Chromium

Chromium is a lustrous, grey metal. Natural sources of chromium include volcanic emissions, forest fires, vegetative debris, and marine aerosols (Canadian Council of Ministers of the Environment, 1999). Anthropogenic sources of chromium to the aquatic

environment include tanneries, cooling towers, steel and nonferrous foundries, metal finishing and plating operations, flat glass and asbestos producing plants, wood treatment facilities, paint and chemical works, oil drilling and recovery rigs, as well as wastes from pulp and paper mills, cement and fertilizer plants, textile mills, power plants, chlor-alkali plants, petrochemical industries, as well as urban runoff and industrial storm waters (Canadian Council of Ministers of the Environment, 1999). Chromium (III) is an essential nutrient for the human body, but higher intake may cause skin rashes. Chromium (VI) is known to cause various health effects such as upset stomachs and ulcers, skin rashes, respiratory problems, weakened immune systems, kidney and liver damage, alteration of genetic material, lung cancer and death. The maximum concentration of chromium under PWQO guidelines is 1 μg/L for Chromium (VI) and 8.9 μg/L for Chromium (III).

Cobalt

Cobalt is a hard, lustrous, silver-grey metal and is found in various ores. Cobalt is an essential element for the growth of various marine algae species and it is shown to enhance the growth of plant at low concentrations. In high concentrations, cobalt can be toxic to humans as well as terrestrial and aquatic plants and animals. Cobalt is present naturally in rock, soil, water, plants, animals, and the air in small concentrations. It is often associated with nickel, silver, lead, copper, and iron ores. Cobalt can also have anthropogenic sources in the aquatic environment such as through cobalt mining, production of alloys and chemicals containing cobalt, sewage effluent, as well as urban and agricultural run-off (Nagpal, 2004). Health effects resulting from exposure to high concentrations include vomiting and nausea, vision problems, heart problems and thyroid damage. The maximum concentration of cobalt under PWQO guidelines is 0.9 μg/L.

Copper

Copper occurs in nature as a metal and can also be found in various minerals. Copper is an essential element to human metabolism, although intake at higher doses can cause adverse health effects. Acute copper poisoning can cause health effects including vomiting, diarrhea, and jaundice. In severe cases, stool and saliva may appear green or blue. In the terminal phases, anuria (kidney failure), hypotension (low blood pressure), and coma precede death. The PWQO criterion for copper is dependent upon the hardness of the water and so varies between 0.001 mg/L to 0.005 mg/L.

Iron

Iron is an abundant metal found in all types of rock. The precipitation of excessive iron creates an objectionable reddish-brown colour to water. Iron may stain plumbing fixtures, produce undesirable tastes in beverages, and promote the growth of certain iron-bacteria, which can lead to the deposition of a slimy coating in water distribution

pipes. The PWQO guideline stipulates that the levels of iron in the water must be below 300 μg/L.

Lead

Lead is a very toxic metal to all forms of life, causing neurological damage and even death. Although natural occurrences can occur from precipitation and the weathering of ores, the majority of lead in watercourses comes from anthropogenic sources. The PWQO requirement for lead varies with different alkalinity as $CaCO_3$ (mg/L). The maximum lead concentration is 25 μg/L.

Lithium

Lithium is a soft, silver-white metal belonging to the alkali metal group of chemical elements. Like all alkali metals, lithium is highly reactive and flammable. Lithium forms a minor part of igneous rocks, with the largest concentrations in granites. Lithium and its compounds have a range of effects on the human body. For instance, compounds of lithium tend to harm the kidneys and lithium carbonate can affect a person's mental health. There are no current PWQO guidelines for lithium.

Magnesium

Magnesium is very abundant in nature and is found in many minerals. It is a dietary requirement, but too much can lead to muscle weakness, lethargy and confusion. There are no current PWQO guidelines for magnesium.

Manganese

Manganese is a very common compound that can be found everywhere on earth. It is essential for humans to survive, but toxic when concentrations in the body are too high. Manganese can cause Parkinson, lung embolism and bronchitis. There are currently no PWQO guidelines for manganese.

Molybdenum

Molybdenum is an element that is found in minerals containing iron, bismuth, or copper and it is a by-product of copper and tungsten mining. It is commonly associated with coal or uranium deposits. Natural sources of molybdenum to the aquatic environment includes weathering of ores from igneous or sedimentary rocks (shale), and subsequent runoff to streams and lakes (Canadian Council of Ministers of the Environment, 1999). Anthropogenic sources of molybdenum to the aquatic environment includes use of fertilizers containing molybdenum, atmospheric wet deposition, leaching processes near molybdenum mines, and burning of fossil fuels It is used as an alloy for various metals and occurs naturally in soil and rock (Canadian Council of Ministers of the Environment, 1999). Potential health impacts associated with molybdenum include neurotoxicity and reproductive toxicity. The maximum concentration of molybdenum under PWQO guidelines is 40 μg/L.

Nickel
Nickel is a compound that occurs in the environment only at very low levels. An uptake of large quantities of nickel may cause higher risks of cancer, respiratory failure, birth defects and heart disorders. The maximum concentration of nickel under PWQO guidelines is 25 μg/L.

Potassium
Potassium is a soft silvery white metal, which is a key plant element and is found in most fertilizers. Potassium is an essential element in humans and is seldom found in drinking water at levels that could be a concern for healthy humans. It is present in all animal and plant tissues so it is found in all foods. Potassium is also a dietary requirement, but many potassium compounds may cause adverse health effects. Such compounds include potassium alum or potassium cyanide. There are currently no PWQO guidelines for potassium.

Selenium
Selenium is one of the rarer elements on the earth. It occurs naturally in the environment and is also released by human activities. Natural sources of selenium in the environment are volcanoes, biogenic processes, atmospheric release, and forest fires. The main source of selenium in surface water today is the result of weathering and sedimentary processes acting on volcanic parent rocks that have high concentrations of selenium (Beatty & Russo, 2014). Anthropogenic sources of selenium in the environment are industrial, agricultural, mining, and petrochemical operations, wastewater discharges from municipal sewage treatment plants, landfills, combustion of coal and fossil fuels, and emissions from smelting and manufacturing of pyritic ores (Beatty & Russo, 2014). Depending on the form of selenium varying health effects can occur including brittle hair and deformed nails, rashes, swelling of the skin, and severe pain. Selenium poisoning may become so severe that it may cause death. Background selenium concentrations in surface waters range from 0.1 to 0.4 μg/L (Beatty & Russo, 2014). The maximum concentration of selenium under PWQO guidelines is 100 μg/L.

Silicon
Silicon is the most abundant element on earth after oxygen. In drinking water only silicic acid is present, which is relatively safe. However, there are a number of silicon compounds that are carcinogenic. There are currently no PWQO guidelines for silicon.

Silver
Silver does not react with pure water. It is stable in both water and air. Moreover, it is acid and base resistant, but it corrodes when it comes in contact with sulphur compounds. Silver oxide is harmful upon swallowing, because it irritates the eyes, respiratory tract and skin. Silver nitrate is much more harmful, because it is a strong

oxidant. It causes corrosion, and an oral uptake can lead to vomiting, dizziness and diarrhea. The maximum concentration of silver under PWQO guidelines is 0.1 μg/L.

Strontium

Strontium is a bright silvery metal that is reactive in water. Natural sources of strontium include leaching from limestone. Anthropogenic sources of strontium include release into the environment as a by-product of other mining operations, air deposition from coal burning and phosphate fertilizers (Federal-Provincial-Territorial Committee on Drinking Water, 2018). Acute effects of strontium include vomiting and diarrhea if ingested, and may also cause irritation to the skin. Chronic skin contact may cause dermatitis. There are currently no PWQO guidelines for strontium.

Tellurium

Tellurium is a brittle, mildly toxic, rare, silver-white metalloid. It is chemically related to selenium and sulfur. It is occasionally found in native form as elemental crystals. Tellurium is far more common in the universe as a whole than on Earth. When taken internally, tellurium can have harmful effects. It may cause nausea, vomiting, and damage to the central nervous system. There are currently no PWQO guidelines for tellurium.

Thallium

Thallium is a silvery-grey metal that is very toxic by inhalation, ingestion and skin absorption. Natural inputs of thallium into the aquatic environment includes weathering processes. Anthropogenic inputs of thallium into the aquatic environment includes potash, effluents production of sulphuric acid, the mining and smelting of copper, gold, zinc, lead, and cadmium, and combustion of coal and oil (Canadian Council of Ministers of the Environment, 1999). It may act as a systemic poison, neurotoxin, and may cause birth abnormalities. It is also a respiratory and eye irritant. The maximum concentration of thallium under PWQO guidelines is 0.3 μg/L.

Tin

Tin is a soft, pliable, silvery-white metal. Acute effects of tin include skin or eye irritation, headaches, stomach aches, dizziness, and breathlessness. Long-term effects include liver damage, malfunctioning of immune systems, chromosomal damage, shortage of red blood cells, and brain damage. There are currently no PWQO guidelines limiting the intake of tin.

Titanium

Titanium is a white-silvery metallic colour and is always found bound to other elements in nature. There are no known health hazards of titanium in water, but it is known to have adverse health effects in powder form. There are currently no PWQO guidelines for titanium.

Tungsten
Tungsten is a lustrous, silvery-white metal. Acute health effects include irritation to the skin and eyes causing watering and redness. There are no known long-term health effects. The maximum concentration of tungsten under PWQO guidelines is 30 μg/L.

Uranium
Uranium is a hard, dense, malleable, ductile, silver-white, radioactive metal. No harmful radiation effects of natural levels of uranium have been found. However, chemical effects may occur after the uptake of large amounts of uranium, which can cause health effects such as kidney disease. Exposure to uranium radionuclides that form during radioactive decay may cause cancer. The maximum concentration of uranium under PWQO guidelines is 5 μg/L.

Vanadium
Vanadium is a rare, soft, ductile grey-white element found combined in certain minerals and used mainly to produce certain alloys. The uptake of vanadium by humans mainly takes place through foodstuffs, such as buckwheat, soy beans, olive oil, sunflower oil, apples and eggs. Some acute health effects associated with the high intake of vanadium include inflammation of stomach and intestines, sickness and headaches, dizziness, skin rashes, nosebleeds and throat pain. Chronic exposure may cause eye, skin and respiratory problems. The maximum concentration of vanadium under PWQO guidelines is 6 μg/L.

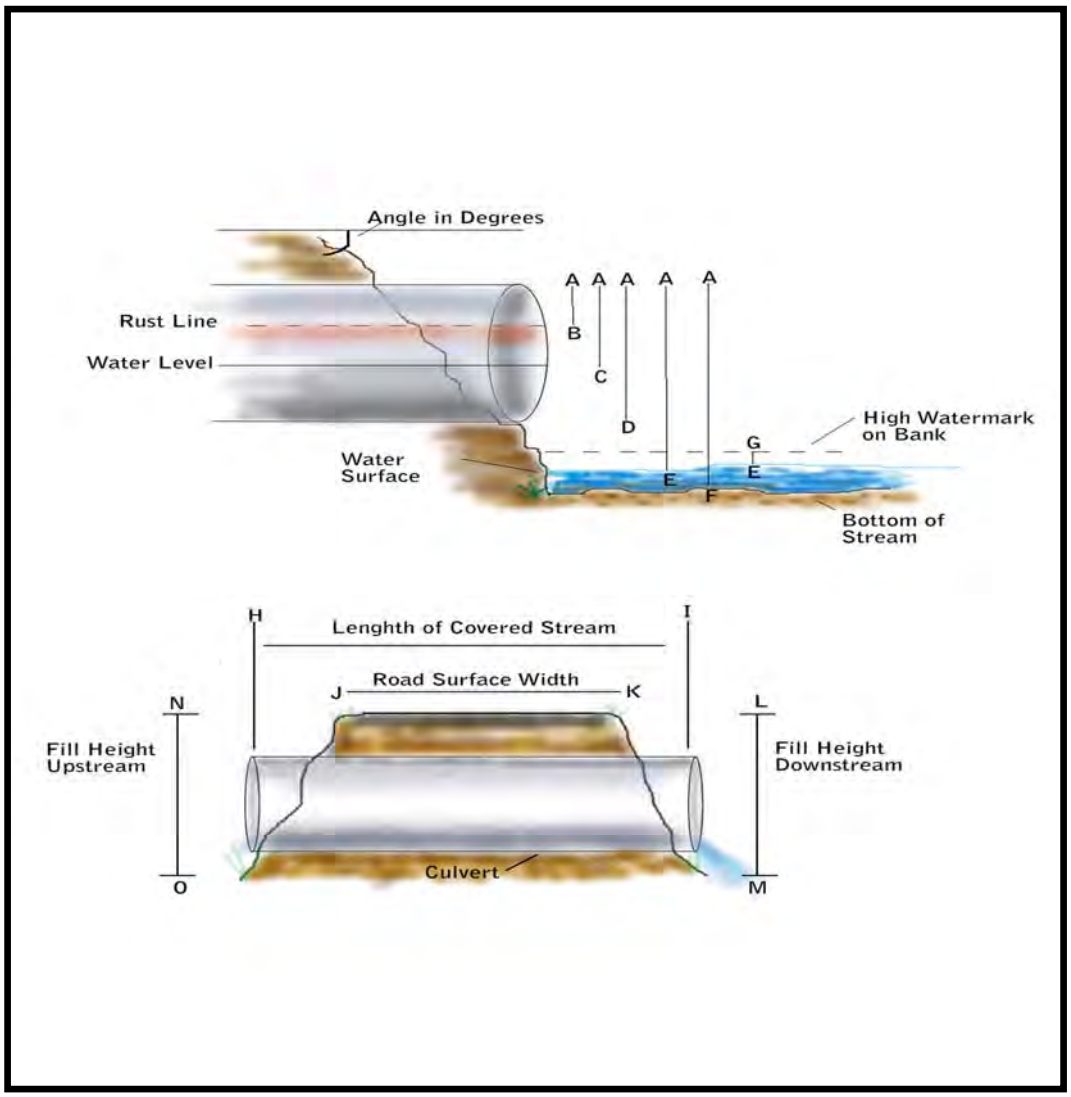
Zinc
Zinc is a lustrous bluish-white metal. Zinc is an essential element for all living things (Health Canada, 1987) and overdoses do not occur very often. Anthropogenic sources of zinc include primary iron and steel production, primary copper and nickel production, fuel combustion, transportation, solid waste incineration, and pesticide applications (Health Canada, 1987). Symptoms include nausea, vomiting, dizziness, fevers, and diarrhea. The maximum concentration of zinc under PWQO guidelines is 20 μg/L.

Zirconium
Zirconium is a very strong, malleable, ductile, lustrous silver-grey metal. Zirconium and its salts generally have low systemic toxicity. The maximum concentration of Zinc under PWQO guidelines is 4 μg/L.

Appendix H:

Culvert Assessments

Appendix H: Culvert Assessments



Culvert Number/ Site Number	**J-K** Road Surface Width (m)	**H-I** Length of Covered Stream (m)	**N-O** Fill Height Upstream (m)	**L-M** Fill Height Downstream (m)		**A-D** Width of Opening (m)	**A-B** Inside Top to Rust Line (m)	**A-C** Inside Top to Water Surface (m)	**A-E** Height Above Outlet Pool (m)	**E-G** Water Surface to High Water Mark (m)	**A-F** Inside Top to Bottom of Stream (m)
C1/Site 2											
Culvert A (East)	8.60	41.50	4.60	4.60	Upstream	1.20	N/A	1.17	N/A	0.16	1.35
					Downstream	1.20	N/A	1.17	0.18	0.38	1.57
Culvert B (West)	8.60	41.50	4.60	4.60	Upstream	1.20	N/A	1.17	N/A	0.21	1.35
					Downstream	1.20	N/A	1.17	0.23	0.28	1.54
C2/Site 3											
Culvert A	9.60	23.0	6.20	5.90	Upstream	3.60	2.68	3.45	N/A	0.55	3.87
					Downstream	3.55	2.68	3.81	3.85	0.66	4.17
C3/Site 4											
Culvert A (West)	8.40	18.50	1.90	2.50	Upstream	1.60	0.26	1.36	N/A	0.19	1.75
					Downstream	1.50	0.52	1.32	N/A	0.51	1.75
Culvert B (East)	8.40	18.50	1.90	2.50	Upstream	1.60	0.55	1.46	N/A	0.70	1.78
					Downstream	1.50	0.55	1.19	N/A	0.30	1.79
C4/Site 5											
Culvert A (East)	8.35	18.4	2.10	1.80	Upstream	1.50	0.5	1.2	N/A	0.70	2.09
					Downstream	1.50	0.7	1.21	N/A	0.69	1.76
Culvert B (West)	8.35	18.4	2.10	1.80	Upstream	1.50	0.55	1.26	N/A	0.69	1.97
					Downstream	1.50	0.65	1.45	N/A	0.73	1.70
C5/Site 6											
Culvert A	16.34	31.64	2.95	3.20	Upstream	2.20	0.53	1.93	N/A	0.29	2.30
					Downstream	2.20	0.99	1.64	N/A	0.46	1.72

Culvert Number/ Site Number	**J-K** Road Surface Width (m)	**H-I** Length of Covered Stream (m)	**N-O** Fill Height Upstream (m)	**L-M** Fill Height Downstream (m)		**A-D** Width of Opening (m)	**A-B** Inside Top to Rust Line (m)	**A-C** Inside Top to Water Surface (m)	**A-E** Height Above Outlet Pool (m)	**E-G** Water Surface to High Water Mark (m)	**A-F** Inside Top to Bottom of Stream (m)
C6/Site 7											
Culvert A (East)	7.40	16.30	1.80	1.80	Upstream	1.20	0.70	0.93	N/A	0.25	1.20
					Downstream	1.20	0.36	0.86	N/A	0.39	0.87
Culvert B	7.40	16.30	1.80	1.80	Upstream	1.20	0.64	1.02	N/A	0.25	1.29
					Downstream	1.20	0.37	0.69	N/A		0.70
Culvert C	7.40	16.30	1.80	1.80	Upstream	1.20	0.54	1.06	N/A	0.23	1.25
					Downstream	1.20	N/A	No Water			
Culvert D (West)	7.40	16.30	1.80	1.80	Upstream	1.20	0.58	1.12	N/A	0.19	1.22
					Downstream	1.20	N/A	No Water			
C7/Site 8											
Culvert A (North)	7.80	16.30	1.19	1.30	Upstream	0.90	0.46	0.50	N/A	0.35	0.99
					Downstream	0.90	0.36	0.36	N/A	0.32	0.78
Culvert B	7.80	16.30	1.19	1.30	Upstream	0.90	0.42	0.48	N/A	0.35	0.95
					Downstream	0.90	0.29	0.32	N/A	0.32	0.87
Culvert C (South)	7.80	16.30	1.19	1.30	Upstream	0.90	0.41	0.45	N/A	0.35	0.86
					Downstream	0.90	0.36	0.36	N/A	0.30	0.91
C8/Site 9											
Culvert A (North)	7.80	12.00	1.10	1.40	Upstream	0.90	0.19	0.87	N/A	0.24	0.90
					Downstream	0.90	0.41	0.71	N/A	0.22	0.80
Culvert B	7.80	12.00	1.10	1.40	Upstream	0.90	No Water				
					Downstream	0.90	No Water				
Culvert C (South)	7.80	12.00	1.10	1.40	Upstream	0.90	No Water				
					Downstream	0.90	No Water				

Culvert 1 / Site 2

Location: Mountain Road, near the White Fox Inn and across from the Fort William Country Club.

