

Peer Review Strada Enclosures (June 2025)

Supporting Exhibits

The following exhibits are enclosed in support of Fifth Cycle Peer Review Comments. These exhibits also support the simultaneous Peer Review of the Site Plans. The reader is advised to review the Exhibits prior to the text.

- Ex H.1** Extract Table: Calibration Statistics for the Groundwater Model from May 2024, August 2024 and October 2024 Appendix D: Model Development and Calibration Report (not changed in 2024 or in January 2025).
- Ex H.2** Extracts from Earthfx (April 14, 2025) Response to Mediation Questions, Peer Review Amended Fig 2, 4 and 5. (Simulated base flow only 25% of NVCA Pine 1)
- Ex H.3** Strada Model vs Observed Stream Flows
- H.3.1** Strada Observed Dry weather Stream Base Flow Monitoring Aug 15, 2024 (with Genivar Sept 17, 2009)
- H.3.2** Model vs Observed Stream Flows
- Ex H.4** Extract from April 14, 2025 Response to Mediation Questions, Peer Review Amended Table 2, Fig 6, Fig 7 and Fig 8 (pg 13 to 17) with Inactive, Destroyed and Dry Monitors.
- Ex H.5** Extract from Earthfx January 31, 2025 Appendix E Impact Assessment (pg 85) (no change since October 2024).
- Ex H.6** Extract from October 2024 NRSI Natural Environmental Assessment (pg 223).
- Ex H.7** Extracts from October 4, 2024 Geotechnical Berm and Slope Stability Feasibility Study and Earthfx January 31, 2025 Appendix E Impact Assessment
- H.7.1** Pgs 4 to 7 Peer Review Amended Figure.
- H.7.2** Cross Section shows Phase 2 Extraction (Uplift Hydraulic Pressures on Lift 2 Floor)
- Ex H.8** Stormwater Management Fluxes, Excerpts from Appendix E: Impact Assessment January 31, 2025. Only 12 L/s allocated to injection wells.
- Ex H.9** MECP Water Well Location Maps:
- H.9.1** Lot 8 to 16, Con 3 & 4 – Melancthon Old Survey, Scale 1:15,000 at 11x17”
- H.9.2** Lot 13 to 16, Con 1 & 2 – Melancthon Old Survey, Scale 1:15,000 at 11x17”
- H.9.3** Horning’s Mills, Scale 1:6,000 at 11x17”.
- Ex H.10 Site Photos:**
- H.10.1** Spring with Bored Well at 177 Main Street, Horning’s Mills (May 8, 2025)
- H.10.2** NAT-3 Noble Farm Tile Drain Outfall (June 3, 2025)
- H.10.3** NAT-19 Inlets and Outlets
- H.10.4** NAT-19 Outlets / 3rd Line Recharge
- H.10.5** Spring Flooding 4th Line and 3rd Line
- Map 1-1** NRSI Environmental Assessment (North)
- Map 1-2** NRSI Environmental Assessment (South)

NDACT DRAFT Model Calibration Report

May, 2024

Table 5.4: Calibration statistics for the groundwater model.

Unit	Number of Wells (n)	ME (m)	MAE (m)	RMSE (m)	Range in Observations (m)	RMSE as Percent of Range (%)
Sand/gravel Outwash	60	2.75	3.72	5.28	119	4.4%
Weathered Bedrock/Guelph	1,071	-0.80	3.46	4.87	165	3.0%
Gasport	218	-2.27	5.19	6.59	148	4.5%
Composite of Above Units	1,349	-0.97	3.72	5.19	165	3.1%

Appendix D: Model Development and Calibration

August, 2024

Table 4.4: Calibration statistics for the groundwater model.

Unit	Number of Wells (n)	ME (m)	MAE (m)	RMSE (m)	Range in Observations (m)	RMSE as Percent of Range (%)
Sand/gravel Outwash	60	2.75	3.72	5.28	119	4.4%
Weathered Bedrock/Guelph	1,071	-0.80	3.46	4.87	165	3.0%
Gasport	218	-2.27	5.19	6.59	148	4.5%
Composite of Above Units	1,349	-0.97	3.72	5.19	165	3.1%

Appendix D: Model Development and Calibration

October, 2024

Table 4.4: Calibration statistics for the groundwater model.

Unit	Number of Wells (n)	ME (m)	MAE (m)	RMSE (m)	Range in Observations (m)	RMSE as Percent of Range (%)
Sand/gravel Outwash	60	2.75	3.72	5.28	119	4.4%
Weathered Bedrock/Guelph	1,071	-0.80	3.46	4.87	165	3.0%
Gasport	218	-2.27	5.19	6.59	148	4.5%
Composite of Above Units	1,349	-0.97	3.72	5.19	165	3.1%

Source: Excerpts from Appendix D: Model Development and Calibration, May, August and October 2024

File Date: Jan 22, 2025

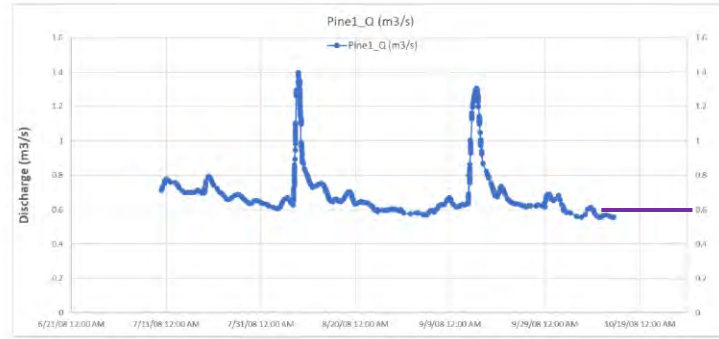


Figure 2: Figure showing streamflow data from Pine 1 NVCA station.

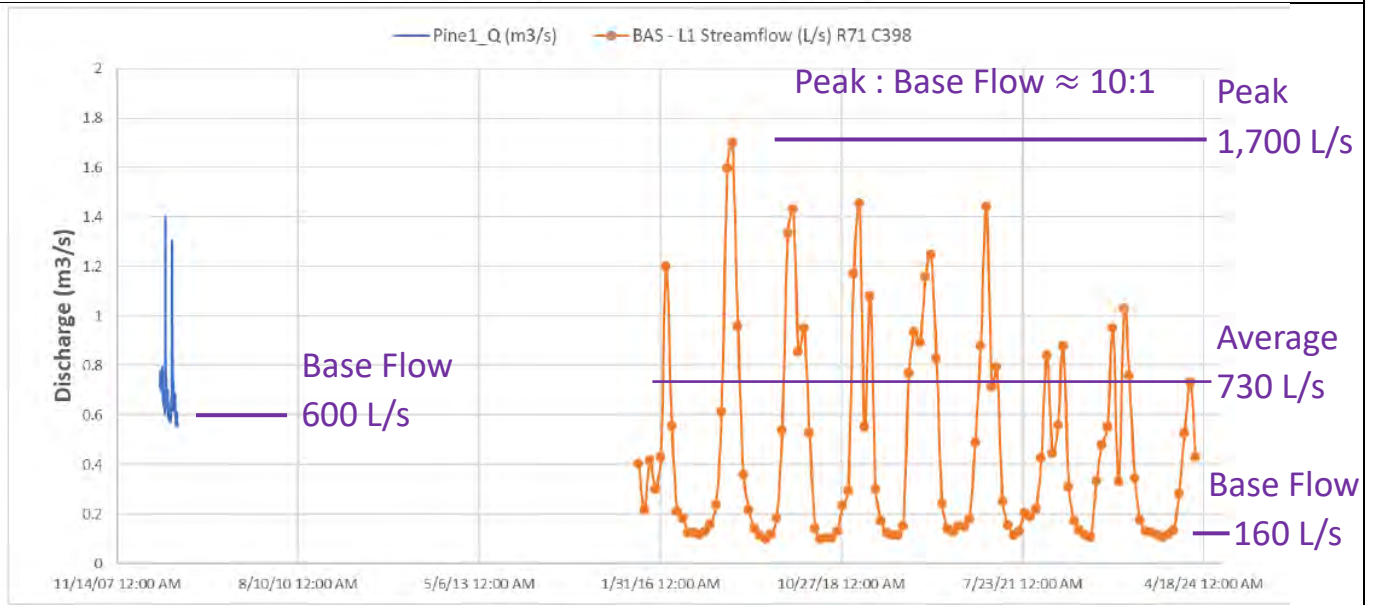


Figure 4: Comparison of Pine River Station 1 flows (blue) to model simulated flows (red).

