Stantec Consulting Ltd.
102 – 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

Final Report: Environmental Assessment Registration for Northumberland Rock Quarry Extension Project

Alva Construction Limited
P.O. Box 1193
5600 Lochaber Road
Antigonish, NS B2G 2L6

File: 121510482

October 2011

Table of Contents

Table of Contents

LIST OF APPENDICES

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 PROPONENT INFORMATION

Name of the Proponent:	Alva Construction Limited
Postal Address:	P.O. Box 1193 5600 Lochaber Road Antigonish, NS B2G 2L6
Tel.:	(902) 863-6445
Fax:	(902) 863-6446

Registry of Joint Stocks for the proponent company is included in Appendix A.

Company President and/or Environmental Assessment Contact

Name:	A.G. MacDonald
Official Title:	Secretary/Treasurer
Address:	As Above
Tel.:	(902) 863-6445
Fax:	(902) 863-6446

Environmental Consultant Contact

Name:	Gillian Asche
Official Title:	Project Manager
Address:	Stantec Consulting Ltd. 102-40 Highfield Park Drive Dartmouth, NS B3A 0A3
Tel.:	(902) 468-7777
Fax:	(902) 468-9009

Signature **Date** Oct 21. 2011

1.2 PROJECT INFORMATION

Name of the Undertaking:	Northumberland Rock Quarry Extension Project
Location of the Undertaking:	Georgeville, Antigonish County, NS

2.0 PROJECT INFORMATION

2.1 DESCRIPTION OF THE UNDERTAKING

Alva Construction Limited (Alva; the Proponent) owns and operates the Northumberland Rock Quarry, located in Georgeville, Antigonish County, Nova Scotia (Figure 2.1). The quarry property is in the Municipality of the County of Antigonish. The existing quarry is operating under an Industrial Approval (No. 2010-075166-R01), pursuant to Division V of the Activities Designation Regulations, issued by Nova Scotia Environment (NSE), effective until April 11, 2021. A copy of the Approval is appended to this report (Appendix A).

Alva proposes to extend the approved quarry site to occupy 54 ha to allow for continued aggregate production (blasting, crushing and stockpiling) and will supply DOT&C Type 1, 2, 1S (Class A, B, C, E), asphalt aggregates, armour stone, rip rap, and concrete aggregates for local construction needs.

The Proponent owns the existing quarry lands as well as the adjacent proposed extension land area. The existing quarry has been in operation since September 6, 1996, with a total disturbed area to date of approximately 3.5 ha. The quarry has produced more than approximately 650,000 tonnes of aggregate.

As a result of field and desktop studies undertaken in support of this environmental registration document, the proposed extension area has been modified to minimize potential environmental impacts including impacts to streams located on the proposed extension property.

The anticipated average production rate is approximately 450,000 tonnes per year; with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule (currently and in the future) is 24 hrs/day, seven days/week, 50 weeks/year or more, depending on the demand for aggregates; however it is unlikely that this level of production would be achieved except on a short term basis. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed extension area. Depending on market demand, the proposed quarry operations will take place over an extended period of time until the material is exhausted. The extended site could therefore sustain aggregate production for as much as 50 years or more.

2.2 GEOGRAPHIC SETTING

Northumberland Rock Quarry is in the small community of Georgeville (situated to the north of Antigonish), Antigonish County, Nova Scotia (Figure 2.2). It is located at the following geographic coordinates: 574,435 Easting, 5,074,230 Northing. The Project property is bounded at its northwest extent by the Northumberland Strait and at its southeast extent by Nova Scotia Route 337, and the existing quarry operation is accessed via a private road. The quarry and proposed quarry extension area are situated on lands that are owned by the Proponent. The Property is regenerating from historical agricultural practices and both the composition and structure of its vegetation reflects this legacy. More recent human activities have also had an important effect on the vegetation, particularly tree harvesting and associated disturbances.

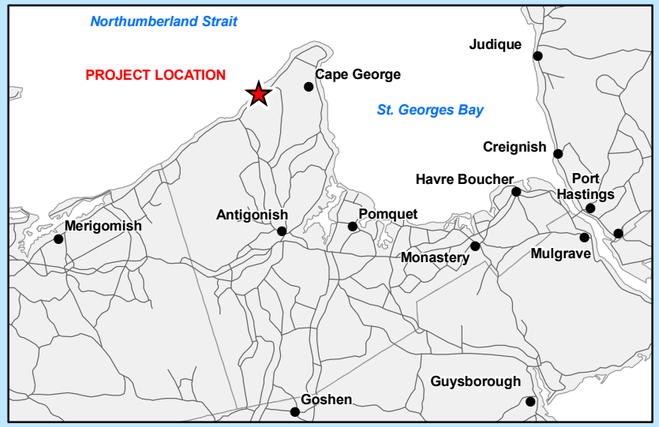
The majority of the Project area is comprised of upland forest but much of this has been recently cut-over. The coastline is represented by a quick transition from upland forest to the rocky intertidal zone of the Northumberland Strait. NSDNR mapping (Figure 2.2) identifies the coastline as having a stretch of beach along its length and the adjacent marine component to be comprised of a “coastal habitat area”. Coastal habitat area is defined by NSDNR as being comprised of “wetland that lies in the ocean” and is comprised of the rocky, shallow water component of the Northumberland Strait, components of which would constitute the intertidal zone. The southwest portion of the Project area is characterized by a steep forested hill. The more easterly portion of the Property coastline is comprised of a cobbly shoreline. Nineteen wetlands are found within the Project area, the large majority of which are treed swamps.