GPS Coordinates: Northing 5355158 Easting 328149

Description: The concrete culverts appeared to be in excellent condition. The downstream side was perched and had abundant vegetation and boulders surrounding the outlet. As a result, the banks appeared stable.

Upstream

Downstream

Culvert 2 / Site 3

Location: 15th Side Road, halfway between Highway 61 and Mountain Road.

GPS Coordinates: Northing 5355172 Easting 327045

Description: The corrugated steel culvert appeared to be in poor condition having deteriorated since 2015. Corrosion is most evident on the downstream side where the bottom of the stream is visible through the culvert. The steep banks surrounding the culvert are somewhat vegetated and have been reinforced by loose rip rap. As a result, the banks appeared to be stable but the culvert is reaching the end of its service life.

Upstream

Downstream

Culvert 3 / Site 4

Location: Mountain Road adjacent to South Neebing Community Center.

GPS Coordinates: Northing 5354184 Easting 326100

Description: The two corrugated steel culverts appeared to be in somewhat good condition with deterioration beginning at the ends of the culverts below the rust line. There is moderate vegetation surrounding the culverts with no signs of erosion. As a result, the banks appeared to be stable. Water had pooled on the downstream side due to a beaver dam that has since breached.

Upstream

Downstream

Culvert 4 / Site 5

Location: Mountain Road, between 1947 and 1953 Mountain Road, across from Nor'Wester View Public School.

GPS Coordinates: Northing 5354200 Easting 325568

Description: The two corrugated steel culverts appeared to be in good condition with superficial corrosion. There is abundant vegetation surrounding the culverts and there are no signs of erosion. As a result, the banks appeared to be stable.

Upstream

Downstream

Culvert 5 / Site 6

Location: Highway 61, adjacent to 1956 Highway 61, approximately 700 metres from Mountain Road.

GPS Coordinates: Northing 5354742 Easting 325576

Description: The corrugated steel culvert appeared to be in somewhat good condition with deterioration beginning on the sides of the culvert below the rust line. The water level was relatively low compared to the size of the culvert opening. There is abundant vegetation surrounding the culvert and there are no signs of erosion. As a result, the banks appeared to be stable.

Upstream

Downstream

Culvert 6 / Site 7

Location: Loch Lomond Road, 400 meters from Gregor Road.

GPS Coordinates: Northing 5353577 Easting 324937

Description: The four corrugated steel culverts appeared to be in excellent condition. There was abundant vegetation surrounding the culverts and rip rap was installed. As a result, the banks appeared to be stable. Water levels were low for the site due to an upstream blockage at Site 9. The two westernmost culverts on the downstream side did not have flowing water due to sediment and vegetation build up.

Upstream

Downstream

Culvert 7 / Site 8

Location: Trendiak Road, 150 metres west of Loch Lomond Road.

GPS Coordinates: Northing 5352207 Easting 324748

Description: The three corrugated steel culverts appeared to be in excellent condition having been replaced in 2017. There was abundant vegetation surrounding the culverts and rip rap was installed. As a result, the banks appeared to be stable. It was noted that water depths on the upstream side were less than the downstream.

Upstream

Downstream

Culvert 8/Site 9

Location: Trendiak Road, 660 metres east of Little Norway Road

GPS Coordinates: Northing 5352215 Easting 323515

Description: The three corrugated steel culverts appeared to be in excellent condition. There was abundant vegetation surrounding the culverts with no signs of erosion. As a result, the banks appeared to be stable. However, a beaver dam adjacent to the upstream culverts had completely blocked off the flow of the two westernmost culverts and severely limited the flow of the easternmost one. This blockage is believed to be responsible for the low water levels downstream.

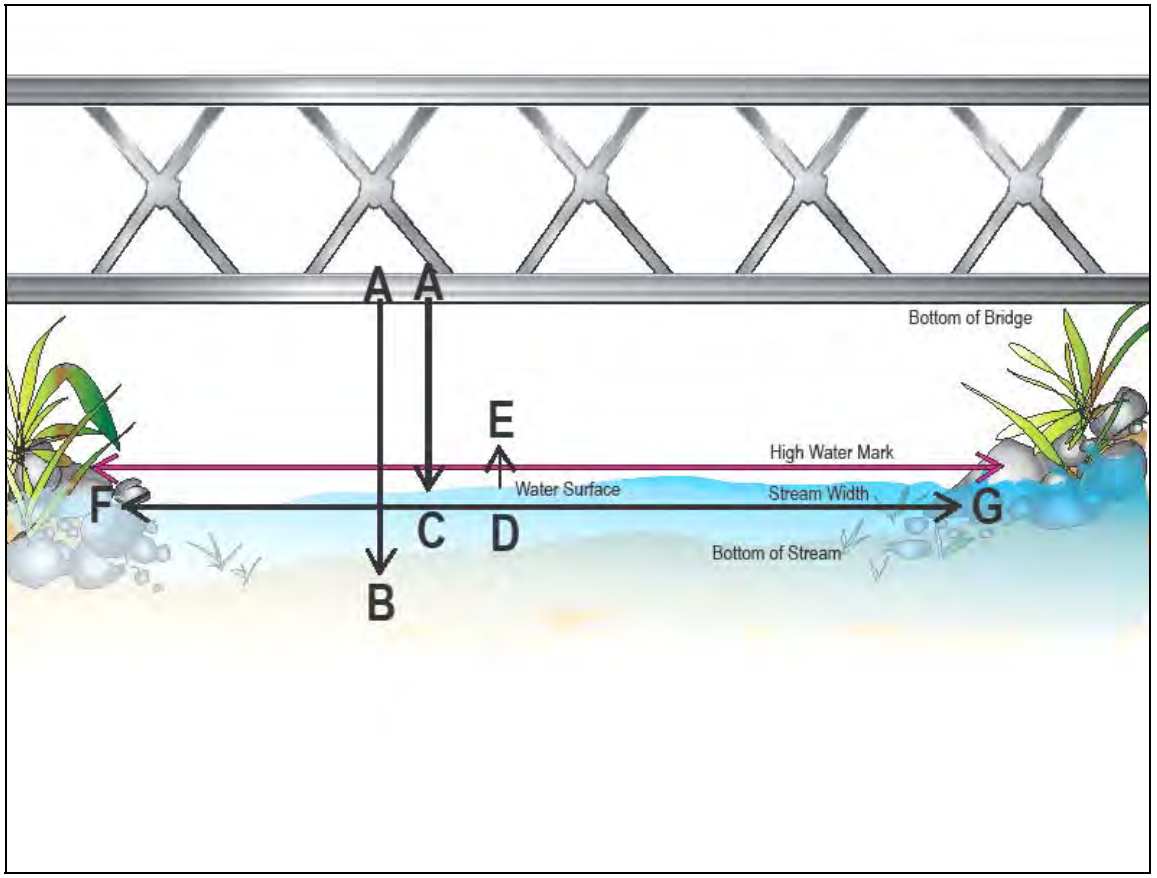
Upstream

Downstream

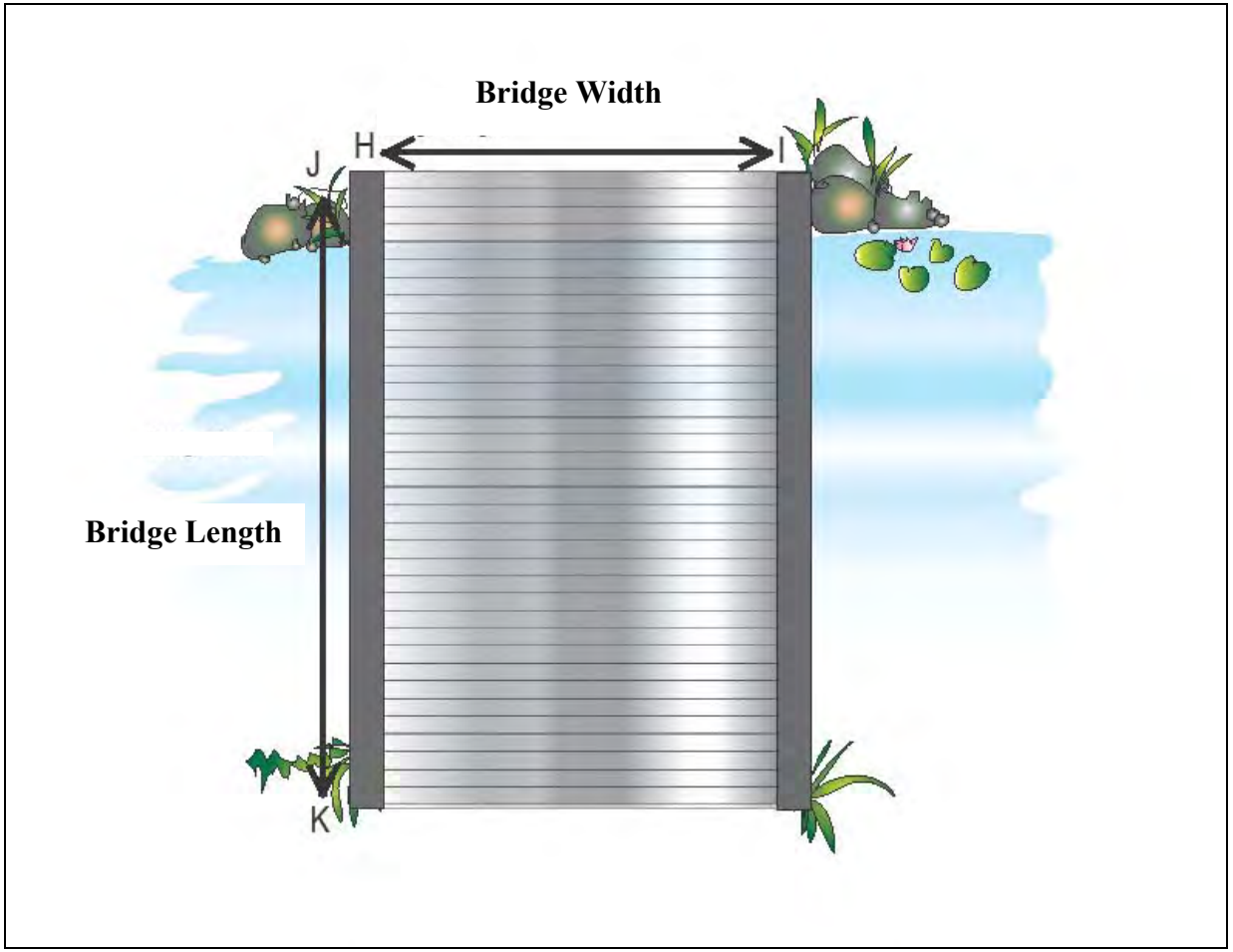
Appendix I:

Bridge Assessments

Appendix I: Bridge Assessments



Bridge Measurement Parameters


Bridge Width
H
I
J
K
Bridge Length

Mosquito Creek 2015 Bridge Measurements

Site Number	Bridge Number	**A-C** Bottom of Bridge to Water Surface (m)	**A-B** Bottom of Bridge to Bottom of Stream (m)	**D-E** Outlet Pool Water Surface to Outlet Pool High Water Mark (m)	**F-G** Width of Stream (m)	**H-I** Length of Bridge (m)	**J-K** Width of Bridge (m)
1	1	5.69	6.02	0.72	6.4	26	11.6

Bridge 1

Location: Chippewa Road

GPS Coordinates: Northing 5356865 Easting 328683

Description: This bridge is a single-span structure made out of steel beams and reinforced concrete including a metal rail on each side of the bridge. It was completed in 1970. Rip rap was placed for erosion control on the banks. The height and width did not appear to alter the natural channel characteristics. The banks surrounding the bridge were fairly steep, but appeared to be stable due to the density of vegetation. The bridge was in very good condition, but regular maintenance should be conducted as it is a high traffic area.

Upstream

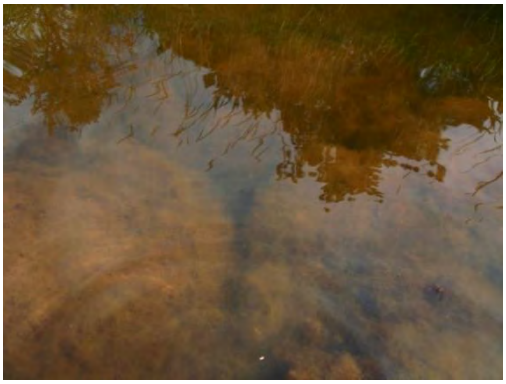
Downstream

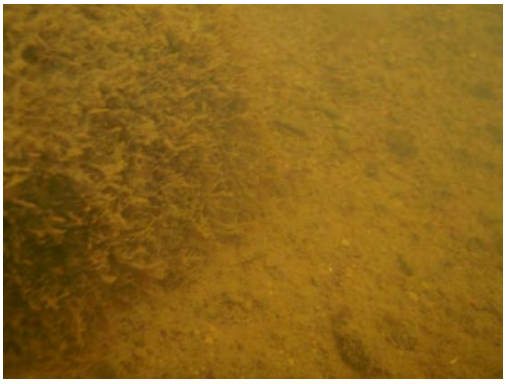
Appendix J:

Site Photography

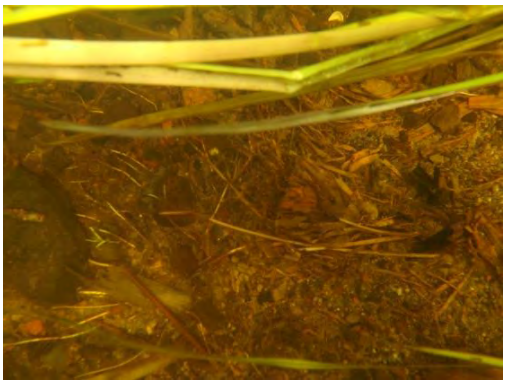
Appendix J: Site Photography

Site 1 – Chippewa Road, Mosquito Creek confluence at Kaministiquia River	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 2 – North side of Mountain Road - Near White Fox Inn, across from the Fort William Country Club	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 3 – East side of 15th Side Road, between Highway 61 and Mountain Road	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 4 - North side of Mountain Road beside the South Neebing Community Centre	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 5 - North side of Mountain Road, between 1947 and 1953 Mountain Road, across from Nor'Wester View Public School	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 6 - South side of Highway 61, adjacent to 1956 Highway 61, approximately 700 metres from Mountain Road	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 7 – East side of Loch Lomond Road, 400 meters from Gregor Road	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 8 - 2176 Trendiak Road, about 150 meters west from Loch Lomond Road	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 9 - Trendiak Road, 660 metres east of Little Norway Road	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Site 10 – East of Norwester Drive at the confluence from Site 2 and 3 tributaries	
A: Upstream	**B: Downstream**
	
C: Vegetation	**D: Substrate**
	

Appendix K:

