Surface Water Review – Strada Pit & Quarry March 18, 2026

Melancthon, Ontario

1. INTRODUCTION – OVERVIEW OF RETAINER AND SCOPE

Scheckenberger & Associates Ltd. ("S&A") has been retained by the Township of Melancthon ("Township") for peer review services associated with the Strada Aggregates ("Strada") application. Through this retainer, S&A has conducted peer review services specific to the submitted studies prepared by Strada's various experts with a focus on surface water; these studies primarily included the work by:

- MHBC – Planning Justification Report
- Tatham and EarthFx – Hydrogeology Assessment Report
- WSP's review of Hunter's Issues

Beyond the foregoing, S&A also reviewed (at a higher level) the following companion reports which were deemed to potentially have an influence on surface water matters:

- NRSI – Natural Environment Report
- Tatham – High Groundwater Level Report
- MHBC – Site Plan Drawings

In regards to surface water, the primary concern for any operation proposing to extract quarry aggregate, relates to the potential for impacts to natural hazards (flooding and erosion), as well as surface water features, such as wetlands, watercourses, headwater drainage features and other water-dependent natural systems (slough forests, vernal pools etc.) and man-made or anthropogenic systems such as culverts, sewers, ditches, ponds etc. These impacts associated with surface water can be categorized into one of two forms: quantity or quality. From a surface water quantity impact perspective, the quarrying activities can both increase and decrease flows expressed as surface water hydrographs representative of runoff peaks and volumes over time. The impacts associated with surface water quantity can involve:

- Flooding
- Erosion
- Water budgets

These impacts can then manifest in environmental degradation of the aforementioned natural systems either due to too much water, too little water or an altered hydro-regime which does not provide water to the systems in an appropriate temporal (seasonal) distribution. As for impacts to man-made systems, the impacts can lead to issues with the performance (level of service) of the infrastructure resulting in risks to the public associated with flooding or destabilization.

As related to water quality, discharge from a quarry operation can, if not properly treated, be contaminated with on-site sediment borne contaminants and/or be altered in terms of its thermal regime (typically warming). Depending on where these systems discharge, the impacts can lead to

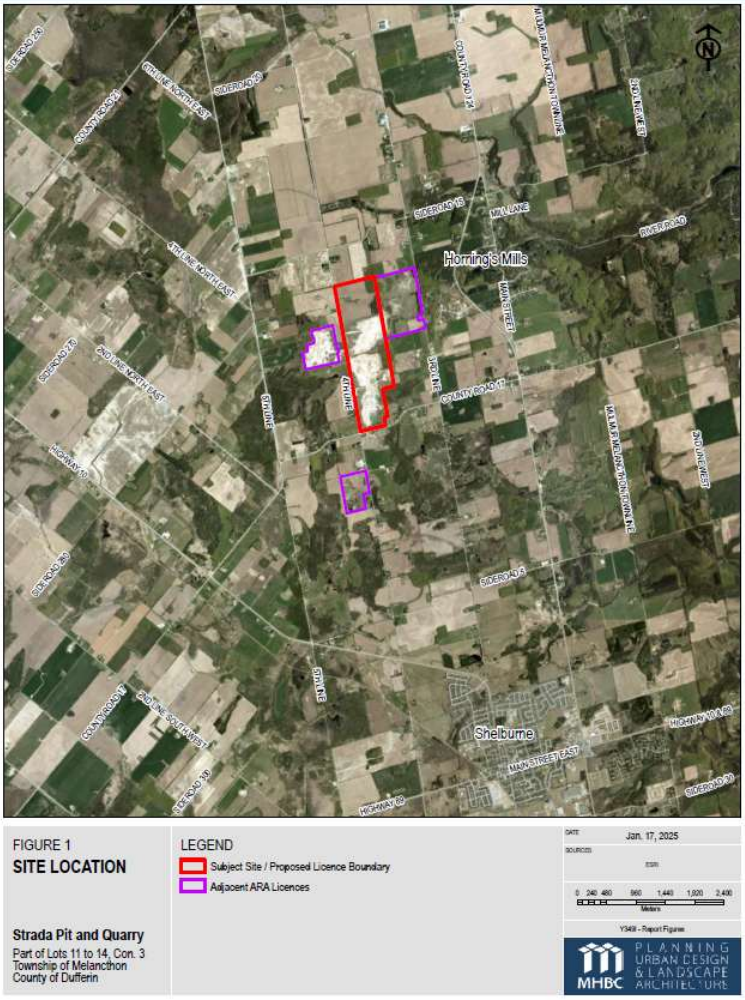
environmental degradation of natural water-dependent features, or in the case of man-made infrastructure lead to adverse operations and maintenance.

2. BACKGROUND REVIEW OF STRADA REPORTING

As noted in the Introduction, various key reports deemed to potentially address and consider surface water impacts have been reviewed on the basis of determining the potential for impacts, and the associated management strategies put forth by the applicant. It should be clear that this review has not in any substantial way commented on the groundwater aspect of the proposed quarry operations and the associated technical modelling. This review has been conducted by another Peer Reviewer retained by the Township.

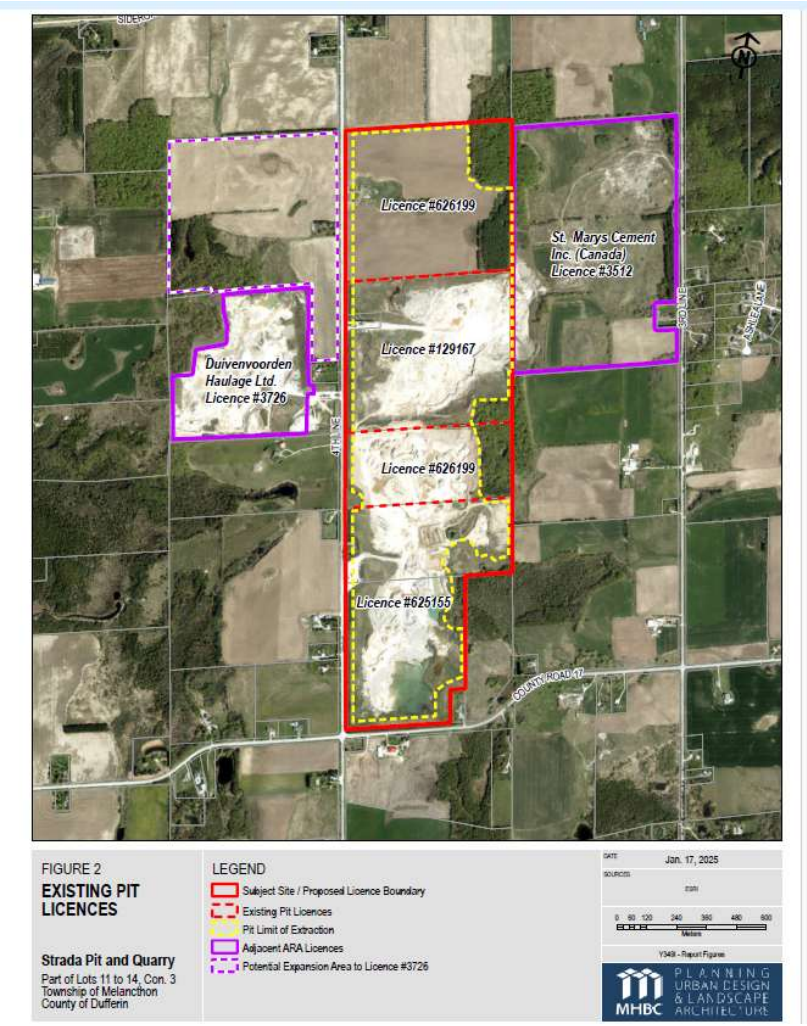
Planning Justification Report, MHBC, January 2025

- Strada is applying for one new licence across the current site referred to as Melancthon Pit #1 and #2 (currently only operated as sand and gravel extraction above water table; operational for about 23 years)