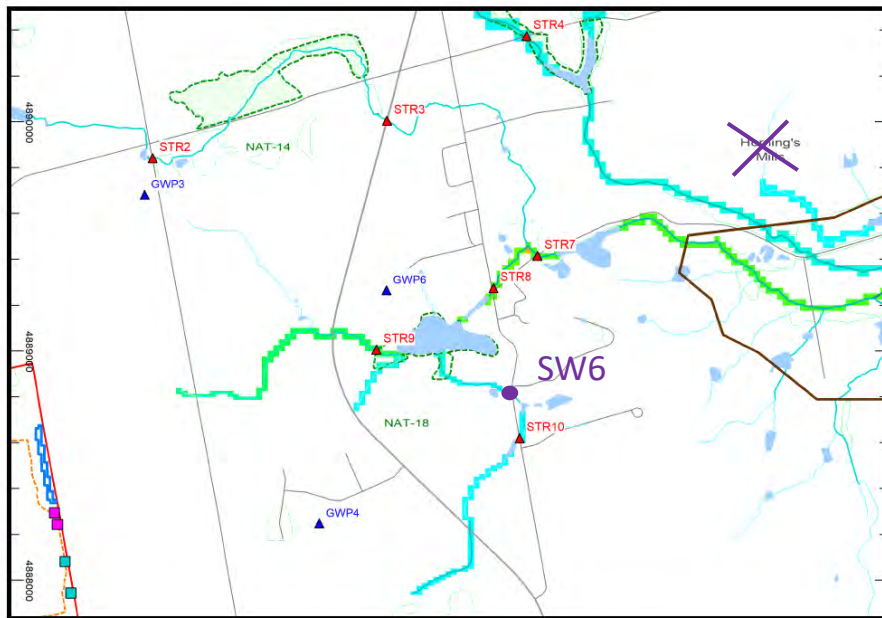
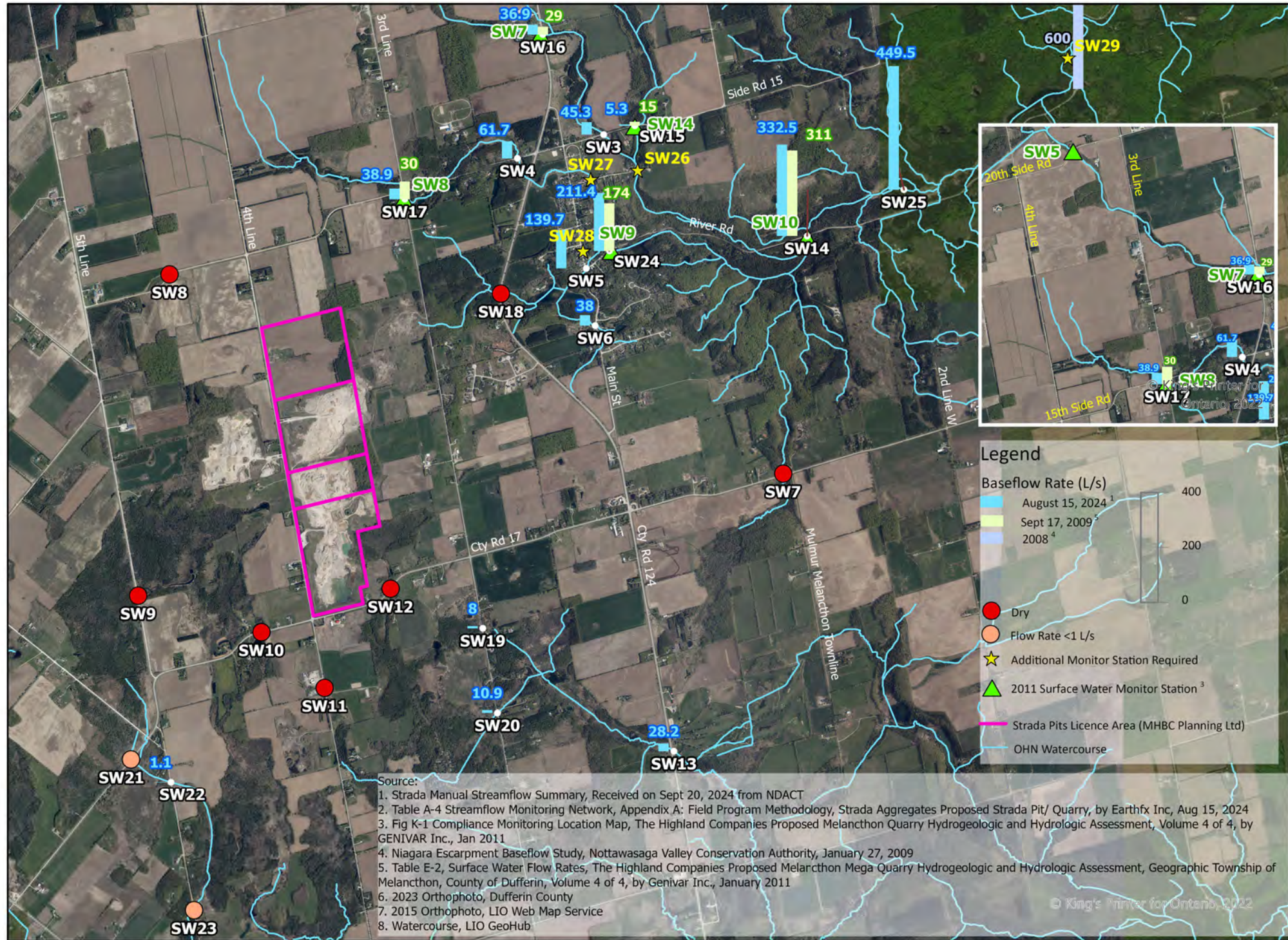


Figure 5: Location of STR9, STR8 and STR7, SW6, SW25, Pine 1 NVCA



DRAFT

Strada Proposed Quarry
Model vs Observed Stream Flows

Geographic Location	Appendix E Model Virtual Base Flow ¹⁾ Lowest Aug. to Sept.			Strada Observed Flows Aug 15, 2024 ²⁾		Genivar Observed Flows Sept 17, 2009 ³⁾		NVCA 2008 ⁵⁾	
	Station		L/s	Station	L/s	Station	L/s	Station	L/s
Newell Funston	STR2	Fig 3.22	0	SW17	38.9	SW8	30		
15th SR	STR3	Fig 3.22	13	SW4	61.7	-			
H.M Lake	STR9	Fig 4.10	18	-		-			
Main Street	STR8	Fig 4.11	56	SW5	139.7	-			
Mill Pond R.R	STR7	Fig 4.11	85	SW24	211.4	SW9	174		
Campbell 124 Cty Rd	STR1		NA	SW16	36.9	SW7	29		
Campbell 15th SR	STR4		NA	SW3	45.3	-			
Honeywood 15th SR				SW15	5.3	SW14	15		
Townline R.R				SW14	332.5	SW10	311		
Honeywood Line R.R				SW25	449.5	-			
Pine River at Prince of Wales Rd								Pine 1	600
Pine River at Everett ⁴⁾		Fig 3.38	830	-		-			
Golf Course 124	STR14	Fig 3.18	0	SW13	28.2	-			

Note: R.R: River Road

H.M: Horning's Mills

NA: Not Available

Date Source:

1) Draft Impact Assessment Report, Proposed Strada Pit/Quarry, by Earthfx Inc, August 2024

2) Strada Manual Streamflow Summary, Received on Sept 20, 2024 from NDACT

3) Table E-2, Surface Water Flow Rates, The Highland Companies Proposed Melancthon Mega Quarry Hydrogeologic and Hydrologic Assessment, Geographic Township of Melancthon, County of Dufferin, Volume 4 of 4, by Genivar Inc., January 2011

4) Appendix D Model Development and Calibration Report, Proposed Strada Pit/Quarry, by Earthfx Inc, August 2024

5) Niagara Escarpment Baseflow Study, Nottawasaga Valley Conservation Authority, January 27, 2009

File Date: January 23, 2025

StreamFlowCompare_20251223.xlsx

Table 2.2: Monthly groundwater budget under baseline conditions (in mm/month) Wetland NAT-18

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Net Water from Storage	-0.30	-0.25	-0.18	0.07	0.77	0.71	0.19	0.10	-0.14	-0.35	-0.28	-0.20	0.01
Recharge	2.31	2.04	2.55	2.35	1.23	0.83	1.07	0.92	1.13	1.47	1.86	2.09	1.65
Net Lateral Flow In	904.3	854.6	963.9	936.4	917.6	848.3	851.8	830.8	793.3	821.2	812.6	861.2	866.3
GW ET	-0.38	-0.58	-1.79	-10.56	-67.18	-99.91	-92.78	-77.52	-48.06	-11.92	-1.88	-0.39	-34.41
Surface Leakage	-499.4	-474.4	-537.3	-519.7	-477.1	-417.6	-420.8	-416.0	-410.1	-444.0	-445.8	-474.7	-461.4
Stream Leakage	-67.35	-65.80	-76.44	-74.08	-63.57	-52.75	-52.10	-51.02	-50.44	-55.64	-57.04	-61.97	-60.68
Net Lake Seepage	-337.0	-315.0	-349.4	-334.5	-311.8	-279.6	-287.4	-286.7	-284.8	-308.7	-308.0	-325.7	-310.7
Streamflow In (L/s)	50.7	56.7	60.5	61.7	50.8	43.1	39.8	37.6	36.6	37.9	40.7	44.3	46.7
Streamflow Out (L/s)	79.0	86.1	91.3	93.0	79.8	69.2	64.4	61.9	61.2	63.3	67.0	71.4	74.0
Avg Lake Stage (masl)	450.8	450.8	450.8	450.8	450.8	450.7	450.7	450.7	450.7	450.7	450.7	450.7	450.8

Source: Table 2.2, Extract from Earthfx January 31, 2025 Appendix E Impact Assessment (pg 43)

Response to Mediation Questions

Proposed Shelburne Pit/Quarry

Prepared for:



Strada Aggregates
30 Floral Parkway
Concord, Ontario L4K 4R1

Prepared by:



71 Cranbrooke Avenue
Toronto, Ontario M5M 1M3

April 2025

Amended Earthfx Table 2
Strada Aggregate Proposed Melancthon Pit/Quarry
Proposed Site Monitors

Model Layer	Mnitor ID	Active	Dry	Inactive	Destroyed	Source
Layer 1 Overburden Shallow	OW6-A	OW6-A				Fig 6
	OW7-A	OW7-A				Fig 6
	OW8-A	OW8-A				Fig 6
	OW11-A				OW11-A	Fig 6
	OW15-A				OW15-A	Fig 6
	OW14-A		OW14-A			Fig 6
	OW21-A		OW21-A			Fig 6
Layer 2 Glacial Till	OW3B-08	OW3B-08				Fig 6
	OW4B-08	OW4B-08				Fig 6
	OW5B-08	OW5B-08				Fig 6
	OW9B-08	OW9B-08				Fig 6
	OW10B-08	OW10B-08				Fig 6
	OW12B-08	OW12B-08				Fig 6
	OW13-A	OW13-A				Fig 6
	OW18-A	OW18-A				Fig 6
	OW19-A	OW19-A				Fig 6
	OW2B-08				OW2B-08	Fig 6
	OW17B-08				OW17B-08	Fig 6
	OW20-A		OW20-A			Fig 6
	OW22-A		OW22-A			Fig 6
	OW23-A		OW23-A			Fig 6
Layer 3 Weathered Bedrock (Epikarst)	OW29-A	OW29-A				Fig 7
	OW3C-07	OW3C-07				Fig 7
	OW4C-07	OW4C-07				Fig 7
	OW5-C	OW5-C				Fig 7
	OW13-C	OW13-C				Fig 7
	OW14-C	OW14-C				Fig 7
	OW18-C	OW18-C				Fig 7
	OW19-C	OW19-C				Fig 7
	OW20-C	OW20-C				Fig 7
	OW22-C	OW22-C				Fig 7
	OW24-A	OW24-A				Fig 7
	OW11-C				OW11-C	Fig 7
	OW15-C				OW15-C	Fig 7
	OW17-C				OW17-C	Fig 7
Layer 4 Guelph Formation	OW7-C	OW7-C				Fig 7
	OW16-C	OW16-C				Fig 7
	OW23-C	OW23-C				Fig 7
	OW25-A	OW25-A				Fig 7
	OW26-A	OW26-A				Fig 7
	OW28-A	OW28-A				Fig 7
Layer 6 Gasport Formation	OW24-C	OW24-C				Fig 8
	OW25-C	OW25-C				Fig 8
	OW26-C	OW26-C				Fig 8
	OW27-C	OW27-C				Fig 8
	OW28-C	OW28-C				Fig 8
	OW29-C	OW29-C				Fig 8
	OW30-C	OW30-C				Fig 8
	OW2C-07				OW2C-07	Fig 8
	OW1			OW1		Fig 8
	PW1			PW1		Fig 8
Total	51	36	5	2	8	