Laboratory Water Quality Results Summary Tables June

Mosquito Creek Update 2022
Laboratory Water Quality Results Summary Tables June

Laboratory Water Quality Results for June 14, 2022

Parameter	Units	PWQO Criterion	MC 1 - Mosquito Creek Site #1	MC 2 - Mosquito Creek Site #2	MC 3 - Mosquito Creek Site #3	MC 4 - Mosquito Creek Site #4	MC 5 - Mosquito Creek Site #5	MC 6 - Mosquito Creek Site #6	MC 7 - Mosquito Creek Site #7	MC 8 - Mosquito Creek Site #8	MC 9 - Mosquito Creek Site #9	MC 10 - Mosquito Creek Site #10	Averages
			14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	June
Physical Tests													
Conductivity (EC)	(uS/cm)	N/A	420	204	500	237	538	950	432	128	206	454	407
pH		6.5-8.5	8.1	7.8	8.1	7.9	8.2	8.4	8.1	7.7	7.9	8.1	8.0
Total Dissolved Solids	(mg/L)	N/A	255	147	292	151	320	554	276	107	147	274	252
Turbidity	(NTU)	N/A	13.4	4.3	5.8	3.9	2.1	1.4	4.3	2.9	2.0	11.2	5.1
Anions and Nutrients													
Alkalinity, Total (as $CaCO_3$)*	(mg/L)	52.2	**145.0**	**86.5**	**166.0**	**100.0**	**181.0**	**297.0**	**165.0**	**69.5**	**94.2**	**157.0**	**146.1**
Ammonia-N, Total	(mg/L)	N/A	0.0137	0.0134	0.0167	0.0079	0.0103	0.0246	0.022	0.0442	<0.0050	0.0129	0.0184
Un-ionized Ammonia (calculated)**	(mg/L)	0.02	0.0003151	0.00003216	0.00003674	0.00001896	0.00002472	0.0000492	0.0000484	0.00001105	0.000012	0.0003096	0.0000858
Chloride (Cl)	(mg/L)	N/A	45.7	12.1	61.4	17.3	67.2	140	43.8	1.6	10.8	52.9	45.3
Nitrate-N (NO_3-N)	(mg/L)	N/A	0.104	<0.020	0.171	<0.020	<0.020	0.68	0.03	<0.020	<0.020	0.159	0.229
Nitrite-N (NO_2-N)	(mg/L)	N/A	<0.010	<0.010	<0.010	<0.010	<0.010	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010
Total Kjeldahl Nitrogen	(mg/L)	N/A	0.587	0.552	0.726	0.722	0.760	0.560	0.834	0.774	0.787	0.628	0.693
Phosphorus (P)-Total	(mg/L)	0.03	0.0253	0.0211	0.0226	**0.0336**	**0.041**	0.0086	**0.0631**	0.0268	0.0224	0.0272	0.0292
Sulphate (SO_4)	(mg/L)	N/A	9.90	6.20	9.39	1.97	8.32	24.90	6.48	0.66	4.42	9.78	8.20
Bacteriological Tests													
Escherichia Coli	(MPN/100mL)	100	67	36	15	58	33	8	96	14	99	91	52
Total Coliforms	(MPN/100mL)	1000 (prior to 1994)	**>2420**	**>2420**	**>2420**	**>2420**	**2420**	**>2420**	**>2420**	**2420**	**2420**	**2420**	**2420**
Total Metals													
Aluminum (Al)-Total***	(mg/L)	0.075	**0.513**	**0.176**	**0.144**	**0.130**	0.037	0.033	**0.132**	**0.122**	0.072	**0.264**	**0.162**
Antimony (Sb)-Total	(mg/L)	0.02	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	(mg/L)	0.005 (interim)	0.000910	0.000590	0.000770	0.000890	0.000850	0.000520	0.000840	0.000750	0.000610	0.000770	0.000750
Barium (Ba)-Total	(mg/L)	N/A	0.0579	0.0129	0.0783	0.0172	0.0331	0.0486	0.0221	0.0107	0.0136	0.0762	0.0371
Beryllium (Be)-Total****	(mg/L)	0.011 (<75 mg/L $CaCO_3$)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.000020	N/A	N/A	<0.000020
	(mg/L)	1.10 (>75 mg/L $CaCO_3$)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	N/A	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Total	(mg/L)	N/A	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total	(mg/L)	0.2	0.015	0.012	0.016	0.011	0.011	0.031	0.01	<0.010	<0.010	0.015	0.015
Cadmium (Cd)-Total****	(mg/L)	0.0001 (0-100 mg/L $CaCO_3$)	0.0000268	N/A	0.0000327	N/A	0.0000208	0.0000545	0.0000297	N/A	0.0000208	0.0000347	0.000031
	(mg/L)	0.0005 (>100 mg/L $CaCO_3$)	N/A	0.0000188	N/A	0.0000208	N/A	N/A	N/A	0.0000198	N/A	N/A	0.000020
Calcium (Ca)-Total	(mg/L)	N/A	38	22.1	41.8	23.3	45.8	72.9	39.1	15.6	23	39.8	36.1
Chromium (Cr)-Total	(mg/L)	0.0089	0.00123	0.00067	0.00062	0.00064	0.00049	0.0004	0.00066	0.00075	0.00053	0.00086	0.00069
Cobalt (Co)-Total	(mg/L)	0.0009	0.00046	0.0002	0.00031	0.0003	0.00031	0.00053	0.00039	0.00019	0.0002	0.0004	0.00033
Copper (Cu)-Total****	(mg/L)	0.001 (0-20 mg/L CaCO3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(mg/L)	0.005 (>20 mg/L CaCO3)	0.00454	0.00365	0.00317	0.00265	0.00149	0.00373	0.00198	0.00301	0.00221	0.00386	0.00303

Notes:

PWQO - Provincial Water Quality Objectives. **Bold indicates exceedance of PWQO criteria**

* - Alkalinity should not be decreased by more than 25% of the natual conditions (Site 8)

** - indicates criterion is pH and temperature dependent

*** - indicates criterion is pH dependent

**** - indicates criteria are Hardness dependent

Mosquito Creek Update 2022
Laboratory Water Quality Results Summary Tables June

Laboratory Water Quality Results for June 14, 2022

Parameter	Units	PWQO Criterion	MC1 - Mosquito Creek SITE #1	MC2 - Mosquito Creek SITE #2	MC3 - Mosquito Creek SITE #3	MC4 - Mosquito Creek SITE #4	MC5 - Mosquito Creek Site #5	MC 6 - Mosquito Creek Site #6	MC 7 - Mosquito Creek Site #7	MC 8 - Mosquito Creek Site #8	MC 9 - Mosquito Creek Site #9	MC 10 - Mosquito Creek Site #10	Averages
			14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	14-Jun-22	June
Total Metals Continued													
Iron (Fe)-Total	(mg/L)	0.3	**0.899**	**0.471**	**0.543**	**0.805**	**0.678**	0.146	**0.666**	**0.663**	**0.595**	**0.657**	**0.612**
Lead (Pb)-Total****	(mg/L)	0.001 (<30 mg/L CaCO3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(mg/L)	0.003 (30-80 mg/L CaCO3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.000068	N/A	N/A	0.000068
	(mg/L)	0.005 (>80 mg/L $CaCO_3$)	0.000276	0.000128	0.000105	0.000095	<0.000050	<0.000050	0.000065	N/A	<0.000050	0.000193	0.0001437
Lithium (Li)-Total	(mg/L)	N/A	0.0032	0.0015	0.0033	0.0011	0.002	0.0065	0.0017	<0.0010	<0.0010	0.0032	0.0028
Magnesium (Mg)-Total	(mg/L)	N/A	15.0	9.1	16.6	9.9	20.3	28.0	19.2	7.2	10.4	16.2	15.2
Manganese (Mn)-Total	(mg/L)	N/A	0.0383	0.0765	0.0534	0.152	0.188	0.0724	0.085	0.0699	0.0625	0.0458	0.0844
Molybdenum (Mo)-Total	(mg/L)	0.04	0.000805	0.000486	0.000811	0.000681	0.000847	0.00114	0.000936	0.000358	0.00038	0.000759	0.000720
Nickel (Ni)-Total	(mg/L)	0.025	0.00218	0.00116	0.00227	0.00139	0.00183	0.00457	0.00193	0.0014	0.00143	0.00219	0.00204
Potassium (K)-Total	(mg/L)	N/A	1.460	<0.030	1.700	0.031	1.310	2.760	1.100	0.935	0.868	1.500	1.296
Selenium (Se)-Total	(mg/L)	0.1	0.000154	0.000137	0.000147	0.00024	0.000144	0.000118	0.000167	0.000169	0.000168	0.000182	0.00016
Silver (Ag)-Total	(mg/L)	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	0.00001	<0.000010	<0.000010	0.00001
Sodium (Na)-Total	(mg/L)	N/A	27.0	9.5	39.4	12.8	37.8	94.1	25.9	2.7	6.6	32.2	28.8
Strontium (Sr)-Total	(mg/L)	N/A	0.0946	0.0443	0.1190	0.0517	0.1000	0.1620	0.0803	0.0303	0.0516	0.1110	0.0845
Tellurium (Te)-Total	(mg/L)	N/A	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)-Total	(mg/L)	0.0003	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin (Sn)-Total	(mg/L)	N/A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	(mg/L)	N/A	0.018	0.00572	0.00476	0.00427	0.00142	0.00104	0.0043	0.00367	0.00239	0.00951	0.00551
Tungsten (W)-Total	(mg/L)	0.03	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium (U)-Total	(mg/L)	0.005	0.000584	0.000169	0.000671	0.000236	0.000812	0.00142	0.000943	0.000185	0.000115	0.000635	0.000577
Vanadium (V)-Total	(mg/L)	0.006	0.00298	0.00133	0.00181	0.00164	0.00121	0.00099	0.00176	0.00156	0.00127	0.00241	0.00170
Zinc (Zn)-Total	(mg/L)	0.02 (interim)	0.0041	0.0083	0.0034	<0.0030	<0.0030	0.0057	<0.0030	<0.0030	<0.0030	0.0049	0.0053
Zirconium (Zr)-Total	(mg/L)	0.004	0.00041	0.00025	0.00025	0.00028	0.00022	<0.0020	0.00021	0.00029	0.00021	0.00033	0.00027

Notes:

PWQO - Provincial Water Quality Objectives. **Bold indicates exceedance of PWQO criteria**

* - Alkalinity should not be decreased by more than 25% of the natual conditions (Site 8)

** - indicates criterion is pH and temperature dependent

*** - indicates criterion is pH dependent

**** - indicates criteria are Alkalinity dependent

Appendix L:

Laboratory Water Quality Results Summary July

Mosquito Creek Update 2022
Laboratory Water Quality Results Summary Tables July

Laboratory Water Quality Results for July 13, 2022

Parameter	Units	PWQO Criterion	MC 1 - Mosquito Creek Site #1	MC 2 - Mosquito Creek Site #2	MC 3 - Mosquito Creek Site #3	MC 4 - Mosquito Creek Site #4	MC 5 - Mosquito Creek Site #5	MC 6 - Mosquito Creek Site #6	MC 7 - Mosquito Creek Site #7	MC 8 - Mosquito Creek Site #8	MC 9 - Mosquito Creek Site #9	MC 10 - Mosquito Creek Site #10	Averages
			13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	July
Physical Tests													
Conductivity (EC)	(uS/cm)	N/A	639	414	626	404	741	620	3090	155	272	688	765
pH		6.5-8.5	8.3	8.1	8.2	7.9	8.0	8.2	7.6	7.8	7.6	8.2	8.0
Total Dissolved Solids	(mg/L)	N/A	384	249	343	247	452	340	2050	132	209	375	478
Turbidity	(NTU)	N/A	4.5	2.5	11.0	3.9	2.5	2.6	90.5	2.1	115.0	16.8	25.1
Anions and Nutrients													
Alkalinity, Total (as $CaCO_3$)*	(mg/L)	<68	**224**	**184**	**207**	**168**	**233**	**200**	**453**	**91**	**160**	**219**	**214**
Ammonia-N, Total	(mg/L)	N/A	0.0066	0.0311	0.0247	0.0098	0.0172	0.0082	0.304	0.0156	0.1030	0.0087	0.0529
Un-ionized Ammonia (calculated)**	(mg/L)	0.02	0.000165	0.000840	0.000667	0.000028	0.000430	0.000172	0.000760	0.000515	0.002987	0.000287	0.000685
Chloride (Cl)	(mg/L)	N/A	86.6	39.7	91.5	45.6	122.0	87.6	892.0	0.6	5.1	105.0	147.6
Nitrate-N (NO_3-N)	(mg/L)	N/A	0.239	0.085	0.064	<0.020	<0.040	0.423	<0.400	<0.020	<0.020	<0.040	0.203
Nitrite-N (NO_2-N)	(mg/L)	N/A	<0.020	<0.010	<0.020	<0.010	<0.020	<0.020	<0.20	<0.010	<0.010	<0.020	<0.020
Total Kjeldahl Nitrogen	(mg/L)	N/A	0.501	0.731	0.709	0.981	1.040	0.229	6.340	0.736	1.680	0.721	1.367
Phosphorus (P)-Total	(mg/L)	0.03	0.0198	0.0233	**0.0319**	0.0063	**0.0452**	0.0090	**0.5400**	0.0254	**0.1740**	0.0055	**0.0880**
Sulphate (SO_4)	(mg/L)	N/A	14.1	3.7	11.6	1.72	6.5	16	<6.0	<0.3	0.7	11.2	8.2
Bacteriological Tests													
Escherichia Coli	(MPN/100mL)	100	26	38	66	50	15	18	<10	29	50	36	36
Total Coliforms	(MPN/100mL)	1000 (prior to 1994)	**1410**	**>2420**	**2420**	**>2420**	**>2420**	**>2420**	**1960**	**1990**	**9800**	**>2420**	**3516**
Total Metals													
Aluminum (Al)-Total***	(mg/L)	0.075	**0.147**	0.053	**0.414**	0.050	0.016	**0.075**	**0.150**	0.031	**4.500**	**0.576**	**0.601**
Antimony (Sb)-Total	(mg/L)	0.02	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	(mg/L)	0.005 (interim)	0.00124	0.00084	0.00091	0.00156	0.00114	0.00045	0.00288	0.00108	0.00205	0.00135	0.00135
Barium (Ba)-Total	(mg/L)	N/A	0.078	0.020	0.188	0.024	0.039	0.030	1.000	0.007	0.097	0.178	0.166
Beryllium (Be)-Total****	(mg/L)	0.011 (<75 mg/L $CaCO_3$)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(mg/L)	1.10 (>75 mg/L $CaCO_3$)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000093	<0.000020	0.000093
Bismuth (Bi)-Total	(mg/L)	N/A	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total	(mg/L)	0.2	0.016	<0.010	0.018	<0.010	0.010	0.015	0.036	<0.010	<0.010	0.018	0.019
Cadmium (Cd)-Total****	(mg/L)	0.0001 (0-100 mg/L $CaCO_3$)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0000051	N/A	N/A	N/A
	(mg/L)	0.0005 (>100 mg/L $CaCO_3$)	0.0000206	0.0000072	0.0000214	<0.0000050	<0.0000050	0.0000122	0.0000786	N/A	0.0001100	0.0000347	0.000036
Calcium (Ca)-Total	(mg/L)	N/A	53.1	43.1	45.1	35.4	53.5	43.3	172	18.2	32.1	51.4	54.7
Chromium (Cr)-Total	(mg/L)	0.0089	0.00096	0.0004	0.00109	0.00058	0.00036	0.00039	0.00072	0.00037	0.00826	0.00127	0.00144
Cobalt (Co)-Total	(mg/L)	0.0009	0.00026	0.00017	0.00049	0.00046	0.00041	0.00027	**0.00822**	0.00024	**0.00343**	0.0006	**0.00146**
Copper (Cu)-Total****	(mg/L)	0.001 (0-20 mg/L CaCO3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(mg/L)	0.005 (>20 mg/L CaCO3)	0.00366	0.00192	0.00321	0.00122	0.00068	0.00223	0.00229	0.00123	0.00805	0.00415	0.00286

Notes:

PWQO - Provincial Water Quality Objectives. **Bold indicates exceedance of PWQO criteria**

* - Alkalinity should not be decreased by more than 25% of the natual conditions (Site 8)

** - indicates criterion is pH and temperature dependent

*** - indicates criterion is pH dependent

**** - indicates criteria are Alkalinity dependent

Mosquito Creek Update 2022
Laboratory Water Quality Results Summary Tables July

Laboratory Water Quality Results for July 13, 2022

Parameter	Units	PWQO Criterion	MC1 - Mosquito Creek SITE #1	MC2 - Mosquito Creek SITE #2	MC3 - Mosquito Creek SITE #3	MC4 - Mosquito Creek SITE #4	MC5 - Mosquito Creek Site #5	MC 6 - Mosquito Creek Site #6	MC 7 - Mosquito Creek Site #7	MC 8 - Mosquito Creek Site #8	MC 9 - Mosquito Creek Site #9	MC 10 - Mosquito Creek Site #10	Averages
			13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	July
Total Metals Continued													
Iron (Fe)-Total	(mg/L)	0.3	**0.276**	**0.407**	**0.748**	**1.400**	**0.935**	0.194	**24.200**	**0.827**	**7.820**	**0.843**	**3.765**
Lead (Pb)-Total****	(mg/L)	0.001 (<30 mg/L CaCO3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(mg/L)	0.003 (30-80 mg/L CaCO3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(mg/L)	0.005 (>80 mg/L $CaCO_3$)	0.000066	<0.000050	0.000212	0.000064	<0.000050	0.000056	0.000058	<0.000050	0.00158	0.000247	0.000326
Lithium (Li)-Total	(mg/L)	N/A	0.0053	0.0025	0.0063	0.0019	0.0035	0.0046	0.0098	0.0013	0.0058	0.0069	0.0048
Magnesium (Mg)-Total	(mg/L)	N/A	20.8	16.7	16.9	15.0	24.5	15.6	71.1	8.4	15.6	20.3	22.5
Manganese (Mn)-Total	(mg/L)	N/A	0.067	0.268	0.060	0.513	0.569	0.034	6.220	0.109	0.917	0.107	0.886
Molybdenum (Mo)-Total	(mg/L)	0.04	0.00158	0.00068	0.00113	0.0010	0.00083	0.00088	0.00131	0.00028	0.00083	0.00134	0.00099
Nickel (Ni)-Total	(mg/L)	0.025	0.00303	0.00149	0.00332	0.0020	0.00237	0.00290	0.00376	0.00133	0.00748	0.00362	0.00313
Potassium (K)-Total	(mg/L)	N/A	2.16	1.23	2.01	1.27	1.17	1.64	5.48	0.28	1.32	2.27	1.88
Selenium (Se)-Total	(mg/L)	0.1	0.000155	0.000133	0.000143	0.000162	0.000198	0.000105	0.000292	0.000157	0.000296	0.000149	0.000179
Silver (Ag)-Total	(mg/L)	0.0001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000028	<0.000010	<0.000010
Sodium (Na)-Total	(mg/L)	N/A	43.0	24.6	54.9	28.0	60.3	58.6	497.0	2.4	7.0	56.8	83.3
Strontium (Sr)-Total	(mg/L)	N/A	0.155	0.086	0.193	0.092	0.148	0.103	0.523	0.039	0.0845	0.226	0.165
Tellurium (Te)-Total	(mg/L)	N/A	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020
Thallium (Tl)-Total	(mg/L)	0.0003	<0.000010	<0.000010	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000044	<0.000010	0.000029
Tin (Sn)-Total	(mg/L)	N/A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	(mg/L)	N/A	0.00504	0.00205	0.0139	0.00179	0.00069	0.00205	0.00432	0.00124	0.0947	0.0195	0.0145
Tungsten (W)-Total	(mg/L)	0.03	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium (U)-Total	(mg/L)	0.005	0.00104	0.00051	0.00085	0.00032	0.00067	0.00077	0.00190	0.00008	0.00069	0.00106	0.00079
Vanadium (V)-Total	(mg/L)	0.006	0.00199	0.00073	0.00271	0.00106	0.00085	0.00072	0.00286	0.00090	**0.00945**	0.00348	0.00248
Zinc (Zn)-Total	(mg/L)	0.02 (interim)	<0.0030	<0.0030	0.0034	<0.0030	<0.0030	<0.0030	0.00950	<0.0030	**0.0225**	0.0037	0.0098
Zirconium (Zr)-Total	(mg/L)	0.004	0.00026	<0.00020	0.00035	0.00022	<0.00020	<0.00020	0.00041	<0.00020	0.00112	0.00046	0.00047

