

CLC Meeting

Goffs Quarry





Agenda

- Introduction to Golder Associates Ltd.
- Golder team introductions
- CLC introductions
- Overview of the on-site wetlands
- Overview of the on-site surface water features (watercourses)
- Overview of the studies completed to support the Industrial Approval
- NSE monitoring and reporting requirements
- Questions



The Golder Team

Kevin MacKenzie, B.Sc., M.Sc., P. Eng. (Ont.),

Principal, Senior Hydrologist

- 21+ years professional experience
 - 21 years of experience in hydrology, hydraulics, water balance analysis for a variety of projects interacting with the environment.
 - 18+ years of experience with aggregate extraction projects including hydrology and water quality assessments, water balances and quarry water management plans.

Callie Andrews, B.Sc., M.Sc. (candidate),

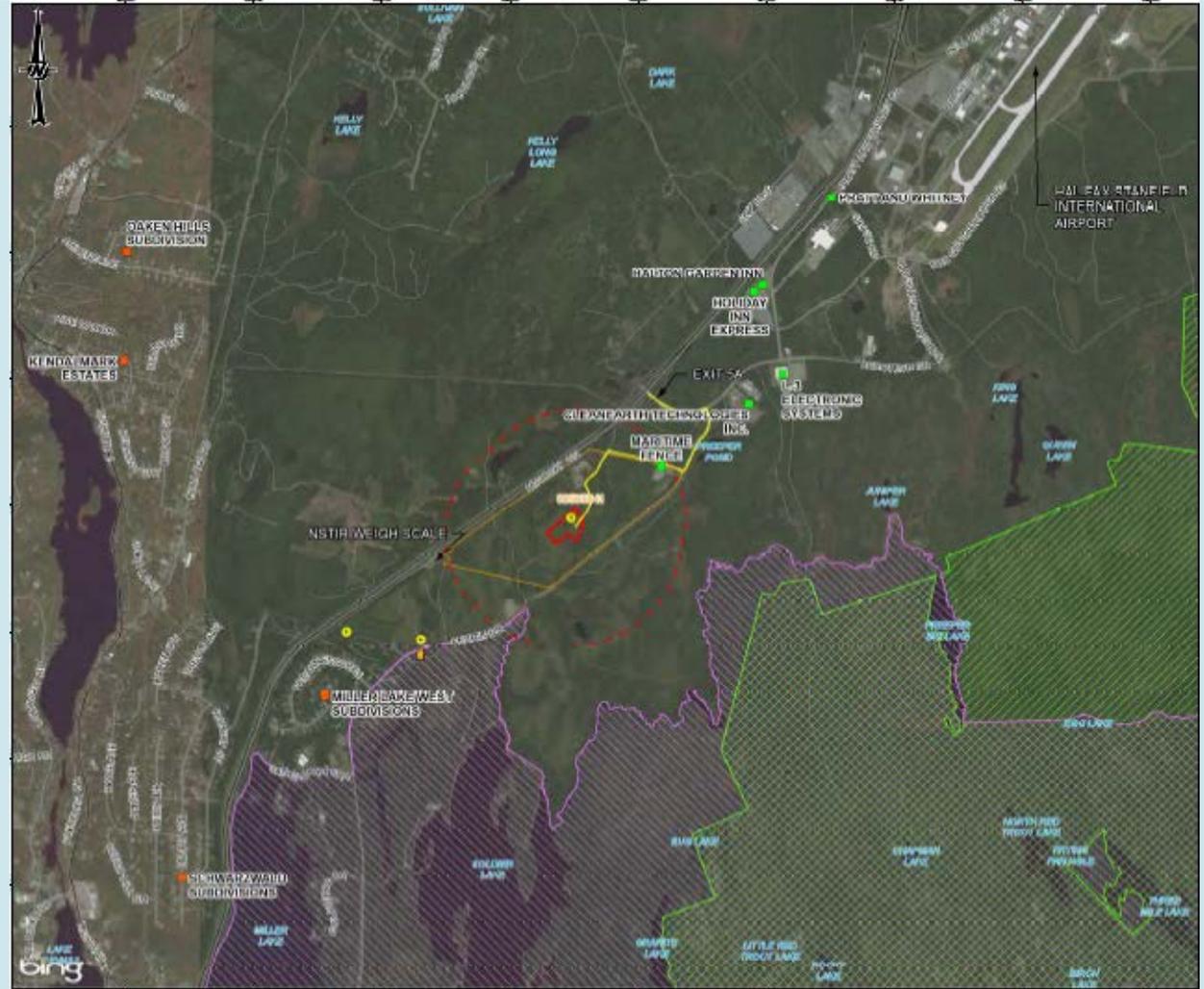
Environmental Assessment Specialist

- 10+ years professional experience
 - Maritime College of Forest Technology training- Nova Scotia Advanced Wetland Delineation and Evaluation, Wetland Plant Identification, Wetland Hydrology and Soil Indicators.
 - Completed wetland assessments for numerous land developments in Atlantic Canada.