Based on available mapping and aerial photography, residential development in the immediate vicinity of the existing Northumberland Rock Quarry is relatively low. The quarry is located just outside of the boundary of the Eastern District Planning Commission’s (EDPC) Plan Area, on land that is not zoned for any particular use.

2.3 PROJECT COMPONENTS

The existing quarry operations consist of a laydown area for the portable crushing equipment, various aggregate stockpiles, quarry floor and working face, weight scales, and a 500 m private access road off of Highway 337. The existing property currently does not have liquid asphalt permanently stored on site; it is delivered to the site while making asphalt and it is removed thereafter. There is no planned storage of fuel oil or other hazardous materials on-site.

Topsoil, grubbing material and overburden that have been stripped prior to drilling and blasting are stored on-site. These materials have been stabilized for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. Similar practices will continue throughout the development and operation of the proposed extension area.



V:\121510\active\121510vxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project Location.mxd

DATE: March 11, 2011 PREPARED BY: R. Sutcliffe SCALE: 1:12,000	Northumberland Rock Quarry Extension Project **Project Location**	FIGURE NO.: **2.1** Stantec

Project Features

- Proposed Quarry Extension Area
- Existing Quarry
- Building / Structure
- Primary Access Road
- Local Road
- Resource Access
- Track/Trial/Abandoned Road
- Quarry Buffer 800m
- Watercourse
- Wetlands (Field Identified)
- Wetlands (NSDNR)
- Property Boundary (PID)

Land Classification (NSDNR)

- Corridor
- Urban
- Agriculture
- Gravel Pit
- Brush
- Forest Alders
- Forest
- Forest Silverculture / Plantation
- Forest Partial Cut
- Forest Dead / Regrowth
- Clear Cut
- Beach
- Coastal Habitat Areas
- Waterbody

Data Source: All data from NSGC unless otherwise noted. Land Classification based on NSDNR Forest Inventory dataset.

Project No.: 121510482

0 250 500

Metres

PID - 01204072

N

V:\1215\active\121510\xxx\121510482\geomatics\Mapping\MXD\ReportFigures\LandClassification.mxd

DATE: March 8, 2011 PREPARED BY: R. Sutcliffe SCALE: 1:12,000	Northumberland Rock Quarry Extension Project **Land Classification**	FIGURE NO.: **2.2** Stantec

The laydown area is located on the quarry floor. The rock is processed by portable crushing equipment that is transported to the site as required (*i.e.,* after blasting). Once the quarry is extended, portable crushing equipment is expected to be on-site for 50 weeks per year. Aggregate stockpiles are currently located at various sites within the quarry limits. As the quarry is extended, and additional space is created, a dedicated stockpile area will be created.

Quarry drainage and surface runoff collection and controls will be in place for the extended quarry. Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water. Excavation will not take place below the groundwater table.

2.4 SITE PREPARATION AND CONSTRUCTION

The existing quarry has been in operation for 15 years. Access to the existing quarry development is along existing roads. To minimize the potential for erosion and sedimentation, grubbing and removal of overburden has been and will continue to be conducted on an as needed basis, to accommodate drilling and blasting activities. Topsoil, grubbed material and overburden are stockpiled on site and have been stabilized with hydroseed for subsequent use during site reclamation. These, or similar stabilization procedures will continue throughout the operations of the proposed extension.

Quarry drainage and surface runoff collects on the quarry floor. Currently there are no conditions in place for overflow from the quarry floor, as it has never been an issue. Additional surface water management capacity will be created, as needed, as the quarry develops. Water that has pooled on the quarry floor may be used to provide a water supply for dust suppression during crushing in dry periods, if needed.

Work will likely commence upon final EA approval and amendment of the Industrial Approval..

2.5 OPERATION AND MAINTENANCE

The proposed Project activities will be consistent with the current quarry operations approved by NSE (Approval No. 2010-075166-R01) and will be in accordance with the Pit and Quarry Guidelines (NSEL 1999). These guidelines apply to all pit and quarry operations in the province of Nova Scotia and provide: separation distances for operations, including blasting; liquid effluent discharge level limits; suspended particulate matter limits; sound level limits; and requirements for a reclamation plan and security bond.

Aggregate production begins with drilling and blasting. It is anticipated that blasting and crushing of aggregate could occur 5 to 7 times a year. This is consistent with current approved operations. A qualified blasting company will conduct this work. The blasting sub-contractor is responsible for blast designs and methods in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Blasting activity will be conducted in accordance with the Pit and Quarry Guidelines. Details of a blast design plan and blast monitoring program will be provided to support the application for Industrial Approval. Where

applicable, consideration will be given to recommendations provided in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998).