Data Sources:

Response to Mediation Questions, Proposed Shelburne Pit/Quarry, by Earthfx Inc. April 14, 2025

Fig 6 Site Monitors Layer 1 Shallow Overburden and Layer 2 Till

Fig 7 Site Monitors Layer 3 Weathered Bedrock and Layer 4 Guelph

Fig 8 Site Monitors: Layer 6 Gasport

Table 2 Monitoring Network including Hydrostratigraphic Layers and Units

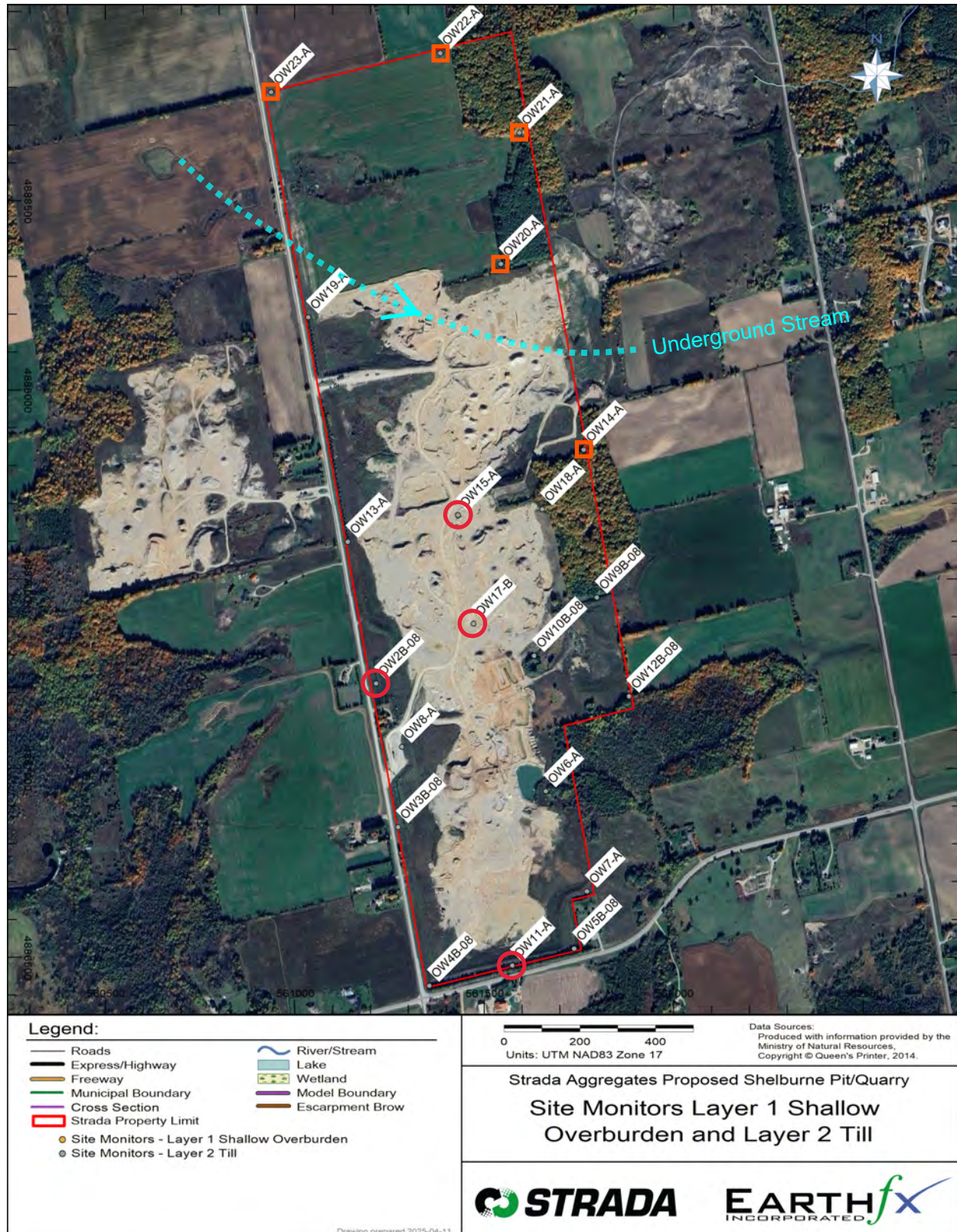


Figure 6: Site monitors in Layers 1 and 2

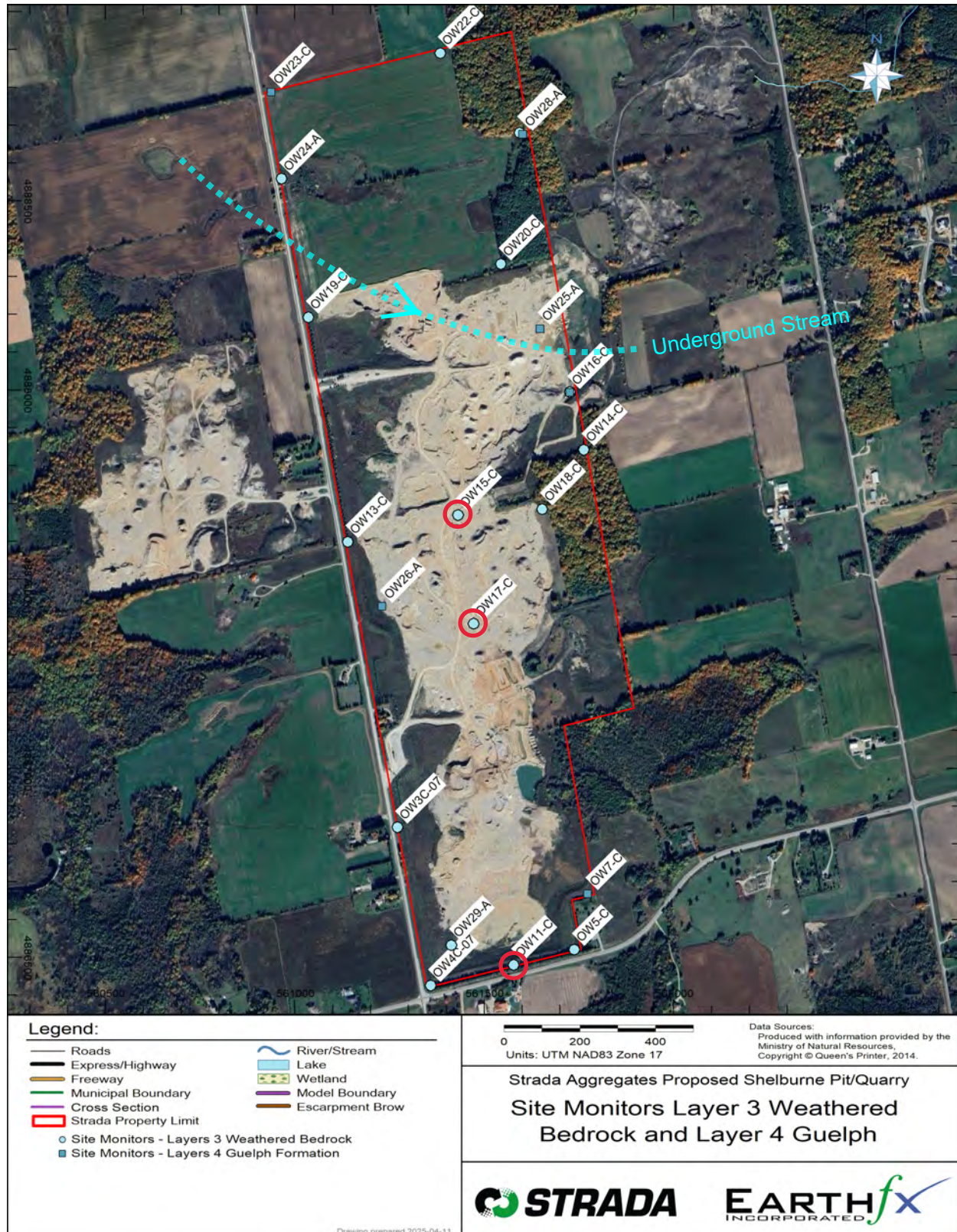


Figure 7: Site monitors in Layers 3 and 4

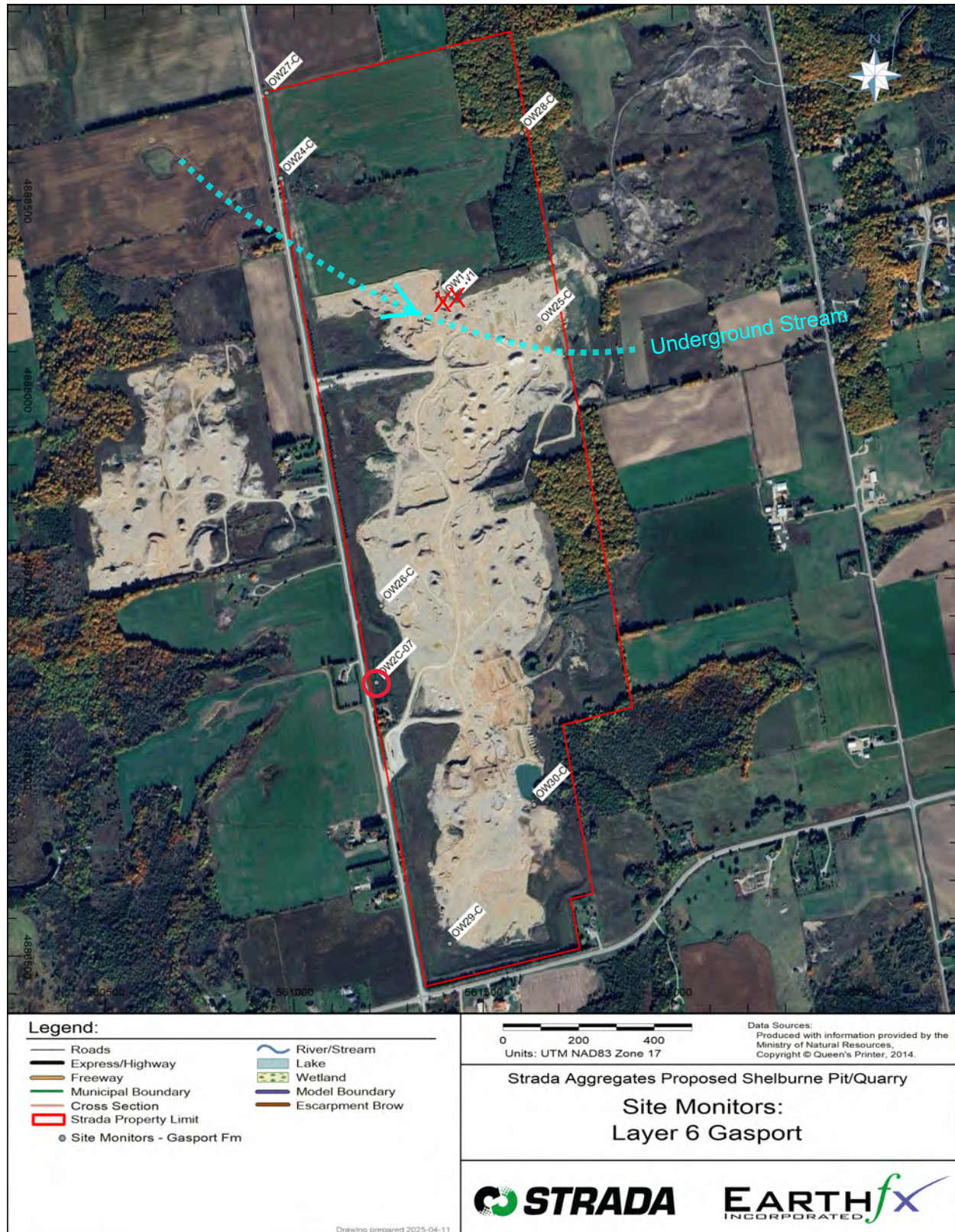


Figure 8: Site monitors in Layer 6



Enhancing our communities



EARTH SYSTEMS ANALYSIS

Strada Pit/Quarry

LEVEL 1 AND 2 HYDROGEOLOGICAL ASSESSMENT

Strada Aggregates

3.6.3 Phase 2 Seasonal and Inter-Annual Change in Flows and Levels

The transient simulations through 2015-2024 provide insight into the effects of Phase 2 during seasonal and inter-annual variation.

The groundwater levels at two key locations, GWP4 and GWP6 (location shown in Figure 2.11), have been selected to illustrate the seasonal variation. Groundwater drawdowns at other locations are minimal, and mounding effects are discussed in the feature-based water budgets. Figure 3.28 shows that the change in groundwater levels between Baseline and Phase 2 in the Guelph and Gasport formations at location GWP4 are generally varying with slightly higher drawdowns during periods of lower water levels. Specifically, water levels during the summer are predicted to be reduced by 1.0 (in Guelph) to 1.8 m (in Gasport), whereas the reduction during the winter will be limited to a range of 1.5 to 2.0 m.

Figure 3.29 shows that the change in groundwater variability between Baseline and Phase 2 in the Guelph and Gasport formations at location GWP6 are minimal. However, in the Gasport formation, slightly greater drawdowns of approximately 0.2 m are predicted during both the summer and the wet seasons.

Figure 3.30 shows the change in streamflow at STR9 between the Baseline and Phase 2 scenario (location shown in Figure 2.11). Peak flows in this small headwater tributary are slightly more affected than summer low flows. This tributary is only one small component of the water budget of Pond NAT-18, and the full water budget for that feature is discussed in the following section. However, similarly as in Phase 1, the very low flows in this stream are significantly affected with percent reductions of 40% to 50% during the dry and wet seasons, respectively.

Figure 3.31 shows the effect of Phase 2 on flows down stream of Pond NAT-18 at locations STR8 and STR7. The hydrograph indicates a reduction between Baseline and Phase 2 streamflows at location STR8 of approximately 30%. At location STR7 streamflow reductions are expected to be between 10% and 20%.

Peer Review Comments:

Page not updated from October 2024 version.

NAT-16 flow reductions assumed similar to NAT-18.



Strada Pit/Quarry

Natural Environment Assessment

Prepared for:

Strada Aggregates Inc.
30 Floral Parkway
Concord, Ontario
L4K 4R1

Project No. 2473A | October 2024



NATURAL RESOURCE SOLUTIONS INC.

Aquatic, Terrestrial and Wetland Biologists

that comprise part of the NAT-18 complex, due to the combined effects of reduced stream inflow and shallow groundwater drawdown during Phase 4A. The species with high sensitivity to hydrological change that were recorded at this complex (i.e., Hooded Merganser, Gray Treefrog, Spring Peeper, and Wood Frog) (TRCA 2017) may be the most susceptible to negative habitat effects caused by the anticipated change in conditions. However, as described above, these smaller features will experience only minor reductions in water level, and minor shifts in fringing vegetation based on these anticipated hydrological effects. These features will continue to maintain a suitable hydroperiod for amphibian breeding, and no changes to their current habitat functions (e.g., as amphibian breeding habitat or as habitat for the observed bird species) are anticipated.