Goffs Quarry

In 2012, Golder completed a baseline study of the Scotian property at Goffs to assess existing conditions including wetlands and watercourses.





Wetlands in Nova Scotia

Nova Scotia Environment Act states:

“wetland” means land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land’s surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.”

Nova Scotia Wetland Conservation Policy aims:

“To manage human activity in or near wetlands, with the goal of no loss in Wetlands of Special Significance and the goal of preventing net loss in area and function for other wetlands”



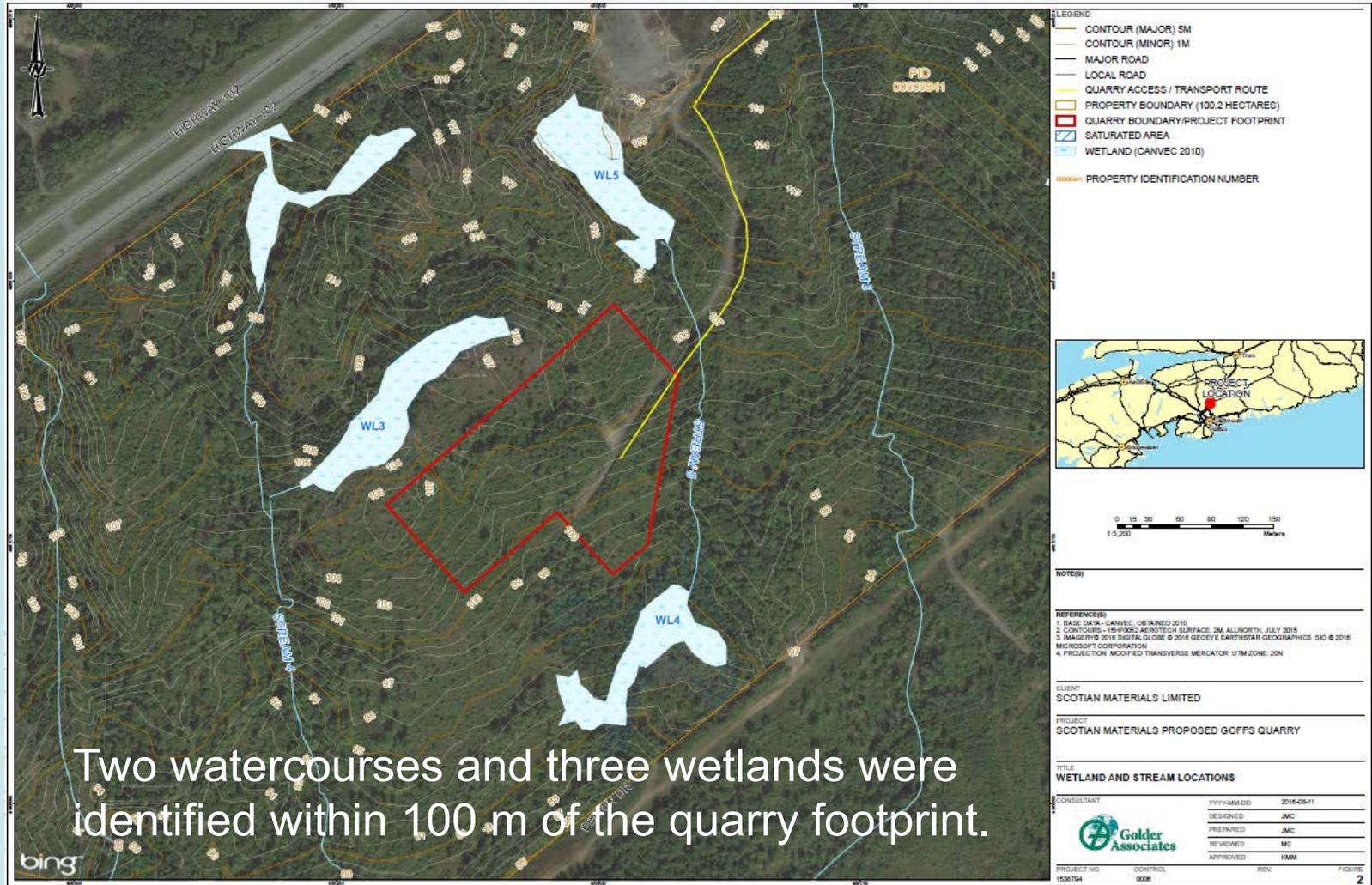
How are Wetlands Assessed?

In Nova Scotian wetlands are delineated using the Army Corps of Engineers approach adapted for the Northcentral and Northeast Regions.

In order to make the determination of a wetland, habitats must have specific indicators for vegetation, soil and hydrology.



Adjacent Water Features



Two watercourses and three wetlands were identified within 100 m of the quarry footprint.