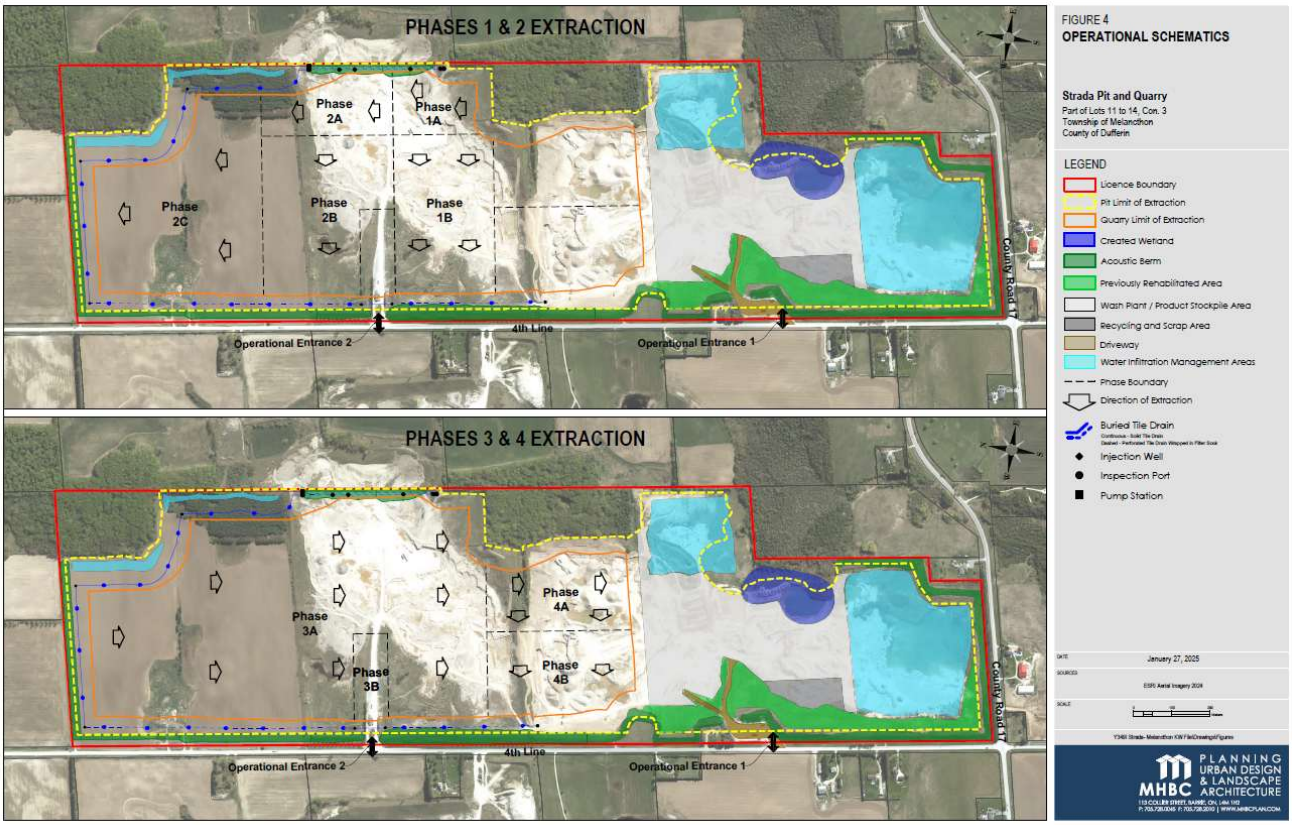


- Site is proposed to be operated as a below water Pit and Quarry
- New licence to occupy the same 149.0 ha footprint as the existing licences.

- Limit of extraction for the pit will be 123.7 ha and the limit of extraction for the quarry will be 65.7 ha



- Below water extraction (pit and quarry) to occur in the northern two-thirds of the site; no quarry extraction is proposed in the southern third of the site
- Southern third is proposed to include water management for the quarry operation and a wetland creation area
- An Official Plan Amendment (OPA) and Zoning By-Law Amendment (ZBA) required for southern third of site; northern two-thirds already designated for pit and quarry operations



- Notably quarry extraction area is located in the existing footprint of the approved pit operation
- Natural Environment Report (NER, NRSI, Jan 2025) confirms that natural heritage features are located outside of the area of site disturbance and will not be negatively impacted
- Impacts though are expected to four small on-site wetlands (0.62 ha) and on-site Eastern Meadowlark habitat (3.25 ha) which is proposed to be removed to construct the water management system.
- Potential bat habitat removal in the wetlands and the assessment of Eastern Meadowlark habitat is to be conducted in accordance with the Endangered Species Act. Intent is to ensure that impacts to individuals are avoided and that habitat impacts are adequately mitigated, including through creation of new habitat to achieve a net gain in habitat area.
- The application includes a mitigation plan to replace this habitat to ensure no negative impact and an overall net gain in ecological area and function.