The working face of the quarry is approximately 15 m in height and does not go below the natural water table (*i.e.,* the quarry floor is not under water and has not flooded since the quarry opened). Alva will continue to excavate from the working face and will not excavate below the water table.

The blasted rock will be processed by portable crushing equipment that will be on-site. The various aggregate products will be stockpiled in designated areas within the quarry. Piles will be built in layers to minimize segregation and prevent contamination by mixing of different piles. Material is hauled and moved within the quarry with a loader. Other equipment will likely include an excavator. Products will be transported from the quarry via tandem and tractor trailer trucks along the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year; with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule (currently and in the future) is 24 hrs/day, seven days/week, 50 weeks/year or more, depending on the demand for aggregates; however it is unlikely that this level of production would be achieved except on a short term basis.

The existing quarry currently employs at least five employees throughout the year, and this number increases to ten during aggregate production. Employment levels are expected to remain the same following site extension. Drilling and blasting activities involve additional resources; these activities are sub-contracted to a professional blasting company. Hauling of materials from the quarry also involves additional labour and equipment requirements. Hauling (or trucking) is typically arranged through the Proponent.

2.6 EFFLUENTS AND EMISSIONS

The implementation and use of environmental devices, techniques and regulations now used in the construction industry will minimize any potential environmental damage to the area. Devices such as diversion ditches, check dams, siltation ponds, straw hay mulch and hydroseeding will be used to control sedimentation, as required. All operations will be carried out in a controlled environment to ensure acoustic, vibration, dust and sediment parameters are met to all Provincial and Federal guidelines and regulations.

In accordance with best practices and standard NSE requirements, runoff controls will be in place to ensure that effluent generated during operations is managed appropriately. Surface runoff at the quarry currently collects on the quarry floor and drainage ditches exist to convey water away from quarry face to the ocean. There is one settling pond to help control

sedimentation and to provide water for any washed product that is produced. Details regarding the size of potential settling capacity required for proposed extended quarry operations and potential runoff mitigation measures are discussed in Appendix B and will be further refined at the Industrial Approval application stage.

Overflow, if any (as this has not been an issue in the past), will be monitored and sampled at the request of NSE to ensure total suspended solids levels do not exceed the approved final effluent discharge limits, as outlined for clear flows and high flows in the facilities Approval permit (Appendix A). In the unlikely event that overflow, during a significant rain fall, exceeds final effluent discharge limits as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from watercourses) or through filter bags for additional filtration and/or use of additional filtration devices or structures.

Dust emissions will be controlled with the application of water, obtained from the water that is pooled on the quarry floor. To minimize the generation of dust, the working areas and laydown areas will be covered with blasted rock. Dust generated by truck movement along the access road will be minimized by speed control, proper truck loading, application of dust suppressants, proper construction of on-site roads, and/ or other means as required by NSE.

Monitoring of airborne particulate emissions (dust) will be conducted at the request of NSE and in accordance with the Pit and Quarry Guidelines, the Nova Scotia Air Quality Regulations and the facilities Approval permit and shall not exceed the following limits at the property boundaries:

Annual Geometric Mean	70 µg/m^3; and
Daily Average (24 hrs)	120 µg/m^3.

Combustion emissions will be generated from the operation of vehicles and equipment during Project activities. Given the scope of the planned operations, these emissions will be minimal, localized and similar in quantities to the operation of a small construction project using one or two pieces of heavy equipment. Emissions will be reduced through proper equipment maintenance and inspection practices to ensure efficient operation. Consideration will be given to methods to reduce idling, as feasible.

As per the Pit and Quarry Guidelines, sound levels from quarry operations will be maintained at a level not to exceed the following sound levels (L_{eq}) at the property boundaries:

L_{eq}	65dBA 0700-1900 hours (Days);
	60dBA 1900-2300 hours (Evenings); and
	55dBA 2300-0700 hours (Nights).

Sound monitoring will be conducted at the request of NSE.

Light emissions will be minimal as there is no source of power on site and therefore light emissions are not generated from road and parking lot lighting or exterior decorative lighting,

such as spotlights or floodlights. When required during the evening or nighttime, lighting is provided via portable lights, for the safety of employees.

As there is not currently a permanent office or building located on this site, there will be minimal solid waste generated. All solid waste will be properly collected and stored until such time that it can be transported to a provincially approved waste disposal facility.

During quarry operations the only hazardous materials anticipated on-site will be those associated with the normal operation of construction equipment. These substances include gasoline, diesel fuel, lubricants and antifreeze liquid. No on-site storage of such materials is anticipated, since all maintenance will be carried out off site.