As described above, no negative effects on the hydrological regime of the NAT-16 natural features are anticipated during or following quarry operation. Provided the existing vegetation communities remain relatively unchanged from baseline conditions, as is anticipated, and since the large open water pond habitat (SA) will continue to exist, no negative effects to terrestrial wildlife or their habitats are anticipated within NAT-16.

Effects on Aquatic Habitats and Fish Communities

The aquatic habitats present throughout NAT-18 include several online ponds and a single permanent watercourse, which connects the ponds and crosses Main Street at several locations as it meanders in a northerly direction. The ponds provide habitat for the local fish community as well as portions of the connecting watercourse where water depths and aquatic vegetation establishment allow. Where it crosses Main Street between Oldfield Court and Fieldway Court the watercourse exhibits a coldwater thermal regime. Where the watercourse crosses Main Street, at its intersection with Mill Street, the thermal regime was characterized as coolwater, suggesting that the large online SA pond associated with NAT-18 is acting to increase the water temperature to some degree within the feature under baseline conditions. The watercourse associated with NAT-18 flows east into a larger watercourse within NAT-16, north of River Road. This larger watercourse flows south from NAT-14 and its headwaters to the north of Sideroad 15. The thermal regime of NAT-14 was cool/coldwater and at that location the watercourse supports Brook Trout (see Section 7.4.1.3). Brook Trout were also confirmed within the watercourse associated with NAT-16 at its crossing of River Road, where both adults and juveniles were captured, in addition to several other coolwater fish species including Blacknose Dace, Creek Chub, and Northern Redbelly Dace. At this location the watercourse

exhibited a coolwater thermal regime and provides more available habitat (i.e. wider wetted width and deeper pools compared to the NAT-14 watercourse.

Under Phase 1, 2C, and 4A conditions, it is predicted that the surface leakage and streamflow to the ponds and associated watercourses occurring within NAT-18 will experience varying amounts of decrease. The watercourses and smaller ponds along Main Street between Oldfield Court and Fieldway Court, which flow to the south side of the large pond, are not expected to experience much of a decrease in surface leakage/discharge but may experience a slight reduction in streamflow. However, the online ponds should act to alleviate potential reductions in flow and, given the small expected decrease, it is not anticipated that there would be any notable change in the quality or quantity of available aquatic habitat, or in the thermal regime when compared to baseline conditions. In comparison, the watercourse features in the vicinity of County Road 124, and that connect to the west side of the large pond, are predicted to experience slightly higher decreases in surface leakage, which would cause decreases in streamflow. These decreases will be higher during Phase 4A compared to Phases 1 and 2C. However, the aquatic habitat associated with these features is limited. In particular, the watercourse at its crossing of County Road 124 does not provide suitable fish habitat at or upstream of that location since the road and its associated culvert acts as a barrier. Fish may utilize the lower reach of the watercourse where it connects to the pond, but this couldn't be assessed during field investigations due to site access limitations. Further, if a direct connection to the large SA pond exists, fish are expected to utilize areas within the pond throughout the year, as required. Potential reductions in surface leakage and streamflow within these reaches may slightly reduce the amount of water flowing to the large pond, including the amount of groundwater, but the aquatic habitat or local fish community is not expected to be affected. The pond level is dictated by a weir at the northeast edge, which should act to maintain water levels within the pond to a certain extent.