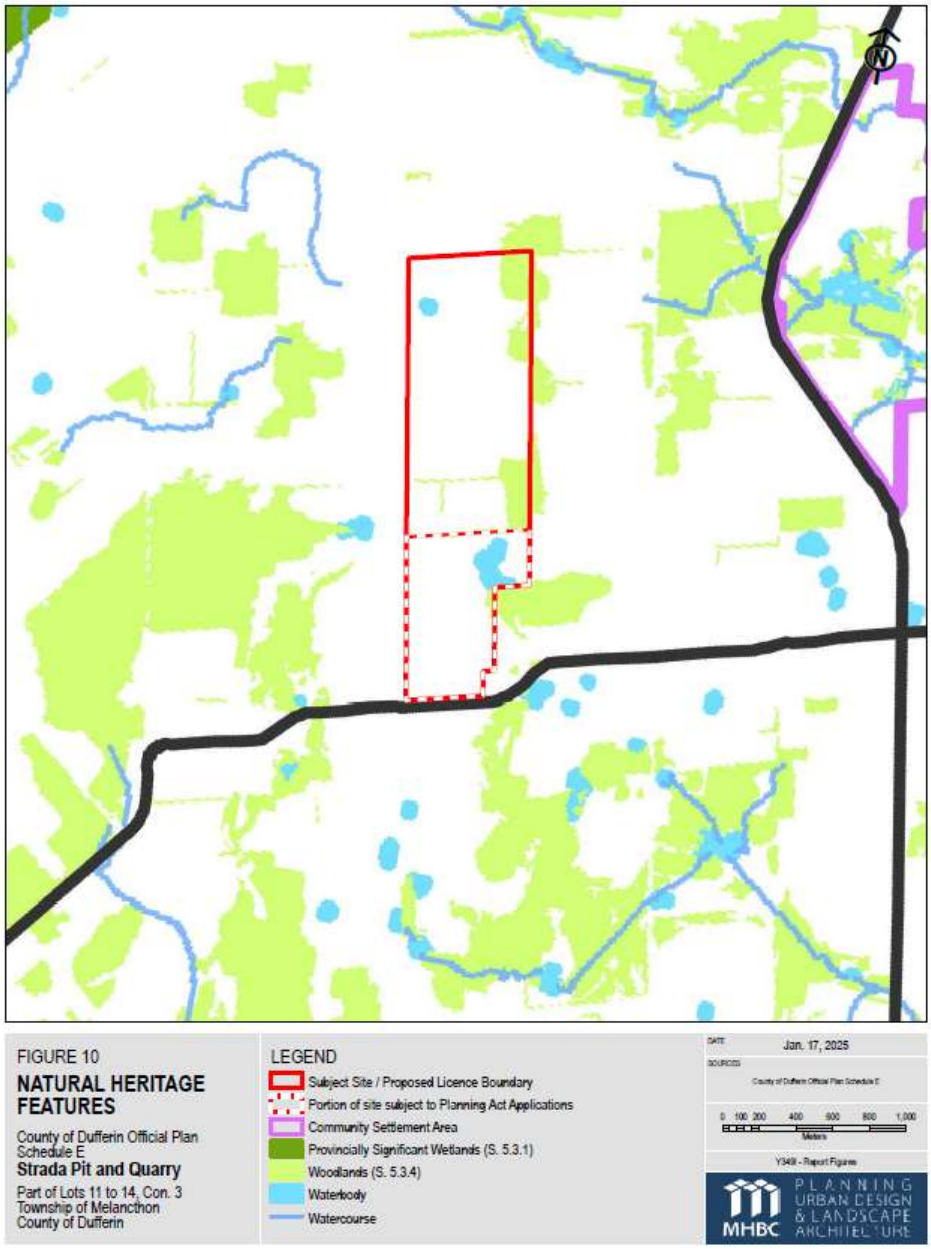
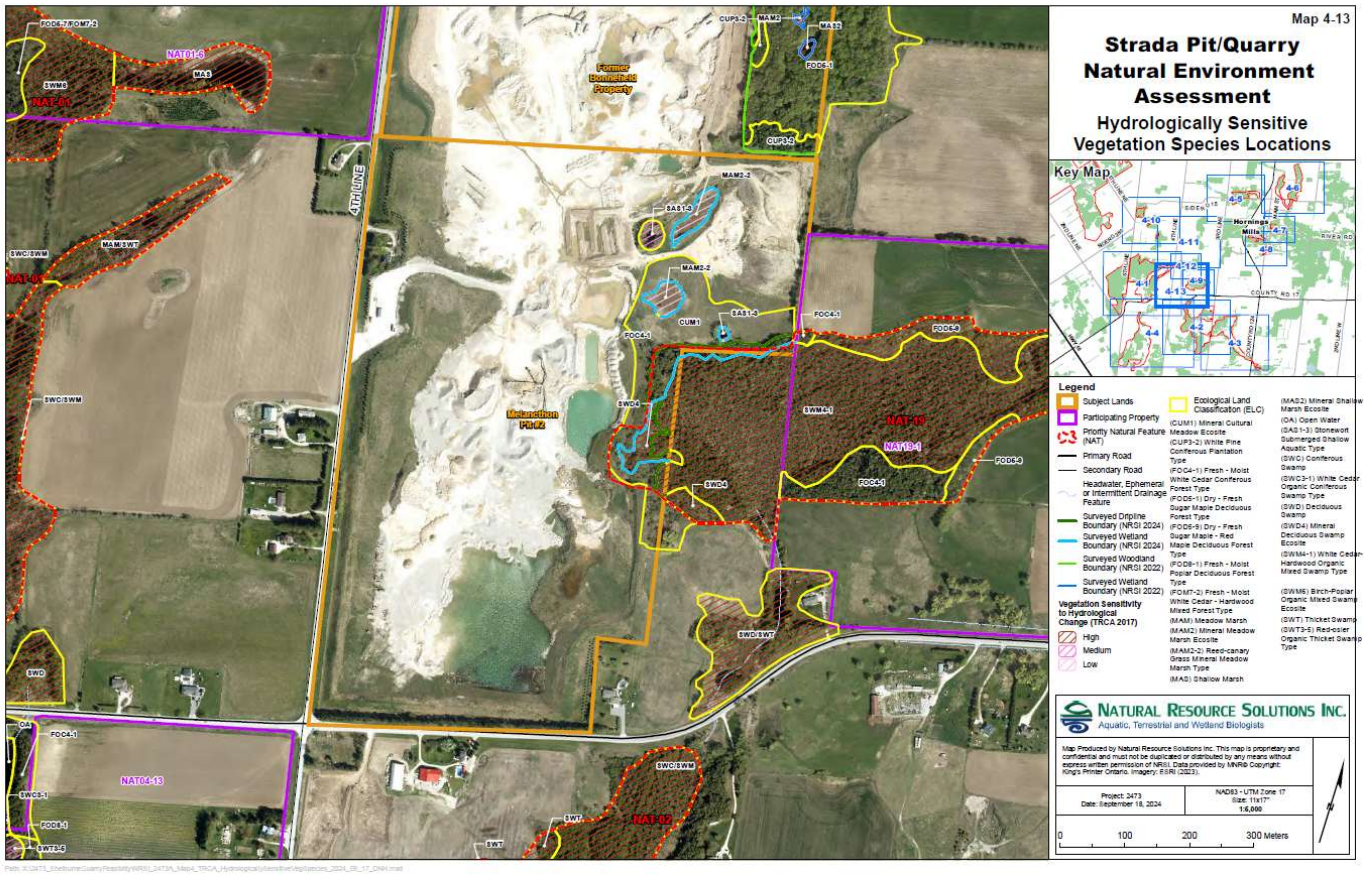
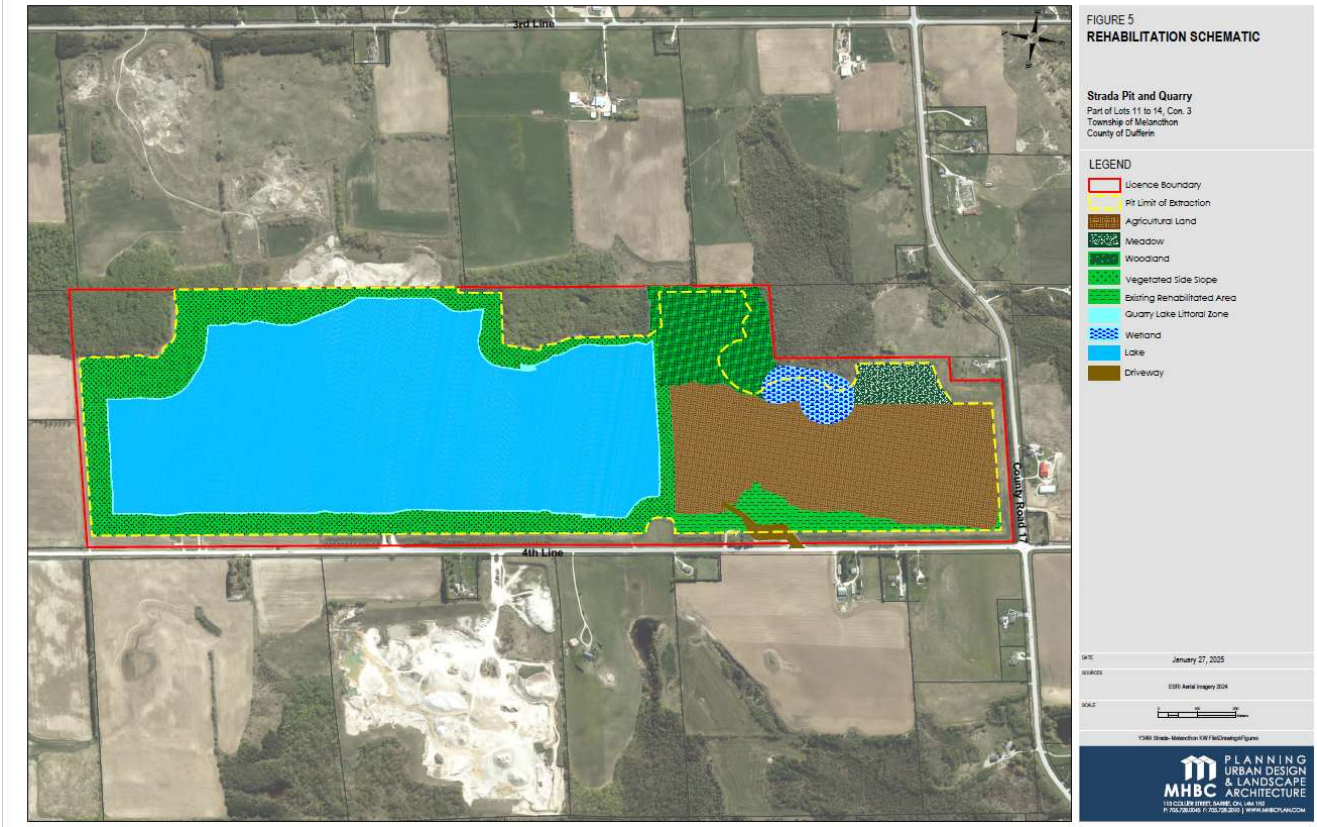