Refueling of equipment will be conducted on-site on a regular basis, under contract by a tanker truck. Refueling activities will not be conducted within 100 m of any surface water, and equipment operators will remain with the equipment at all times during refueling in accordance with the Petroleum Management Regulations of the Nova Scotia *Environment Act.*

In the event of a leak or spill during refueling, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material. All contaminated material will be collected and stored in an appropriate manner so as not to be re-released to the environment until such time as it will be transported to an approved treatment/disposal facility. All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations. A Spill Contingency Plan will be developed in support of the application for amendment to the existing Industrial Approval.

2.7 DECOMMISSIONING AND RECLAMATION

Alva will undertake a progressive rehabilitation program at the quarry site by striving to reclaim every two years during operation where practical. In this progressive reclamation process, only the area needed for quarry extension in any one year would be grubbed in advance of blasting. All areas affected by quarry activities, including the quarry floor, will be eventually rehabilitated. The subsoil, topsoil and root mat of grubbed areas would be placed in a portion of the pit that is no longer in use. Overburden will be stockpiled for use in future reclamation.

Since work at this site is sporadic,, the Proponent shall strive to ensure all overburden is piled in an area that will control any surface water runoff. Stockpiles of overburden not necessary for future site reclamation may be removed for operational purposes.

Hydroseeding stockpiles, as conducted for current operations, will be an acceptable alternative to utilizing root mats in future activities. This approach would provide a source of native plant species well adapted to local soil and climatic conditions and would greatly reduce the need to fertilize the reclaimed pit. If it is necessary to seed reclaimed areas where grubbings have not produced sufficient plant biomass to stabilize soils, wherever practical, native plants should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species

which are well established in Nova Scotia and which are not aggressive weeds in the plant communities which are present in the area should be used for reclamation.

As distinct areas within the quarry become inactive, the earthen areas will be graded to a stable slope (max 2:1) or rock slopes (max 1:1), where required, or leveled to allow future commercial, industrial, recreational, or residential land use. These inactive areas will be covered with overburden and seeded in the absence of laying a root mat. Generally the rehabilitation will also consist of, but not be limited to: grading and contouring of all slopes and exposed rock faces in consideration of rock falls, slope stability, and safety; spreading existing stockpiled topsoil; and hydroseeding in the absence of laying a root mat.

As for the areas that have been stripped clean of all overburden and have been worked to the appropriate level of elevation, called the quarry floor, they will form part of the staging area for the stockpiles of newly exposed and blasted rock. Once the operations reach a stage where the storage area can be reduced, these areas will be rehabilitated as per the above requirements.

A reclamation plan will be developed for the extended site and submitted to NSE as part of the quarry development plan, to be included in the Industrial Approval amendment application. The reclamation plan will include information on such things as the proposed final topography, maximum slopes, revegetation plans and an outline of the plan for progressive reclamation at the site.

3.0 SCOPE

3.1 SCOPE OF THE UNDERTAKING

Section 2.0 describes the scope of the undertaking (*i.e.,* the proposed Project) that is the subject of this environmental assessment including spatial assessment boundaries (*e.g.,* Project footprints and zones of influence) and temporal assessment boundaries (*e.g.,* Project time frames).

3.2 PURPOSE AND NEED FOR THE UNDERTAKING

The purpose for the Project is to allow Alva Construction Limited to extend the existing quarry footprint and continue operations at their quarry in Georgeville. The quarry is currently operating under an Industrial Approval (No.2010-075166-R01) issued by NSE. A copy of the NSE Approval is included in Appendix A.

The aggregates produced at the quarry are an important requirement in construction projects in the region and are of an appropriate quality for highway construction and maintenance projects. The Proponent anticipates the source material in the proposed extension area to be of similar quality to the material currently extracted at the existing quarry.

The quarry under consideration as well as other quarries in Nova Scotia are an important component of the natural resource sector of the economy and provide essential raw materials to the province's construction industry. The quarry also provides direct and indirect employment for its workers and suppliers, as well as for the transportation and construction industries.

3.3 PROJECT ALTERNATIVES

Other methods for carrying out the undertaking may include different methods of extraction of the resource and alternative facility locations. The current method of aggregate extraction at the Northumberland Rock Quarry is drilling and blasting. Alternative methods for extraction of the rock (*i.e.,* mechanical means) are not practical or feasible in this instance due to the nature and characteristics of the rock (*e.g.,* hard and dense). Therefore, there are no feasible alternatives to drilling and blasting as a means of extracting this material.

An alternative facility location is also not a feasible alternative. Extension of the quarry will not require immediate construction of any new facilities (*i.e.,* roads or buildings), as the existing facilities are currently sufficient for current and extended operations. Additional flow retention structures will be installed/constructed as the quarry develops to accommodate the additional surface runoff and quarry drainage. Relocation of the quarry to another location may likely require development of a new site, construction of new facilities, and would potentially have greater effect on the surrounding biophysical and socio-economic environment.

3.4 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The proposed Project must be registered for Environmental Assessment under the Environmental Assessment Regulations of the Nova Scotia *Environment Act* as a Class I Undertaking. This report fulfills the primary requirements for project registration under this legislation.