A single channel collects water from NAT-18 at its northeast outlet from the large SA pond and directs it across Main Street towards NAT-16 where it flows into the watercourse flowing south from NAT-14, a distance of approximately 450m. Modelling predicts that this reach, flowing from the NAT-18 pond, will experience the largest decrease in surface discharge and streamflow, particularly during Phase 4A. Under Phase 1 conditions, this reach may experience a relatively small decrease in surface discharge at various locations along its length, which would result in an overall decrease in streamflow. However, it is also predicted that there would be an increase in surface discharge to the SWM4 swamp north of River Road, which would help

to offset some of the potential effects from the reduction in surface discharge to the watercourse reach upstream. A more substantial decrease in streamflow within this reach is predicted to occur during Phase 4A due to the reductions in surface leakage and streamflow that are anticipated in the vicinity of the large NAT-18 pond and the inflowing watercourses, which feed into and influence this reach. Under baseline conditions, this reach exhibits a coolwater thermal regime and provides direct fish habitat, evidenced by observations of fish within the channel at the crossing of Main Street. Further, it is expected that the fish community that occupy this affected reach would have access to the watercourse within the NAT-16 SWM4 swamp north of River Road, which flows southwards from NAT-14, which the affected reach confluences with. Given that Brook Trout were confirmed within the NAT-16 watercourse at River Road, it is anticipated that the NAT-18 would also contain Brook Trout. However, due to site access limitations, this could not be confirmed. The decrease in the surface leakage and streamflow, as modeled for the watercourse reach outflowing from the NAT-18 pond, may result in an overall reduction in the amount of available fish habitat, and less coldwater input to the watercourse. However, it is expected that this reach will still provide adequate water depths and suitable water temperatures to continue to support the existing cool and coldwater species within it. Under baseflow conditions, the channel just east of the River Road crossing was measured with a wetted width of approximately 2.5m with a water depth of approximately 0.3m, which is predicted to be near the minimum water depth for that location under baseflow conditions. Seasonal fluctuations will occur at this location and it is expected that water depths will be higher for much of the year and in particular throughout the spring and during precipitation events. For watercourses that exhibit a stream width of $\leq 5.0\text{m}$, a water depth of 0.3m falls within the optimal range for Brook Trout (Raleigh 1982) when considering the average thalweg depth during the late growing season low water period. While suitability generally decreases for water depths below 0.25m, water depths above approximately 0.1m could still be considered suitable, albeit less than optimal. The proposed quarry operation is expected to result in a temporary reduction in streamflow up to a maximum of roughly 40-50% during times of the year that may see water depths drop below the optimal depth for Brook Trout during the low flow period. However, given that suitable water depths occur down to approximately 0.1m, and that the modeled reduction in streamflow will generally be less than the maximum predicted 40-50% reduction, it is expected that this reach of watercourse will still provide adequate water depths for Brook Trout. Additionally, given its connection to the larger watercourse flowing southwards from NAT-14 through NAT-16, which provides a relatively deeper channel and pools

over 0.6m deep, the opportunity exists for fish to utilize the aquatic habitats within both watercourses, as needed, throughout the year.

The decrease in surface leakage and streamflow that is predicted for the watercourse connecting NAT-18 and NAT-16 is not expected to affect the available habitat or the thermal regime of the downstream watercourse to which it flows. As noted in section 7.4.1.3, it is predicted that NAT-14 will experience an overall increase in surface leakage within the complex under Phase 1, 2C, and 4A conditions, which will provide additional groundwater to the associated watercourse and will result in an increase in streamflow and a potential cooling effect. Since this watercourse flows from NAT-14 and then through NAT-16, this increase in streamflow and the potential cooling effect associated with it will also be realized within the NAT-16 watercourse at River Road and downstream. Overall, it is expected that the NAT-16 watercourse will continue to provide suitable habitat for the existing fish community, including Brook Trout.

7.4.1.7 Predicted Effects Within the Subject Lands

Natural Feature Water Balance

The Impact Assessment Report (Earthfx 2024a) provides a west to east cross-section of the various surficial materials and bedrock conditions, along with baseline groundwater levels. The cross-section is located north of the former Bonnefield property, approximately through the centre of the Melancthon Pit #1 property (Fig. 2.6, Earthfx 2024a). A layer of Tavistock Till is present beneath the surface sand and gravel layer (Earthfx 2024b). On the east side of the former Bonnefield property, within the Dry-Fresh Sugar Maple Deciduous Forest (FOD5-1) the Tavistock till limits groundwater interaction with the surface. The baseline depth to the groundwater table near the former Bonnefield property wetlands is approximately 2.5-4.5m below the ground surface (Appendix XII, Fig. 2.9). In the area immediately surrounding the MAM2 and MAS2 wetlands, the depth to the groundwater table is greater than 5m (Fig. 2.9; Earthfx 2024a). These conditions result in perched wetlands on the former Bonnefield property. As such, the effects of groundwater dewatering and mounding during Phases 1, 2C, 4A and the rehabilitation phase will not impact the MAM2 and MAS2 wetlands. No negative impacts are expected to these wetlands during pit operations.

A portion of the NAT-19 complex extends onto the Melancthon Pit #2 property, including SWD4 and SWM4-1 vegetation communities (Map 3-14). A detailed description of the effects of groundwater mounding resulting from the central and southern infiltration ponds for the NAT-19



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October 4, 2024

File: 1000876.086 – Rev2

Tatham Engineering Limited
41 King Street, Unit 4
Barrie, Ontario
L4N 685

Attention: Alicia Kimberley, P.Geo., Group Leader - Hydrogeology

**Re: Geotechnical Berm and Slope Stability Feasibility Study
Proposed Strata Shelburne Quarry/Pit, 437159 4 Line, Melancthon, Ontario**

Enclosed is our Geotechnical Feasibility Study to support the proposed quarry/pit berms, trench, and ponds of the proposed Shelburne Quarry/Pit in Melancthon, Ontario. The report presented herein is based on the scope of work summarized in our proposal dated April 16, 2024, the subsequent change order dated June 10, 2024, and peer review comments received on August 27, 2024. Authorization to proceed was given by Grant C. Horan of Strada Aggregates on May 16, 2024 for the original scope of work, and on June 11, 2024 for the extended scope of work. This report was prepared by Connor McCormick, P.Eng., and reviewed by Graeme Skinner, PhD., P.Eng.

A handwritten signature in blue ink, appearing to read "Connor McCormick".

Connor McCormick, P.Eng.
Geotechnical Engineering

A handwritten signature in blue ink, appearing to read "Graeme Skinner".

Graeme Skinner, PhD., P.Eng.
Principal Geotechnical Engineer

JCM/GDS/sv/af

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4.1.1 Quarry/Pit Berm Global and Sliding Stability Analysis

It is understood that the current conceptual design of the quarry/pit excavation includes the use of low permeability/impermeable berms to limit infiltration of groundwater through the identified permeable soil and bedrock strata. The proposed berms would be placed on the benches where the permeable units have been identified. The Client provided three (3) cross sections showing the proposed quarry/pit and berm construction (Sections A-A', B-B' and C-C'; see Appendix B). The stratigraphy elevations and composition included in the preliminary stability assessment discussed herein were taken directly from these cross sections. While the Client cross sections appear to show the berms as near vertical features (due to horizontal versus vertical scale exaggeration), it was confirmed that they would have a typical inclination of 2 Horizontal to 1 Vertical (2H:1V). Section C-C' was identified as the critical section, due to the presence of relatively thick overburden, and high groundwater (head) pressure from the hydrogeological models. The proposed upper berm will abut the soil overburden at the site, while the middle and lower berms will abut permeable bedrock; and all berms are expected to be founded on competent bedrock. The Factor of Safety (FOS) for global stability of the berm slopes was analysed based on limit equilibrium analysis using the commercially available program Slide 2018, produced by Rocscience Inc., employing the Morgenstern Price method of analysis for static loading conditions. The lowest, or minimum, FOS against slope instability is presented herein. The FOS against potential sliding of the berms along the berm / bedrock interface was analyzed and is presented herein. The results of the global slope stability and sliding analyses for quarry/pit Section C-C' are provided below:

Section	Berm Inclination	Berm Height (m)	Stability Mode	Estimated Minimum Factor of Safety	Target Factor of Safety
Section C-C' (Upper Quarry/Pit Section)	2H:1V	19.6	Global ¹	0.90	1.3 to 1.5
			Sliding ²	1.0	2.0
Section C-C' (Middle Quarry/Pit Section)	2H:1V	10.8	Global ¹	0.74	1.3 to 1.5
			Sliding ²	1.0	2.0
Section C-C' (Lower Quarry/Pit Section)	2H:1V	12.2	Global ¹	0.73	1.3 to 1.5
			Sliding ²	1.0	2.0

Note: 1. The global stability analysis evaluates the stability of the berm but does not fully account for the potential high hydraulic pressures found in the lower berms.

2. The sliding analysis assumes the berms will behave "monolithically", and potential instability of the berm due to groundwater pressures was not assessed.

Based on the results of our analyses, the current berm configurations (i.e., 2H:1V slopes) are not meeting the target minimum FOS for global stability or sliding.

The FOS for the berms can be increased by:

- Decreasing the slope inclination from 2H:1V to 3H:1V;
- Adding positive drainage to the berms (i.e., lower the groundwater level in the berms); and / or,
- A combination of both.

A preliminary global and sliding stability assessment was undertaken incorporating the additional stability measures outlined above, and it showed that these measures still fall short of the target minimum FOS where the berm is composed entirely of impermeable (i.e., clayey) material.

Therefore, it is recommended that, at the feasibility level, a composite berm construction using a 'core' of impermeable clay (or sufficiently impermeable material) with a well compacted cohesionless granular shell or outer material comprising of the majority of the berm backfill be utilized for the berm construction. Based on an initial limited global stability and sliding assessment, a composite berm structure could provide satisfactory FOS for both global and sliding stability at a 2H:1V slope. It should be noted that potential high hydraulic heads are anticipated at the lowest berms, and consideration may need to be given to raising the berm height in order to extend the "clay core" across the bedrock units, while also increasing the berm thickness (and stability) at contact. This would be expected to limit groundwater "punching" through the berm where it is thinnest. As noted above, the feasibility level sliding analysis did not consider partial failure i.e., "punching" or "piping" of the berms, and the overall stability of the berms, including these potential failure mechanisms, should be confirmed during the detailed design stage based on a site-specific geotechnical field investigation and prior to construction.

