

DRAFT MEMO

To:	Natalie Kotyck and Carl Cosack (NDACT)
From:	Garry T. Hunter, M.A.Sc., P.Eng.
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File:	21-407
Subject	Strada Proposed Quarry Alternative Site Plan / Water Management Concept and Supporting Figures

1.0 INTRODUCTION

I enclose seven Figures for an Alternative Site Plan Concept for your review and comment. These are intended to form the fundamental basis for an 'Alternative Site Plan' acceptable to NDACT with operational flexibility acceptable to Strada. The standard Peer Review process of 'pushing on strings' through four review and now a fifth cycle doesn't cut it for anyone. Critique (positive or negative) from the Strada Team is required to reach a final mutually acceptable Site Plan and Water Management solution so this Project may move efficiently forwards.

This design concept is based on our July 2024 alternative Quarry footprint and advanced GIS processing of Strada's and agencies high quality downhole geological, hydrogeological, water quantity and quality data and review of all available Strada draft submissions but with only preliminary review of Blasting, Noise and Air Quality Reports (received today). Our phasing and extraction directions vary from these reports. Review of these reports is necessary to understand Strada's proposed mining strategy.

This Site / Water Management Plan Concept is not yet complete.

Strada will need to update all its component Reports to the legal Site Plans for a formal complete application to MNRF. However, it never takes as long to update as to prepare the original reports.

2.0 CONCEPTUAL SUPPORTING FIGURES

The following Site Plan / Water Management Supporting Figures have been prepared (Conceptual).

- Fig QSP1: Proposed Strada Quarry Monitor Wells
- Fig QSP2: Proposed Strada Quarry Extraction Limits – Adaptive Management Zone
- Fig QSP3: Proposed Strada Quarry – Existing Topographic Shaded Relief
- Fig QSP4: Proposed Strada Quarry – Top of Bedrock
- Fig QSP5: Upper Aquifer Interceptor and Infiltration System (Conceptual)
- Fig QSP6: Deep Aquifer Extraction and Infiltration Wells (Conceptual)
- Fig QSP7: Quarry Profile along the 4th Line with Groundwater Extraction Infrastructure Conceptual)
- Fig QSP8: Quarry Profile along Mid Township Con 3 OS Boundary with Groundwater Infiltration Infrastructure (Conceptual) - not yet completed

3.0 GROUNDWATER MODEL

The Groundwater Model when ‘fit for purpose’ will assist in determination of flow quantities (fluxes) for sizing of infrastructure and assessing drawdowns to the west of 4th Line. However, the model completion is not required prior to submission of Site Plans for the initial application to MNRF based on the following adaptive management proposal.

The groundwater model or any other procedure is unlikely to be able to predict actual hydrogeological conditions as found. A currently anticipated operational procedure is described in the Phasing below.

4.0 DECEMBER 10, 2024 DATA REQUEST

My December 10, 2024 Data Request was not frivolous and was intended to further assist with integration of Quarry hydrogeological conditions and formulating a water management strategy. A positive response would be appreciated.

Pump Tests are required in the underground stream area to assess flow quantities.

5.0 QUARRY ADAPTIVE OPERATIONAL PRINCIPLES (Preliminary)

The following Mandatory and Adaptive Discretionary Quarry operation principles are proposed.

5.1 Mandatory Principles

The Mandatory Operational Principles are:

1. Implementation of an Adaptive Management Plan.
2. Performance Criteria to protect Horning’s Mills Community and Pine River headwaters from water quantity and quality degradation.
3. No diversion of surface or groundwater flows from the Pine River headwaters to the Boyne River headwaters.
4. No raising of water tables on Duivenwoorden Pit lands or in NAT-01 Wetland.
5. No root zone flooding of agricultural fields.
6. Removal of Deep (Gasport) Aquifer Hydraulic Barriers prior to closure.
7. Termination of quarry and / or groundwater extraction if Performance Criteria are breached by Quarry operations.