Notes:

PWQO - Provincial Water Quality Objectives. **Bold indicates exceedance of PWQO criteria**

* - Alkalinity should not be decreased by more than 25% of the natual conditions (Site 8)

** - indicates criterion is pH and temperature dependent

*** - indicates criterion is pH dependent

**** - indicates criteria are Alkalinity dependent

Appendix M:

Laboratory Certificates of Analysis and Test Results

LAKEHEAD REGION CONSERVATION AUTHORITY - TB
ATTN: Gail Willis
Lakehead Region Conservation Authority
130 Conservation Road PO Box 10427
Thunder Bay ON P7B 6T8

Date Received: 14-JUN-22
Report Date: 06-JUL-22 14:29 (MT)
Version: FINAL

Client Phone: 807-344-5857

Certificate of Analysis

Lab Work Order #: L2714858

Project P.O. #: NOT SUBMITTED
Job Reference: MOSQUITO CREEK
C of C Numbers:
Legal Site Desc:

Stephanie Finley
Project Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-1 MC1 - MOSQUITO CREEK SITE #1 Sampled By: EJ on 14-JUN-22 @ 13:10 Matrix: Grab							
Physical Tests							
Conductivity (EC)	420		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	156	HTC	0.50	mg/L		21-JUN-22	
pH	8.10		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	255		20	mg/L		15-JUN-22	R5802962
Turbidity	13.4		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	145		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0137		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	45.7		0.10	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrate (as N)	0.104		0.020	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	16-JUN-22	R5804158
Total Kjeldahl Nitrogen	0.587		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0253		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	9.90		0.30	mg/L	15-JUN-22	16-JUN-22	R5804158
Bacteriological Tests							
Escherichia Coli	67		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	>2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.513		0.0030	mg/L	15-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00091		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0579		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	15-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.015		0.010	mg/L	15-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000268		0.0000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	38.0		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	0.000044		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00123		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00046		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00454		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.899		0.010	mg/L	15-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000276		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0032		0.0010	mg/L	15-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	15.0		0.0050	mg/L	15-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0383		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000805		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00218		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	<0.030		0.030	mg/L	15-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	1.46		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00136		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000154		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-1 MC1 - MOSQUITO CREEK SITE #1 Sampled By: EJ on 14-JUN-22 @ 13:10 Matrix: Grab							
Total Metals							
Silicon (Si)-Total	5.18		0.10	mg/L	15-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	27.0		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.0946		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	3.38		0.50	mg/L	15-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.0180		0.00030	mg/L	15-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000584		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00298		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	0.0041		0.0030	mg/L	15-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00041		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-2 MC2 - MOSQUITO CREEK SITE #2 Sampled By: EJ on 14-JUN-22 @ 12:45 Matrix: Grab							
Physical Tests							
Conductivity (EC)	204		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	92.8	HTC	0.50	mg/L		21-JUN-22	
pH	7.79		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	147		13	mg/L		15-JUN-22	R5802962
Turbidity	4.25		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	86.5		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0134		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	12.1		0.10	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrate (as N)	<0.020		0.020	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	16-JUN-22	R5804158
Total Kjeldahl Nitrogen	0.552		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0211		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	6.20		0.30	mg/L	15-JUN-22	16-JUN-22	R5804158
Bacteriological Tests							
Escherichia Coli	36		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	>2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.176		0.0030	mg/L	15-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00059		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0129		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-2 MC2 - MOSQUITO CREEK SITE #2 Sampled By: EJ on 14-JUN-22 @ 12:45 Matrix: Grab							
Total Metals							
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	15-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.012		0.010	mg/L	15-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000188		0.0000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	22.1		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	0.000016		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00067		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00020		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00365		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.471		0.010	mg/L	15-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000128		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0015		0.0010	mg/L	15-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	9.12		0.0050	mg/L	15-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0765		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000486		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00116		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	<0.030		0.030	mg/L	15-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	0.964		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00073		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000137		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	5.94		0.10	mg/L	15-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	9.49		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.0443		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	1.95		0.50	mg/L	15-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00572		0.00030	mg/L	15-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000169		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00133		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	0.0083		0.0030	mg/L	15-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00025		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-3 MC3 - MOSQUITO CREEK SITE #3 Sampled By: EJ on 14-JUN-22 @ 11:55 Matrix: Grab							
Physical Tests							
Conductivity (EC)	500		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	173	HTC	0.50	mg/L		21-JUN-22	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-3 MC3 - MOSQUITO CREEK SITE #3 Sampled By: EJ on 14-JUN-22 @ 11:55 Matrix: Grab							
Physical Tests							
pH	8.12		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	292		20	mg/L		15-JUN-22	R5802962
Turbidity	5.79		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	166		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0167		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	61.4		0.10	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrate (as N)	0.171		0.020	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	16-JUN-22	R5804158
Total Kjeldahl Nitrogen	0.726		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0226		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	9.39		0.30	mg/L	15-JUN-22	16-JUN-22	R5804158
Bacteriological Tests							
Escherichia Coli	15		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	>2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.144		0.0030	mg/L	15-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00077		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0783		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	15-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.016		0.010	mg/L	15-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000327		0.0000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	41.8		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	0.000013		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00062		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00031		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00317		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.543		0.010	mg/L	15-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000105		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0033		0.0010	mg/L	15-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	16.6		0.0050	mg/L	15-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0534		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000811		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00227		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	0.032		0.030	mg/L	15-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	1.70		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00106		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000147		0.000050	mg/L	15-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	4.15		0.10	mg/L	15-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-3 MC3 - MOSQUITO CREEK SITE #3 Sampled By: EJ on 14-JUN-22 @ 11:55 Matrix: Grab							
Total Metals							
Sodium (Na)-Total	39.4		0.050	mg/L	15-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.119		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	3.36		0.50	mg/L	15-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00476		0.00030	mg/L	15-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	15-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000671		0.000010	mg/L	15-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00181		0.00050	mg/L	15-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	0.0034		0.0030	mg/L	15-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00025		0.00020	mg/L	15-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-4 MC4 - MOSQUITO CREEK SITE #4 Sampled By: EJ on 14-JUN-22 @ 11:40 Matrix: Grab							
Physical Tests							
Conductivity (EC)	237		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	98.8	HTC	0.50	mg/L		21-JUN-22	
pH	7.87		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	151		13	mg/L		16-JUN-22	R5803911
Turbidity	3.88		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	100		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0079		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	17.3		0.10	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrate (as N)	<0.020		0.020	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	16-JUN-22	R5804158
Total Kjeldahl Nitrogen	0.722		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0336		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	1.97		0.30	mg/L	15-JUN-22	16-JUN-22	R5804158
Bacteriological Tests							
Escherichia Coli	58		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	>2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.130		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00089		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0172		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-4 MC4 - MOSQUITO CREEK SITE #4 Sampled By: EJ on 14-JUN-22 @ 11:40 Matrix: Grab							
Total Metals							
Boron (B)-Total	0.011		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000208		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	23.3		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	0.000011		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00064		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00030		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00265		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.805		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000095		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0011		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	9.90		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.152		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000681		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00139		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	0.031		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	1.29		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00078		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000240		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	3.44		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	12.8		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.0517		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	0.66		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00427		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000236		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00164		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00028		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-5 MC5 - MOSQUITO CREEK SITE #5 Sampled By: EJ on 14-JUN-22 @ 11:30 Matrix: Grab							
Physical Tests							
Conductivity (EC)	538		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	198	HTC	0.50	mg/L		21-JUN-22	
pH	8.23		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	320		20	mg/L		16-JUN-22	R5803911

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-5 MC5 - MOSQUITO CREEK SITE #5 Sampled By: EJ on 14-JUN-22 @ 11:30 Matrix: Grab							
Physical Tests							
Turbidity	2.10		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	181		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0103		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	67.2		0.10	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrate (as N)	<0.020		0.020	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	16-JUN-22	R5804158
Total Kjeldahl Nitrogen	0.760		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0410		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	8.32		0.30	mg/L	15-JUN-22	16-JUN-22	R5804158
Bacteriological Tests							
Escherichia Coli	33		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.0367		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00085		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0331		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.011		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000208		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	45.8		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00049		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00031		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00149		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.678		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0020		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	20.3		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.188		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000847		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00183		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	0.052		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	1.31		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00068		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000144		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	3.35		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	37.8		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.100		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-5 MC5 - MOSQUITO CREEK SITE #5 Sampled By: EJ on 14-JUN-22 @ 11:30 Matrix: Grab							
Total Metals							
Sulfur (S)-Total	3.08		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00142		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000812		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00121		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00022		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-6 MC6 - MOSQUITO CREEK SITE #6 Sampled By: EJ on 14-JUN-22 @ 11:05 Matrix: Grab							
Physical Tests							
Conductivity (EC)	950		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	297	HTC	0.50	mg/L		21-JUN-22	
pH	8.42		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	554		20	mg/L		16-JUN-22	R5803911
Turbidity	1.43		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	297		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0246		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	140		0.50	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrate (as N)	0.68		0.10	mg/L	15-JUN-22	16-JUN-22	R5804158
Nitrite (as N)	<0.050	DLDS	0.050	mg/L	15-JUN-22	16-JUN-22	R5804158
Total Kjeldahl Nitrogen	0.560		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0086		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	24.9		1.5	mg/L	15-JUN-22	16-JUN-22	R5804158
Bacteriological Tests							
Escherichia Coli	8		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	>2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.0328		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00052		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0486		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.031		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000545		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-6 MC6 - MOSQUITO CREEK SITE #6 Sampled By: EJ on 14-JUN-22 @ 11:05 Matrix: Grab							
Total Metals							
Calcium (Ca)-Total	72.9		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00040		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00053		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00373		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.146		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0065		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	28.0		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0724		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.00114		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00457		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	<0.030		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	2.76		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00183		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000118		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	6.94		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	94.1		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.162		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	9.93		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00104		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.00142		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00099		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	0.0057		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-7 MC7 - MOSQUITO CREEK SITE #7 Sampled By: EJ on 14-JUN-22 @ 10:30 Matrix: Grab							
Physical Tests							
Conductivity (EC)	432		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	177	HTC	0.50	mg/L		21-JUN-22	
pH	8.14		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	276		20	mg/L		16-JUN-22	R5803911
Turbidity	4.30		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-7 MC7 - MOSQUITO CREEK SITE #7 Sampled By: EJ on 14-JUN-22 @ 10:30 Matrix: Grab							
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	165		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0220		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	43.8		0.10	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrate (as N)	0.030		0.020	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	17-JUN-22	R5804739
Total Kjeldahl Nitrogen	0.834		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0631		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	6.48		0.30	mg/L	15-JUN-22	17-JUN-22	R5804739
Bacteriological Tests							
Escherichia Coli	96		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	>2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.132		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00084		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0221		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.010		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000297		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	39.1		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00066		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00039		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00198		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.666		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000065		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0017		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	19.2		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0850		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000936		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00193		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	0.069		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	1.10		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00083		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000167		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	3.96		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	25.9		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.0803		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	2.29		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-7 MC7 - MOSQUITO CREEK SITE #7 Sampled By: EJ on 14-JUN-22 @ 10:30 Matrix: Grab							
Total Metals							
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00430		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000943		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00176		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00021		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-8 MC8 - MOSQUITO CREEK SITE #8 Sampled By: EJ on 14-JUN-22 @ 10:10 Matrix: Grab							
Physical Tests							
Conductivity (EC)	128		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	68.6	HTC	0.50	mg/L		21-JUN-22	
pH	7.69		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	107		13	mg/L		16-JUN-22	R5803911
Turbidity	2.86		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	69.5		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0442		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	1.60		0.10	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrate (as N)	<0.020		0.020	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	17-JUN-22	R5804739
Total Kjeldahl Nitrogen	0.774		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0268		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	0.66		0.30	mg/L	15-JUN-22	17-JUN-22	R5804739
Bacteriological Tests							
Escherichia Coli	14		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.122		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00075		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0107		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	<0.010		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000198		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	15.6		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-8 MC8 - MOSQUITO CREEK SITE #8 Sampled By: EJ on 14-JUN-22 @ 10:10 Matrix: Grab							
Total Metals							
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00075		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00019		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00301		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.663		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000068		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	<0.0010		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	7.21		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0699		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000358		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00140		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	<0.030		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	0.935		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00057		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000169		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	3.97		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	2.66		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.0303		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	<0.50		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00367		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000185		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00156		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00029		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-9 MC9 - MOSQUITO CREEK SITE #9 Sampled By: EJ on 14-JUN-22 @ 09:30 Matrix: Grab							
Physical Tests							
Conductivity (EC)	206		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	100	HTC	0.50	mg/L		21-JUN-22	
pH	7.93		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	147		13	mg/L		16-JUN-22	R5803911
Turbidity	2.00		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	94.2		2.0	mg/L		04-JUL-22	R5814417