Wetlands in the Vicinity of the Quarry

Wetland 3

A basin, swamp and forested wetland complex dominated by balsam fir, red spruce, raspberries and grass species. The soil profile consisted wetland soils. Standing water observed in the western portion of the wetland.



Wetland 4

A sloped forested wetland dominated by balsam fir, red spruce and various species of ferns. The soil profile consisted wetland soils and the wetland is saturated from surface. Wetland 4 has a stream flowing into the northwest from Wetland 5.



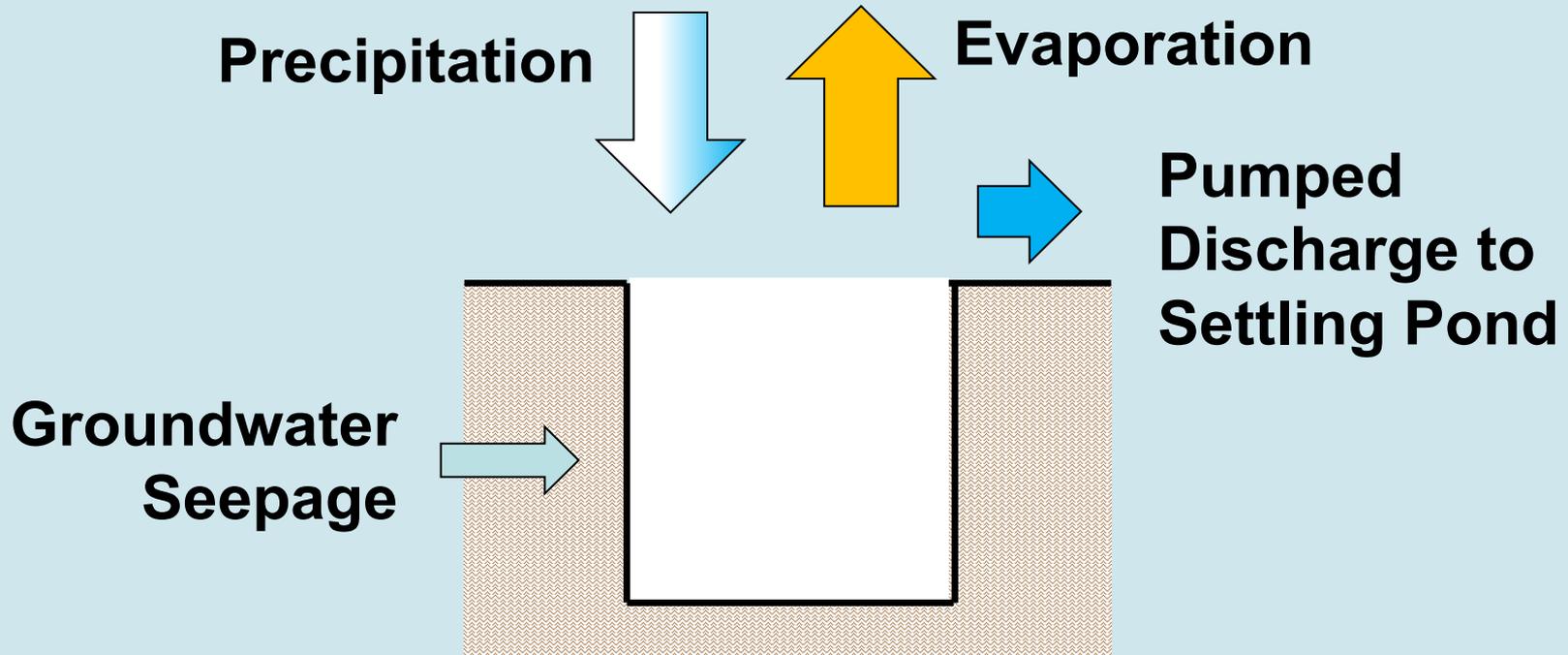
Wetland 5

A marsh and swamp wetland complex with steep, mostly manmade, banks which easily define the borders of this wetland complex. Wetland 5 has a stream flowing from its south end to Wetland 4. Dominated by alders, red maple and fern species.





