APPENDIX E. WATER BALANCE
1. **Background**

The following technical memorandum summarizes the water balance assessment completed for the proposed Gillis Lake Quarry Expansion (Project) located near Portage, Nova Scotia. The proposed quarry expansion area (i.e. the Quarry Development Area) includes an additional 9.34 hectares (ha) of land. There are two streams (Watercourse 4 and Watercourse 5) and extensive drainage system within the Quarry Development Area, with the majority of the drainage heading off site to the south. A portion of the drainage flows west to road drainage, and a small amount of drainage from the north flows east. MacDonalds Brook is the watercourse located to the east of the Project Site that receives a small portion of flow from Watercourse 4 and Watercourse 5.

The water balance presented here is a preliminary assessment of the predicted effects on surrounding surface waterbodies caused by development of the quarry area expansion. Two site conditions were analyzed; existing (baseline) conditions and end-of-quarry (EOQ) conditions. EOQ conditions consider the quarry expansion at full development of approximately 41 ha.

Due to the range of infiltration rates possible and associated changes in surface water movement caused by quarry development, the water balance assessment was completed for two infiltration potential scenarios for the EOQ situation. The two infiltration scenarios represent the range of possible outcomes from existing infiltration (most likely infiltration) to 100% impervious.

1.1 **Data Collection**

1.1.1 **Climate Data**

Precipitation totals were obtained from the Environment Canada Sydney A Climate Station (Climate ID 8205700) from 1981-2010. This station was selected based on its proximity to the Project Study Area, approximately 31 km from the Study Area, and relatively long record. Monthly potential evapotranspiration normals were calculated using the Hamon equation (1961) (Lu et al., 2005). The Hamon equation requires monthly average hours of daylight and monthly average temperature as input. Monthly average hours of daylight were calculated for the Study Area using the Sunrise and Sunset Calculator (https://www.timeanddate.com/sun/, last accessed 24 September 2019). Monthly average temperature
values were obtained from the Environment Canada Sydney A Climate Station. Table 1.1 presents temperature, total precipitation and evaporation rates that are used in the analysis.

### Table 1.1 Climate Normals (Data taken from Sydney Environment Canada Climate Station)

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature(^1) (°C)</td>
<td>-5.4</td>
<td>-5.9</td>
<td>-2.6</td>
<td>2.5</td>
<td>7.9</td>
<td>13.2</td>
<td>17.9</td>
<td>18</td>
<td>14</td>
<td>8.5</td>
<td>3.8</td>
<td>-1.5</td>
</tr>
<tr>
<td>Precipitation(^1) (mm)</td>
<td>152.5</td>
<td>128.1</td>
<td>130</td>
<td>133.3</td>
<td>103.2</td>
<td>96.9</td>
<td>88.5</td>
<td>100.2</td>
<td>118.7</td>
<td>142.9</td>
<td>156</td>
<td>167</td>
</tr>
<tr>
<td>Evaporation(^2) (mm)</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>89.9</td>
<td>102.0</td>
<td>117.8</td>
<td>96.1</td>
<td>69.0</td>
<td>40.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Potential Evapotranspiration</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>33.7</td>
<td>52.5</td>
<td>73.4</td>
<td>97.6</td>
<td>90.0</td>
<td>60.9</td>
<td>39.1</td>
<td>25.4</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Notes:

1. Values obtained from the Sydney climate station 8205700
2. Evaporation was determined using the Hamon equation (1961), (Lu et al., 2005) for Potential Evapotranspiration

### 2. Methodology

GHD developed a preliminary water balance assessment to assess the potential environmental impacts of the proposed Project expansion from existing conditions to EOQ conditions. The assessment was developed to determine the yearly changes to flow composition during an average year for the two site conditions, and two impervious scenarios mentioned previously.

#### 2.1 Watershed Delineation

The area surrounding the Study Area was delineated into three (3) watersheds: Outfall 1 (177.5 ha), Outfall 2 (71.0 ha) and Outfall 3 (144.8 ha) using a combination of aerial imagery, field investigation and topographical data sourced from GeoNova Scotia Elevation Dataset. Watershed delineations are presented based on two life-cycle phases of the proposed quarry: Figure 1, Baseline Watershed Delineation and Figure 2, End of Quarry Watershed Delineation. During EOQ, water which falls on the quarry is discharged to the Outfall 2 and downstream receiver (Outfall 1).