5.2 Operational Discretionary – Design Principles

The following discretionary solutions may be implemented based on operational experience for conditions ‘as found’ or reasonably anticipated and as determined by Strada to be necessary to meet Performance criteria. Typical Design Details to be shown on the Site Plans.

8. Provision for separation (or merging) of Upper Aquifer (Guelph), Deep Aquifer Non-Contact Water and Quarry Sump Contact Water based on operating conditions as found or as anticipated.
9. Ground Water Extraction and Infiltration Infrastructure and transmission components to be implemented when there are excess quantity and/or adverse quality inflows into the Quarry excavation or as anticipated.
10. Implementation of Pressure Relief Wells as required to facilitate Lift 2 / Lift 3 extraction and construct Lift 3 Hydraulic Barriers if deemed necessary.
11. Implementation of vertical Hydraulic Barrier Walls for Lift 1 or Lift 3 (High or Low Pressure) if deemed necessary.
12. Provision of stormwater quality treatment (denitrification) riparian wetland storage pond for Quarry contact water and contaminated Upper Aquifer non-contact water as may be required.
13. Provision of surface pond and/or aquifer storage to support continuous 24/7/365 groundwater infiltration to Pine River headwaters.
14. Implementation of pathogenic treatment of surface water discharge to Infiltration media as required.
15. Implementation of SCADA and hydraulic controls for water management and maintenance of downgradient dry weather flows to the Pine River headwaters and Horning’s Mills community.

6.0 DESCRIPTIONS OF QUARRY EXTRACTION PHASE (CONCEPTUAL)

The following Quarry Extraction Phases are based on this Peer Reviewer’s interpretation of underground hydrogeological conditions from Strada’s data available to date. Conditions may (will) vary from those described. Phase boundaries may vary depending on operational and processing needs. Phase boundaries will be stepped by Lifts to provide a variety of aggregate types. Lift 1, 2 and 3 may be extracted progressively at the same time across Phase boundaries.

Currently, the Upper Aquifer intercepted flow is expected to be about 40%, the Deep Aquifer extracted flow about 40% and the Quarry contact water about 20%. This may vary by Phase.

6.1 Phase 1

Phase 1 is located in the Cabot Head down dip corner of the Quarry footprint at a location where minimal quarry groundwater inflow is anticipated based on legacy open hole pump tests. The use of extraction wells and vertical hydraulic barriers may not be required due to low inflows. Phase 1 Quarry sump water may be used as make up wash water or discharged to a temporary surface ponds in Phase 5 area.

Extraction will proceed northerly towards Phase 2 with stepped Lift benches and eventually towards Phase 5.

The Fourth Line interceptor drain will be constructed within the top of the Lift 1 epikarst bench and connected to the Upper Aquifer Infiltration and Treatment Infrastructure to be constructed within the eastern Adaptive Management Infiltration Zone, as required.

Enclosed Fig QSP5 shows the Phase 1, 2 and 3 location and invert elevations of this proposed Upper Aquifer (Epikarst) Interceptor Drain. The drain is perforated and filter wrapped along the 4th Line and solid to the south of the Quarry footprint. The interceptor drain will discharge either directly to Infiltration Infrastructure in the Adaptive Management Zone or to the Riparian Wetland Denitrification Storage Pond for water quality treatment.

6.2 Phase 2

Extraction will proceed northerly from Phase 1 with sequentially stepped Lift Benches towards Phase 3 and Phase 6 based on Strada's needs.

The 4th Line Interceptor Drain will be constructed progressively northerly as overburden is removed exposing the Lift 1 Top of Epikarst Bench.

The 4th Line Watermain will be constructed to transmit Deep Aquifer non-contact water to the eastern Adaptive Management Infiltration Corridor. No treatment is anticipated based on water quality data currently available.

Increased groundwater flow is expected in the northerly part of Phase 2 as the underground stream corridor is encountered. Extraction (pressure relief) wells are anticipated to be required as excavation proceeds northerly. If needed, progressive low and/or high pressure vertical barrier walls may be established as extraction proceeds into Lift 3.