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-9 MC9 - MOSQUITO CREEK SITE #9 Sampled By: EJ on 14-JUN-22 @ 09:30 Matrix: Grab							
Anions and Nutrients							
Ammonia, Total (as N)	<0.0050		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	10.8		0.10	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrate (as N)	<0.020		0.020	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	17-JUN-22	R5804739
Total Kjeldahl Nitrogen	0.787		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0224		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	4.42		0.30	mg/L	15-JUN-22	17-JUN-22	R5804739
Bacteriological Tests							
Escherichia Coli	99		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.0717		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00061		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0136		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	<0.010		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000208		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	23.0		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Chromium (Cr)-Total	0.00053		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00020		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00221		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.595		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	<0.0010		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	10.4		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0625		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000380		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00143		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	<0.030		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	0.868		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00061		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000168		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	3.64		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	6.63		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.0516		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	1.56		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-9 MC9 - MOSQUITO CREEK SITE #9 Sampled By: EJ on 14-JUN-22 @ 09:30 Matrix: Grab							
Total Metals							
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00239		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000115		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00127		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00021		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							
L2714858-10 MC10 - MOSQUITO CREEK SITE #10 Sampled By: EJ on 14-JUN-22 @ 12:20 Matrix: Grab							
Physical Tests							
Conductivity (EC)	454		1.0	uS/cm		04-JUL-22	R5814417
Hardness (as CaCO3)	166	HTC	0.50	mg/L		21-JUN-22	
pH	8.14		0.10	pH		04-JUL-22	R5814417
Total Dissolved Solids	274		20	mg/L		16-JUN-22	R5803911
Turbidity	11.2		0.10	NTU		15-JUN-22	R5800357
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	157		2.0	mg/L		04-JUL-22	R5814417
Ammonia, Total (as N)	0.0129		0.0050	mg/L	15-JUN-22	16-JUN-22	R5805156
Chloride (Cl)	52.9		0.10	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrate (as N)	0.159		0.020	mg/L	15-JUN-22	17-JUN-22	R5804739
Nitrite (as N)	<0.010		0.010	mg/L	15-JUN-22	17-JUN-22	R5804739
Total Kjeldahl Nitrogen	0.628		0.050	mg/L	15-JUN-22	20-JUN-22	R5805346
Phosphorus (P)-Total	0.0272		0.0030	mg/L	16-JUN-22	20-JUN-22	R5805484
Sulfate (SO4)	9.78		0.30	mg/L	15-JUN-22	17-JUN-22	R5804739
Bacteriological Tests							
Escherichia Coli	91		0	MPN/100mL		15-JUN-22	R5802217
Total Coliforms	2420		0	MPN/100mL		15-JUN-22	R5802217
Total Metals							
Aluminum (Al)-Total	0.264		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Arsenic (As)-Total	0.00077		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Barium (Ba)-Total	0.0762		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	17-JUN-22	20-JUN-22	R5805365
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Boron (B)-Total	0.015		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cadmium (Cd)-Total	0.0000347		0.0000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Calcium (Ca)-Total	39.8		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Cesium (Cs)-Total	0.000022		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2714858-10 MC10 - MOSQUITO CREEK SITE #10 Sampled By: EJ on 14-JUN-22 @ 12:20 Matrix: Grab							
Total Metals							
Chromium (Cr)-Total	0.00086		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Cobalt (Co)-Total	0.00040		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Copper (Cu)-Total	0.00386		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Iron (Fe)-Total	0.657		0.010	mg/L	17-JUN-22	20-JUN-22	R5805365
Lead (Pb)-Total	0.000193		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Lithium (Li)-Total	0.0032		0.0010	mg/L	17-JUN-22	20-JUN-22	R5805365
Magnesium (Mg)-Total	16.2		0.0050	mg/L	17-JUN-22	20-JUN-22	R5805365
Manganese (Mn)-Total	0.0458		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Molybdenum (Mo)-Total	0.000759		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Nickel (Ni)-Total	0.00219		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Phosphorus (P)-Total	<0.030		0.030	mg/L	17-JUN-22	20-JUN-22	R5805365
Potassium (K)-Total	1.50		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Rubidium (Rb)-Total	0.00106		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Selenium (Se)-Total	0.000182		0.000050	mg/L	17-JUN-22	20-JUN-22	R5805365
Silicon (Si)-Total	4.77		0.10	mg/L	17-JUN-22	20-JUN-22	R5805365
Silver (Ag)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Sodium (Na)-Total	32.2		0.050	mg/L	17-JUN-22	20-JUN-22	R5805365
Strontium (Sr)-Total	0.111		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Sulfur (S)-Total	3.10		0.50	mg/L	17-JUN-22	20-JUN-22	R5805365
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Thorium (Th)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Tin (Sn)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Titanium (Ti)-Total	0.00951		0.00030	mg/L	17-JUN-22	20-JUN-22	R5805365
Tungsten (W)-Total	<0.00010		0.00010	mg/L	17-JUN-22	20-JUN-22	R5805365
Uranium (U)-Total	0.000635		0.000010	mg/L	17-JUN-22	20-JUN-22	R5805365
Vanadium (V)-Total	0.00241		0.00050	mg/L	17-JUN-22	20-JUN-22	R5805365
Zinc (Zn)-Total	0.0049		0.0030	mg/L	17-JUN-22	20-JUN-22	R5805365
Zirconium (Zr)-Total	0.00033		0.00020	mg/L	17-JUN-22	20-JUN-22	R5805365
Report Remarks : #REF!							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L2714858-1, -2, -3
Matrix Spike	Barium (Ba)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Boron (B)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L2714858-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2714858-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L2714858-1, -2, -3
Matrix Spike	Manganese (Mn)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Potassium (K)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Rubidium (Rb)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L2714858-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L2714858-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L2714858-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Ammonia, Total (as N)	MS-B	L2714858-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Phosphorus (P)-Total	MS-B	L2714858-1, -10, -2, -3, -4, -5, -6, -7, -8, -9

Sample Parameter Qualifier key listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-TB	Water	Alkalinity	APHA 2320B modified

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CL-L-IC-N-TB	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-TITR-TB	Water	Conductivity	APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-TB	Water	Hardness (as CaCO3)	CALCULATION
MET-T-CCMS-TB	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020B (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-F-TB	Water	Ammonia, Total (as N)	catnr 157/158 062217/99321057 (modified)

Ammonia is determined by Flow-injection analysis with fluorescence detection

NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Reference Information

P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

SO4-IC-N-TB	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TC,EC-QT97-TB	Water	Total Coliform and E.coli	APHA 9223 B

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture of hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

TKN-F-TB	Water	TKN in Water by Fluorescence	catnr 157/158, 062818/99334821

Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection

TURBIDITY-TB	Water	Turbidity	APHA 2130 B-Nephelometer

Aqueous matrices are analyzed using nephelometry with the light scatter measured at a 90” angle.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2714858 Report Date: 06-JUL-22

Client: LAKEHEAD REGION CONSERVATION AUTHORITY-TB
Lakehead Region Conservation Authority 130 Conservation Road PO Box 10427
Thunder Bay ON P7B 6T8

Contact: Gail Willis

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-TITR-TB	**Water**							
Batch R5814417								
WG3739893-3 DUP		**L2714858-1**						
Alkalinity, Total (as CaCO3)		145	143		mg/L	1.3	20	04-JUL-22
WG3739893-2 LCS								
Alkalinity, Total (as CaCO3)			98.9		%		85-115	04-JUL-22
WG3739893-1 MB								
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	04-JUL-22
CL-L-IC-N-TB	**Water**							
Batch R5804158								
WG3739904-2 LCS								
Chloride (Cl)			99.5		%		90-110	16-JUN-22
WG3739904-1 MB								
Chloride (Cl)			<0.10		mg/L		0.1	16-JUN-22
Batch R5804739								
WG3739907-3 DUP		**L2714858-7**						
Chloride (Cl)		43.8	43.7		mg/L	0.1	20	17-JUN-22
WG3739907-2 LCS								
Chloride (Cl)			108.4		%		90-110	17-JUN-22
WG3739907-1 MB								
Chloride (Cl)			<0.10		mg/L		0.1	17-JUN-22
WG3739907-4 MS		**L2714858-8**						
Chloride (Cl)			105.8		%		75-125	17-JUN-22
EC-TITR-TB	**Water**							
Batch R5814417								
WG3739893-3 DUP		**L2714858-1**						
Conductivity (EC)		420	418		uS/cm	0.5	10	04-JUL-22
WG3739893-2 LCS								
Conductivity (EC)			98.0		%		90-110	04-JUL-22
WG3739893-1 MB								
Conductivity (EC)			<1.0		uS/cm		2	04-JUL-22
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3739920-7 DUP		**L2714858-2**						
Aluminum (Al)-Total		0.176	0.177		mg/L	0.5	20	20-JUN-22
Antimony (Sb)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	20-JUN-22
Arsenic (As)-Total		0.00059	0.00061		mg/L	3.9	20	20-JUN-22
Barium (Ba)-Total		0.0129	0.0132		mg/L	1.9	20	20-JUN-22
Beryllium (Be)-Total		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3739920-7 DUP		**L2714858-2**						
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	20-JUN-22
Boron (B)-Total		0.012	0.012		mg/L	0.2	20	20-JUN-22
Cadmium (Cd)-Total		0.0000188	0.0000208		mg/L	10	20	20-JUN-22
Calcium (Ca)-Total		22.1	22.0		mg/L	0.5	20	20-JUN-22
Cesium (Cs)-Total		0.000016	0.000013	J	mg/L	0.000003	0.00002	20-JUN-22
Chromium (Cr)-Total		0.00067	0.00062		mg/L	7.0	20	20-JUN-22
Cobalt (Co)-Total		0.00020	0.00019		mg/L	3.6	20	20-JUN-22
Copper (Cu)-Total		0.00365	0.00359		mg/L	1.7	20	20-JUN-22
Iron (Fe)-Total		0.471	0.452		mg/L	4.1	20	20-JUN-22
Lead (Pb)-Total		0.000128	0.000113		mg/L	13	20	20-JUN-22
Lithium (Li)-Total		0.0015	0.0014		mg/L	2.9	20	20-JUN-22
Magnesium (Mg)-Total		9.12	9.05		mg/L	0.8	20	20-JUN-22
Manganese (Mn)-Total		0.0765	0.0775		mg/L	1.3	20	20-JUN-22
Molybdenum (Mo)-Total		0.000486	0.000493		mg/L	1.4	20	20-JUN-22
Nickel (Ni)-Total		0.00116	0.00117		mg/L	0.7	20	20-JUN-22
Phosphorus (P)-Total		<0.030	<0.030	RPD-NA	mg/L	N/A	20	20-JUN-22
Potassium (K)-Total		0.964	0.961		mg/L	0.4	20	20-JUN-22
Rubidium (Rb)-Total		0.00073	0.00071		mg/L	3.7	20	20-JUN-22
Selenium (Se)-Total		0.000137	0.000124		mg/L	9.5	20	20-JUN-22
Silicon (Si)-Total		5.94	5.96		mg/L	0.3	20	20-JUN-22
Silver (Ag)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	20-JUN-22
Sodium (Na)-Total		9.49	9.67		mg/L	1.8	20	20-JUN-22
Strontium (Sr)-Total		0.0443	0.0443		mg/L	0.2	20	20-JUN-22
Sulfur (S)-Total		1.95	2.20		mg/L	12	20	20-JUN-22
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	20-JUN-22
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	20-JUN-22
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	20-JUN-22
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	20-JUN-22
Titanium (Ti)-Total		0.00572	0.00581		mg/L	1.5	20	20-JUN-22
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	20-JUN-22
Uranium (U)-Total		0.000169	0.000169		mg/L	0.0	20	20-JUN-22
Vanadium (V)-Total		0.00133	0.00137		mg/L	3.0	20	20-JUN-22
Zinc (Zn)-Total		0.0083	0.0046	J	mg/L	0.0037	0.006	20-JUN-22
Zirconium (Zr)-Total		0.00025	0.00025		mg/L	1.2	20	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3739920-6 LCS								
Aluminum (Al)-Total			105.4		%		80-120	20-JUN-22
Antimony (Sb)-Total			105.1		%		80-120	20-JUN-22
Arsenic (As)-Total			105.3		%		80-120	20-JUN-22
Barium (Ba)-Total			100.5		%		80-120	20-JUN-22
Beryllium (Be)-Total			100.1		%		80-120	20-JUN-22
Bismuth (Bi)-Total			104.5		%		80-120	20-JUN-22
Boron (B)-Total			97.4		%		80-120	20-JUN-22
Cadmium (Cd)-Total			100.9		%		80-120	20-JUN-22
Calcium (Ca)-Total			103.4		%		80-120	20-JUN-22
Cesium (Cs)-Total			103.1		%		80-120	20-JUN-22
Chromium (Cr)-Total			101.8		%		80-120	20-JUN-22
Cobalt (Co)-Total			99.4		%		80-120	20-JUN-22
Copper (Cu)-Total			99.0		%		80-120	20-JUN-22
Iron (Fe)-Total			102.2		%		80-120	20-JUN-22
Lead (Pb)-Total			103.2		%		80-120	20-JUN-22
Lithium (Li)-Total			100.1		%		80-120	20-JUN-22
Magnesium (Mg)-Total			103.5		%		80-120	20-JUN-22
Manganese (Mn)-Total			100.5		%		80-120	20-JUN-22
Molybdenum (Mo)-Total			103.9		%		80-120	20-JUN-22
Nickel (Ni)-Total			106.5		%		80-120	20-JUN-22
Phosphorus (P)-Total			104.7		%		80-120	20-JUN-22
Potassium (K)-Total			109.1		%		80-120	20-JUN-22
Rubidium (Rb)-Total			104.8		%		80-120	20-JUN-22
Selenium (Se)-Total			108.1		%		80-120	20-JUN-22
Silicon (Si)-Total			104.7		%		80-120	20-JUN-22
Silver (Ag)-Total			96.0		%		80-120	20-JUN-22
Sodium (Na)-Total			108.3		%		80-120	20-JUN-22
Strontium (Sr)-Total			96.1		%		80-120	20-JUN-22
Sulfur (S)-Total			102.1		%		80-120	20-JUN-22
Tellurium (Te)-Total			104.4		%		80-120	20-JUN-22
Thallium (Tl)-Total			103.5		%		80-120	20-JUN-22
Thorium (Th)-Total			100.5		%		80-120	20-JUN-22
Tin (Sn)-Total			103.0		%		80-120	20-JUN-22
Titanium (Ti)-Total			101.6		%		80-120	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3739920-6 LCS								
Tungsten (W)-Total			104.6		%		80-120	20-JUN-22
Uranium (U)-Total			103.8		%		80-120	20-JUN-22
Vanadium (V)-Total			102.8		%		80-120	20-JUN-22
Zinc (Zn)-Total			102.8		%		80-120	20-JUN-22
Zirconium (Zr)-Total			102.1		%		80-120	20-JUN-22
WG3740845-2 LCS								
Aluminum (Al)-Total			105.8		%		80-120	20-JUN-22
Antimony (Sb)-Total			105.0		%		80-120	20-JUN-22
Arsenic (As)-Total			103.7		%		80-120	20-JUN-22
Barium (Ba)-Total			101.0		%		80-120	20-JUN-22
Beryllium (Be)-Total			102.0		%		80-120	20-JUN-22
Bismuth (Bi)-Total			103.3		%		80-120	20-JUN-22
Boron (B)-Total			96.7		%		80-120	20-JUN-22
Cadmium (Cd)-Total			100.6		%		80-120	20-JUN-22
Calcium (Ca)-Total			103.2		%		80-120	20-JUN-22
Cesium (Cs)-Total			101.4		%		80-120	20-JUN-22
Chromium (Cr)-Total			98.1		%		80-120	20-JUN-22
Cobalt (Co)-Total			98.6		%		80-120	20-JUN-22
Copper (Cu)-Total			97.0		%		80-120	20-JUN-22
Iron (Fe)-Total			101.2		%		80-120	20-JUN-22
Lead (Pb)-Total			102.8		%		80-120	20-JUN-22
Lithium (Li)-Total			100.6		%		80-120	20-JUN-22
Magnesium (Mg)-Total			103.6		%		80-120	20-JUN-22
Manganese (Mn)-Total			99.0		%		80-120	20-JUN-22
Molybdenum (Mo)-Total			102.6		%		80-120	20-JUN-22
Nickel (Ni)-Total			106.3		%		80-120	20-JUN-22
Phosphorus (P)-Total			101.5		%		80-120	20-JUN-22
Potassium (K)-Total			107.8		%		80-120	20-JUN-22
Rubidium (Rb)-Total			101.3		%		80-120	20-JUN-22
Selenium (Se)-Total			104.8		%		80-120	20-JUN-22
Silicon (Si)-Total			105.9		%		80-120	20-JUN-22
Silver (Ag)-Total			95.5		%		80-120	20-JUN-22
Sodium (Na)-Total			107.7		%		80-120	20-JUN-22
Strontium (Sr)-Total			95.4		%		80-120	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3740845-2 LCS								
Sulfur (S)-Total			103.3		%		80-120	20-JUN-22
Tellurium (Te)-Total			102.5		%		80-120	20-JUN-22
Thallium (Tl)-Total			102.6		%		80-120	20-JUN-22
Thorium (Th)-Total			99.9		%		80-120	20-JUN-22
Tin (Sn)-Total			101.3		%		80-120	20-JUN-22
Titanium (Ti)-Total			106.7		%		80-120	20-JUN-22
Tungsten (W)-Total			105.5		%		80-120	20-JUN-22
Uranium (U)-Total			102.3		%		80-120	20-JUN-22
Vanadium (V)-Total			101.8		%		80-120	20-JUN-22
Zinc (Zn)-Total			103.9		%		80-120	20-JUN-22
Zirconium (Zr)-Total			100.4		%		80-120	20-JUN-22
WG3739920-5 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	20-JUN-22
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Arsenic (As)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Barium (Ba)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	20-JUN-22
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Boron (B)-Total			<0.010		mg/L		0.01	20-JUN-22
Cadmium (Cd)-Total			<0.000005C		mg/L		0.000005	20-JUN-22
Calcium (Ca)-Total			<0.050		mg/L		0.05	20-JUN-22
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Copper (Cu)-Total			<0.00050		mg/L		0.0005	20-JUN-22
Iron (Fe)-Total			<0.010		mg/L		0.01	20-JUN-22
Lead (Pb)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Lithium (Li)-Total			<0.0010		mg/L		0.001	20-JUN-22
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	20-JUN-22
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	20-JUN-22
Phosphorus (P)-Total			<0.030		mg/L		0.03	20-JUN-22
Potassium (K)-Total			<0.050		mg/L		0.05	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3739920-5 MB								
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	20-JUN-22
Selenium (Se)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Silicon (Si)-Total			<0.10		mg/L		0.1	20-JUN-22
Silver (Ag)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Sodium (Na)-Total			<0.050		mg/L		0.05	20-JUN-22
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	20-JUN-22
Sulfur (S)-Total			<0.50		mg/L		0.5	20-JUN-22
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	20-JUN-22
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Thorium (Th)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Tin (Sn)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	20-JUN-22
Tungsten (W)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Uranium (U)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Vanadium (V)-Total			<0.00050		mg/L		0.0005	20-JUN-22
Zinc (Zn)-Total			<0.0030		mg/L		0.003	20-JUN-22
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	20-JUN-22
WG3740845-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	20-JUN-22
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Arsenic (As)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Barium (Ba)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	20-JUN-22
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Boron (B)-Total			<0.010		mg/L		0.01	20-JUN-22
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	20-JUN-22
Calcium (Ca)-Total			<0.050		mg/L		0.05	20-JUN-22
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Copper (Cu)-Total			<0.00050		mg/L		0.0005	20-JUN-22
Iron (Fe)-Total			<0.010		mg/L		0.01	20-JUN-22
Lead (Pb)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Lithium (Li)-Total			<0.0010		mg/L		0.001	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3740845-1 MB								
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	20-JUN-22
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	20-JUN-22
Phosphorus (P)-Total			<0.030		mg/L		0.03	20-JUN-22
Potassium (K)-Total			<0.050		mg/L		0.05	20-JUN-22
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	20-JUN-22
Selenium (Se)-Total			<0.000050		mg/L		0.00005	20-JUN-22
Silicon (Si)-Total			<0.10		mg/L		0.1	20-JUN-22
Silver (Ag)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Sodium (Na)-Total			<0.050		mg/L		0.05	20-JUN-22
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	20-JUN-22
Sulfur (S)-Total			<0.50		mg/L		0.5	20-JUN-22
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	20-JUN-22
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Thorium (Th)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Tin (Sn)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	20-JUN-22
Tungsten (W)-Total			<0.00010		mg/L		0.0001	20-JUN-22
Uranium (U)-Total			<0.000010		mg/L		0.00001	20-JUN-22
Vanadium (V)-Total			<0.00050		mg/L		0.0005	20-JUN-22
Zinc (Zn)-Total			<0.0030		mg/L		0.003	20-JUN-22
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	20-JUN-22
WG3739920-8 MS		**L2714858-3**						
Aluminum (Al)-Total			128.5		%		70-130	20-JUN-22
Antimony (Sb)-Total			106.2		%		70-130	20-JUN-22
Arsenic (As)-Total			104.0		%		70-130	20-JUN-22
Barium (Ba)-Total			N/A	MS-B	%		-	20-JUN-22
Beryllium (Be)-Total			98.9		%		70-130	20-JUN-22
Bismuth (Bi)-Total			98.7		%		70-130	20-JUN-22
Boron (B)-Total			96.2		%		70-130	20-JUN-22
Cadmium (Cd)-Total			103.8		%		70-120	20-JUN-22
Calcium (Ca)-Total			N/A	MS-B	%		-	20-JUN-22
Cesium (Cs)-Total			103.5		%		70-130	20-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5805365								
WG3739920-8 MS		**L2714858-3**						
Chromium (Cr)-Total			102.6		%		70-130	20-JUN-22
Cobalt (Co)-Total			100.0		%		70-130	20-JUN-22
Copper (Cu)-Total			98.7		%		70-130	20-JUN-22
Iron (Fe)-Total			101.6		%		70-130	20-JUN-22
Lead (Pb)-Total			101.3		%		70-130	20-JUN-22
Lithium (Li)-Total			100.9		%		70-130	20-JUN-22
Magnesium (Mg)-Total			N/A	MS-B	%		-	20-JUN-22
Manganese (Mn)-Total			N/A	MS-B	%		-	20-JUN-22
Molybdenum (Mo)-Total			104.5		%		70-130	20-JUN-22
Nickel (Ni)-Total			108.8		%		70-130	20-JUN-22
Phosphorus (P)-Total			103.5		%		70-130	20-JUN-22
Potassium (K)-Total			101.7		%		70-130	20-JUN-22
Rubidium (Rb)-Total			102.4		%		70-130	20-JUN-22
Selenium (Se)-Total			108.2		%		70-130	20-JUN-22
Silicon (Si)-Total			94.3		%		70-130	20-JUN-22
Silver (Ag)-Total			104.1		%		70-130	20-JUN-22
Sodium (Na)-Total			N/A	MS-B	%		-	20-JUN-22
Strontium (Sr)-Total			N/A	MS-B	%		-	20-JUN-22
Sulfur (S)-Total			97.1		%		70-130	20-JUN-22
Tellurium (Te)-Total			100.7		%		70-130	20-JUN-22
Thallium (Tl)-Total			96.6		%		70-130	20-JUN-22
Thorium (Th)-Total			106.9		%		70-130	20-JUN-22
Tin (Sn)-Total			102.8		%		70-130	20-JUN-22
Titanium (Ti)-Total			108.9		%		70-130	20-JUN-22
Tungsten (W)-Total			103.3		%		70-130	20-JUN-22
Uranium (U)-Total			104.0		%		70-130	20-JUN-22
Vanadium (V)-Total			103.3		%		70-130	20-JUN-22
Zinc (Zn)-Total			103.6		%		70-130	20-JUN-22
Zirconium (Zr)-Total			101.7		%		70-130	20-JUN-22
NH3-F-TB	**Water**							
Batch R5805156								
WG3740041-2 LCS								
Ammonia, Total (as N)			94.8		%		85-115	16-JUN-22
WG3740041-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-TB	**Water**							
Batch R5805156								
WG3740041-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	16-JUN-22
NO2-IC-N-TB	**Water**							
Batch R5804158								
WG3739904-2 LCS								
Nitrite (as N)			95.5		%		90-110	16-JUN-22
WG3739904-1 MB								
Nitrite (as N)			<0.010		mg/L		0.01	16-JUN-22
Batch R5804739								
WG3739907-3 DUP		**L2714858-7**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	17-JUN-22
WG3739907-2 LCS								
Nitrite (as N)			103.4		%		90-110	17-JUN-22
WG3739907-1 MB								
Nitrite (as N)			<0.010		mg/L		0.01	17-JUN-22
WG3739907-4 MS		**L2714858-8**						
Nitrite (as N)			98.0		%		75-125	17-JUN-22
NO3-IC-N-TB	**Water**							
Batch R5804158								
WG3739904-2 LCS								
Nitrate (as N)			97.1		%		90-110	16-JUN-22
WG3739904-1 MB								
Nitrate (as N)			<0.020		mg/L		0.02	16-JUN-22
Batch R5804739								
WG3739907-3 DUP		**L2714858-7**						
Nitrate (as N)		0.030	0.029		mg/L	4.3	20	17-JUN-22
WG3739907-2 LCS								
Nitrate (as N)			107.0		%		90-110	17-JUN-22
WG3739907-1 MB								
Nitrate (as N)			<0.020		mg/L		0.02	17-JUN-22
WG3739907-4 MS		**L2714858-8**						
Nitrate (as N)			103.2		%		75-125	17-JUN-22
P-T-COL-TB	**Water**							
Batch R5805484								
WG3740055-2 LCS								
Phosphorus (P)-Total			93.5		%		80-120	20-JUN-22
WG3740055-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-TB	**Water**							
Batch R5805484								
WG3740055-1 MB								
Phosphorus (P)-Total			<0.0030		mg/L		0.003	20-JUN-22
PH-TITR-TB	**Water**							
Batch R5814417								
WG3739893-3 DUP		**L2714858-1**						
pH		8.10	8.11	J	pH	0.01	0.2	04-JUL-22
WG3739893-2 LCS								
pH			6.90		pH		6.9-7.1	04-JUL-22
SO4-IC-N-TB	**Water**							
Batch R5804158								
WG3739904-2 LCS								
Sulfate (SO4)			101.3		%		90-110	16-JUN-22
WG3739904-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	16-JUN-22
Batch R5804739								
WG3739907-3 DUP		**L2714858-7**						
Sulfate (SO4)		6.48	6.45		mg/L	0.4	20	17-JUN-22
WG3739907-2 LCS								
Sulfate (SO4)			109.6		%		90-110	17-JUN-22
WG3739907-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	17-JUN-22
WG3739907-4 MS		**L2714858-8**						
Sulfate (SO4)			106.5		%		75-125	17-JUN-22
TC,EC-QT97-TB	**Water**							
Batch R5802217								
WG3739948-1 MB								
Total Coliforms			0		MPN/100mL		1	15-JUN-22
Escherichia Coli			0		MPN/100mL		1	15-JUN-22
COMMENTS: #REF!								
TDS-TB	**Water**							
Batch R5802962								
WG3740049-2 LCS								
Total Dissolved Solids			90.1		%		85-115	15-JUN-22
WG3740049-1 MB								
Total Dissolved Solids			<10		mg/L		10	15-JUN-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TDS-TB	**Water**							
Batch R5803911								
WG3740305-3 DUP		**L2714858-4**						
Total Dissolved Solids		151	156		mg/L	3.7	20	16-JUN-22
WG3740305-2 LCS								
Total Dissolved Solids			99.0		%		85-115	16-JUN-22
WG3740305-1 MB								
Total Dissolved Solids			<10		mg/L		10	16-JUN-22
TKN-F-TB	**Water**							
Batch R5805346								
WG3739921-2 LCS								
Total Kjeldahl Nitrogen			103.2		%		75-125	20-JUN-22
WG3739921-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	20-JUN-22
TURBIDITY-TB	**Water**							
Batch R5800357								
WG3739776-2 LCS								
Turbidity			98.0		%		85-115	15-JUN-22
WG3739776-1 MB								
Turbidity			<0.10		NTU		0.1	15-JUN-22