#### 2.2 Evaporation & Evapotranspiration Potential

Evaporation describes the process of the return of moisture to the atmosphere from open water and land surfaces. The magnitude of evaporation or evapotranspiration over time is a function of the climate, soil and the vegetation in the area. Evaporation rates tend to peak in the summer months when temperatures are highest, daylight hours are longest, sun intensity is greatest and the growing season is at its peak.

Evapotranspiration rates were calculated using the Hamon equation (1961) as described in Section 1.1.1 based on average monthly temperature and daylight hours. The total potential evapotranspiration rate used for this water balance is 472.57 mm per year. Table 1-1 provides a summary of the potential evaporation rates used as a water loss parameter in the water balance assessment on a monthly basis.
### 2.3 Infiltration Factor

The water storage/infiltration has been estimated using the infiltration factors taken from Table 3.1 from the Ontario Ministry of Environment, Conservation and Parks (OMCEP) SWM planning and Design Manual (2003). The infiltration factors are used to determine the fraction of water surplus that infiltrates into the ground and the fraction that runs off to nearby streams. The infiltration factors cover a wide range of soil types, topography and land cover that is applicable for use in Nova Scotia and the Study Area. Each watershed was individually analyzed to determine the slope, land use and soil type drainage factors. If multiple slope or land use segments existed within a watershed an area-ratio method was used to determine the appropriate infiltration factor. During existing conditions the watersheds in the Study Area were determined to be hilly land (0.1 infiltration factor) with woodland (0.2) and open Sandy Loam soil (0.4). The soil in the area was determined through the Nova Scotia Soil Survey of Cape Breton Island and is classified as Thom, a sandy loam till with good drainage (Soil Survey Reports for Nova Scotia, Reprinted 1981).

Two scenarios were assessed for the infiltration conditions during baseline and EOQ conditions; an impervious quarry floor where no infiltration occurred through the bed of the quarry; and a pervious quarry floor consisting of similar infiltration capabilities to existing surficial soils (Sandy Loam). Due to the well-drained nature of the surficial soils it is unlikely the soil will have greater infiltration at the base of the quarry than the existing surface. As such, these two scenarios present the maximum and minimum values for expected infiltration in the quarry. These two scenarios provide a range of potential outcomes as a result of quarry development. New infiltration parameters for these scenarios were computed based on an area-ratio method.

End of Quarry conditions were expected to be similar to existing conditions with the exception of Flat Land (0.3) and Cultivated Land (0.1) in the area where the quarry was located. An area-ratio method was applied to determine the appropriate infiltration factor for slope and land use in the watersheds with multiple different slope and land use segments. This was mostly used for the watersheds containing the proposed quarry.

Runoff volumes for this water balance were assumed to equal the total precipitation less the evaporation and infiltration. Groundwater recharge was not included in this water balance.

### 3. Results

Table 3.1, Table 3.2, and Table 3.3 present the annual water balance analysis during existing and EOQ conditions (Pervious and Impervious) respectively. Table 3.6 and Table 3.7 display the percentage change in area, runoff and infiltration from existing conditions to EOQ conditions respectively. A negative represents a decrease in the value compared to existing condition and a positive value represents an increase in the value compared to existing conditions.
### Table 3.1 Existing Condition Annual Water Balance

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Area (ha)</th>
<th>Runoff (m³)</th>
<th>Evaporation (m³)</th>
<th>Potential Evaporation (m³)</th>
<th>Infiltration (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 1</td>
<td>177.50</td>
<td>500,061</td>
<td>6,387</td>
<td>832,949</td>
<td>1,046,538</td>
</tr>
<tr>
<td>Outfall 2</td>
<td>71.00</td>
<td>175,275</td>
<td>0</td>
<td>335,524</td>
<td>443,364</td>
</tr>
<tr>
<td>Outfall 3</td>
<td>144.80</td>
<td>441,587</td>
<td>66,963</td>
<td>622,845</td>
<td>820,089</td>
</tr>
</tbody>
</table>

### Table 3.2 End-of-Quarry (Impervious) Annual Water Balance

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Area (ha)</th>
<th>Runoff (m³)</th>
<th>Evaporation (m³)</th>
<th>Potential Evaporation (m³)</th>
<th>Infiltration (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 1</td>
<td>187.40</td>
<td>564,784</td>
<td>6,387</td>
<td>910,007</td>
<td>1,000,093</td>
</tr>
<tr>
<td>Outfall 2</td>
<td>80.90</td>
<td>218,991</td>
<td>0</td>
<td>395,464</td>
<td>456,562</td>
</tr>
<tr>
<td>Outfall 3</td>
<td>135.00</td>
<td>394,559</td>
<td>66,963</td>
<td>596,373</td>
<td>732,753</td>
</tr>
</tbody>
</table>