Quarry Water Balance

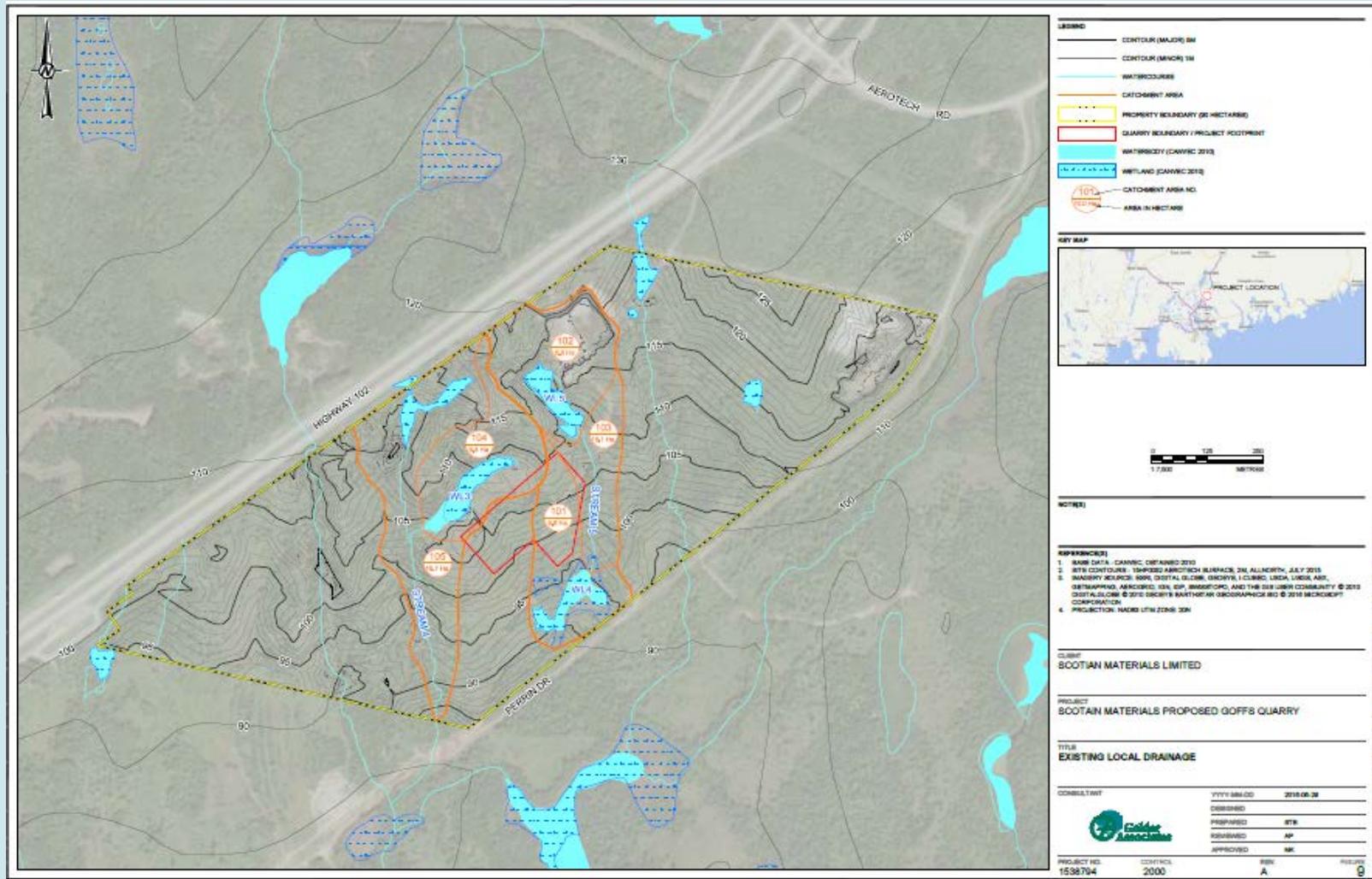




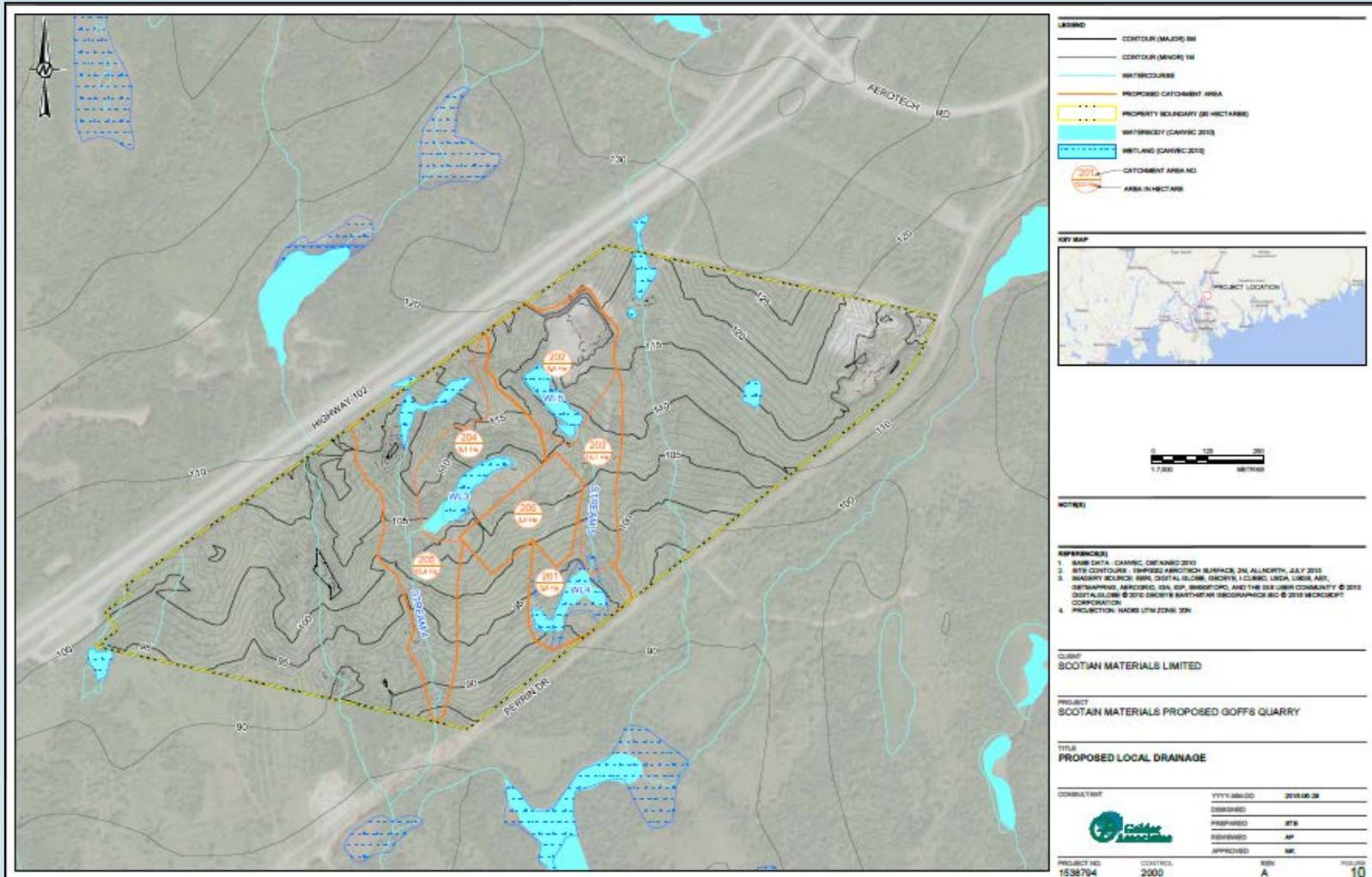
Quarry Water Balance

- The water balance accounts for typical water inputs and losses from the quarry excavation.
- Used to compare expected operational conditions to pre-development conditions to assess potential effects.
- Expected volumes of water to be handled and dewatered from the quarry are estimated using the water balance and groundwater inflow estimates.

Catchment Areas – Pre-Development



Catchment Areas – Operational Phase





Surface Water Quality

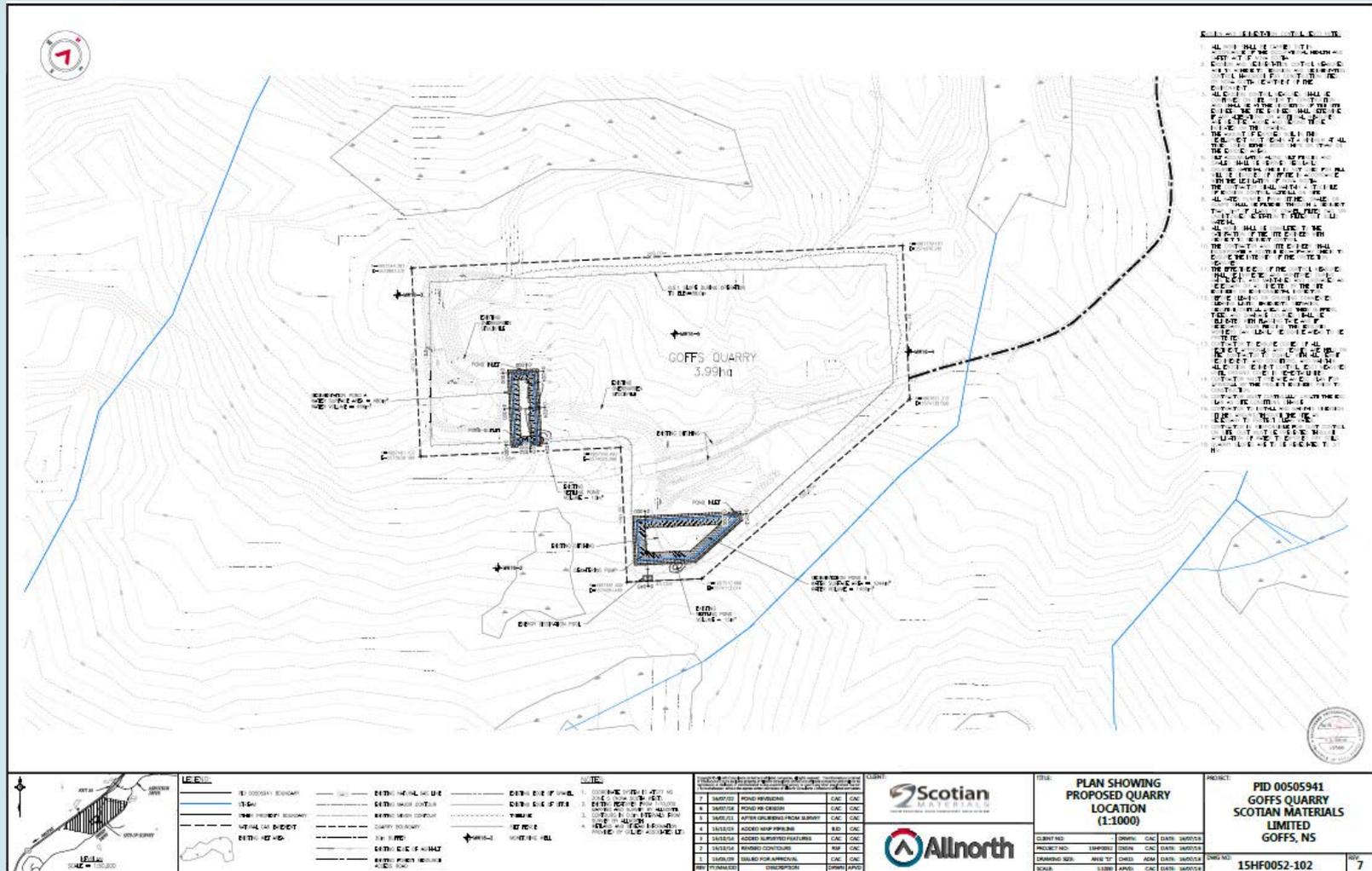
- Pre-Development Water Quality samples were taken on May 27, 2016 and September 28-29, 2017
 - Aluminum – exceeded the CCME guideline at Stream 4 upstream and downstream (May 2016 & Sept 2017); Stream 5 downstream (May, 2016)
 - Cadmium – exceeded the CCME guideline at Stream 4 upstream (May, 2016 & Sept 2017); Stream 5 downstream (May, 2016)
 - Copper – exceeded the CCME guideline at Stream 4 upstream (May 2016 & Sept 2017) and downstream (Sept 2017); Stream 5 upstream and downstream (Sept 2017)
 - Iron – exceeded the CCME guideline at Stream 4 upstream (May 2016 & Sept 2017) and downstream (Sept 2017); Stream 5 downstream (May 2016)
 - Lead – exceeded the CCME guideline at Stream 4 upstream (May 2016 & Sept 2017) and downstream (Sept 2017); Stream 5 downstream (May 2016)