Injection / Infiltration Infrastructure implementation will be required in the eastern Adaptive Management Corridor for both Upper Aquifer and Deep Aquifer Non-Contact water. Riparian Wetland and Treatment (Storage Pond) capacity will be required during Phase 2 to accommodate Quarry Sump Contact Water and perhaps agriculturally contaminated Nitrate rich Upper Aquifer water.

Alternatively, Nitrate rich water may be seasonally provided for nearby farm irrigation providing sufficient water is available to meet performance criteria.

6.3 Phase 3

Phase 3 extraction with sequentially stepped Lift Benches will continue northerly from Phase 2 and into Phase 4 with progressive installation of Extraction Wells and Hydraulic Barrier Walls along the 4th Line to about OW24A-B1.

Expansion of Adaptive Management Zone Injection / Infiltration / Treatment infrastructure may be required. Upper Aquifer Interceptor Drains may continue easterly along Township Lot 14/15 boundary, if required.

6.4 Phase 4

Progressive extraction from Phase 3 with sequentially stepped Lift Benches will proceed easterly into Phase 4 from south to north. Groundwater inflow from the Phase 3 and 4 northerly boundaries is expected to be minimal and not require Extraction Wells and Hydraulic Barriers.

However, the Upper Aquifer interceptor drain, if required, may need a direct gravity connection to the eastern Adaptive Management Infiltration Zone.

No expansion of infiltration infrastructure is anticipated.

6.5 Phase 5

Phase 5 will be extracted easterly from Phase 1 in sequentially stepped lifts towards the Adaptive Management Infiltration Zone. Extraction of Lift 1 in Phase 5 may require construction of a Backflow Barrier (grout curtain?) and extraction wells to allow Lift 2 and 3 extraction west of the Adaptive Management Infiltration Zone.

6.6 Phase 6

Phase 6 will likely require use of Backflow Barriers for Lift 1 and Extraction Wells for Lift 2 and 3 excavation. Considerable groundwater will need to be recirculated during Phase 6 extraction to maintain water levels in the Adaptive Management Infiltration Zone.

A significant portion of the Deep Aquifer (Gasport formation) along the 4th Line and through the Adaptive Management Zone must be left open on Quarry Closure.

Deep (Gasport) Aquifer Hydraulic Barrier Walls, if constructed along the 4th Line or adjacent to the Adaptive Management Zone will have to be removed prior to Quarry Closure. Construction of Lift 3 Hydraulic Barrier Walls are not recommended during Phase 5 and 6 extraction.

The Upper Aquifer Phase 5 and 6 Lift 1 Backflow Barrier may likely be left in place depending on 3rd Line Sentry Well water level history and the degree of Upper and Deep Aquifer mixing (if any) observed at downgradient Sentry wells over the life of the Quarry operation.

7.0 SITE PLAN NOTES – CONSIDERATIONS / DISCUSSION

The following Site Plan Notes and discussions are enclosed for consideration. These are edited in part and added to from previous submissions. The development of a Site Plan consensus will permit further reduction of monitoring and preparation of abbreviated Site Plan notes in ‘legalese’ style.

7.1 Source Water Protection (Horning’s Mills) and Pine River Headwaters

7.1.1 Water Quantity

Under quarrying operational and rehabilitation conditions, Strada will be assuming source water drinking quantity and quality responsibility for the community of Horning’s Mills as well as local nearby downgradient rural residents.

Strada will also be responsible for maintaining existing high quality groundwater dry weather flows in the nearby Pine River headwater streams and Brook Trout habitat. The following water level and water quality controls are proposed by this Peer Reviewer during proposed quarry operation and rehabilitation phases.

Diversion of Pine River headwater stream flows to the Boyne River headwaters shall not be permitted.