4.1.2 Quarry/Pit Trench and Pond Global Stability Analysis

Global slope stability analyses were carried out for two water control features. A drainage trench located toward the northwest end of the site (within Section A-A'; see Appendix B) and an infiltration pond located south of the main quarry pit (within Section C-C'; see Appendix B). Cross sections for the trench and pond were provided by the Client (Appendix B). Further, based on information provided by the Client, it is understood that the trench would have a bottom elevation of about 503.0 m (about 7.0 m below grade) and that the West wall of the trench would be coincidental with the back side of a quarry/pit berm. It is understood that the north and west pond walls would be provided with an impermeable (i.e., clayey) liner, while the south and east walls would be left as native soils. The global stability of the trench and pond slopes was analyzed based on limit equilibrium analysis, again using the commercially available program Slope/W®, produced by Geo-Slope International Ltd., employing the Morgenstern Price method of analysis for static loading conditions. The slope stability assessment considered both the steady-state and elevated design groundwater level in the trench, while the pond only considered the design

steady-state groundwater level, and it is understood the temporary elevated groundwater level is not applicable to the feasibility design at this time. The results of the global stability analysis are provided below:

Section	Berm Inclination	Slope Height (m)	Minimum Factor of Safety		Target Factor of Safety
			Steady-State Groundwater Level (Dry)	Temporary Elevated Groundwater	
Section A-A' (West Trench Wall)	2 H : 1 V	7.0	1.68	1.54	1.3 to 1.5
Section A-A' (East Trench Wall)	2 H : 1 V	7.0	1.37	1.28	1.3 to 1.5
Section C-C' (North Pond Wall)	3 H : 1 V*	17.0	1.84	N/A	1.3 to 1.5
Section C-C' (South Pond Wall)	2 H : 1 V	17.0	1.40	N/A	1.3 to 1.5

* The impermeable liner on the north pond wall is expected to be unstable / marginally stable at inclinations steeper than 3 H:1V.
N/A – Not applicable.

Based on the results of our feasibility analysis, we expect that these two water control features will generally be stable with respect global stability at the given FOS ranges. With that said, we note that both the trench and pond walls may be marginally stable to unstable in the event of rapid drawdown and with an impermeable liner. The effects of rapid drawdown and slope liner stability should be further analyzed during the detailed design stage using site specific information.

4.2 Re-Use of On-Site Soils for Impermeable Layers

It is understood that the quarry/pit developer is proposing to re-use any on-site fine grained (i.e., clayey) soils from the site to construct the impermeable pond liner and cores which form part of the composite berms. An initial review of the soils from the available borehole information (see Appendix A) indicate that the fine grained till present on site may be suitable for re-use as an impermeable liner for the pond and berms. However, site specific borings (i.e., field investigation drilling and sampling), particle size analyses and Atterberg Limits testing would be required to verify that the soils encountered on site are suitable for this use, which should be conducted prior to construction and re-use of soils on site as detailed below.

All materials to be used in the construction of a compacted clay / impermeable liner shall be analyzed for particle size distribution following ASTM D2487 and ASTM 422-63, and Atterberg

Limits following ASTM D4318, or any other method pre-approved by the ultimate approval / regulatory agency (as applicable).

Typical particle size ranges (by weight) for a compacted clay liner are provided below, where the fines are defined as the soil fraction which passes through a No. 200 (75 μ m) US standard sieve, and clay and sand are defined in the ASTM Standard D2487-00:

- Percents fines $\geq 50\%$;
- Clay Content $\geq 20\%$; and,
- Sand content $\leq 45\%$.

Acceptable Atterberg Limits:

- Plasticity Index (PI): PI $\geq 20\%$; and
- Liquid Limit (LL): LL $\geq 30\%$.

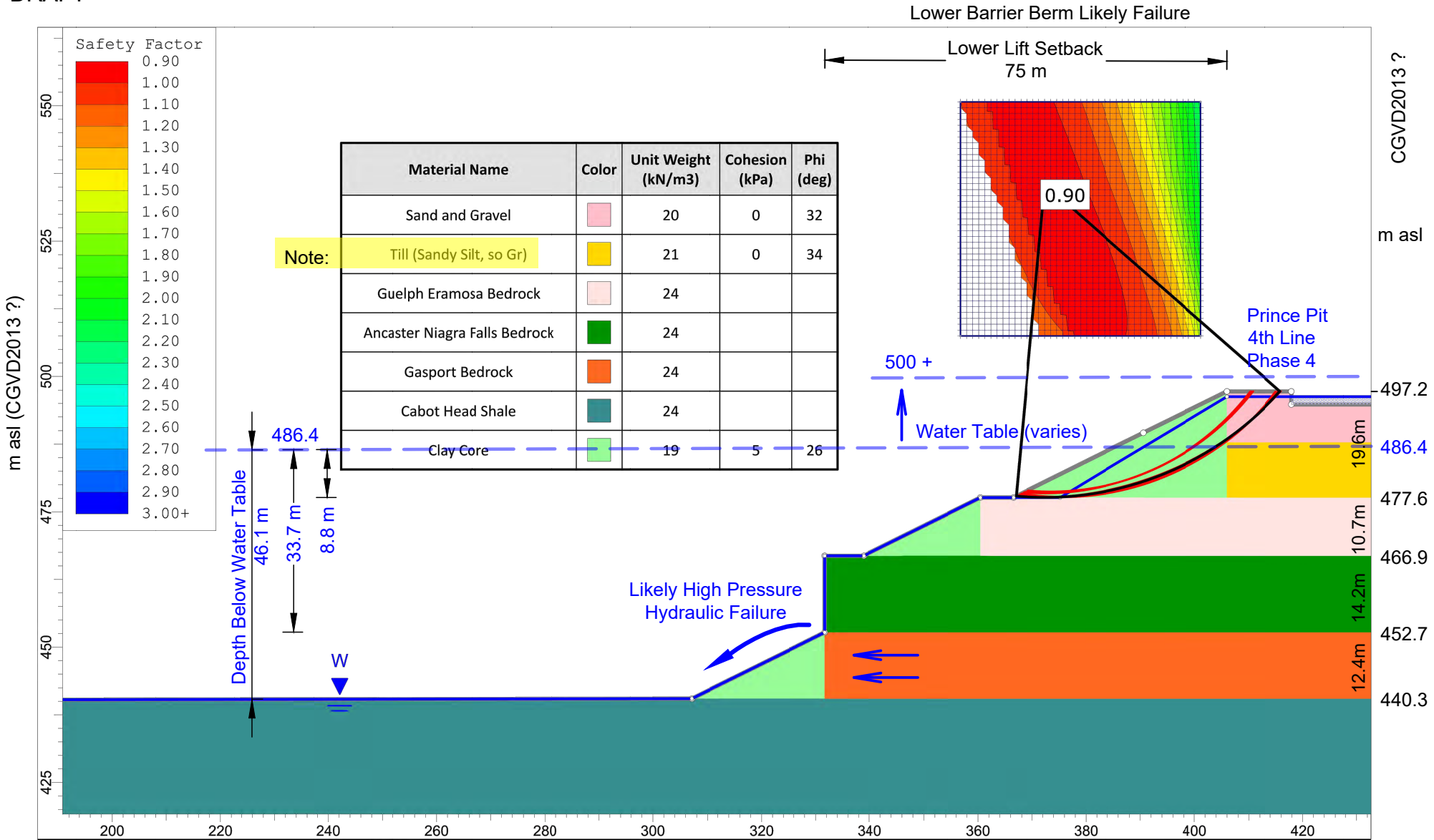
A detailed geotechnical study including site specific boreholes and relevant geotechnical testing should be carried out during the detailed design phase and prior to construction and re-use of on-site materials for the berm construction. Should the fine grained material on-site not meet these requirements then additional testing may be conducted to demonstrate a design (i.e., laboratory testing) and / or an “as-constructed” field hydraulic conductivity of 1×10^{-9} m/s or less. Otherwise, importing of suitable low-permeable materials may be required.

4.3 Constructability Considerations

During the Phase 2 stage of excavation of the quarry, it has been noted that there will be a point where about 2 m of the Ancaster/Niagara Formation would be left overlying the permeable Gasport unit. The effects of groundwater uplift on the underside of the 2 m layer of the Ancaster/Niagara Falls unit should be considered during the detailed design phase. At the current feasibility level assessment, it is anticipated that potential excess pressures from the Gasport unit can be managed with through pressure relief wells and drainage galleries within the excavation.

At the final (Phase 4) stage of the excavation, it is not expected that significant uplift pressures would develop within the relatively thick layer of Cabot Head Shale (generally understood to be impermeable). However, if evidence of fractures and / or bulging due to uplift are noticed, then again, these pressures are anticipated to be manageable through the use of pressure and drainage galleries in the excavation.

Again, both aspects of the quarry development should be reviewed during the detailed design phase.



 GEMTEC CONSULTING ENGINEERS AND SCIENTISTS	Project			10876.086 Melancthon Quarry Slope Stability	
	Analysis Description			Slope Stability - Section C-C' Upper Berm	
	Drawn By		Connor McCormick	Scale	1:950
	Date		2024-05-28	Company	GEMTEC Consulting Engineers and Scientists
				File Name	100876.086 Berm Stability.slmd