Surface Water Quality

- Settling of suspended solids is generally accepted as the best available technology economically achievable for quarry dewatering.
- Suspended solids and associated (adsorbed) parameter concentrations can be significantly reduced in discharge water.
- Settling ponds will be used to remove suspended solids from the quarry water prior to discharge.

Dewatering Infrastructure





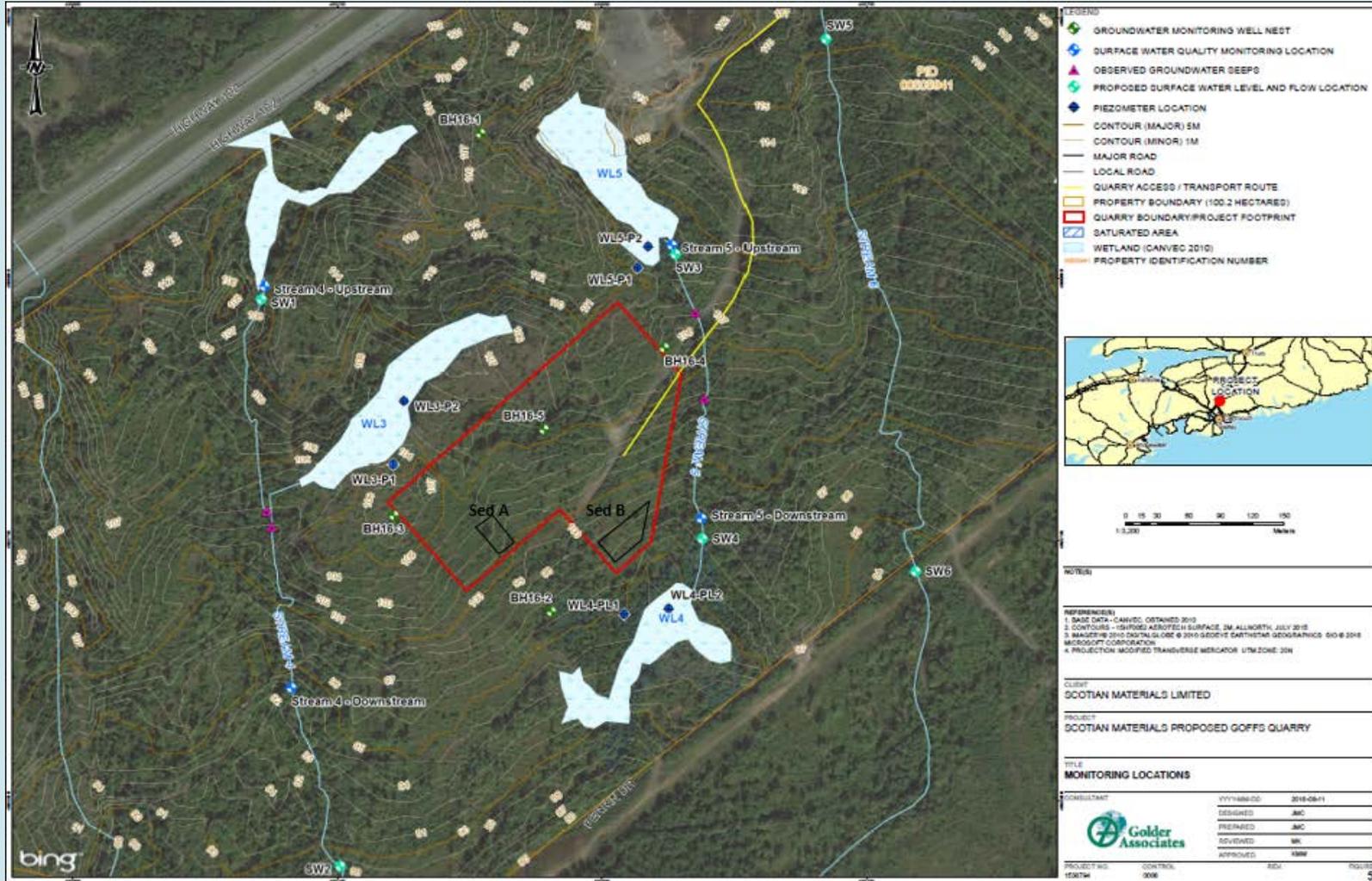
Surface Water Monitoring