### Table 3.3 End-of-Mine (Pervious) Annual Water Balance

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Area (ha)</th>
<th>Runoff (m³)</th>
<th>Evaporation (m³)</th>
<th>Potential Evaporation (m³)</th>
<th>Infiltration (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 1</td>
<td>187.40</td>
<td>496,477</td>
<td>6,387</td>
<td>910,007</td>
<td>1,068,400</td>
</tr>
<tr>
<td>Outfall 2</td>
<td>80.90</td>
<td>185,213</td>
<td>0</td>
<td>395,464</td>
<td>490,339</td>
</tr>
<tr>
<td>Outfall 3</td>
<td>135.00</td>
<td>394,559</td>
<td>66,963</td>
<td>596,373</td>
<td>732,753</td>
</tr>
</tbody>
</table>
Table 3.4 End of Quarry Impervious Conditions comparison to Existing Conditions

<table>
<thead>
<tr>
<th>Catchment</th>
<th>% Area Change</th>
<th>% Runoff Change</th>
<th>% Infiltration Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 1</td>
<td>5.58%</td>
<td>12.94%</td>
<td>-4.44%</td>
</tr>
<tr>
<td>Outfall 2</td>
<td>13.94%</td>
<td>24.94%</td>
<td>2.98%</td>
</tr>
<tr>
<td>Outfall 3</td>
<td>-6.77%</td>
<td>-10.65%</td>
<td>-10.65%</td>
</tr>
</tbody>
</table>

Table 3.5 End of Quarry Pervious Conditions comparison to Existing Conditions

<table>
<thead>
<tr>
<th>Catchment</th>
<th>% Area Change</th>
<th>% Runoff Change</th>
<th>% Infiltration Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall 1</td>
<td>5.58%</td>
<td>-0.72%</td>
<td>2.09%</td>
</tr>
<tr>
<td>Outfall 2</td>
<td>13.94%</td>
<td>5.67%</td>
<td>10.60%</td>
</tr>
<tr>
<td>Outfall 3</td>
<td>-6.77%</td>
<td>-10.65%</td>
<td>-10.65%</td>
</tr>
</tbody>
</table>

4. Conclusions

The results from the water balance analysis can be used to assess the potential impact of the proposed quarry development on the receiving environment in terms of the change in runoff volume discharged to the surrounding watercourses.

Outfall 1 is the largest catchment and includes all of Outfall 2 subcatchment (Quarry) within its boundaries. The catchment increases in contributing area with the quarry expansion by approximately 5.58%. Due to the increase in area and land use type there is a corresponding change in annual runoff and infiltration for both EOQ scenarios. An increase of 12.94% for runoff and a decrease of 4.44% of infiltration is seen during Impervious-EOQ conditions. A decrease of 0.72% for runoff and an increase of 2.09% of infiltration is seen during Pervious-EOQ conditions. It is likely that the actual changes to runoff and infiltration will be somewhere within the range estimated for Impervious-EOQ and Pervious-EOQ. As the increases and decreases are relatively small (other than the increase in runoff during Impervious-EOQ) it is unlikely there will be an adverse impact to the Outfall 1 watershed. A mitigation option for the potential increase in runoff of 12.94% during Impervious-EOQ scenario would include settling pond outlet controls at the downstream portion of the Quarry.

Outfall 2 is comprised of the Quarry footprint and an off-site drainage area upstream of the Quarry. The catchment increases in contributing area with the quarry expansion by approximately 13.94%. Due to the increase in area and land use type there is a corresponding change in annual runoff and infiltration for both EOQ scenarios. An increase of 24.94% for runoff and an increase of 2.98% of infiltration is seen during Impervious-EOQ conditions. An increase of 5.67% for runoff and an increase of 10.60% of infiltration is seen during Pervious-EOQ conditions. It is likely that the actual changes to runoff and infiltration will be somewhere within the range estimated for Impervious-EOQ and Pervious-EOQ. As the increases and decreases are relatively small (other than the increase in runoff during Impervious-EOQ) it is unlikely there will be an adverse impact to the Outfall 2 watershed. A mitigation option for the potential increase in runoff of
24.94% during Impervious-EOQ scenario would include settling pond outlet controls at the downstream portion of the Quarry.