FIGURE 10
NATURAL HERITAGE FEATURES
County of Dufferin Official Plan Schedule E
Strada Pit and Quarry
Part of Lots 11 to 14, Con. 3
Township of Melancthon
County of Dufferin
LEGEND
Subject Site / Proposed Licence Boundary
Portion of site subject to Planning Act Applications
Community Settlement Area
Provincially Significant Wetlands (S. 5.3.1)
Woodlands (S. 5.3.4)
Waterbody
Watercourse
DATE: Jan. 17, 2025
SOURCES:
County of Dufferin Official Plan Schedule E
0 100 200 400 600 800 1,000
Meters
Y349 - Report Figures
MHBC
PLANNING
URBAN DESIGN
& LANDSCAPE
ARCHITECTURE



- Level 1 and 2 Hydrogeological Assessment prepared by Tatham Engineering and EarthFx consists of five components including:
    - field program to characterize the existing conditions
    - data collection and assessment
    - Conceptual Model Report
    - Model Development and Calibration Report
    - Impact Assessment Report
- Subject Lands predominately located within a highly vulnerable aquifer and a significant groundwater recharge area.
- No watercourses located within the Subject Lands.
- Closest municipal drinking water source is located approximately 5 km south in Shelburne
- Assessment concluded that the recharge function of the Site will be maintained and the aquifer will be protected.
- Water Management System (WMS) designed to ensure that direct precipitation, collected surface water, and intercepted groundwater is managed on-site during the operation of the pit and quarry, and water is intended to infiltrate into the groundwater and surface water systems throughout operations and as part of rehabilitation.
- No off-site discharge is proposed; rehabilitation plan does not propose perpetual active pumping.

- The water management plan is intended to maintain dry operating conditions within the extraction and operations areas, while mitigating potential off-site impacts.
- WMS includes:
    - water control barriers
    - buried tile drain and injection wells
    - quarry sumps
    - settling pond and clean water pond
    - infiltration ponds and barriers
- Multi-disciplinary monitoring program proposed during operations and rehabilitation periods to verify that the extraction will not adversely impact surface water or groundwater resources; program to include:
    - Long term groundwater monitoring program consisting of water level and water quality monitoring at 48 on-site well monitoring locations and 5 off-site well locations
    - Long term surface water monitoring program consisting of water level monitoring and streamflow monitoring at 12 surface water features
- Pit/Quarry Rehabilitation includes the creation of
    - quarry lake
    - quarry lake littoral zone (i.e. shoreline wetlands)
    - vegetated side slopes around the lake
    - wetlands
    - agricultural field
    - meadow
    - woodlands
- Proposed rehabilitation plan noted to result in an overall increase in natural cover and net gain of natural features



- According to the NE Report (NRSI), adjacent key natural heritage features (NHF) and key hydrologic features (HF) will not be negatively impacted by the proposed pit and quarry; Key NHF and Key HF to be maintained in the long-term based on the proposed rehabilitation plan
- Hydrogeologic assessment concluded that:
    - no negative impacts to on-site and adjacent key hydrological and hydrologic features
    - no changes to the overall surface water and groundwater flow system
    - water quality and quantity will be protected
    - no municipal wellhead protection areas will be impacted.

<u>Strada Pit/Quarry Level 1 and 2 Hydrogeological Assessment, Tatham/EarthFx, June 26, 2025</u>

<u>Scope of Work</u>

- EarthFx and Tatham conducted a Level 1 and Level 2 hydrogeological assessment of the site to determine:
    - potential impact to aquifers, watercourses and surface water bodies, springs, and discharge areas
    - evaluate potential mitigation measures
- Scope of Work included:
    - field investigations (bedrock, overburden geology, groundwater levels, water quality)
    - development of a conceptual hydrogeologic model
    - development and calibration of an integrated surface water/groundwater model (SW/GW Model); model provides estimates of:
        - groundwater recharge

        - baseflow
        - overland runoff to streams
        - groundwater discharge to local streams, ponds, wetlands
- SW/GW Model (based on the Precipitation Recharge Modelling System – PRMS) calibrated to groundwater level and flow data; used to assess impacts of proposed below waterline quarry activities on: groundwater and surface water flows and wetland water budgets (baseline and various stages of development). Note: Baseline represents the near future not Current conditions when the gravel extraction operations are complete.
- Study area limits set to support an early warning system to identify adverse interference resulting from the proposed quarry operations that may affect domestic water supplies and surface water and natural heritage features.
- Study Area extends south of County Road 17, to the east by Mulmur/Melancthon Townline, to the north of Sideroad 15, and west to County Road 124
- Level 1 assessment reported on potential impacts of below waterline quarry activities and Level 2 assessment provided details on the water management systems and residual impacts and mitigation (per ARA)
- Field investigations included:
    - 21 GW Well nest locations monitoring 41 aquifer/aquitard intervals and water levels
    - Records of pumping