7.1.1.1 East Strada Pit Boundary Monitor Wells

To ensure maintenance of existing groundwater and stream flows to the Horning’s Mills community, Strada shall maintain the existing four seasons minimum water levels or as may be determined by continual monitoring at the Melancthon Pit (Lot 13) east boundary as follows:

OW25A-B1 at 484.3 m asl (Guelph / Eramosa)

OW25C-D1 at 479.5 m asl (Gasport Aquifer)

OW16C-D1 at 477.8 m asl (Gasport Aquifer equivalent)

Alternatively, the trigger monitors may be water levels within the Upper and Deep Aquifer infiltration infrastructure.

7.1.1.2 Third line Sentry Monitor Wells (Downgradient)

Five multi-level sentry monitors are proposed to be constructed by Strada along the Third Line OS Right-of-Way at each of County Road 17, Lot 11/12 boundary, Lot 12/13 boundary, Lot 13/14 boundary and Lot 14/15 boundary intersections subject to permission from the Township of Melancthon. Each dual level monitor well to be screened near the base of the respective Guelph/ Eramosa (Layer 4) and Gasport Aquifers (Layer 6).

Strada will ensure that minimum water levels in Third Line Sentry Wells during the life of the Quarry and beyond will not fall below the static water levels as observed for a two year monitoring period after construction at each well and that the water level in the Sentry Wells at County Rd 17 and Lot 14/15 Boundary will not rise above the maximum annual observed static water levels during a two year monitoring period after well construction.

No maximum water level is proposed for Lot 11/ 12, Lot 12/ 13 and Lot 13/14 boundary sentry wells. This area may accommodate greater ground water flow, if necessary.

These 3rd Line Sentry Wells may be constructed before or after Site Plan approval at Strada's discretion with at least two years of continuous monitoring available before initiation of extraction below the existing Strada Pit water table plus 1.5 m.

7.1.2 Infiltration Infrastructure

Infiltration infrastructure to be located in the Adaptive Management Zone may include:

- Injection Wells
- Extracted Bedrock (Guelph / Eramosa) backfilled with crushed rock with surface elevated inverse granular filter
- Blast fractured in situ bedrock (Guelph Eramosa) with surface elevated inverse granular filter
- Possible blast fractured in situ bedrock (Deep Aquifer Zone) – requires deep controlled blast hole drilling capabilities and protection of the Goat Island Aquitard

No infiltration ponds should be proposed on W½ Lot 11 Con 3 OS discharging directly or indirectly via surface or shallow groundwater to the Boyne River catchment south of County Road 17.

7.1.3 Infiltration Water Quality

Despite repeated Peer Review requests since 2023, Strada has not provided any information on Hydrocarbon and Ammonium Nitrate / Fuel Oil / Emulsion (AN/FO) residual contamination which will be conveyed to the quarry floor ‘contact’ sump water after potential incomplete combustion of blasting events.

Strada will also, in the proposed infiltration of ‘contact’ and ‘non-contact’ waters to local Drinking Water Aquifers, ensure that the infiltrated water shall be pathogen-free, Turbidity does not exceed 5 NTU and Nitrate (as N) concentration does not exceed 3 mg/L consistent with the Long-Term Protection of Aquatic life (CCME 2012) and, by default, Drinking Water Aquifer users.

Strada will ensure that Petroleum Hydrocarbons do not exceed potable groundwater standards (MOE 2011) in infiltration / injection water.

F1	750 ug/ L
F2	150 ug/L
F3	500 ug/L
F4	500 ug/L

Oil and grease should be non-detectible.

Sampling will be monthly (four seasons) at each infiltration infrastructure facility inlet for the full set of water quality parameters including calculated Total Dissolved Solids as specified elsewhere on the Site Plans.