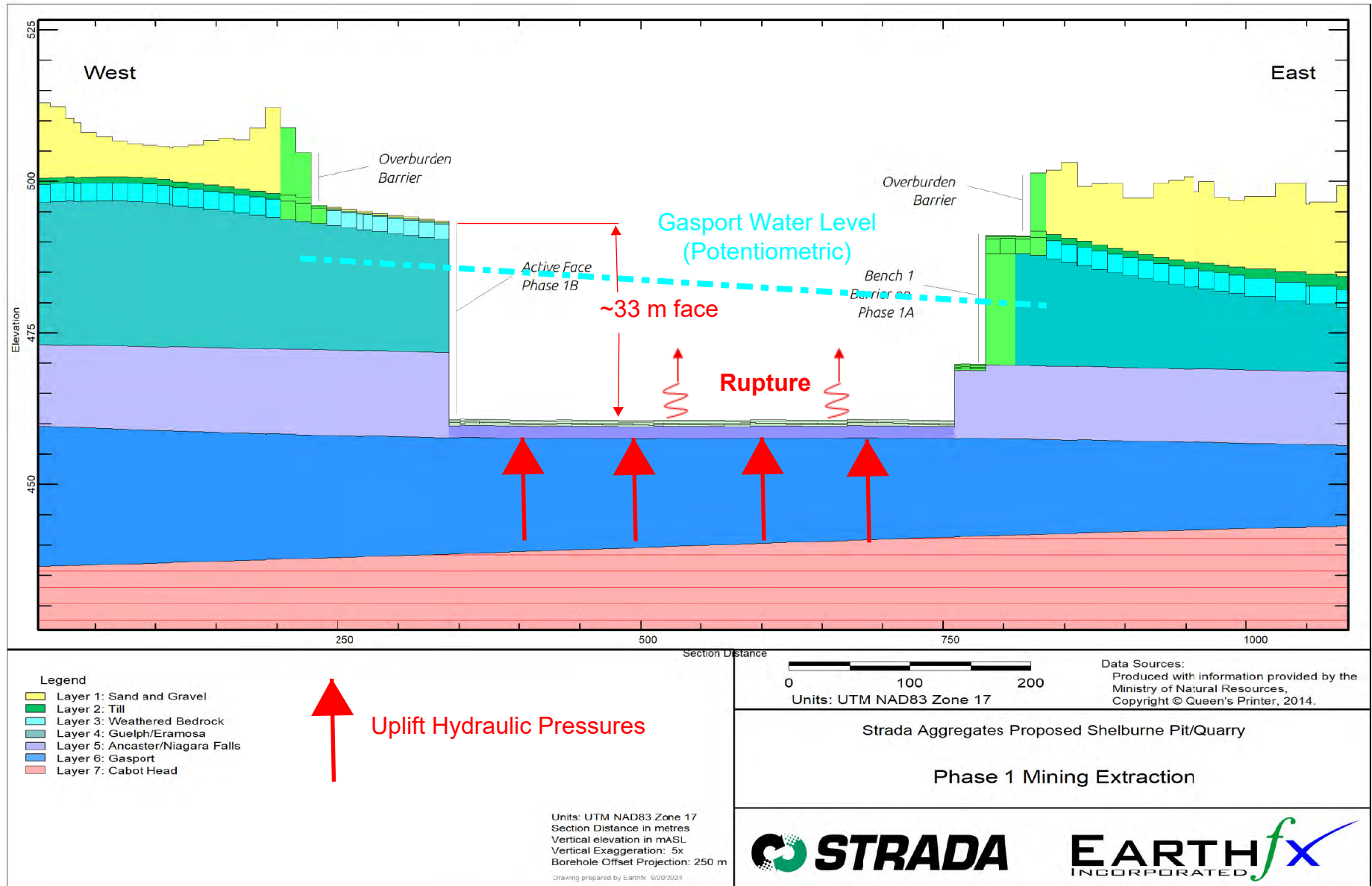


Figure 3.5: Cross section (elevations in CGVD13) showing Phase 1 extraction

Source: Fig 3.5 Extract from Earthfx January 31, 2025 Appendix E Impact Assessment (pg 56)

File Date: June 4, 2025

6 Stormwater Management

Table 6.1: Summary of water management fluxes.

Flux Components	Flux (L/s)	Percentage (%)
PHASE 1		
Total Flux of water from quarry	29.5	
Flux to Northern Trench	11.6	39%
Flux between Trenches	0	0%
Flux to Southern Trench	4.3	15%
Flux to Central Infiltration Site	13.1	44%
Flux to South Infiltration Site	0.52	2%
PHASE 2C		
Total Flux of water from quarry	71.0	
Flux to Northern Trench	25.5	36%
Flux between Trenches	0	0%
Flux to Southern Trench	19.5	27%
Flux to Central Infiltration Site	21.6	30%
Flux to South Infiltration Site	4.4	6%
Flux From Buried Tile Drain to Injection Wells ¹	12.0	
PHASE 4A		
Total Flux of water from quarry	40.9	
Flux to Northern Trench	13.0	30%
Flux between Trenches	0	0%
Flux to Southern Trench	11.3	27%
Flux to Central Infiltration Site	16.6	39%
Flux to South Infiltration Site	1.8	4%
Flux From Buried Tile Drain to Injection Wells ¹	12.0	

¹ Flux to injection wells not included in total flux from quarry.

All Infiltration Trenches and Ponds to Model Layers 1 to 4.

Injection Wells

5 L/s to Model Layer 4 (Guelph)

7 L/s to Model Layer 6 (Gasport)

Earthfx Inc.

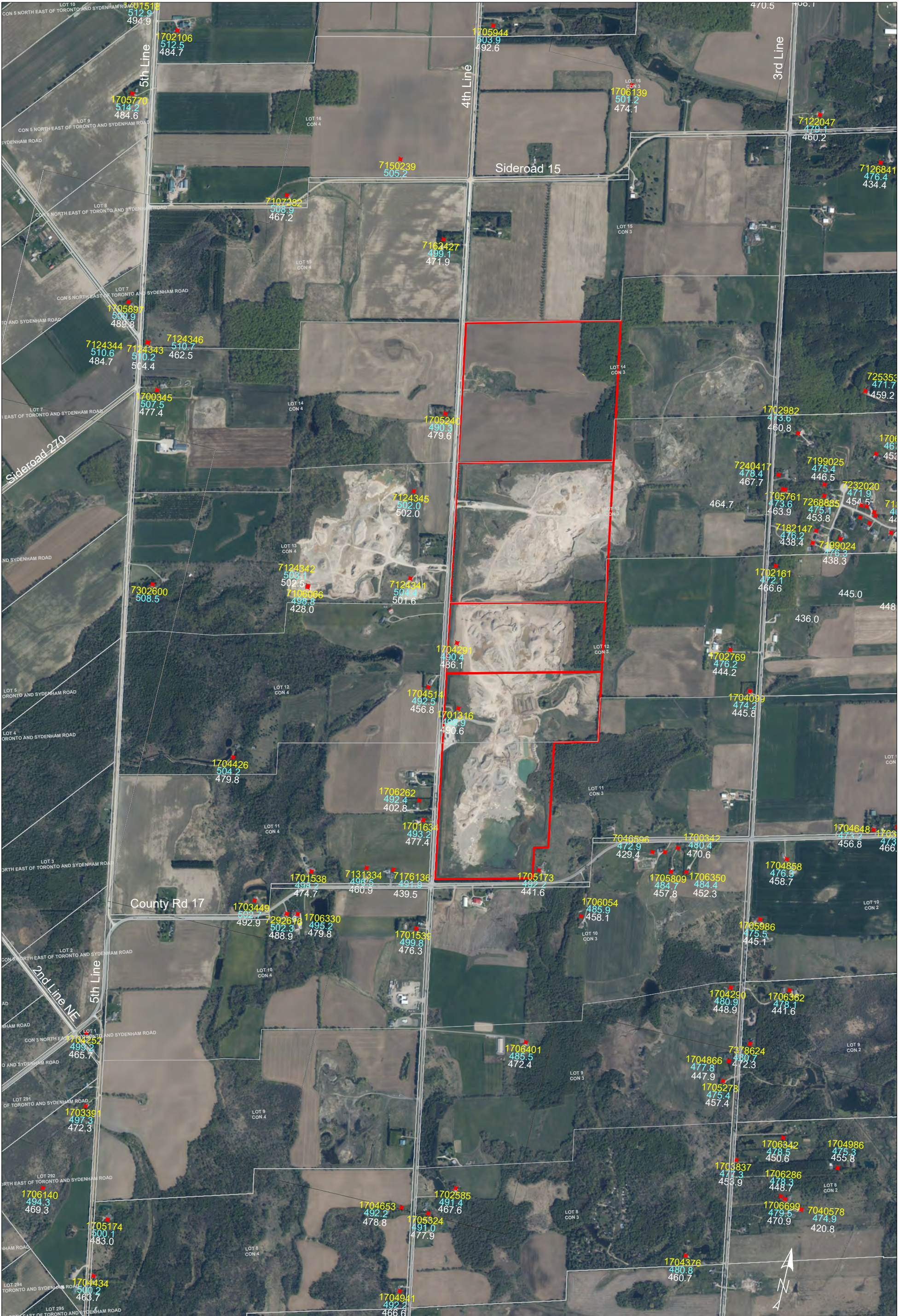
Model Phase 2 C Total Flow (flux) from the Quarry is estimated at 71 L/s or 6,100 m³/day.

- **Shelburne ~ 2,200 m³/day**
- **Fergus Elora ~5,800 m³/day**
- **Orangeville ~8,200 m³/day**

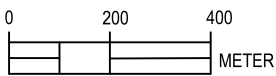
Source: Excerpts from Appendix E: Impact Assessment, January 2025