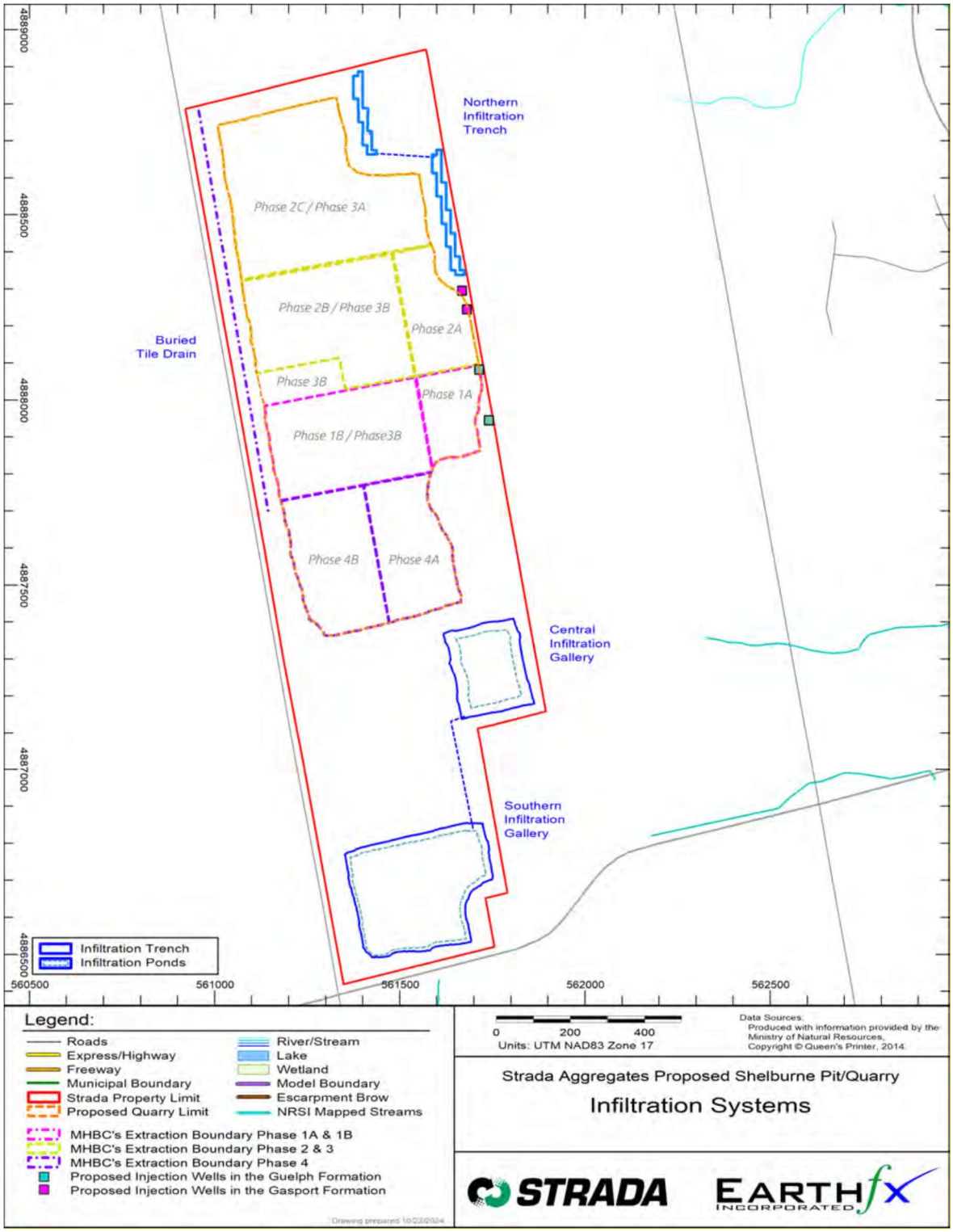
<u>Phasing</u>

- Quarry operations to commence when sand and gravel resources have been fully extracted (except in northern portion)
- Four primary phases of quarry extraction with various sub-phases
    - Phase 1 – final extraction of sand and gravel from northern pit area; extraction of bedrock from Bench 1 and 2 from central portion; includes construction of water control barriers on three sides, as well as quarry floor drains to distribute inflows to infiltration trenches and south infiltration galleries
    - Phase 2 – complete extraction of aggregate from Bench 1 and 2; water control barriers on all four sides; buried tile drain is constructed and water injected into injection wells along east boundary
    - Phase 3 – continued extraction of Bench 2 and initial extraction of Bench 3
    - Phase 4 – remaining portion of Bench 3 removed

<u>Water Control Features</u>

- Water control Features proposed to be comprised of:
    - Benches – 3 in total associated with various formations; also noted that there are bench barriers to ensure no off-site surface water discharge will occur
    - Water Control barriers – to manage influx of GW built on benches 1 and 3; proposing to use on-site Tavistock Till for barriers
    - Injection well – 4 to be constructed along eastern boundary (Phase 1) – combined capacity 12 L/s
    - On-site infiltration system – GW and surface water (runoff and precipitation) to be captured and infiltrated on-site; comprised of 3 systems:
        - 2 infiltration ponds (to be located in south portion of site)
        - Two-part infiltration trench along northeast portion of site
        - Buried tile drain along western boundary to collect GW to reduce mounding; captured water to be discharged into injection wells

- Assumed that no off-site overland surface water flow will be recharged



Rehabilitation

- Rehabilitation scenario represents conditions after closure of the pit and quarry.
- Assumes all on-site water control and infiltration systems modified and/or removed to allow groundwater and surface water conditions to return to near baseline conditions without any active long-term water management.
- Water control barriers will remain in place for the purpose of slope rehabilitation, except for a 365-m portion of the eastern overburden barrier which will be opened to allow lateral seepage into the shallow groundwater system east of the property.
- Barriers constructed on Bench 3 to remain in place; small portion of the western face of Phase 4 to remain open to the quarry lake to ensure that the lake does not overtop and discharge as surface water.
- Site proposed to be returned to a condition that restores local and regional surface and groundwater conditions, with no need for any form of active water management.

Modelling Assessment Results

- Under ***Baseline Conditions*** – surface water analysis demonstrates limited interactions between the surface and groundwater systems
- Most of the wetlands are "headwater" features with strong seasonal variability in groundwater seepage.
- Dammed pond west of Horning's Mills is located in a groundwater discharge area, receiving relatively high groundwater inflows
- Under ***Phase 1 Extraction Conditions*** - groundwater drawdown will be created in the central portion of the site; this will be offset by groundwater mounding related to the infiltration systems. The net change is noted to be small (<1m drawdown in the deepest layer) and extends less than 800 m from the proposed excavation.
- The drawdowns are small relative to the available drawdown in the aquifer, indicating that any shallow private wells could be readily deepened if necessary.
- Drawdown reduces streamflow and surface leakage into Pond NAT-18.
- Hydrograph differences between Baseline and Phase 1 stream flows at location STR8 are noted to be moderate while low at STR7.
- Modelled impact on stream flows tends to affect headwater streams with low flows throughout the year and higher-order streams during the summer.
- At NAT-19 the water table is expected to rise, leading to increased groundwater ET, groundwater discharge to land surface, and decreased groundwater recharge (i.e. seepage out the bottom of the wetland)
- Under ***Phase 2 Extraction Conditions*** – as per Phase 1, groundwater drawdown in the central portion of the site, offset by groundwater mounding created by the infiltration systems. The net change noted through the modelling is small, (< 0.5 m drawdown extending approximately 1700 m from the excavation)
- As per Phase 1, drawdown per the modelling reduces streamflow and surface leakage into Pond NAT-18, of similar magnitude but slightly greater.
- Balance of impacts essentially the same as Phase 1
- Under ***Phase 4 Extraction Conditions*** – as per Phases 1 and 2, the modelling shows that groundwater drawdown in the central portion of the site would be offset by groundwater mounding related to the infiltration systems. The <1 m drawdown in the deepest layer extends approximately 2000 m from the excavation.

- Again, the drawdown per the modelling would reduce streamflow and surface leakage into Pond NAT-18, with the predicted differences downstream of the pond projected as significant during the summer and moderate during the spring.
- Further, streamflow at location STR8, a low-order stream, is expected to be significantly reduced throughout the year.
- Under **Rehabilitation Conditions** - water levels and flows return to near baseline conditions, with a small drawdown in the immediate vicinity of the quarry lake, due to the small window to the deep Gasport aquifer, to ensure that the lake does not overflow to nearby properties.
- Drawdowns per the predictive modelling are noted to be small relative to the available drawdown in the aquifer, indicating that any shallow private wells could be readily deepened, if necessary.
- Stream flows at STR locations are expected to still exhibit an impact, albeit small to moderate, depending upon the season.

Source Water Protection

- Site is located in the Nottawasaga Valley Source Protection Area (SPA) which falls within the South Georgian Bay Lake Simcoe (SGBLS) Source Protection Region (SPR) comprised of the following watersheds under the jurisdiction of the Lake Simcoe Region Conservation Authority, Nottawasaga Valley Conservation Authority and Severn Sound Environmental Association:
    - Black-Severn
    - Lake Simcoe
    - Nottawasaga Valley
    - Severn
- Shelburne municipal wellfield is the closest to the site, located approximately 5 km south of the site.
- Analysis from 2022 indicates that the Shelburne wells capture groundwater from the west, thus confirming that the proposed Strada development is lateral to, or downgradient of, the wellfield, hence not considered a water quality threat to the Shelburne wellfield.
- Operational design of the proposed quarry, including the proposed southern infiltration system, noted by applicant to ensure that drawdowns will not propagate towards the Shelburne municipal wellfield.