Outfall 3 catchment area is mainly located outside of the Project Site. This catchment contains numerous watercourses and contributes the vast majority of the water to the main receiver to the east of the Study Area, MacDonalds Brook. The changes to Outfall 3 are a direct result of the quarry expansion removing contributing drainage area. As such, Outfall 3 experiences a decrease in watershed area of 6.77%. Additionally, since none of Outfall 3 is within the Quarry area infiltration parameters do not change from existing conditions and a decrease of infiltration volume by approximately 10.65% is estimated to occur during both EOQ scenarios. A potential decrease of 10.65% in runoff volume is estimated to occur during both EOQ scenarios.

5. References


Outfall Locations

- Outfall 1
- Outfall 2
- Outfall 3

Local Catchment Areas

- Outfall 1 (186.7 ha)
- Outfall 2 (80.2 ha)
- Outfall 3 (135.7 ha)

Legend

- Study Area
- Development Area
- Elevation Contour (10m)
- Mapped Watercourse
- Field Identified Watercourse
- Field Identified Drainage
- Field Identified Wetland

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 20N

GILLIS LAKE, NOVA SCOTIA
LOCAL CATCHMENT AREAS

END OF MINE
WATERSHED DELINEATION

APPENDIX F. WATER QUALITY RESULTS
<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample Parameters</th>
<th>CCME Guidelines</th>
<th>Units</th>
<th>Reportable Detection Limit</th>
<th>WQ1</th>
<th>WQ2</th>
<th>WQ3</th>
<th>WQ4</th>
<th>WQ5</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS</td>
<td>Maximum increase of 25mg/L (short-term) or 5mg/L (long-term) from baseline levels</td>
<td>mg/L</td>
<td>2.5</td>
<td>Not sampled</td>
<td>73</td>
<td>73</td>
<td>73</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td></td>
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<td>09/25/19</td>
<td>11/06/19</td>
<td>09/25/19</td>
<td>11/06/19</td>
<td>09/25/19</td>
</tr>
</tbody>
</table>

**CALCULATED PARAMETERS**

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<thead>
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<th>Parameter</th>
<th>Units</th>
<th>WQ1</th>
<th>WQ2</th>
<th>WQ3</th>
<th>WQ4</th>
<th>WQ5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anion Sum</td>
<td>me/L</td>
<td>4.91</td>
<td>2.66</td>
<td>4.26</td>
<td>4.10</td>
<td>4.27</td>
</tr>
<tr>
<td>Bicarb. Alkalinity (calc. as CaCO3)</td>
<td>mg/L</td>
<td>1.0</td>
<td>91</td>
<td>58</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Calculated TDS</td>
<td>mg/L</td>
<td>1.0</td>
<td>270</td>
<td>140</td>
<td>240</td>
<td>220</td>
</tr>
<tr>
<td>Carb. Alkalinity (calc. as CaCO3)</td>
<td>mg/L</td>
<td>1.0</td>
<td>ND</td>
<td>ND</td>
<td>1.6</td>
<td>ND</td>
</tr>
<tr>
<td>Cation Sum</td>
<td>me/L</td>
<td>4.71</td>
<td>2.36</td>
<td>4.23</td>
<td>3.94</td>
<td>4.02</td>
</tr>
<tr>
<td>Hardness (CaCO3)</td>
<td>mg/L</td>
<td>1.0</td>
<td>110</td>
<td>68</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Ion Balance (% Difference)</td>
<td>%</td>
<td>N/A</td>
<td>2.08</td>
<td>5.98</td>
<td>0.350</td>
<td>1.99</td>
</tr>
<tr>
<td>Langelier Index (@ 20C)</td>
<td>N/A</td>
<td>-0.174</td>
<td>-0.588</td>
<td>0.521</td>
<td>0.239</td>
<td>-0.669</td>
</tr>
<tr>
<td>Langelier Index (@ 4C)</td>
<td>N/A</td>
<td>-0.423</td>
<td>-0.838</td>
<td>0.271</td>
<td>-0.0100</td>
<td>-0.919</td>
</tr>
<tr>
<td>Nitrate (N)</td>
<td>mg/L</td>
<td>0.050</td>
<td>0.96</td>
<td>0.44</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td>Saturation pH (@ 20C)</td>
<td>N/A</td>
<td>7.90</td>
<td>8.26</td>
<td>7.68</td>
<td>7.66</td>
<td>8.53</td>
</tr>
<tr>
<td>Saturation pH (@ 4C)</td>
<td>N/A</td>
<td>8.15</td>
<td>8.51</td>
<td>7.93</td>
<td>7.91</td>
<td>8.78</td>
</tr>
</tbody>
</table>