7.1.4 Dry Weather Stream Flow Protection

Strada will maintain (four seasons) minimum dry weather stream flow quantity throughout quarry operations as observed at the following stream flow monitoring stations:

Station	Minimum Flow Criteria	Monitoring Frequency
SW3	No constraint	Single Day (Oct)
SW4	60 L/s	Single Day (Oct)
SW5	150 L/s	Continuous (365 days)
SW6	40 L/s	Single Day (Oct)
SW13	25 L/s	Single Day (Oct)

Station	Minimum Flow Criteria	Monitoring Frequency
SW14	300 L/s	Continuous (365 days)
SW17	35 L/s	Single Day (Sept)
SW24	210 L/s	Single Day (Oct)
SW25	No constraint	Single Day (Oct)
SW26	No constraint	Continuous (365 days)
SW27	TBD	Continuous (365 days)
SW28	TBD	Single Day (Oct)
SW29	No constraint	Single Day (Oct)
SW30	TBD	Continuous (365 days)

TBD = To be Determined

Continuous water level elevation and flow data loggers will be installed at the selected stream flow stations and monitored for a two year period prior to pit extraction below the water table +1.5 m. Minimum dry weather flow performance criteria may be further evaluated following this monitoring.

Single day dry weather flow monitoring is recommended in late September / early October outside of the farm irrigation season.

Monitoring at SW 15 at 15th Sideroad is not recommended as this appears to be a 'losing' stream.

Monitoring at SW26 is not anticipated to be impacted by Strada quarry operations. It is provided for comparative purposes to indicate if observed low flows may be related to other external factors.

An additional monitoring station (SW30) on River Road below the Mill Dam near the waterfall (Manitoulin / Whirlpool outcrop) would provide the most strategic monitor location for observing NAT-16 and NAT-18 Quarry induced flow changes. However, access to private property is required.

Strada has not yet provided single day dry weather flows for a number of stations including SW26, SW27, SW28, SW29 and SW30 to inform these Site and Water Management Plans.

The proposed stream flow monitoring reflects observation of Upper and Deep Aquifer flow quantities above and below the Goat Island aquitards.

7.1.5 Operational Performance Controls – Termination of Extraction

Extraction will be terminated (but not processing, shipping, treatment and infiltration) when (if) the above water quantity and quality exceedances occur until remedial measures are implemented and proven feasible.

7.2 Agricultural Crop Protection

1. Strada will ensure that after April 15 at the beginning of each year growing season and until after harvest at November 30, that water table levels will be a minimum 50 cm below existing depressional field surfaces and below tile drain outlet inverts from existing cultivated lands adjacent to, contiguous with and / or connected to RDSI Wetlands NAT-01, 02, 03, 04, 14, 19 and 20. A key known farm tile drainage outlet to be monitored is located at the rear of E1/2 Lot 9 Con 2 OS (Noble Farm).
2. Strada will ensure that existing groundwater discharge zones within and adjacent to normally cultivated lands in Township Lot 15 east and west of the Third Line OS and south of Sideroad 15 will not be expanded due to incidental Quarry barrier wall or infiltration mounding effects or as may be agreed with land owners.
3. Strada will ensure that necessary root zone drainage and recharge topographic swales downgradient of the proposed quarry within Lot 10 and 11 Con 2 and 3 OS Melancthon remain dry throughout the agricultural planting, growing and harvesting seasons (April 15 to Nov 15 each year).
4. To avoid wetland, contiguous field, residential lot and Lot of Record flooding, Strada shall ensure that the eastern groundwater outlet of NAT-01 located about 200 m west of the 4th Line on E½ Lot 12, Con 4 OS will not be barricaded from subsurface flow onto the Strada property.
5. To avoid flooding of upgradient farm fields and aggregate properties, Strada shall ensure that groundwater flows from E½ of Lot 14, Con 4 OS natural existing infiltration basin are not barricaded from entry into the Strada property at existing Upper Aquifer levels.
6. Strada will compensate Farmers for land losses and crop damage due to Quarry induced rising water levels on a field (not depressional area) basis recognizing the row crop nature of local area specialty crops.

7.3 Multi-level Groundwater Monitors - Rationalization

Monitor wells PW1, OW1, OW6, OW10, OW18, OW20, OW25, OW29 and OW30, as illustrated in Groundwater Model Appendix E, Fig 4.1 (pg 152) and Table 4.1 (pg 153 to 156 incl), are located in areas not protected from proposed Quarry Site Extraction, Operations,

Stockpile, Infiltration and Storage Pond Areas. These wells are not suitable as permanent long-term pre- to post-Quarry monitors (see also Site Plan Dwg 1 of 5).