Water Management Plan

- Targeted at direct precipitation, surface water and intercepted GW on-site
- Objective is to maintain dry operating conditions within the active work areas while mitigating potential off-site impacts
- Comprised of water control features as described earlier in the Planning Report, include:
    - Water control barriers to prevent groundwater inflows at the extraction face
    - Buried tile drain (1105m at min 0.3% slope) constructed during Phase 2 behind water control barriers to reduce groundwater mounding and convey flows to an injection well and via a pump station (rated for 12 L/s) to the central infiltration feature; fitted with inspection ports and control valves for monitoring operations and maintenance; noted that as a contingency, this system can be fitted with a pumping station, if necessary
    - 4 injection wells (rated from 5 to 7 L/s) to discharge non-contact water back into the aquifer; proposed as drilled wells; any overflows at these locations would be pumped to north and south infiltration trenches

- Quarry sumps will be designed to capture direct precipitation, with the quarry floor graded to capture surface runoff; sump locations will vary with operations depending on the phase; captured water to then be pumped into settling ponds for treatment or depending on its quality discharged directly to the central infiltration pond
- Settling and clean water ponds, as noted are planned to be constructed on the floor of the quarry and used to treat the runoff and process water and once clean, the water would either be re-used in the operations or transferred to the central infiltration pond
- Infiltration ponds (central and south) and Trenches (north and south) to be located in the license area to manage on-site water which would be allowed to infiltrate into the sand and gravel layer
- The proposed characteristics (volume and area) for the various infiltration ponds and trenches are per the table below:

Table 2: Infiltration Ponds and Trenches Characteristics Summary

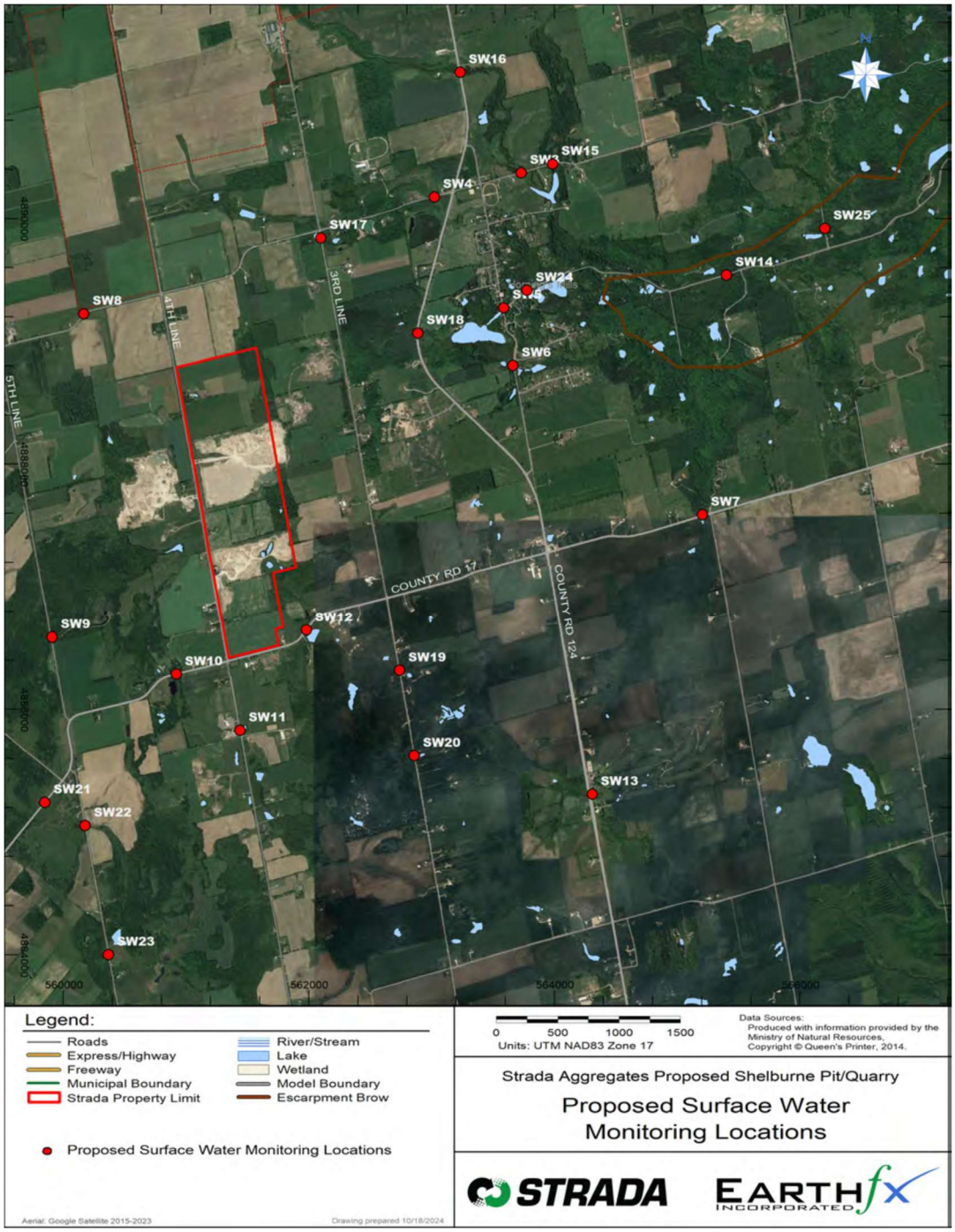
INFILTRATION FEATURE	ELEVATION (m)			AREA (m^2)	VOLUME (m^3)
	Floor	Top of Bank	Max Water Level		
Central Infiltration Pond	475.35	495.00	494.00	43,594	618,410
South Infiltration Pond	480.60	495.00	494.00	104,062	947,950
North Infiltration Trench	503.00	510.00	509.00	6,554	23,730
South Infiltration Trench	503.00	507.00	506.00	4,368	10,920

- Given that there are no watercourses in the vicinity of the Strada Pit/Quarry, off site discharge of non-contact water is not proposed, leading to the need to manage all water on site, through capture, storage and infiltration
- Flow rate estimates were established through modelling under average and peak conditions between features towards the infiltration systems

<u>Proposed Groundwater (GW) and Surface Water Monitoring Program</u>

- Proposed to be comprised of three types:
  - On-site GW monitoring (key 48 GW wells, 4 injection wells – water levels and quality – twice annually)
  - Off-site domestic wells (5 domestic wells)
  - Surface water monitoring (key surface water features – water levels and stream flow and semi-annual water quality)
    - 6 streamflow locations
    - 2 ponds

  - 2 wetlands/vernal pools
  - 2 natural areas
- Water levels to be collected continuously with automatic water level transducers during the open water period of April through November, with monthly manual measurements collected during the same period
- Figure below depicts the proposed locations of surface water monitoring sites



Report Conclusions

The following provides a summary of select extracts related to the main conclusions, presented in the report, as related to surface water and natural systems:

- "At the subwatershed scale, the proposed pit/quarry will not change the overall surface water and groundwater flow system."
- "There will be no cross-watershed impacts, groundwater recharge rates will be preserved, and groundwater and surface water in and around the quarry will continue to flow toward the Pine River Valley."
- "The quality and quantity of groundwater needed for the natural environment and wells will be protected, and no municipal wellhead protection areas will be impacted."
- "The evaluated rehabilitation option preserves the surface water and groundwater system."
- "A comprehensive monitoring and response plan has been developed."

Additional Materials Referenced/Reviewed

- In addition to the foregoing primary materials which were reviewed in detail, the following documents/materials were also reviewed at a high-level as a cross-check on the information provided in those reports; this included:
    - Strada Pit/Quarry - Natural Environment Assessment Report, NRSI, January 2025
    - Maximum Predicted Water Table Report, Tatham, January 13, 2025
    - Correspondence from WSP (McFarland), April 17, 2025, commenting on the Issues identified by Hunter
    - Site Plan Drawings 1 to 5, MHBC, July 2025

Strada Pit/Quarry - Natural Environment Assessment Report, NRSI, January 2025

- Natural Environment (NE) Report provides background information on natural heritage features and results of field surveys; information used to:
    - define natural features on the subject lands as potential quarry development and operational constraints
    - characterize the external lands' natural features, with a focus on features and functions that could be influenced by possible changes in the hydrological and hydrogeological regimes specific to their relationship to surface and groundwater resources
- NRSI established a Study Area that extends 3.5 km west, 1.5 km north, 3.0 km east, and 2.0 km south of the subject lands. NRSI notes that the intent of studying these "external lands" was to determine the potential for off-site impacts to surface water and groundwater resources.
- NRSI determined potential impacts arising from the proposed quarry operation by comparing the details of the proposed activity with the characteristics of the Study Area's existing natural features and their ecological functions at the two scales noted above (local and external), and classified these as "direct" (within the sand/gravel pit) and "indirect" (associated with impacts to features due to the changes to the hydrologic regime).
- NRSI determined that there are three areas of Site Plan encroachment beyond the existing pit limit of extraction including:
    - a portion of the central infiltration pond,
    - a portion of the proposed created wetland, and