**INORGANICS**
<table>
<thead>
<tr>
<th>Sample</th>
<th>WQ1</th>
<th>WQ2</th>
<th>WQ3</th>
<th>WQ4</th>
<th>WQ5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Alkalinity (Total as CaCO3)</td>
<td>NV</td>
<td>mg/L</td>
<td>5.0</td>
<td>92 (1)</td>
<td>58</td>
</tr>
<tr>
<td>Dissolved Chloride (Cl)</td>
<td>640 (short-term) or 120 (long-term)</td>
<td>mg/L</td>
<td>1.0</td>
<td>99</td>
<td>47</td>
</tr>
<tr>
<td>Colour</td>
<td>shall not be significantly higher than the seasonally adjusted expected value</td>
<td>TCU</td>
<td>25</td>
<td>6.2</td>
<td>26</td>
</tr>
<tr>
<td>Nitrate + Nitrite (N)</td>
<td>NV</td>
<td>mg/L</td>
<td>0.050</td>
<td>0.96</td>
<td>0.45</td>
</tr>
<tr>
<td>Nitrite (N)</td>
<td>60</td>
<td>mg/L</td>
<td>0.010</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Nitrogen (Ammonia Nitrogen)</td>
<td>NV</td>
<td>mg/L</td>
<td>0.050</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Organic Carbon (C)</td>
<td>NV</td>
<td>mg/L</td>
<td>0.50</td>
<td>1.3</td>
<td>3.8</td>
</tr>
<tr>
<td>Orthophosphate (P)</td>
<td>NV</td>
<td>mg/L</td>
<td>0.010</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>pH</td>
<td>6.5 to 9.0</td>
<td>pH</td>
<td>N/A</td>
<td>7.73</td>
<td>7.67</td>
</tr>
<tr>
<td>Reactive Silica (SiO2)</td>
<td>NV</td>
<td>mg/L</td>
<td>0.50</td>
<td>6.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Dissolved Sulphate (SO4)</td>
<td>NV</td>
<td>mg/L</td>
<td>2.0</td>
<td>10</td>
<td>7.2</td>
</tr>
<tr>
<td>Turbidity</td>
<td>maximum increased of 8 NTUs (short-term) or 2 NTUs (long-term) from background levels</td>
<td>NTU</td>
<td>0.10</td>
<td>0.27</td>
<td>7.6</td>
</tr>
<tr>
<td>Conductivity</td>
<td>NV</td>
<td>uS/cm</td>
<td>1.0</td>
<td>540</td>
<td>270</td>
</tr>
</tbody>
</table>

**METALS**
# Gillis Lake Quarry Expansion Project
## Surface Water Samples Results

<table>
<thead>
<tr>
<th>Sample</th>
<th>Unit</th>
<th>WQ1</th>
<th>WQ2</th>
<th>WQ3</th>
<th>WQ4</th>
<th>WQ5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Aluminum (Al)</td>
<td>ug/L</td>
<td>5.0</td>
<td>16</td>
<td>470</td>
<td>20</td>
<td>110</td>
</tr>
<tr>
<td>Total Antimony (Sb)</td>
<td>ug/L</td>
<td>1.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Arsenic (As)</td>
<td>ug/L</td>
<td>1.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Barium (Ba)</td>
<td>ug/L</td>
<td>1.0</td>
<td>180</td>
<td>78</td>
<td>230</td>
<td>150</td>
</tr>
<tr>
<td>Total Beryllium (Be)</td>
<td>ug/L</td>
<td>1.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Bismuth (Bi)</td>
<td>ug/L</td>
<td>2.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Boron (B)</td>
<td>ug/L</td>
<td>50</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Cadmium (Cd)</td>
<td>ug/L</td>
<td>0.010</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Calcium (Ca)</td>
<td>ug/L</td>
<td>100</td>
<td>35000</td>
<td>22000</td>
<td>49000</td>
<td>50000</td>
</tr>
<tr>
<td>Total Chromium (Cr)</td>
<td>ug/L</td>
<td>1.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Cobalt (Co)</td>
<td>ug/L</td>
<td>0.40</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Copper (Cu)</td>
<td>ug/L</td>
<td>0.50</td>
<td>0.55</td>
<td>1.2</td>
<td>0.88</td>
<td>0.93</td>
</tr>
<tr>
<td>Total Iron (Fe)</td>
<td>ug/L</td>
<td>50</td>
<td>ND</td>
<td>380</td>
<td>ND</td>
<td>89</td>
</tr>
<tr>
<td>Total Lead (Pb)</td>
<td>ug/L</td>
<td>0.50</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Magnesium (Mg)</td>
<td>ug/L</td>
<td>100</td>
<td>5000</td>
<td>3200</td>
<td>7100</td>
<td>6700</td>
</tr>
<tr>
<td>Total Manganese (Mn)</td>
<td>ug/L</td>
<td>2.0</td>
<td>9.6</td>
<td>24</td>
<td>6.1</td>
<td>19</td>
</tr>
<tr>
<td>Total Molybdenum (Mo)</td>
<td>ug/L</td>
<td>2.0</td>
<td>4.8</td>
<td>2.1</td>
<td>6.4</td>
<td>4.7</td>
</tr>
<tr>
<td>Total Nickel (Ni)</td>
<td>ug/L</td>
<td>2.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Phosphorus (P)</td>
<td>ug/L</td>
<td>100</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Potassium (K)</td>
<td>ug/L</td>
<td>100</td>
<td>930</td>
<td>800</td>
<td>1200</td>
<td>1300</td>
</tr>
<tr>
<td>Total Selenium (Se)</td>
<td>ug/L</td>
<td>0.50</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Silver (Ag)</td>
<td>ug/L</td>
<td>0.25</td>
<td>0.10</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