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	14-JUN-22 13:10	04-JUL-22 16:03	4	20	days	EHT
	2	14-JUN-22 12:45	04-JUL-22 16:03	4	20	days	EHT
	3	14-JUN-22 11:55	04-JUL-22 16:03	4	20	days	EHT
	4	14-JUN-22 11:40	04-JUL-22 16:03	4	20	days	EHT
	5	14-JUN-22 11:30	04-JUL-22 16:03	4	20	days	EHT
	6	14-JUN-22 11:05	04-JUL-22 16:03	4	20	days	EHT
	7	14-JUN-22 10:30	04-JUL-22 16:03	4	20	days	EHT
	8	14-JUN-22 10:10	04-JUL-22 16:03	4	20	days	EHT
	9	14-JUN-22 09:30	04-JUL-22 16:03	4	20	days	EHT
	10	14-JUN-22 12:20	04-JUL-22 16:03	4	20	days	EHT
Leachable Anions & Nutrients							
Alkalinity							
	1	14-JUN-22 13:10	04-JUL-22 16:03	14	20	days	EHT
	2	14-JUN-22 12:45	04-JUL-22 16:03	14	20	days	EHT
	3	14-JUN-22 11:55	04-JUL-22 16:03	14	20	days	EHT
	4	14-JUN-22 11:40	04-JUL-22 16:03	14	20	days	EHT
	5	14-JUN-22 11:30	04-JUL-22 16:03	14	20	days	EHT
	6	14-JUN-22 11:05	04-JUL-22 16:03	14	20	days	EHT
	7	14-JUN-22 10:30	04-JUL-22 16:03	14	20	days	EHT
	8	14-JUN-22 10:10	04-JUL-22 16:03	14	20	days	EHT
	9	14-JUN-22 09:30	04-JUL-22 16:03	14	20	days	EHT
	10	14-JUN-22 12:20	04-JUL-22 16:03	14	20	days	EHT

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2714858 were received on 14-JUN-22 14:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

L2714858-COFC

Istody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 22 -

Page of

L2714858

www.alsglob

Report To	Contact and company name below will appear on the final report
Company:	Lakehead Region Conservation Authority
Contact:	Gail Willis/Scott Drebit
Phone:	807-344-5857 ext223
	Company address below will appear on the final report
Street:	130 Conservation rd PO Box 10427
City/Province:	Thunder Bay, ON
Postal Code:	P7B 6T8
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	City of Thunder Bay - Infrastructure and Operations Dept
Contact:	Aaron Ward - 807-625-2444

Reports / Recipients	
Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA	☐ YES ☑ NO ☐ N/A
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gailw@lakeheadca.com
Email 2	scott@lakeheadca.com
Email 3	

Invoice Recipients	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	aaron.ward@thunderbay.ca
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	18510 / Q89663	AFE/Cost Center:	PO#
Job #:	Mosquito Creek	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):		ALS Contact:	Sampler: E. JOHNSTON

Turnaround Time (TAT) Requested

- ☑ Routine [R] if received by 3pm M-F - no surcharges apply
- ☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
- ☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
- ☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
- ☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
- ☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.

Additional fees may apply to rush requests on weekends, statutory holidays and for non-routine tests.

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Alkalinity, Conductivity, pH	Chloride, Nitrate, Nitrite, Sulphate	TDS, Turbidity	NH3 TKN, Tp	Total Metals & hardness	TC/EC	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
1	MC1 - Mosquito Creek Site #1	14-06-22	13:10	Grab	4	R	R	R	R	R	R			
2	MC2 - Mosquito Creek Site #2	14-06-22	12:45	Grab	4	R	R	R	R	R	R			
3	MC3 - Mosquito Creek Site #3	14-06-22	11:55	Grab	4	R	R	R	R	R	R			
4	MC4 - Mosquito Creek Site #4	14-06-22	11:40	Grab	4	R	R	R	R	R	R			
5	MC5 - Mosquito Creek Site #5	14-06-22	11:30	Grab	4	R	R	R	R	R	R			
6	MC6 - Mosquito Creek Site #6	14-06-22	11:05	Grab	4	R	R	R	R	R	R			
7	MC7 - Mosquito Creek Site #7	14-06-22	10:30	Grab	4	R	R	R	R	R	R			
8	MC8 - Mosquito Creek Site #8	14-06-22	10:10	Grab	4	R	R	R	R	R	R			
9	MC9 - Mosquito Creek Site #9	14-06-22	09:30	Grab	4	R	R	R	R	R	R			
10	MC10 - Mosquito Creek Site #10	14-06-22	12:26	Grab	4	R	R	R	R	R	R			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☑ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
10.9							

SHIPMENT RELEASE (client use)		
Released by: Cody Lane	Date: 14-06-22	Time:

INITIAL SHIPMENT RECEPTION (ALS use only)		
Received by: SCF	Date: 14-06-22	Time: 14:15

FINAL SHIPMENT RECEPTION (ALS use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

FED 2022 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

LAKEHEAD REGION CONSERVATION AUTHORITY-TB
ATTN: Gail Willis
Lakehead Region Conservation Authority
130 Conservation Road PO Box 10427
Thunder Bay ON P7B 6T8

Date Received: 13-JUL-22
Report Date: 31-JUL-22 14:49 (MT)
Version: FINAL

Client Phone: 807-344-5857

Certificate of Analysis

Lab Work Order #: L2722274

Project P.O. #: NOT SUBMITTED
Job Reference: MOSQUITO CREEK
C of C Numbers:
Legal Site Desc:

Stephanie Finley
Project Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-1 MC1-MOSQUITO CREEK SITE #1 Sampled By: CL on 13-JUL-22 @ 09:30 Matrix: Grab							
Physical Tests							
Conductivity (EC)	639		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	218	HTC	0.50	mg/L		29-JUL-22	
pH	8.28		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	384		20	mg/L		16-JUL-22	R5822765
Turbidity	4.50		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	224		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0066		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	86.6		0.20	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	0.239		0.040	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.020	DLDS	0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.501		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0198		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	14.1		0.60	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	26		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	1410		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.147		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00124		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.0784		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	0.016		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000206		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	53.1		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	0.000017		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00096		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00026		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00366		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.276		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.000066		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0053		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	20.8		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.0670		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.00158		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00303		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	<0.030		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	2.16		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00131		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000155		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-1 MC1-MOSQUITO CREEK SITE #1 Sampled By: CL on 13-JUL-22 @ 09:30 Matrix: Grab							
Total Metals							
Silicon (Si)-Total	4.57		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	43.0		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.155		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	4.75		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00504		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.00104		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00199		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	0.00026		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-2 MC2-MOSQUITO CREEK SITE #2 Sampled By: CL on 13-JUL-22 @ 12:40 Matrix: Grab							
Physical Tests							
Conductivity (EC)	414		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	176	HTC	0.50	mg/L		29-JUL-22	
pH	8.10		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	249		20	mg/L		16-JUL-22	R5822765
Turbidity	2.49		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	184		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0311		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	39.7		0.10	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	0.085		0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.010		0.010	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.731		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0233		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	3.72		0.30	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	38		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	>2420		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.0525		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00084		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.0197		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-2 MC2-MOSQUITO CREEK SITE #2 Sampled By: CL on 13-JUL-22 @ 12:40 Matrix: Grab							
Total Metals							
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	<0.010		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000072		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	43.1		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00040		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00017		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00192		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.407		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0025		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	16.7		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.268		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.000679		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00149		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	<0.030		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	1.23		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00111		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000133		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	4.83		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	24.6		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.0856		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	1.60		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00205		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000506		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00073		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-3 MC3-MOSQUITO CREEK SITE #3 Sampled By: CL on 13-JUL-22 @ 11:30 Matrix: Grab							
Physical Tests							
Conductivity (EC)	626		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	182	HTC	0.50	mg/L		29-JUL-22	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-3 MC3-MOSQUITO CREEK SITE #3 Sampled By: CL on 13-JUL-22 @ 11:30 Matrix: Grab							
Physical Tests							
pH	8.20		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	343		20	mg/L		16-JUL-22	R5822765
Turbidity	11.0		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	207		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0247		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	91.5		0.20	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	0.064		0.040	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.020	DLDS	0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.709		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0319		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	11.6		0.60	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	66		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	2420		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.414		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00091		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.188		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	0.018		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000214		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	45.1		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	0.000034		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00109		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00049		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00321		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.748		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.000212		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0063		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	16.9		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.0599		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.00113		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00332		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.037		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	2.01		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00156		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000143		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	4.44		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-3 MC3-MOSQUITO CREEK SITE #3 Sampled By: CL on 13-JUL-22 @ 11:30 Matrix: Grab							
Total Metals							
Sodium (Na)-Total	54.9		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.193		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	4.28		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	0.000013		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.0139		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000847		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00271		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	0.0034		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	0.00035		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-4 MC4-MOSQUITO CREEK SITE #4 Sampled By: CL on 13-JUL-22 @ 11:00 Matrix: Grab							
Physical Tests							
Conductivity (EC)	404		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	150	HTC	0.50	mg/L		29-JUL-22	
pH	7.87		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	247		20	mg/L		16-JUL-22	R5822765
Turbidity	3.89		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	168		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0098		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	45.6		0.10	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	<0.020		0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.010		0.010	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.981		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0063		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	1.72		0.30	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	50		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	>2420		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.0495		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00156		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.0238		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-4 MC4-MOSQUITO CREEK SITE #4 Sampled By: CL on 13-JUL-22 @ 11:00 Matrix: Grab							
Total Metals							
Boron (B)-Total	<0.010		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	35.4		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00058		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00046		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00122		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	1.40		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.000064		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0019		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	15.0		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.513		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.00100		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00200		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.060		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	1.27		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00076		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000162		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	4.22		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	28.0		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.0924		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	0.86		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00179		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000324		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00106		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	0.00022		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-5 MC5-MOSQUITO CREEK SITE #5 Sampled By: CL on 13-JUL-22 @ 10:30 Matrix: Grab							
Physical Tests							
Conductivity (EC)	741		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	235	HTC	0.50	mg/L		29-JUL-22	
pH	7.98		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	452		20	mg/L		16-JUL-22	R5822765