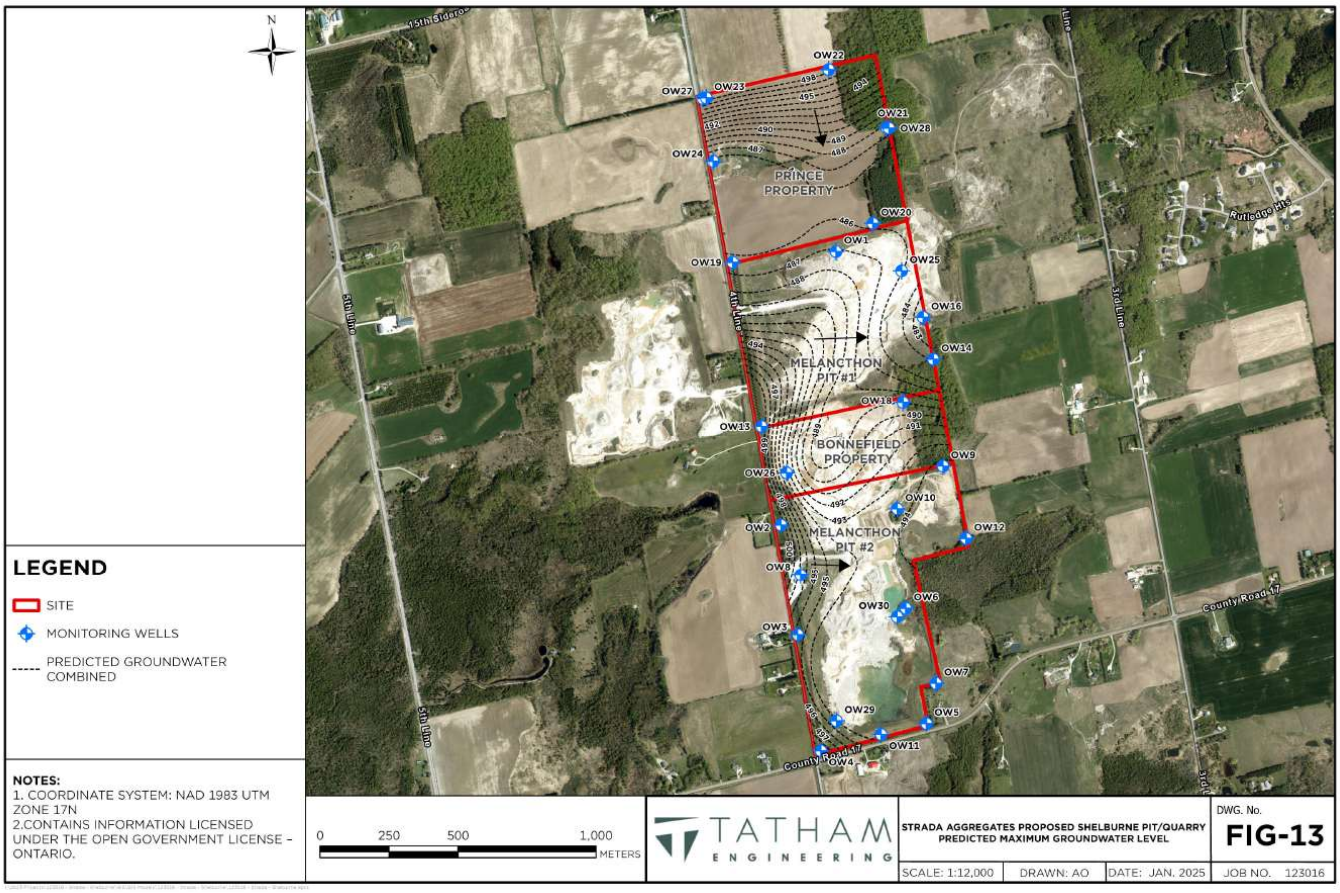
    - a small northern extension of a proposed berm along the east side of the south infiltration pond
- ***Direct Impacts***: Proposed quarry operation will require the removal of the four small wetland features on the Melancthon Pit #2 site to accommodate the central infiltration pond
- According to NRSI, the subject wetland community types do not represent unique or significant features on the landscape; they do not contain significant vegetation species
- NRSI recommended that a wetland offsetting plan be implemented to mitigate the negative impacts associated with the required removal of these wetlands.
- NRSI proposed a new wetland to be created on the subject lands, located immediately southwest of the existing wetlands proposed for removal, and design this to functionally tie in with the existing feature (Mineral Deciduous Swamp) to its immediate east. NRSI proposes 15m buffers around the proposed wetland limits which is 1.44ha (1.99ha including its 15m buffer), representing a greater than 2:1 area-based compensation ratio. NRSI concludes that this strategy will provide a net gain in the area of wetland coverage on the subject lands.
- ***Indirect Impacts***: as noted earlier, hydrogeological modelling results show that groundwater mounding is anticipated to the south, southeast and northeast of the subject lands, while groundwater drawdown is anticipated to the east, west, and southwest of the subject lands.
- Groundwater drawdown effects downstream of the quarry are proposed to be mitigated through the water management strategy, whereby groundwater that exfiltrates into the quarry, or is collected within the west-property buried tile drain, will be captured and infiltrated onsite within the three infiltration facilities and through drainage from the buried tile drain to the injection wells.
- NRSI notes that the on-site infiltration of groundwater, and maintenance of the prevailing groundwater flow paths, is important in maintaining existing connectivity between groundwater flows and surface ecological receptors.
- Despite the application of the water management and mitigation strategy, the modelling shows some degree of groundwater drawdown to the east and west of the subject lands
- The modelling also predicts changes in groundwater elevations and increases in surface water leakage which could cause increases and decreases in total streamflow in the Study Area (per NRSI boundary limits) watercourses relative to baseline conditions.
- Notably, several of the Study Area watercourses are projected to experience an increase in total streamflow based on the increased surface leakage which will create excess surface runoff and interflow conditions, essentially representing a shift in hydrologic regime. The increased streamflow rates are noted to be a result of increased contributions of groundwater (via direct upwelling or through surface leakage inputs) and are not due to changes in surface catchment drainage or increases in surface runoff (direct) to the watercourses.
- Conversely, certain watercourse features to the east of the subject lands are projected to experience a decrease in streamflow
- Prevailing groundwater flows will generally be maintained through the water management plan, thereby minimizing or reducing negative effects on down-gradient ecological groundwater receptors. According to NRSI, these effects are not anticipated to cause negative ecological impacts to vegetation communities or species, terrestrial wildlife habitat, or to fish habitat. NRSI notes that in large part, these effects will not result in significant change to surface conditions among the Study Area features.
- NRSI advises that no watercourses are associated with the subject lands that provide aquatic habitat, or that support a fish community, hence, any potential changes to the water balance

within the subject lands are not expected to negatively affect the local aquatic habitat or fish community

- NRSI concludes that the quarry operations are not anticipated to cause indirect negative effects on the Study Area natural features or their ecological functions as a result of groundwater level changes. Furthermore, no negative indirect effects are anticipated following quarry closure during the Rehabilitation Phase

Maximum Predicted Water Table Report, Tatham, January 13, 2025

- This report represents a companion to the "Strada Pit/Quarry Level 1 and 2 Hydrogeological Assessment, Tatham/EarthFx, June 26, 2025", with its intended purpose focused on identifying the maximum predicted water table elevation relative to the proposed depth of excavation
- The report reiterates the water control features and phased operations per the Hydrogeological Assessment, and also offers details on the field program conducted on the site to determine the subject water table information
- Predicted Maximum GW Level map was prepared using the highest GW elevations measured on-site to-date (ref. below)



Correspondence from WSP (McFarland), April 17, 2025, commenting on the Issues identified by Hunter