**Notes:**
- NV: Not Measured
- ND: Not Determined
- ug/L: micrograms per liter
- long-term: years
- short-term: weeks
## Gillis Lake Quarry Expansion Project
### Surface Water Samples Results

<table>
<thead>
<tr>
<th>Sample</th>
<th>WQ1</th>
<th>WQ2</th>
<th>WQ3</th>
<th>WQ4</th>
<th>WQ5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sodium (Na)</td>
<td>NV</td>
<td>ug/L</td>
<td>100</td>
<td>58000</td>
<td>22000</td>
</tr>
<tr>
<td>Total Strontium (Sr)</td>
<td>NV</td>
<td>ug/L</td>
<td>2.0</td>
<td>230</td>
<td>97</td>
</tr>
<tr>
<td>Total Thallium (Ti)</td>
<td>0.8</td>
<td>ug/L</td>
<td>0.10</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Tin (Sn)</td>
<td>NV</td>
<td>ug/L</td>
<td>2.0</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Titanium (Ti)</td>
<td>NV</td>
<td>ug/L</td>
<td>2.0</td>
<td>ND</td>
<td>8.8</td>
</tr>
<tr>
<td>Total Uranium (U)</td>
<td>15 (long-term) or 33 (short-term)</td>
<td>ug/L</td>
<td>0.10</td>
<td>1.6</td>
<td>0.86</td>
</tr>
<tr>
<td>Total Vanadium (V)</td>
<td>NV</td>
<td>ug/L</td>
<td>2.0</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Total Zinc (Zn)</td>
<td>7 (long-term) or 37 (short-term)</td>
<td>ug/L</td>
<td>5.0</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

### PETROLEUM HYDROCARBONS

<table>
<thead>
<tr>
<th>Sample</th>
<th>ND= Not detected, N/A= Not Applicable, NV= No value, NC = Not calculated, due to no detection of an alkalinity value, (1) = Elevated reporting limit due to sample matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>0.37 mg/L 0.0010 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>Toluene</td>
<td>0.002 mg/L 0.0010 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>0.09 mg/L 0.0010 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>Total Xylenes</td>
<td>NV mg/L 0.0020 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>C6 - C10 (less BTEX)</td>
<td>NV mg/L 0.10 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>&gt;C10-C16 Hydrocarbons</td>
<td>NV mg/L 0.050 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>&gt;C16-C21 Hydrocarbons</td>
<td>NV mg/L 0.050 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>&gt;C21-C32 Hydrocarbons</td>
<td>NV mg/L 0.10 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>Modified TPH (Tier1)</td>
<td>NV mg/L 0.10 ND ND ND ND ND ND ND ND ND</td>
</tr>
<tr>
<td>Reached Baseline at C32</td>
<td>NV mg/L N/A</td>
</tr>
<tr>
<td>Hydrocarbon Resemblance</td>
<td>NV mg/L N/A</td>
</tr>
</tbody>
</table>