This leaves only 18 existing monitor well sites, some with multi-level screens remaining. However, the existing vertical and horizontal distribution of these remaining monitor screens is not optimal by Model / Layer / Lifts and has not been visually disclosed by Strada for network evaluation.

Strada will rationalize its 2024 existing Site Plan groundwater monitors to provide a minimum of ten (10) multi-level monitors at protected locations, one at each approximate original Township (100 acre) Lot corner, more or less, plus at least one (1) additional monitor at the entrance (Prince Pit) and exit (Melancthon Pit No. 1) of the underground stream corridor at the Strada property (Modelers in inferred zone of higher conductivity).

Each of the 12 (minimum number) monitors to be screened within the existing Water Table Aquifer, at the base of the Guelph / Eramosa Aquifer and at the base of the Gasport Aquifer (minimum 36 screens). Monitors to be located on the perimeters of the site external to the berms protected from quarry activities and maintained (or replaced at the same location if damaged) throughout the life of the quarry and until two years after full water level recovery after quarry closure.

The location of the rationalized long-term multilevel monitoring infrastructure including proposed salvaged and replacement wells to be described on the Site Plans by Model / Lift Layer.

New long-term quarry monitoring infrastructure to be constructed before or after Quarry Site Plan approval at Strada's discretion. However, initiation of extraction below the water table plus 1.5 m to be delayed until after at least two years of continuous water level monitoring is completed.

Existing interior Pit and redundant monitors to be abandoned in accordance with MECP regulations after Quarry Site Plan approval and after at least two years of water level monitoring is available for the newly constructed permanent Quarry monitoring network prior to any extraction below the water table plus 1.5 m.

7.4 Geotechnical

7.4.1 Hydraulic Barrier Berm Factor of Safety (FOS) (pg 5)

Based on the results of the Geotechnical Consultants' analyses, the berm configurations at 2H:1V slopes do not meet the target minimum FOS (Factor of Safety) for global stability or sliding.

The Factor of Safety for berms may 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 by the Geotechnical Consultants 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. (pg 5)

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 Factor of Safety for both global and sliding stability at a 2H:1V slope.

7.4.2 High Hydraulic Heads

It should be noted that potential high hydraulic heads are anticipated at the lowest berms (Lift 3), 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.

7.4.3 As Constructed Field Hydraulic Conductivity

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.

7.4.4 Construction Considerations – 2 m Thin Niagara Falls Unit (pg 7)

During the Phase 2 stage of excavation of the quarry, the Geotechnical Consultants 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 pressure relief wells and drainage galleries within the excavation. (pg 7)

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 relief and drainage galleries in the excavation. (pg 7)

For Site Plan development purposes, it should be assumed in the Groundwater Model that the 2 m thick Ancaster / Niagara Formation will be compromised by progressive blast hole drilling and blasting and at some locations by natural ‘windows’ in the formation (see this Peer Review Gasport Groundwater Quality Analysis (Matrix Oct 4, 2024)).

Strada needs to model the quarry Lift 2 as though the proposed 2 m remnants of Niagara Falls Formation is fractured and no longer an aquitard under the excavated quarry floor.

There is a high probability that pressure relief wells will be required upgradient of the Quarry excavation, especially in the underground stream area, to allow construction and stabilization of the proposed Deep (Gasport) Aquifer hydraulic barriers.

7.5 Deep Aquifer Hydraulic Barrier Berm Wedges

The Geotechnical proposed composite construction of the lower hydraulic barrier berms are likely to require imported low permeability (10^{-9}) materials for 2:1 slope construction. These composite barrier berm wedges may have to extend higher than the top of the Gasport Formation to seal off aquitards within the upper Goat Island Formation as well as vertical face blast fracturing to 5 or 6 m.