Other relevant provincial regulations and guidelines include the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996) and the Nova Scotia Pit and Quarry Guidelines (NSEL 1999). Relevant federal legislation include the *Fisheries Act*, *Species at Risk Act,* and the *Migratory Birds Convention Act*. There are no triggers for assessment of the Project under the *Canadian Environmental Assessment Act*.

The scope of the environmental assessment in relation to the proposed Project has been determined by the Proponent and their consultant and is based upon the proposed Project elements and activities, the professional judgment and expert knowledge of the study team, consultations with the public and regulatory authorities on this and similar projects, and the results of field studies conducted in support of this environmental assessment. The Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSE 2008) as well as Environment Canada Guidance Related to the Environmental Assessment of Aggregate Pit Mines and Quarries in the Atlantic Provinces (Environment Canada 2008a) were also used to determine/focus the scope of the assessment. The Proponent and their consultant met with NSE on February 4, 2011 to discuss the location of proposed extension, and elements and activities associated with the proposed Project, in an effort to further focus the scope of the assessment. Landowners adjacent to the quarry were also contacted (see Section 4.0) for the purpose of issues identification.

This environmental assessment evaluates the potential environmental effects of the proposed Project elements and activities, for all Project phases, with regard to each Valued Environmental Component (VEC). By assessing potential impacts on VECs within the study boundaries, a meaningful evaluation of project effects on relevant environmental aspects is achieved. The following VECs were identified based on government guidance, consultation, and professional judgment of the study team noted above:

- Surface Water Resources;
- Rare and sensitive flora;
- Wetlands;
- Wildlife;
- Groundwater;
- Archaeological and heritage resources;
- Air quality; and
- Socio-economic environment.

4.0 PUBLIC INVOLVEMENT

4.1 METHODS OF INVOLVEMENT

In the fall of 2010, Project Information Bulletins (Appendix C) were distributed to landowners within approximately 1.0 km of the quarry. The purpose of the bulletin was to advise local residents and businesses close to the existing quarry and proposed Project site (*i.e.*, those who are potentially most affected) and provide them with opportunity to comment on the proposed undertaking.

Information letters were also sent to the Confederacy of Mainland Mi'kmaq, the Native Council, the Kwilmu'kw Maw-klusuaqn (Mi'kmaq Rights Initiative, KMK), the Union of Nova Scotia Indians and the chief and council of the Paq'tnkek First Nation to encourage the submission of comments, concerns, and questions regarding the Project (Appendix C).

4.2 STAKEHOLDER COMMENTS AND STEPS TAKEN TO ADDRESS ISSUES

To date, no comments have been received from stakeholders as a result of the Project Information Bulletin or First Nation information letters.

The EA Registration document will be subject to a public review process as required under provincial legislation. The document will be posted on the NSE website with paper copies at several locations including near the Project Area. Publication dates and Registration document locations will be advertised in one Province-wide newspaper and one local newspaper. Public comments will be solicited by NSE as part of this process.

5.0 VALUED ENVIRONMENTAL/SOCIO-ECONOMIC COMPONENTS (VEC) AND EFFECTS MANAGEMENT

5.1 ASSESSMENT METHODS

Field studies were conducted by Stantec between June 16 and November 25, 2010, to investigate and establish the existing environmental conditions in the Project area and to determine appropriate mitigation, if necessary, to minimize environmental effects from the proposed extension Project. These surveys consisted of: vegetation survey; wetlands survey; breeding bird survey; mammal survey; and herpetile survey. These surveys were undertaken by a qualified biologist employed by Stantec. An aquatic field survey was undertaken by qualified aquatic specialists. A desktop assessment of potential archaeological and heritage resources was undertaken by a professional archaeologist. Additional information, in support of the field studies and the assessment, was gathered through a review of: air photos; site mapping; and other information sources, such as the Nova Scotia Museum, Statistics Canada, the Nova Scotia Department of Transportation and Public Works, and the Nova Scotia Department of Natural Resources.

Temporal and spatial boundaries encompass those periods and areas within which the VECs are likely to interact with, or be influenced by, the Project. Temporal boundaries are generally limited to the duration of, and for a period of time after, the Project activities. Spatial boundaries are generally limited to the immediate project area unless otherwise noted.

To assess the potential environmental effects of a project and determine the significance of an effect, it is important to consider the magnitude, frequency, duration, geographical extent and reversibility of the potential effect. The study team has considered these elements for each VEC. In particular, regulatory standards were used, where appropriate, to determine thresholds of significance for predicted environmental effects after application of mitigation (i.e., residual effects). Where regulatory standards are not available other key factors such as the sustainability of biological populations, and rarity of species and critical habitats has been used as indicators of significance.