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-5 MC5-MOSQUITO CREEK SITE #5 Sampled By: CL on 13-JUL-22 @ 10:30 Matrix: Grab							
Physical Tests							
Turbidity	2.48		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	233		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0172		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	122		0.20	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	<0.040	DLDS	0.040	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.020	DLDS	0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	1.04		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0452		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	6.52		0.60	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	15		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	>2420		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.0161		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00114		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.0393		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	0.010		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	53.5		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00036		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00041		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00068		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.935		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0035		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	24.5		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.569		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.000834		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00237		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.060		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	1.17		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00071		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000198		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	5.24		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	60.3		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.148		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-5 MC5-MOSQUITO CREEK SITE #5 Sampled By: CL on 13-JUL-22 @ 10:30 Matrix: Grab							
Total Metals							
Sulfur (S)-Total	2.48		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00069		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000670		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00085		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-6 MC6-MOSQUITO CREEK SITE #6 Sampled By: CL on 13-JUL-22 @ 10:15 Matrix: Grab							
Physical Tests							
Conductivity (EC)	620		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	173	HTC	0.50	mg/L		29-JUL-22	
pH	8.22		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	340		20	mg/L		16-JUL-22	R5822765
Turbidity	2.59		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	200		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0082		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	87.6		0.20	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	0.423		0.040	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.020	DLDS	0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.229		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0090		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	16.0		0.60	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	18		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	>2420		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.0746		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00045		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.0304		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	0.015		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000122		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-6 MC6-MOSQUITO CREEK SITE #6 Sampled By: CL on 13-JUL-22 @ 10:15 Matrix: Grab							
Total Metals							
Calcium (Ca)-Total	43.3		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00039		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00027		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00223		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.194		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.000056		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0046		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	15.6		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.0340		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.000878		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00290		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	<0.030		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	1.64		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00115		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000105		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	5.18		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	58.6		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.103		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	5.49		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00205		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000765		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00072		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-7 MC7-MOSQUITO CREEK SITE #7 Sampled By: CL on 13-JUL-22 @ 13:20 Matrix: Grab							
Physical Tests							
Conductivity (EC)	3090		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	722	HTC	0.50	mg/L		29-JUL-22	
pH	7.63		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	2050		20	mg/L		16-JUL-22	R5822765
Turbidity	90.5		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-7 MC7-MOSQUITO CREEK SITE #7 Sampled By: CL on 13-JUL-22 @ 13:20 Matrix: Grab							
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	453		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.304		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	892		2.0	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	<0.40	DLDS	0.40	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.20	DLDS	0.20	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	6.34		0.10	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.540		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	<6.0	DLDS	6.0	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	<10	DLM	10	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	1960		10	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.150		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00288		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	1.00		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	0.036		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000786		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	172		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	0.000046		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00072		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00822		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00229		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	24.2		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.000058		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0098		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	71.1		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	6.22		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.00131		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00376		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.704		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	5.48		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00332		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000292		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	11.6		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	497		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.523		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	4.75		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-7 MC7-MOSQUITO CREEK SITE #7 Sampled By: CL on 13-JUL-22 @ 13:20 Matrix: Grab							
Total Metals							
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00432		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.00190		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00286		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	0.0095		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	0.00041		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-8 MC8-MOSQUITO CREEK SITE #8 Sampled By: CL on 13-JUL-22 @ 14:00 Matrix: Grab							
Physical Tests							
Conductivity (EC)	155		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	79.9	HTC	0.50	mg/L		29-JUL-22	
pH	7.83		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	132		13	mg/L		16-JUL-22	R5822765
Turbidity	2.10		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	90.7		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0156		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	0.59		0.10	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	<0.020		0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.010		0.010	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.736		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0254		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	<0.30		0.30	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	29		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	1990		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.0309		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00108		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.00730		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	<0.010		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000051		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	18.2		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-8 MC8-MOSQUITO CREEK SITE #8 Sampled By: CL on 13-JUL-22 @ 14:00 Matrix: Grab							
Total Metals							
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00037		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00024		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00123		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.827		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0013		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	8.38		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.109		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.000279		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00133		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.035		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	0.276		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00026		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000157		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	1.67		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	2.37		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.0391		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	<0.50		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.00124		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000080		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00090		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-9 MC9-MOSQUITO CREEK SITE #9 Sampled By: CL on 13-JUL-22 @ 13:50 Matrix: Grab							
Physical Tests							
Conductivity (EC)	272		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	145	HTC	0.50	mg/L		29-JUL-22	
pH	7.60		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	209		13	mg/L		16-JUL-22	R5822765
Turbidity	115		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	160		2.0	mg/L		16-JUL-22	R5823476

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-9 MC9-MOSQUITO CREEK SITE #9 Sampled By: CL on 13-JUL-22 @ 13:50 Matrix: Grab							
Anions and Nutrients							
Ammonia, Total (as N)	0.103		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	5.06		0.10	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	<0.020		0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.010		0.010	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	1.68		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.174		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	0.66		0.30	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	50		10	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	9800		10	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	4.50		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00205		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.0971		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	0.000093		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	<0.010		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.000110		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	32.1		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	0.000313		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Chromium (Cr)-Total	0.00826		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00343		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00805		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	7.82		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.00158		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0058		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	15.6		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.917		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.000833		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00748		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.153		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	1.32		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00452		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000296		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	14.3		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	0.000028		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	7.02		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.0845		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	<0.50		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-9 MC9-MOSQUITO CREEK SITE #9 Sampled By: CL on 13-JUL-22 @ 13:50 Matrix: Grab							
Total Metals							
Thallium (Tl)-Total	0.000044		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	0.00022		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.0947		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.000693		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00945		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	0.0225		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	0.00112		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							
L2722274-10 MC10-MOSQUITO CREEK SITE #10 Sampled By: CL on 13-JUL-22 @ 11:50 Matrix: Grab							
Physical Tests							
Conductivity (EC)	688		1.0	uS/cm		16-JUL-22	R5823476
Hardness (as CaCO3)	212	HTC	0.50	mg/L		29-JUL-22	
pH	8.19		0.10	pH		16-JUL-22	R5823476
Total Dissolved Solids	375		20	mg/L		16-JUL-22	R5822765
Turbidity	16.8		0.10	NTU		14-JUL-22	R5822238
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	219		2.0	mg/L		16-JUL-22	R5823476
Ammonia, Total (as N)	0.0087		0.0050	mg/L	14-JUL-22	18-JUL-22	R5824676
Chloride (Cl)	105		0.20	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrate (as N)	<0.040	DLDS	0.040	mg/L	14-JUL-22	15-JUL-22	R5823378
Nitrite (as N)	<0.020	DLDS	0.020	mg/L	14-JUL-22	15-JUL-22	R5823378
Total Kjeldahl Nitrogen	0.721		0.050	mg/L	14-JUL-22	19-JUL-22	R5824896
Phosphorus (P)-Total	0.0055		0.0020	mg/L	15-JUL-22	18-JUL-22	R5824316
Sulfate (SO4)	11.2		0.60	mg/L	14-JUL-22	15-JUL-22	R5823378
Bacteriological Tests							
Escherichia Coli	36		0	MPN/100mL		14-JUL-22	R5822352
Total Coliforms	>2420		0	MPN/100mL		14-JUL-22	R5822352
Total Metals							
Aluminum (Al)-Total	0.576		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Arsenic (As)-Total	0.00135		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Barium (Ba)-Total	0.178		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Beryllium (Be)-Total	<0.000020		0.000020	mg/L	20-JUL-22	28-JUL-22	R5831017
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Boron (B)-Total	0.018		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cadmium (Cd)-Total	0.0000347		0.0000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Calcium (Ca)-Total	51.4		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Cesium (Cs)-Total	0.000051		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2722274-10 MC10-MOSQUITO CREEK SITE #10 Sampled By: CL on 13-JUL-22 @ 11:50 Matrix: Grab							
Total Metals							
Chromium (Cr)-Total	0.00127		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Cobalt (Co)-Total	0.00060		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Copper (Cu)-Total	0.00415		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Iron (Fe)-Total	0.843		0.010	mg/L	20-JUL-22	28-JUL-22	R5831017
Lead (Pb)-Total	0.000247		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Lithium (Li)-Total	0.0069		0.0010	mg/L	20-JUL-22	28-JUL-22	R5831017
Magnesium (Mg)-Total	20.3		0.0050	mg/L	20-JUL-22	28-JUL-22	R5831017
Manganese (Mn)-Total	0.107		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Molybdenum (Mo)-Total	0.00134		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Nickel (Ni)-Total	0.00362		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Phosphorus (P)-Total	0.053		0.030	mg/L	20-JUL-22	28-JUL-22	R5831017
Potassium (K)-Total	2.27		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Rubidium (Rb)-Total	0.00186		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Selenium (Se)-Total	0.000149		0.000050	mg/L	20-JUL-22	28-JUL-22	R5831017
Silicon (Si)-Total	4.37		0.10	mg/L	20-JUL-22	28-JUL-22	R5831017
Silver (Ag)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Sodium (Na)-Total	56.8		0.050	mg/L	20-JUL-22	28-JUL-22	R5831017
Strontium (Sr)-Total	0.226		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Sulfur (S)-Total	4.07		0.50	mg/L	20-JUL-22	28-JUL-22	R5831017
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Thorium (Th)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Tin (Sn)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Titanium (Ti)-Total	0.0195		0.00030	mg/L	20-JUL-22	28-JUL-22	R5831017
Tungsten (W)-Total	<0.00010		0.00010	mg/L	20-JUL-22	28-JUL-22	R5831017
Uranium (U)-Total	0.00106		0.000010	mg/L	20-JUL-22	28-JUL-22	R5831017
Vanadium (V)-Total	0.00348		0.00050	mg/L	20-JUL-22	28-JUL-22	R5831017
Zinc (Zn)-Total	0.0037		0.0030	mg/L	20-JUL-22	28-JUL-22	R5831017
Zirconium (Zr)-Total	0.00046		0.00020	mg/L	20-JUL-22	28-JUL-22	R5831017
Report Remarks : #REF!							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Manganese (Mn)-Total	B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sulfur (S)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Phosphorus (P)-Total	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sulfate (SO4)	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L2722274-1, -10, -2, -3, -4, -5, -6, -7, -8, -9

Sample Parameter Qualifier key listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-TB	Water	Alkalinity	APHA 2320B modified

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CL-L-IC-N-TB	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-TITR-TB	Water	Conductivity	APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-TB	Water	Hardness (as CaCO3)	CALCULATION
MET-T-CCMS-TB	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020B (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-F-TB	Water	Ammonia, Total (as N)	catnr 157/158 062217/99321057 (modified)

Ammonia is determined by Flow-injection analysis with fluorescence detection

NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Reference Information

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

SO4-IC-N-TB	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TC,EC-QT97-TB	Water	Total Coliform and E.coli	APHA 9223 B

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture of hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

TKN-F-TB	Water	TKN in Water by Fluorescence	catnr 157/158, 062818/99334821

Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection

TURBIDITY-TB	Water	Turbidity	APHA 2130 B-Nephelometer

Aqueous matrices are analyzed using nephelometry with the light scatter measured at a 90” angle.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2722274 Report Date: 31-JUL-22

Client: LAKEHEAD REGION CONSERVATION AUTHORITY-TB
Lakehead Region Conservation Authority 130 Conservation Road PO Box 10427
Thunder Bay ON P7B 6T8