- WSP (Sean McFarland, P.Geo., Ph.D.) provided a professional opinion on the responses by EarthFx to the review by Garry Hunter (Hunter and Associates), who is understood to have been engaged for three years in providing guidance and oversight on the assessment by EarthFx
- The six "remaining" issues which were raised by Hunter, related to:
    - GW Model Fitness
    - Pine-to-Boyne Diversion
    - Water Quantity Management
    - Water Quality Standards
    - Geotechnical Contingencies
    - Monitoring Network
- Premised on his review of each of these issues and the response provided by EarthFx, McFarland comments that "… (he is) confident the six remaining hydrogeology issues have been addressed …"

Site Plans Drawings 1 to 5, MHBC, July 2025

- Five (5) drawings prepared which documented:
    - Existing Features (specific to natural systems as well as details on land uses and zoning, and topography which depicts drainage directions)
    - Operational Plan (depicting all four proposed phases)
    - Operational Notes (in support of the four phases and related activities)
    - Rehabilitation Plan (including details and notes on Pit Floor Agricultural rehabilitation)
    - Cross-sections depicting existing and rehabilitated conditions

3. SUMMARY OF OPINION - Surface Water – Impacts and Management

The following provides a summary of my key conclusions based on the review of the applicant's materials as cited herein:

a. Notable that the operations are restricted to the existing sand and gravel pit operating licence; this infers no new spatial expansion into adjacent table land areas and features
b. The northern two-thirds of the site are proposed to be actively quarried and the southern third is to be dedicated to water management, hence having different forms of impact
c. The NE Report confirms that natural heritage features are located outside of the area of site disturbance (proposed quarry activities) and will not be negatively impacted; that said, impacts are expected to four small on-site wetlands and on-site Eastern Meadowlark habitat, located within the proposed quarry footprint, associated with the water management plan works
d. There are no watercourses or headwater drainage features flowing through or out of the subject site
e. There are no adjacent natural systems which are reliant on direct contributions of surface water
f. There are no adjacent anthropogenic systems (culverts, bridges, engineered channels) which received direct discharge from the subject lands
g. Surface water in the form of precipitation and runoff is proposed by Strada to be captured and treated on site through a system of settling ponds and clean water ponds
h. Further, once treated, surface water is proposed to be directed to infiltration systems (trenches or ponds) and/or used in the system of injection wells (Note: intercepted groundwater is to be managed in a similar method as surface water)
i. No direct off-site discharge is proposed; rehabilitation plan does not propose perpetual active pumping
j. Largely to ensure that the quarrying operations do not have an impact on surrounding natural systems (and domestic wells), Strada proposes a monitoring program focussed on water levels in on-site and off-site wells, as well as key natural surface water features; this monitoring is based on the potential for changes in the groundwater regime, not premised on the direct discharge of surface water
k. NE Report (NRSI) states that adjacent key natural heritage features and key hydrologic features will not be negatively impacted by the proposed pit and quarry

Based on the foregoing, and my interpretation of same, the potential for direct surface water impacts (quantity and quality) is considered low. With that said, there are some elements of the mitigation/management plan and monitoring plan, which should be considered further and also technically assessed in more detail through the various planning and design stages of this application with the intent of reducing risks to the Township and surrounding properties; these include:

i. The topographic plan (ref. Site Plan Dwg 1, MHBC) depicts contours which largely show that there is no drainage across Strada property limits, however a more detailed review does show some potential of minor surface water alteration. For completeness, a more detailed and discrete surface water catchment plan should be prepared to rule out any potential surface drainage impacts.
ii. Given that the proposed bench barriers are being constructed to ensure that no off-site surface water discharge will occur, the material used in their construction and the associated properties of this material need to be aligned with the geotechnical design

objectives; adding specific geotechnical oversight on this aspect of the plan would be recommended during implementation. Further, there should be strict adherence to the recommendations from the geotechnical report in terms of berm geometry and associated factor of safety requirements.

iii. Further to the above, depending the duration of each phase and given the importance of these barriers from an operational perspective, the Township may wish to incorporate a requirement to have these barriers inspected annually in order that their function can be maintained, thus protecting any off-site properties.

iv. The modelling assessment conducted by the applicant is noted to cause impacts to a variety of features (HWDF, wetlands, watercourses etc.) of varying amounts over the various phases of the quarrying activities; some of these impacts, depending on the phase and feature, are noted to be moderate and/or high (ref. STR8 and NAT-18 in particular); additional consideration/study should be afforded to these impacts and additional/supplementary mitigation should be advanced to further limit the effects of these predicted impacts.

v. In the event the Township's ecologist considers the predicted change in flows to the Headwater streams to be an adverse and unacceptable impact (counter to the perspective offered by NRSI), there could be consideration for some short-term compensatory pumping of treated runoff from the clean water pond (and/or other form of mitigation which will need to be assessed appropriately); the logistics of this have not been reviewed nor considered further by me, as the potential and need for this mitigation is yet to be determined; notably this would likely only be during the extraction phases and not post-remediation. Perhaps this can be introduced as part of an adaptive management plan recommendation.

vi. At the rehabilitation phase, the applicant indicates a small portion of the western face of Phase 4 is to remain open to the quarry lake to ensure that the lake does not overtop and discharge as surface water. Given this potential, it is recommended that the applicant consider a contingency plan to ensure that there would be no potential for adverse off-site discharges.

vii. Furthermore, the setting of the final lake levels in the rehabilitation phase, should include a sensitivity analysis related to sustainability in terms of a range of possible operating water levels which should ultimately lead to a recommendation for a preferred lake level based on ecological and sustainability criteria.

viii. It is understood that the applicant proposes a system of settling ponds and clean water ponds to manage the surface runoff in the quarry and appropriately treat the captured water prior to discharge to the infiltration systems; treatment for a range of water quality parameters is recommended and the provisions for treatment and testing should be included in an ECA secured through the Province; furthermore, while risks of flooding are acknowledged to be very low (if these systems (ponds) are undersized) and the resulting impact will undoubtedly be to the quarry operations first, it would be beneficial if the applicant provide calculations which document the proposed capture quantity and design of the settling and clean water ponds at each stage of the application which also includes details on the efficacy of the proposed water treatment. This is particularly in the event of an emergency which has the potential to "flood-out" operations which then may promote the request for short-term dewatering to the surface.

ix. Infiltration systems (trenches, ponds and injection wells) are being proposed by the applicant; it is important that appropriate forms of fine sediment pre-treatment be incorporated into the water management "treatment train" in order to avoid clogging and reduced efficacy long-term of these infiltration systems; furthermore, there should be

monitoring provisions which document the ability of the infiltration systems to infiltrate water to their defined receivers and if this function is reduced below acceptable levels then remediation will be required – provisions to this effect should be included in an Adaptive Management Plan.

x. NRSI noted that the NAT-19 wetland complex, located immediately southeast of the subject lands, will receive shallow groundwater leakage from the adjacent central and southern infiltration ponds, and notably also receive some periodic outflows of surface water from the created wetland when water levels reach a specific elevation during seasonally wetter periods. Further investigations are required for this feature to ensure that there would be no adverse flood or erosion risks associated with the predicted surface water outflows during extreme conditions to ensure the long-term environmental integrity of this feature and the downstream agricultural lands.

xi. In light of the above, it is suggested that the Township reinforce the need to collect data on water levels and water quality in the on-site settling ponds and clean water ponds, which would also include information on the bathymetry (capacity) of each and the means of pumping.

xii. While more of a groundwater matter, breakout conditions associated with breaches of the unexcavated aquitard, resulting in possible flooding of the quarry should be considered through an emergency management plan which includes consideration for pumping water to surface; the potential for off-site impacts (albeit short-term) should be assessed and appropriate management provisions should be in-place.

xiii. Given some of the predicted impacts through modelling (during and post-operations), additional monitoring locations should be considered through an integrated discussion amongst the various disciplines involved including NE, HG and Surface water. Strengthened and more comprehensive triggers and adaptive management actions should also be advanced based on the feedback offered by the enhanced monitoring network. The Township, Province and other stakeholders should have an opportunity to provide input on the proposed monitoring network to ensure that all potentially affected features are appropriately captured in the monitoring scope.

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