5.2 SURFACE WATER RESOURCES

The freshwater habitat surveys were conducted based on internal Stantec sampling protocol and the Environment Canada CABIN protocol (Canadian Aquatic Biomonitoring Network; Reynoldson *et al*. 2007). Habitat surveying was also influenced by the Ontario Benthos Biomonitoring Network (OBBN) protocols (Jones *et al.* 2005). The stream assessment included the identification of physical units (*i.e.,* run, riffle, or pool), designation of substrate type, and description of the riparian zone. The presence or absence of macrophytes, algae, over-head cover, and woody debris was recorded. The depth, width, and velocity of the stream were also taken and the presence of existing anthropogenic impacts was noted. All measurements were taken at a representative section of each stream that contained water. Where stream

characteristics varied considerably from one section to another multiple measurements were taken one set of measurements at each representative habitat (see Figure 5.1). All physical stream measurements reported represent the conditions during the single point-in-time survey. The physical conditions of moving water systems such as those found on the Alva Construction Quarry property undergo seasonal and annual variation.

Watercourse descriptions are provided below for the two assessed streams. This information details the watercourse survey results and characterizes each watercourse. By characterizing the watercourses, Alva Construction can ensure that appropriate mitigation is implemented. Additionally, any site-specific concerns that may require special mitigation can be identified.

Key water quality results are outlined for each watercourse. The intent of the water quality discussion is to compare the results with applicable guidelines from the Canadian Council of Ministers of the Environment (CCME). Specifically, results are compared with the CCME guidelines for the protection of freshwater aquatic life (CCME-FAL 2007) to determine the likelihood that each watercourse can or cannot support aquatic life. Additionally, the collection of water quality data prior to proposed Project activities helps to establish a baseline against which pre-, during-, and post-construction water quality data can be compared. The water quality parameters collected in-situ using a handheld multimeter (YSI 556) includes dissolved oxygen, pH, specific conductivity and water temperature. The in-situ water quality parameters were collected in each watercourse containing water at the time of the survey (see Table 5.1).

5.2.1 Description of Existing Conditions

Watercourse Descriptions

Stream 1 is a small 2nd order unnamed watercourse that originates from beyond the limits of the Alva Construction quarry property and flows into the Northumberland Strait (refer to Figure 5.1). The origin of the watercourse is likely from a combination of groundwater upwelling and overland drainage from the mount approximately 1800 m to the east. On the date of the survey the water levels appeared to be at or near bankfull and in the two days prior to the assessment 20.6 mm of precipitation fell at the weather station located at nearby Tracadie, NS. The bankfull conditions observed during the assessment will portray a deeper, wider stream with a greater discharge than during low flow or late summer conditions.

Based on the assessment, Stream 1 appeared to be a perennial stream with hard substrate, stable banks and not anticipated to support a fish community. The initial 440 m of channel flowed along the Northeast of the quarry road and passed through a chain of wetlands (Wetland #'s 7, 6, 18, and 13) before flowing under the quarry road, through a concrete culvert. The substrate within this upper section was an equal mix of small cobble, large and small pebble, mixed with gravel and sand, a small portion of the streambed contains fine organics most likely decomposition from the surrounding wetland vegetation. Channel width measured 1.34 m with an average depth of 10 cm. Stream banks were well vegetated with grasses, small woody stemmed plants, and immature mixed forest, a section of stream bank approximately 10 m in length was undergoing some minor erosion associated with an old forestry road crossing.

Downstream of the culvert the stream flows through the length of Wetland 14; within Wetland 14 the stream became braided and multiple small channels disperse, converging again at the outlet of Wetland 14 before draining into a large artificial pond. Stream width varied in association the extent of channel braiding but most of the several smaller channels measured between 0.30 and 0.40 m wide, with an average depth of 25 cm. Substrate size increased compared with the upper section with the majority being boulder, surrounded with large and small cobble. Stream banks within the wetland were stable and well vegetated with woody stemmed plants and immature mixed forest.

From the outlet of the pond the gradient of the stream increased substantially the average gradient below the pond is 14% compared to 6% in the upper section. The slope associated with the lower section of stream creates a barrier to fish passage from the Strait.

Stream 2, a small 1st order stream originates from the NSDNR wetland to the Northeast of highway 337 and flowed into the Northumberland Strait (refer to Figure 5.1). On the date of the survey the water levels appeared to be near bankfull due to high precipitation in the two days prior to the assessment. The bankfull conditions observed during the assessment would not normally be expected during low flow or late summer conditions.

Based on the conditions observed during the assessment Stream 2 appears to be a perennial watercourse with hard substrate consisting of large and small cobble interspersed with boulders. Pockets of gravel and sand were present as well as a layer of fine organic matter. The average channel width was 0.77 m with the bankfull channel measuring 0.82 m. The average depth was 18 cm. Banks appeared stable and vegetated with no signs of erosion. The riparian vegetation consisted of immature mixed wood forest with woody stemmed vegetation and grasses along the banks. Slope approaches 40% in the lower section of the watercourse and as such provides a barrier to fish passage from the Northumberland Strait. The headwaters of the unnamed stream originate from a NSDNR tall shrub swamp and the channel within the wetland exhibits different characteristics from the remainder of the stream. Within the wetland the channel substrate becomes finer with mostly sand and fine organic matter observed. Riparian vegetation is mostly grasses and woody stemmed plants with the canopy cover provided from the immature forest diminishing into the tall shrub swamp.