File Date: June 4, 2025

MECP Water Wells - Strada Quarry Application, Melancthon Township



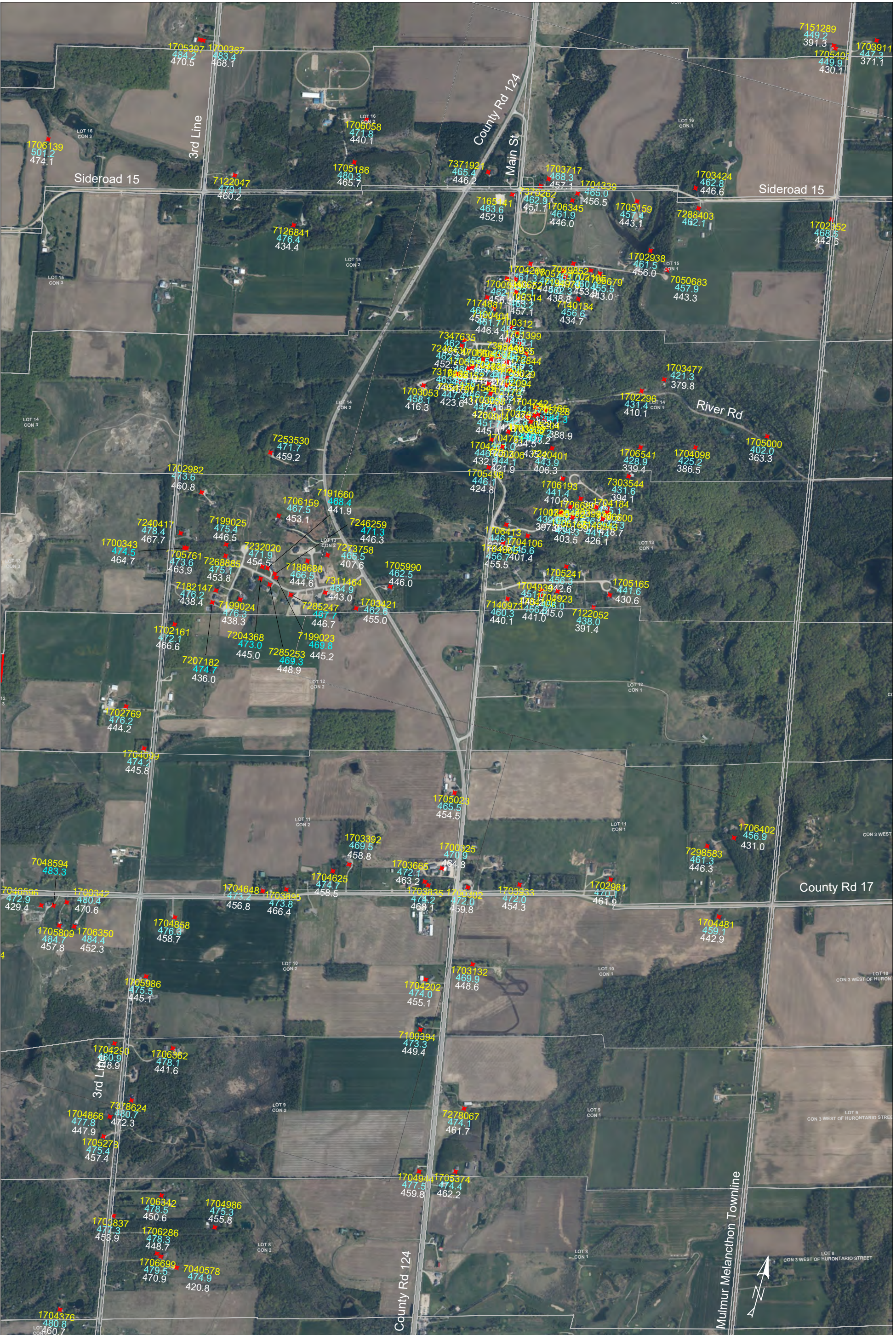
File Date: June 3, 2025
Horizontal Scale: 1:15,000 @ 11x17"



1704941	MECP Well ID
492.2	Static Water Level (CGVD2013, m asl)
166.6	Base of Water Well (CGVD2013, m asl)
	Strada Licence Area (MHBC Planning Ltd)

- Data Source:
- 1) MECP Water Well Database, March 31, 2023 version
 - 2) 2023 Orthophoto: Dufferin County
 - 3) Ground Elevation from 2022 LiDAR DEM, LIO Geohub
 - 4) Township Lot Fabric: LIO Geohub







Spring discharge into NAT-16 with Bored Well at 177 Main Street,
Horning's Mills

May 8, 2025



Spring discharge (Gasport) will be impacted by proposed Quarry Drawdowns
(Not monitored by Strada)



June 3, 2025



Partially submerged drainage outlet tiles at NAT-3 drainage ditch. No tolerance for increased water levels.



Noble Farm newly planted potatoes field with tile drainage. Sensitive to water table rises.

June 3, 2025



June 3, 2025



June 3, 2025



May 8, 2018



June 3, 2025



June 3, 2025

NAT-19 (Squirrell Farm) adjacent to Strada Melancthon Pit No 2 (upper right), eastern seasonal outlet (upper and lower left), and western outlet (lower right).



NAT-19 Seasonal flow outlets at the Squirrell Farm upstream of 3rd Line April 27, 2025
(Top photo looking west) and downstream of 3rd Line (Bottom photo looking east).



NAT-19 Seasonal flow recharges towards County Road 17 (right background). April 27, 2025
NAT-19 is the default outlet for the existing Strada Pits and the
Proposed Strada Quarry,

Spring Flooding 4th Line and 3rd Line

Ex H.10.5



Spring flooding at the eastern outlet of NAT-01 west of 4th Line (Lot 18). Water recharges to Strada Pits.

April 18, 2025



Spring flooding on Duivenvoorden lands (Lot 14), all water recharges to proposed Quarry underground stream.

April 18, 2025



April 18, 2025

Marshall Brook at 3rd Line south of 15th Sideroad (NAT-14) tile drain outlet and groundwater discharge (lower left and right). Groundwater discharge will increase under proposed Quarry conditions resulting in wetter fields on the Coe and Thomas farms.



April 18, 2025

	Subject Lands		Unevaluated Wetland
	Priority Natural Feature (NAT)		Wooded Area
	Watershed Boundary		Lot and Concession Boundary
	Regulation Limit (GRCA 2024)		White-tailed Deer Overwintering
	Above-Water Table Pit Limit of Extraction (MHBC)		White-tailed Deer Yarding
	Quarry Limit of Extraction (MHBC)		
	Highway		
	Primary Road		
	Secondary Road		
	Permanent Watercourse		
	Headwater, Ephemeral or Intermittent Drainage Feature		
	Surveyed Woodland Boundary (NRSI 2022)		
	Surveyed Wetland Boundary (NRSI 2022)		
	Water Body		
	Provincially Significant Wetland (PSW)		
	Other Wetland (Non-PSW)		



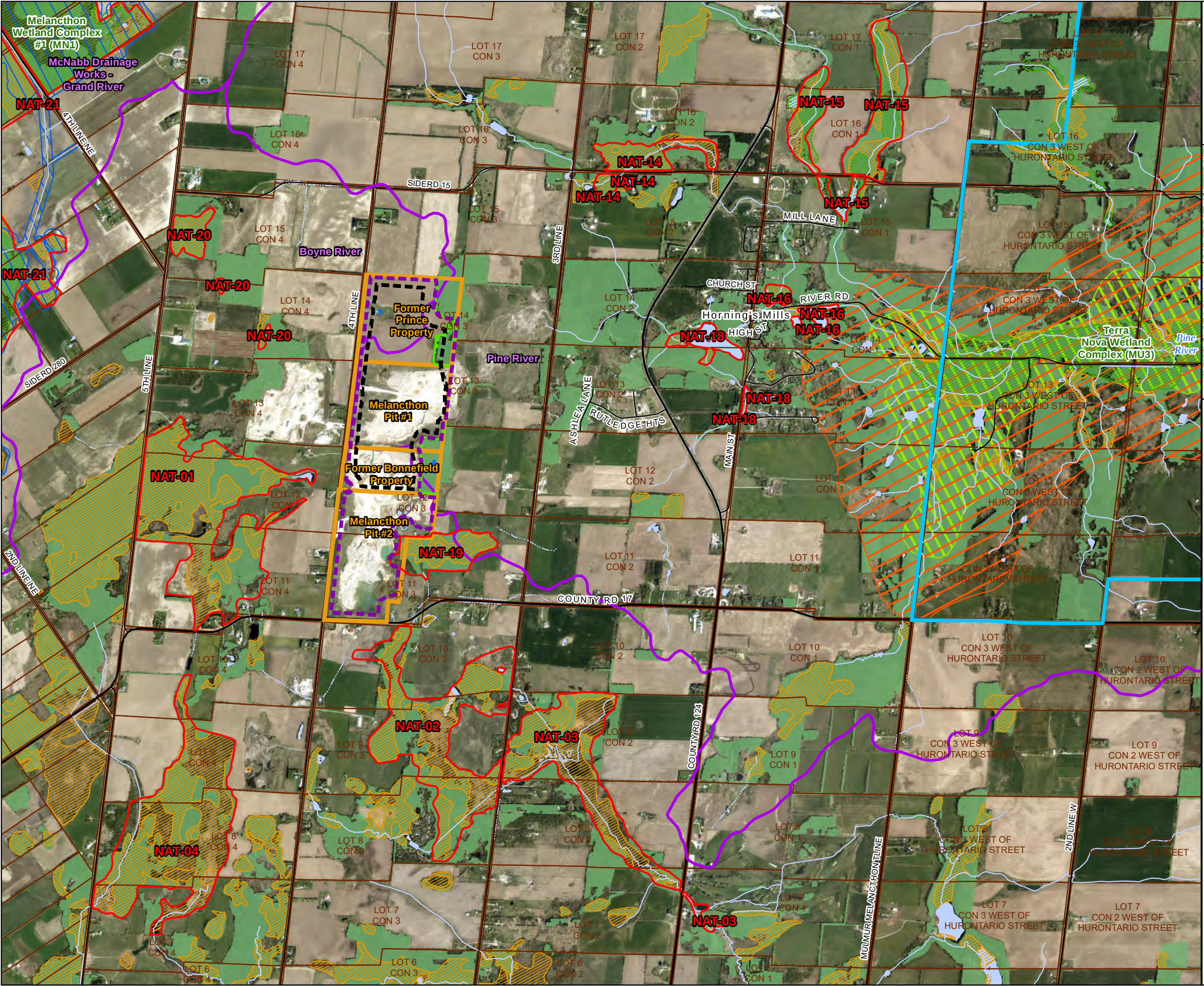
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Project: 2473A
Date: January 24, 2025

NAD83 - UTM Zone 17
Size: 11x17"
1:26,000





Map 1-2

Strada Pit/Quarry
Natural Environmental
Assessment
Study Area

Key Map

Legend

Subject Lands

Priority Natural Feature (NAT)

Watershed Boundary

Regulation Limit (GRCA 2024)

Niagara Escarpment Plan Boundary

Above-Water Table Pit Limit of Extraction (MHBC)

Quarry Limit of Extraction (MHBC)

Primary Road

Secondary Road

Permanent Watercourse

Headwater, Ephemeral or Intermittent Drainage Feature

Surveyed Woodland Boundary (NRSI 2022)

Surveyed Wetland Boundary (NRSI 2022)

Water Body

Provincially Significant Wetland (PSW)

Unevaluated Wetland

Wooded Area

Lot and Concession Boundary

White-tailed Deer Overwintering

White-tailed Deer Yarding

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Project: 2473A
Date: January 24, 2025

NAD83 - UTM Zone 17
Size: 11x17"
1:26,000

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Path: X:\2473_ShelburneQuarryFeasibility\NRSI_2473A_Map1_StudyArea_26K_2025_01_24_DNH.mxd