The Monitoring Program was designed to meet the following objectives:

- Monitor quarry discharge water quality and quantity to confirm that the pond design is meeting the proposed criteria
- Monitor the on-site water features (Streams 4 and 5), for water quality and quantity, to establish baseline conditions and assess the potential effects of the quarry extraction



Surface Water Monitoring Locations





Wetland Monitoring

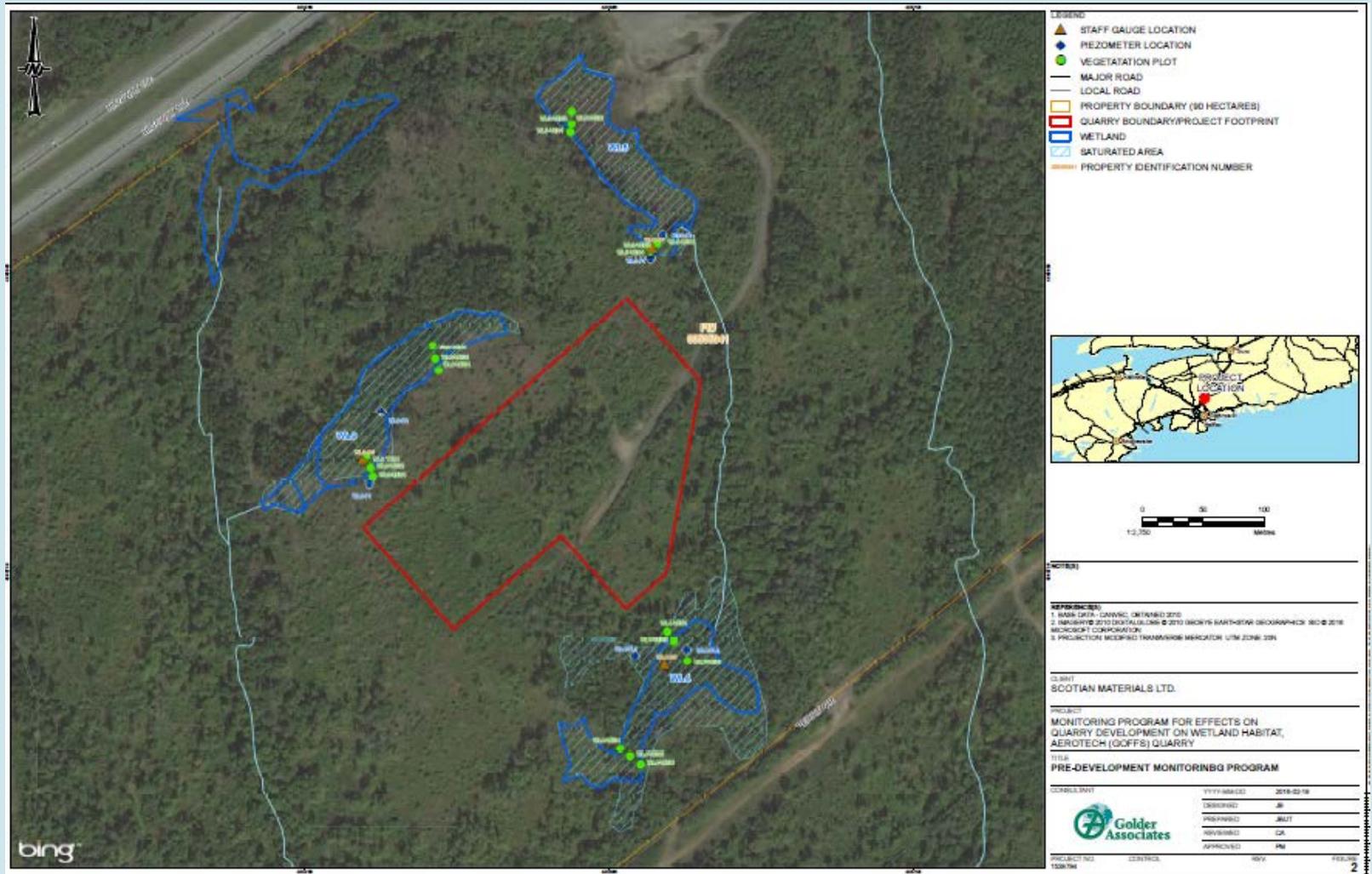
The Monitoring Program was designed to meet the following objectives:

- Monitor changes to wetland boundaries and vegetation through annual delineation and plant community assessments.
- Record groundwater levels over on a quarterly basis, from piezometers installed within, and adjacent to, wetlands.
- Record surface water levels within each wetland over the course of the Project on a quarterly basis.



Baseline monitoring has indicated Wetland 3 and Wetland 4 showed sign of increased saturation (i.e., flooding) due to clearing activities in the vicinity of the site. The function of Wetland 3 and Wetland 4 remains consistent with the previous assessment. Short-term effects related to clearing of vegetation have resulted in changes to hydrology and soil indicators. Monitoring of wetland habitat will continue throughout the development and operation of the Quarry in consultation with NSE.

Wetland Monitoring Locations





Industrial Approval Monitoring Requirements

Appendix A

Groundwater, Surface Water and Wetland Monitoring		
Parameter	Location	Frequency
Water Level	BH16-1*, BH16-2*, BH16-3*, BH16-4*, BH16-6, BH16-7	Weekly: March to November; Monthly: December to February
General Chemistry, Metals, BTEX and PHC's	BH16-1*, BH16-2*, BH16-3*, BH16-4*	Quarterly: Year 1; Semi-Annual (2 times per year) thereafter
General Chemistry, Metals, BTEX and PHC's	BH16-6, BH16-7	Quarterly: Year 1; Upon Department request.
General Chemistry, Metals, TSS and pH	Stream 4 - Upstream, Stream 4 - Downstream, Stream 5 - Upstream, Stream 5 - Downstream	Quarterly
Surface Flow	SW1, SW2, SW3, SW4	Monthly
General Chemistry, Metals and TSS	Outlet of Sedimentation Ponds A and B	Prior to discharge to the environment; Monthly while discharge is occurring
pH	Outlet of Sedimentation Ponds A and B	Weekly while discharge is occurring
Visual Observations	Groundwater Seeps	Monthly
Benthic Invertebrates	Stream 4	Baseline prior to quarrying activities; Upon Department Request
Wetland Water Level	WL3, WL4, WL5	Automatic level logger recording an hourly time interval; Quarterly manual measurement
Wetland extent, structure and function	WL3, WL4, WL5	Baseline prior to quarrying activities; Annual at the same time every year using standardized methods.

*All nested wells are to be included in monitoring events



Reporting to Nova Scotia Environment

An annual monitoring report is to be submitted to NSE by February 15th. The report is to include the following:

- Methods used for sampling and methods used to analyze data.
- Description and map of sample locations.
- A review of the current monitoring programs and recommendations for modifications, as applicable.
- Current and historical static water elevation data.
- Current and historical groundwater and surface water quality including an analysis of trends with comparison to applicable guidelines and historical (baseline) data.
- Laboratory certificates of analysis.
- Identification of any adverse impacts, potential adverse impacts or changes resulting from operations and activities on this property and associated recommendations, if applicable.
- Identification of any instances of significant water drop, along with an analysis into the cause and any additional mitigation measures, as applicable.
- Summary of water withdrawal rates.



Potential Mitigation Options

While not expected to be necessary, routine monitoring during gradual development of the quarry will identify any issues early and allow mitigation to be implemented as required.

- Under the IA report the quarry water from Sedimentation Pond B will be pumped towards WL4. In the event of unacceptable flow reductions in Stream 4, there is enough water to allow a split of 50/50 between Stream 4 and Stream 5 to provide mitigative flows to the wetlands and streams.

Any unexpected water quality issues will be investigated and depending on the identified cause may be addressed by:

- Increasing maintenance frequency of the settling ponds.
- Expanding housekeeping and Best Management Practices (BMP) in the quarry.
- Temporarily reducing the pumped discharge rate from Pond B.
- Increasing the volume of the settling ponds.
- Other options may be considered depending on the nature of issue.



Questions