Stream 3, a small drainage channel that flows through Wetland 13 and converges with Stream 1 just upstream of the culvert, was expected to be ephemeral in nature with defined banks and substrate (refer to Figure 5.1). The width of Stream 3 was approximately 0.55 m with an average depth of 7 cm. Substrate within the watercourse is predominantly fine organic material with areas of exposed sand and gravel. The banks were stable and vegetated with grasses, woody stemmed plants and trees from the surrounding mixed young growth forest.

Additional physical habitat features are summarized for each watercourse in Table 5.1.

The *in situ* water quality results collected in each stream (Table 5.1) show a collection of cool, well oxygenated neutral to slightly acidic streams. Water quality values were compared to the Canadian Council of the Ministers of the Environment Guidelines for the Protection of

Freshwater Aquatic Life (CCME – FWAL). The CCME guideline values for pH range from 6.5 to 9.0, Streams 2 and 3 are slightly more acidic than the guideline presents (ie. pH values< 6.5). Slightly to moderately acidic waters are found throughout Nova Scotia and often are associated with drainage from wetlands and hydric soils.

Dissolved oxygen is measured in milligrams per litre (mg/L) and represents the amount of oxygen within the watercourse available to aquatic organisms. CCME FWAL guidelines vary and are dependent on fish species, and maturity. The most stringent of the guidelines associated with dissolved oxygen is for embryos/juvenile fish species inhabiting cold waters. The guideline is based on a minimum concentration of 9.5mg/L; all of the watercourses within the Project area exceeded this minimum.

None of the watercourses identified on the Project property are known to interact with drinking water supplies or other protected surface waters. The groundwater section (*i.e.,* Section 5.6) of this document addresses the presence of water supply wells within 800 m of the quarry extension boundaries. All of the water supply wells identified within the 800 m assessment zone were associated with private residences. There are no known Protected Water Areas (PWA) in the vicinity of the Project Property. Therefore, no impact to surface waters with reservoir, private supply, or protected area uses is anticipated to result from the proposed Project Activities.

Table 5.1 The *in situ* Water Quality Results

Date & Time	**25-Nov-09**		**25-Nov-09**		**25-Nov-09**
Site Coordinates	**574140E; 5074090N**		**574500E; 5074690N**		**574500E; 5074060N**
Site Description	Stream 1 - Perennial, hard substrate stream that flows adjacent to the existing quarry road into the Northumberland Strait.		Stream 2 - Perennial, hard substrate stream that flows from NSDNR wetland into the Northumberland Strait.		Stream 3 - Small ephemeral stream that flows through Wetland 13 into Stream 1
Site Measurments and Characteristics	Above Detention Pond	Below Detention Pond	Headwaters	Main Channel	Main Channel
Transect Location	0571541E; 5073914N	573982E; 5074218N	574715E; 5074488N	574597E; 5074542N	574529E; 5074038N
Precipitation Previous 24 hours (mm)	20.3	20.3	20.3	20.3	20.3
Physical unit	Run	Riffle	Run	Riffle	Run
Wetted Width (m)	1.34	2.29	0.76	0.81	0.57
Bankfull Width (m)	1.58	2.29	0.82	0.9	0.65
Depth (min. - max. range) (m)	0.09 - 0.010	0.06 - 0.17	0.04 - 0.012	0.17- 0.19	0.05 - 0.11
Velocity (avg. in thalweg) (m/s)	0.89	0.65	0.4	0.26	0.19
Discharge (m^3/s)	0.11926	0.163735	0.02432	0.037908	0.008664
Woody Debris	Present	Present	Present	Present	Present
Macrophytes	Absent	Submergent	Submergent	Submergent, Emergent	Submergent
Algae	Absent	Absent	Absent	Absent	Absent
Canopy Cover (%)	20	20	15	15	30
Riparian Vegetation (Dominant)	Immature Forest	Immature Forest	Immature Forest	Immature Forest	Immature Forest
Water Quality					
DO (mg/L)	11.41	11.91	11.1	11.54	10.54
DO(%)	90.8	93.2	87.3	91	84.3
Water Temperature (˚C)	5.6	4.94	5.09	5.18	5.71
Specific Conductivity (µS/cm)	141	234	140	150	346
pH	6.97	6.6	6.11	6.32	6.3
TDS (g/L)	0.09	0.151	0.094	0.1	0.224

Fish Survey Results

No electrofishing fishing was carried out in stream 1 or stream 2. The steep gradient from the lower portion of both Stream 1 and 2 into the Northumberland Strait is anticipated to be prohibitive to fish passage. Additionally, the flow pattern in the lower reach of the stream is characterized by cascades, and shallow pools, which is not considered desirable fish habitat. A resident fish population is not anticipated to inhabit the upper reaches of either watercourse. Stream 3 was not fished as the watercourse was intermittent during the habitat assessment and there was no direct connection of the channel with Stream 1. Based on the lack of connection to fish bearing waters, the anticipated low flow conditions during the summer months and the poor substrate within the upper reaches Stream 3 is not anticipated to be fish bearing based on lack of connection with fish bearing waters and the absence of suitable fish habitat.