7.6 Excess Fill

Import of Excess Fill should not be permitted except as may be required for construction of the 10^{-9} m/s Hydraulic Conductivity ‘clay core’ hydraulic barrier berm wedges.

7.7 Quarry Sump Contact Water

Pumped water from the quarry floor sump will need to be discharged to a separate large settlement pond on the existing Pit Floor for treatment prior to infiltration to drinking Water Aquifers. Pathogen treatment may be required.

Construction of a South Storage Pond with riparian inlet and shoreline wetland denitrification zones on the existing impermeable pit floor may (will) be required to accommodate wet season pump out of quarry floor flooding and / or for emergency Quarry Floor flooding events.

7.8 Phase 1 Quarry Extraction and Possible Premature Abandonment

Extraction (Phase 1) should be initiated at the southwest corner of the proposed Quarry at the 'down dip' Geological Structure formation to permit natural downgradient Quarry Floor Drainage to successive Lift Sumps at this location.

This southwest corner of the Quarry has lower hydraulic conductivities and expected lower groundwater inflows into the quarry excavation. This is a better lower cost location for Strada to gain local quarry experience and implement an adaptive water management plan.

Furthermore, if sale of the upper Guelph Formation bedrock is determined to be not commercially feasible or excessive groundwater inflow is experienced, the excavation may be abandoned and permitted to fill with water with minimal effect on the local groundwater systems.

7.9 Adaptive Management Plan

An adaptive management plan will be required as actual (as found) extraction experience may vary significantly to predicted conditions.

The Site Plans need to protect a contingency quarry water management corridor about 200 m wide along the east limit of the Prince / Melancthon #1 / Bonnefield Pits. This corridor may include infiltration trenches with crushed rock or blast fragmented media and/or deep injection wells recharging the Pine River headwater local Guelph Eramosa Upper Aquifers, and the Deep Gasport Aquifers.

Infiltration facilities need to be priority located over the underground stream location at the Melancthon Pit No. 1 east quarry boundary and not just on the high shoulders of this feature.

These eastern ponds / trenches may be arranged in alternative cells to allow periodic maintenance and clean out of sediment. Surplus injection wells will be provided for resting

and as an alternative to local aquifer clogging. This surplus infiltration infrastructure should provide contingency for groundwater modelling errors including underestimated flows.

Infiltration facilities in the east Adaptive Management Zone corridor will have to be operated continuously 365 days per year in accordance with seasonal transients as determined by pre-bedrock extraction monitoring well annual hydrographs.

The Adaptive Management Zone and Third Line Monitor Wells may indicate a mixing zone of Upper and Deeper Aquifer waters. This will become apparent (or not) with additional field investigations.

7.10 Site Plans / Model Vertical Working Faces and Bench Heights

The Occupational Health and Safety Act R.R.O. 1990, Regulation 854 Mines and Mining Plants states:

89.(1) Where metallic or non-metallic rock is being removed from a surface mine,

(a) the vertical height of the working face shall be not more than twenty-five metres

(b)

(2) Clause (1) does not apply if an engineer certifies in writing that no worker would be endangered if the vertical height of the working face is more than twenty-five metres...

Both the proposed Site Plans and the Model scenarios show continuous vertical working faces up to 35 m in height without intervening benches (Site Plan Dwg 5 of 5).

The Site Plans need to reflect these 25 m vertical working face bench regulatory height constraint limits. Intermediate benches are required. Variances may be applied for at a later date.

Site Plans Drawing 2 of 5 should also include for convenience the typical top of bedrock elevation.

7.11 Upper Epikarst Aquifer Inceptor Drain Profile

This anticipated Site Plan Interceptor Drain may (will) intercept Upper Aquifer groundwater flows with elevated agricultural ‘nitrates’.

7.12 Riparian Wetland / Storage Pond (Denitrification)

A Riparian Wetland Treatment / denitrification Storage Pond is proposed to receive and treat turbid Quarry Sump contact water and/or agriculturally contaminated (Nitrate as N) Upper Aquifer Water that is captured by the 4th Line Interceptor Drain. Pathogen treatment may be required for the effluent water prior to discharge to the Adaptive Management Zone.