Contact: Gail Willis

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-TITR-TB	**Water**							
Batch R5823476								
WG3749407-2 LCS								
Alkalinity, Total (as CaCO3)			105.9		%		85-115	16-JUL-22
WG3749407-1 MB								
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	16-JUL-22
CL-L-IC-N-TB	**Water**							
Batch R5823378								
WG3749442-2 LCS								
Chloride (Cl)			105.0		%		90-110	15-JUL-22
WG3749442-1 MB								
Chloride (Cl)			<0.10		mg/L		0.1	15-JUL-22
EC-TITR-TB	**Water**							
Batch R5823476								
WG3749407-2 LCS								
Conductivity (EC)			103.4		%		90-110	16-JUL-22
WG3749407-1 MB								
Conductivity (EC)			<1.0		uS/cm		2	16-JUL-22
MET-T-CCMS-TB	**Water**							
Batch R5827948								
WG3750740-2 LCS								
Aluminum (Al)-Total			98.2		%		80-120	21-JUL-22
Antimony (Sb)-Total			107.7		%		80-120	21-JUL-22
Arsenic (As)-Total			103.8		%		80-120	21-JUL-22
Barium (Ba)-Total			104.5		%		80-120	21-JUL-22
Beryllium (Be)-Total			101.5		%		80-120	21-JUL-22
Bismuth (Bi)-Total			105.7		%		80-120	21-JUL-22
Boron (B)-Total			101.6		%		80-120	21-JUL-22
Cadmium (Cd)-Total			101.4		%		80-120	21-JUL-22
Calcium (Ca)-Total			102.8		%		80-120	21-JUL-22
Cesium (Cs)-Total			105.7		%		80-120	21-JUL-22
Chromium (Cr)-Total			101.8		%		80-120	21-JUL-22
Cobalt (Co)-Total			102.1		%		80-120	21-JUL-22
Copper (Cu)-Total			100.3		%		80-120	21-JUL-22
Iron (Fe)-Total			111.0		%		80-120	21-JUL-22
Lead (Pb)-Total			108.4		%		80-120	21-JUL-22
Lithium (Li)-Total			100.4		%		80-120	21-JUL-22
Magnesium (Mg)-Total			102.2		%		80-120	21-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5827948								
WG3750740-2 LCS								
Manganese (Mn)-Total			102.9		%		80-120	21-JUL-22
Molybdenum (Mo)-Total			103.6		%		80-120	21-JUL-22
Nickel (Ni)-Total			99.3		%		80-120	21-JUL-22
Phosphorus (P)-Total			110.1		%		80-120	21-JUL-22
Potassium (K)-Total			110.2		%		80-120	21-JUL-22
Rubidium (Rb)-Total			105.2		%		80-120	21-JUL-22
Selenium (Se)-Total			104.9		%		80-120	21-JUL-22
Silicon (Si)-Total			104.9		%		80-120	21-JUL-22
Silver (Ag)-Total			98.2		%		80-120	21-JUL-22
Sodium (Na)-Total			104.1		%		80-120	21-JUL-22
Strontium (Sr)-Total			100.5		%		80-120	21-JUL-22
Sulfur (S)-Total			87.4		%		80-120	21-JUL-22
Tellurium (Te)-Total			107.6		%		80-120	21-JUL-22
Thallium (Tl)-Total			108.3		%		80-120	21-JUL-22
Thorium (Th)-Total			105.6		%		80-120	21-JUL-22
Tin (Sn)-Total			101.4		%		80-120	21-JUL-22
Titanium (Ti)-Total			95.4		%		80-120	21-JUL-22
Tungsten (W)-Total			106.9		%		80-120	21-JUL-22
Uranium (U)-Total			107.9		%		80-120	21-JUL-22
Vanadium (V)-Total			103.2		%		80-120	21-JUL-22
Zinc (Zn)-Total			106.1		%		80-120	21-JUL-22
Zirconium (Zr)-Total			101.6		%		80-120	21-JUL-22
WG3750740-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	21-JUL-22
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Arsenic (As)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Barium (Ba)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	21-JUL-22
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	21-JUL-22
Boron (B)-Total			<0.010		mg/L		0.01	21-JUL-22
Cadmium (Cd)-Total			<0.000005C		mg/L		0.000005	21-JUL-22
Calcium (Ca)-Total			<0.050		mg/L		0.05	21-JUL-22
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	21-JUL-22
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	21-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5827948								
WG3750740-1 MB								
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Copper (Cu)-Total			<0.00050		mg/L		0.0005	21-JUL-22
Iron (Fe)-Total			<0.010		mg/L		0.01	21-JUL-22
Lead (Pb)-Total			<0.000050		mg/L		0.00005	21-JUL-22
Lithium (Li)-Total			<0.0010		mg/L		0.001	21-JUL-22
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	21-JUL-22
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	21-JUL-22
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	21-JUL-22
Phosphorus (P)-Total			<0.030		mg/L		0.03	21-JUL-22
Potassium (K)-Total			<0.050		mg/L		0.05	21-JUL-22
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	21-JUL-22
Selenium (Se)-Total			<0.000050		mg/L		0.00005	21-JUL-22
Silicon (Si)-Total			<0.10		mg/L		0.1	21-JUL-22
Silver (Ag)-Total			<0.000010		mg/L		0.00001	21-JUL-22
Sodium (Na)-Total			<0.050		mg/L		0.05	21-JUL-22
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	21-JUL-22
Sulfur (S)-Total			<0.50		mg/L		0.5	21-JUL-22
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	21-JUL-22
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	21-JUL-22
Thorium (Th)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Tin (Sn)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	21-JUL-22
Tungsten (W)-Total			<0.00010		mg/L		0.0001	21-JUL-22
Uranium (U)-Total			<0.000010		mg/L		0.00001	21-JUL-22
Vanadium (V)-Total			<0.00050		mg/L		0.0005	21-JUL-22
Zinc (Zn)-Total			<0.0030		mg/L		0.003	21-JUL-22
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	21-JUL-22
Batch R5831017								
WG3750740-3 DUP		**L2722274-1**						
Aluminum (Al)-Total		0.147	0.148		mg/L	0.3	20	28-JUL-22
Antimony (Sb)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	28-JUL-22
Arsenic (As)-Total		0.00124	0.00125		mg/L	1.2	20	28-JUL-22
Barium (Ba)-Total		0.0784	0.0792		mg/L	1.1	20	28-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5831017								
WG3750740-3 DUP		**L2722274-1**						
Beryllium (Be)-Total		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	28-JUL-22
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	28-JUL-22
Boron (B)-Total		0.016	0.017		mg/L	2.2	20	28-JUL-22
Cadmium (Cd)-Total		0.0000206	0.0000217		mg/L	4.8	20	28-JUL-22
Calcium (Ca)-Total		53.1	53.8		mg/L	1.3	20	28-JUL-22
Cesium (Cs)-Total		0.000017	0.000015		mg/L	13	20	28-JUL-22
Chromium (Cr)-Total		0.00096	0.00099		mg/L	3.1	20	28-JUL-22
Cobalt (Co)-Total		0.00026	0.00028		mg/L	5.0	20	28-JUL-22
Copper (Cu)-Total		0.00366	0.00365		mg/L	0.3	20	28-JUL-22
Iron (Fe)-Total		0.276	0.276		mg/L	0.1	20	28-JUL-22
Lead (Pb)-Total		0.000066	0.000067		mg/L	1.5	20	28-JUL-22
Lithium (Li)-Total		0.0053	0.0054		mg/L	2.0	20	28-JUL-22
Magnesium (Mg)-Total		20.8	20.9		mg/L	0.4	20	28-JUL-22
Manganese (Mn)-Total		0.0670	0.0669		mg/L	0.1	20	28-JUL-22
Molybdenum (Mo)-Total		0.00158	0.00151		mg/L	4.5	20	28-JUL-22
Nickel (Ni)-Total		0.00303	0.00308		mg/L	1.6	20	28-JUL-22
Phosphorus (P)-Total		<0.030	<0.030	RPD-NA	mg/L	N/A	20	28-JUL-22
Potassium (K)-Total		2.16	2.14		mg/L	0.9	20	28-JUL-22
Rubidium (Rb)-Total		0.00131	0.00128		mg/L	2.6	20	28-JUL-22
Selenium (Se)-Total		0.000155	0.000136		mg/L	13	20	28-JUL-22
Silicon (Si)-Total		4.57	4.48		mg/L	2.1	20	28-JUL-22
Silver (Ag)-Total		0.000010	<0.000010	RPD-NA	mg/L	N/A	20	28-JUL-22
Sodium (Na)-Total		43.0	43.1		mg/L	0.3	20	28-JUL-22
Strontium (Sr)-Total		0.155	0.154		mg/L	0.4	20	28-JUL-22
Sulfur (S)-Total		4.75	4.72		mg/L	0.5	20	28-JUL-22
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	28-JUL-22
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	28-JUL-22
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	28-JUL-22
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	28-JUL-22
Titanium (Ti)-Total		0.00504	0.00519		mg/L	3.0	20	28-JUL-22
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	28-JUL-22
Uranium (U)-Total		0.00104	0.00105		mg/L	1.0	20	28-JUL-22
Vanadium (V)-Total		0.00199	0.00204		mg/L	2.3	20	28-JUL-22
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	28-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5831017								
WG3750740-3 DUP		**L2722274-1**						
Zirconium (Zr)-Total		0.00026	0.00027		mg/L	4.3	20	28-JUL-22
WG3750740-6 LCS								
Aluminum (Al)-Total			101.7		%		80-120	28-JUL-22
Antimony (Sb)-Total			102.8		%		80-120	28-JUL-22
Arsenic (As)-Total			105.4		%		80-120	28-JUL-22
Barium (Ba)-Total			106.9		%		80-120	28-JUL-22
Beryllium (Be)-Total			98.1		%		80-120	28-JUL-22
Bismuth (Bi)-Total			104.5		%		80-120	28-JUL-22
Boron (B)-Total			92.9		%		80-120	28-JUL-22
Cadmium (Cd)-Total			103.2		%		80-120	28-JUL-22
Calcium (Ca)-Total			99.97		%		80-120	28-JUL-22
Cesium (Cs)-Total			101.9		%		80-120	28-JUL-22
Chromium (Cr)-Total			100.8		%		80-120	28-JUL-22
Cobalt (Co)-Total			101.0		%		80-120	28-JUL-22
Copper (Cu)-Total			100.9		%		80-120	28-JUL-22
Iron (Fe)-Total			107.2		%		80-120	28-JUL-22
Lead (Pb)-Total			105.5		%		80-120	28-JUL-22
Lithium (Li)-Total			98.5		%		80-120	28-JUL-22
Magnesium (Mg)-Total			102.7		%		80-120	28-JUL-22
Manganese (Mn)-Total			101.2		%		80-120	28-JUL-22
Molybdenum (Mo)-Total			100.3		%		80-120	28-JUL-22
Nickel (Ni)-Total			102.4		%		80-120	28-JUL-22
Phosphorus (P)-Total			112.3		%		80-120	28-JUL-22
Potassium (K)-Total			110.2		%		80-120	28-JUL-22
Rubidium (Rb)-Total			106.8		%		80-120	28-JUL-22
Selenium (Se)-Total			104.6		%		80-120	28-JUL-22
Silicon (Si)-Total			103.9		%		80-120	28-JUL-22
Silver (Ag)-Total			97.0		%		80-120	28-JUL-22
Sodium (Na)-Total			102.7		%		80-120	28-JUL-22
Strontium (Sr)-Total			103.4		%		80-120	28-JUL-22
Sulfur (S)-Total			102.9		%		80-120	28-JUL-22
Tellurium (Te)-Total			106.3		%		80-120	28-JUL-22
Thallium (Tl)-Total			105.7		%		80-120	28-JUL-22
Thorium (Th)-Total			102.5		%		80-120	28-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5831017								
WG3750740-6 LCS								
Tin (Sn)-Total			101.4		%		80-120	28-JUL-22
Titanium (Ti)-Total			101.2		%		80-120	28-JUL-22
Tungsten (W)-Total			104.9		%		80-120	28-JUL-22
Uranium (U)-Total			101.4		%		80-120	28-JUL-22
Vanadium (V)-Total			103.5		%		80-120	28-JUL-22
Zinc (Zn)-Total			103.0		%		80-120	28-JUL-22
Zirconium (Zr)-Total			94.5		%		80-120	28-JUL-22
WG3750740-5 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	28-JUL-22
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Arsenic (As)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Barium (Ba)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	28-JUL-22
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	28-JUL-22
Boron (B)-Total			<0.010		mg/L		0.01	28-JUL-22
Cadmium (Cd)-Total			<0.000005(		mg/L		0.000005	28-JUL-22
Calcium (Ca)-Total			<0.050		mg/L		0.05	28-JUL-22
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	28-JUL-22
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Copper (Cu)-Total			<0.00050		mg/L		0.0005	28-JUL-22
Iron (Fe)-Total			<0.010		mg/L		0.01	28-JUL-22
Lead (Pb)-Total			<0.000050		mg/L		0.00005	28-JUL-22
Lithium (Li)-Total			<0.0010		mg/L		0.001	28-JUL-22
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	28-JUL-22
Manganese (Mn)-Total			0.00011	B	mg/L		0.0001	28-JUL-22
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	28-JUL-22
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	28-JUL-22
Phosphorus (P)-Total			<0.030		mg/L		0.03	28-JUL-22
Potassium (K)-Total			<0.050		mg/L		0.05	28-JUL-22
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	28-JUL-22
Selenium (Se)-Total			<0.000050		mg/L		0.00005	28-JUL-22
Silicon (Si)-Total			<0.10		mg/L		0.1	28-JUL-22
Silver (Ag)-Total			<0.000010		mg/L		0.00001	28-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5831017								
WG3750740-5 MB								
Sodium (Na)-Total			<0.050		mg/L		0.05	28-JUL-22
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	28-JUL-22
Sulfur (S)-Total			<0.50		mg/L		0.5	28-JUL-22
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	28-JUL-22
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	28-JUL-22
Thorium (Th)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Tin (Sn)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	28-JUL-22
Tungsten (W)-Total			<0.00010		mg/L		0.0001	28-JUL-22
Uranium (U)-Total			<0.000010		mg/L		0.00001	28-JUL-22
Vanadium (V)-Total			<0.00050		mg/L		0.0005	28-JUL-22
Zinc (Zn)-Total			<0.0030		mg/L		0.003	28-JUL-22
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	28-JUL-22
WG3750740-4 MS		**L2722274-2**						
Aluminum (Al)-Total			118.5		%		70-130	28-JUL-22
Antimony (Sb)-Total			113.7		%		70-130	28-JUL-22
Arsenic (As)-Total			111.7		%		70-130	28-JUL-22
Barium (Ba)-Total			105.4		%		70-130	28-JUL-22
Beryllium (Be)-Total			106.7		%		70-130	28-JUL-22
Bismuth (Bi)-Total			107.8		%		70-130	28-JUL-22
Boron (B)-Total			103.5		%		70-130	28-JUL-22
Cadmium (Cd)-Total			108.4		%		70-120	28-JUL-22
Calcium (Ca)-Total			N/A	MS-B	%		-	28-JUL-22
Cesium (Cs)-Total			113.4		%		70-130	28-JUL-22
Chromium (Cr)-Total			109.3		%		70-130	28-JUL-22
Cobalt (Co)-Total			108.4		%		70-130	28-JUL-22
Copper (Cu)-Total			108.4		%		70-130	28-JUL-22
Iron (Fe)-Total			103.8		%		70-130	28-JUL-22
Lead (Pb)-Total			109.1		%		70-130	28-JUL-22
Lithium (Li)-Total			99.0		%		70-130	28-JUL-22
Magnesium (Mg)-Total			N/A	MS-B	%		-	28-JUL-22
Manganese (Mn)-Total			N/A	MS-B	%		-	28-JUL-22
Molybdenum (Mo)-Total			109.2		%		70-130	28-JUL-22
Nickel (Ni)-Total			106.3		%		70-130	28-JUL-22

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R5831017								
WG3750740-4 MS		**L2722274-2**						
Phosphorus (P)-Total			116.2		%		70-130	28-JUL-22
Potassium (K)-Total			110.0		%		70-130	28-JUL-22
Rubidium (Rb)-Total			109.0		%		70-130	28-JUL-22
Selenium (Se)-Total			110.5		%		70-130	28-JUL-22
Silicon (Si)-Total			97.1		%		70-130	28-JUL-22
Silver (Ag)-Total			113.5		%		70-130	28-JUL-22
Sodium (Na)-Total			N/A	MS-B	%		-	28-JUL-22
Strontium (Sr)-Total			N/A	MS-B	%		-	28-JUL-22
Sulfur (S)-Total			111.1		%		70-130	28-JUL-22
Tellurium (Te)-Total			111.5		%		70-130	28-JUL-22
Thallium (Tl)-Total			108.4		%		70-130	28-JUL-22
Thorium (Th)-Total			116.9		%		70-130	28-JUL-22
Tin (Sn)-Total			111.1		%		70-130	28-JUL-22
Titanium (Ti)-Total			113.4		%		70-130	28-JUL-22
Tungsten (W)-Total			112.5		%		70-130	28-JUL-22
Uranium (U)-Total			112.5		%		70-130	28-JUL-22
Vanadium (V)-Total			111.9		%		70-130	28-JUL-22
Zinc (Zn)-Total			108.2		%		70-130	28-JUL-22
Zirconium (Zr)-Total			108.9		%		70-130	28-JUL-22
NH3-F-TB	**Water**							
Batch R5824676								
WG3749179-2 LCS								
Ammonia, Total (as N)			99.6		%		85-115	18-JUL-22
WG3749179-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	18-JUL-22
NO2-IC-N-TB	**Water**							
Batch R5823378								
WG3749442-2 LCS								
Nitrite (as N)			109.3		%		90-110	15-JUL-22
WG3749442-1 MB								
Nitrite (as N)			<0.010		mg/L		0.01	15-JUL-22
NO3-IC-N-TB	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-N-TB	**Water**							
Batch R5823378								
WG3749442-2 LCS								
Nitrate (as N)			106.9		%		90-110	15-JUL-22
WG3749442-1 MB								
Nitrate (as N)			<0.020		mg/L		0.02	15-JUL-22
P-T-COL-TB	**Water**							
Batch R5824316								
WG3749366-2 LCS								
Phosphorus (P)-Total			116.3		%		80-120	18-JUL-22
WG3749366-1 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	18-JUL-22
PH-TITR-TB	**Water**							
Batch R5823476								
WG3749407-2 LCS								
pH			6.99		pH		6.9-7.1	16-JUL-22
SO4-IC-N-TB	**Water**							
Batch R5823378								
WG3749442-2 LCS								
Sulfate (SO4)			105.5		%		90-110	15-JUL-22
WG3749442-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	15-JUL-22
TC,EC-QT97-TB	**Water**							
Batch R5822352								
WG3749197-1 MB								
Total Coliforms			0		MPN/100mL		1	14-JUL-22
Escherichia Coli			0		MPN/100mL		1	14-JUL-22
COMMENTS: #REF!								
TDS-TB	**Water**							
Batch R5822765								
WG3749855-3 DUP		**L2722274-1**						
Total Dissolved Solids		384	386		mg/L	0.6	20	16-JUL-22
WG3749855-2 LCS								
Total Dissolved Solids			99.3		%		85-115	16-JUL-22
WG3749855-1 MB								
Total Dissolved Solids			<10		mg/L		10	16-JUL-22
TKN-F-TB	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-F-TB	**Water**							
Batch R5824896								
WG3749183-2 LCS								
Total Kjeldahl Nitrogen			106.5		%		75-125	19-JUL-22
WG3749183-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	19-JUL-22
TURBIDITY-TB	**Water**							
Batch R5822238								
WG3749408-3 DUP		**L2722274-7**						
Turbidity		90.5	89.7		NTU	0.9	15	14-JUL-22
WG3749408-2 LCS								
Turbidity			101.0		%		85-115	14-JUL-22
WG3749408-1 MB								
Turbidity			<0.10		NTU		0.1	14-JUL-22

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

COC Number: L2722274-COFC

Page: of

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To	Contact and company name below will appear on the final report
Company:	Lakehead Region Conservation Authority
Contact:	Gail Willis/Scott Drebit
Phone:	807-344-5857 ext223
	Company address below will appear on the final report
Street:	130 Conservation rd PO Box 10427
City/Province:	Thunder Bay, ON
Postal Code:	P7B 6T8
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	City of Thunder Bay - Infrastructure and Operations Dept
Contact:	Aaron Ward - 807-625-2444

Project Information	
ALS Account # / Quote #:	18510 / Q89663
Job #:	Mosquito Creek
PO / AFE:	
LSD:	
ALS Lab Work Order # (ALS use only):	L2722274

Reports / Recipients	
Select Report Format:	☑ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA	☐ YES ☑ NO ☐ N/A
Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gailw@lakeheadca.com
Email 2	scott@lakeheadca.com
Email 3	

Invoice Recipients	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	aaron.ward@thunderbay.ca
Email 2	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler: C. LANE

Turnaround Time (TAT) Requested
☑ Routine [R] If received by 3pm M-F - no surcharges apply
☐ 4 day [P4] If received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] If received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] If received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] If received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] If received by 10am M-S - 200% rush surcharge.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Additional fees may apply to rush requests on weekends, statutory holidays and for non-routine tests.

Date and Time Required for all E&P TATs: dd-mmm-yy hh mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Alkalinity, Conductivity, pH	Chloride, Nitrate, Nitrite, Sulphate	TDS, Turbidity	NH3 TKN, Tp	Total Metals & hardness	TC/EC	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
1	MC1 - Mosquito Creek Site #1	13-JUL-22	09:30	GRAB	4	R	R	R	R	R	R			
2	MC2 - Mosquito Creek Site #2	13-JUL-22	12:40	GRAB	4	R	R	R	R	R	R			
3	MC3 - Mosquito Creek Site #3	13-JUL-22	11:30	GRAB	4	R	R	R	R	R	R			
4	MC4 - Mosquito Creek Site #4	13-JUL-22	11:00	GRAB	4	R	R	R	R	R	R			
5	MC5 - Mosquito Creek Site #5	13-JUL-22	10:30	GRAB	4	R	R	R	R	R	R			
6	MC6 - Mosquito Creek Site #6	13-JUL-22	10:15	GRAB	4	R	R	R	R	R	R			
7	MC7 - Mosquito Creek Site #7	13-JUL-22	13:20	GRAB	4	R	R	R	R	R	R			
8	MC8 - Mosquito Creek Site #8	13-JUL-22	14:00	GRAB	4	R	R	R	R	R	R			
9	MC9 - Mosquito Creek Site #9	13-JUL-22	13:50	GRAB	4	R	R	R	R	R	R			
10	MC10 - Mosquito Creek Site #10	13-JUL-22	11:50	GRAB	4	R	R	R	R	R	R			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☒ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
8.7							

SHIPMENT RELEASE (client use)		
Released by:	Date: 13-JUL-22	Time:

INITIAL SHIPMENT RECEPTION (ALS use only)		
Received by: AJ	Date: 07/13/22	Time: 7:40

FINAL SHIPMENT RECEPTION (ALS use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

FEB 2022 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.