7.13 Waste Overburden / Rock

This quarry site is likely to generate considerable waste overburden and rock which will require stockpiling on a temporary and / or permanent basis. There needs to be a space allocation and / or limit in the Site Plan notes. These stockpile areas if located on the Quarry floor cannot interfere with post closure groundwater flow through the Quarry site.

7.14 Quarry Closure - Hydraulic Barrier Opening of Lifts 1 and 3

The underground stream communication should be restored on Quarry closure, including in front of the Prince Pit at the 4th Line and at the rear of the Melancthon Pit No. 1 and the former Bonnefield Pit.

7.15 Local Source Protection

Although formal provincial Wellhead Protection Area policies do not apply, there continues to be a need to protect the Horning's Mills community drinking water supply aquifers from adverse quantity and quality influences resulting from Quarry activities.

7.16 Adverse Impact on Water Supply Wells

Nearby Private Wells at Noise Receptors R01, R02, R03 and R15 require advance inspection and implementation of remedial measures as necessary to compensate for anticipated drawdown effects.

Impacts on Horning's Mills 'Gasport' wells with less than 5 m of drawdown above the Cabot Head Shales has not yet been assessed.

7.17 Blasting

Blasting should be undertaken at a regular day of the week and time of day, say between 1:00 and 2:00 pm, so adjacent residents and farm field workers, who may be in close

proximity (5 m) to berm enclosures may be aware as a precaution. Flashing lights warning of pending blasts may be advisable on the midpoint (parcel divide) of Prince Pit north boundary as well as on the 4th Line and County Rd 17.

Elevated cab eye levels on large tractors, application equipment and harvesters may be at or above the height of the berms specified on the Site Plans.

Wild fly rock may also be an issue. Most quarries do not have active farming at immediately adjacent boundaries as on the north Prince Pit boundary. Agricultural equipment, although mobile, should be considered blast sensitive receptors at 5 m from the property boundaries. Wild fly rock in fields may damage agricultural equipment, especially swathers and combines.

The Explotech November 2024 Blast Report (pg 22) should consider applying the more conservative ‘soft rock’ 13.5 K factor for the Lift 1 Guelph Formation Rock. Table 4 Maximum Flyrock Horizontal should be updated.

Furthermore, the WSP (Golder 2023) estimated Flyrock range minimum separation distance at up to 330 m (Table 7, pg 33) for the proposed CBM / St. Mary’s Caledon Quarry appears to contradict Explotech Strada estimates. WSP / Explotech need to clarify this issue.

7.18 Management of Quarry Fines

Quarry fines may end up in sold product, in berms, as turbidity in Quarry Sump effluent and as dust in the air. Turbidity will clog infiltration infrastructure.

Dolomitic dust in the air may be a positive agriculture field soil amendment but deposited on crop foliage may have adverse growth effects. Dust may also have adverse effects on grazing animals.

Quarry fines management is essential.

7.19 Rehabilitation / Closure

Strada has provided no rationale for the Site Plan (Note 11.8) specified Post Quarry water level of 487.0 m asl. This selected level appears to be related to leaving the Deep Aquifer Hydraulic Barrier Walls in situ on Quarry closure.

This Peer Review proposes a closure water level consistent with the existing Deep Aquifer (Gasport) potentiometric water level at about 479 m asl in the Adaptive Management Zone. This lower water level will reduce the time to fill the Quarry excavation after closure.

Strada will ensure that adequate post closure open Gasport aquifer wall is available to transmit water through the Quarry excavation to the Horning's Mills Pine River headwater streams.

Strada will ensure that existing water levels will be maintained in 3rd Line multi-level Sentry Wells and that groundwater discharge / surface flow will be maintained for five years after Quarry water fill to this 479 m asl elevation similar to existing pre-Quarry Gasport water levels in the Horning's Mills Pine River headwaters.

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