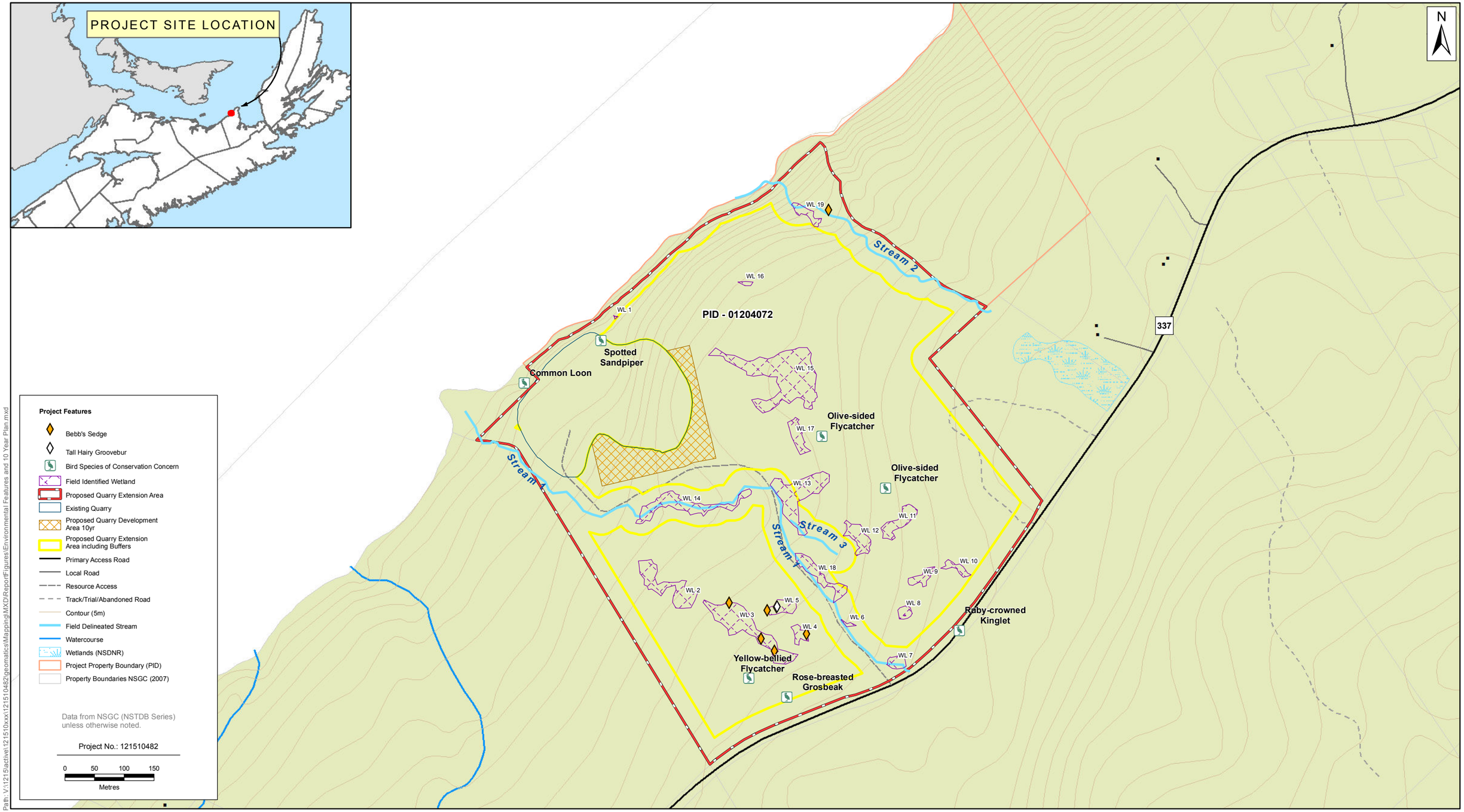
Summary

Three distinct watercourses were confirmed in the Project Area based on the habitat assessment completed on November 25, 2010.

Stream 1, a small 2nd order unnamed watercourse originates from beyond the limits of the Alva Construction quarry property and flows into the Northumberland Strait. This watercourse provides suitable fish habitat in the upper reaches but a resident population is not anticipated based on the lack of connection to fish bearing waters. The lower reaches of the stream are steeply graded and eliminate passage from the Northumberland Strait.

Stream 2, a small 1st order stream originates from the NSDNR wetland to the Northeast of Highway 337 and flows into the Northumberland Strait. This watercourse provides suitable fish habitat in the upper reaches, but a resident population is not anticipated based on the lack of connection to fish bearing waters. The lower reaches of the stream are steeply graded and eliminate passage from the Northumberland Strait.

Stream 3, is a small drainage channel that flows through Wetland 13 and converges with Stream 1. This watercourse provides unsuitable habitat for most fish species, with the potential exception for small bodied minnows. Stream 3 does not connect to fish bearing waters and based on the ephemeral nature of the watercourse resident fish populations are not expected.



Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Environmental Features and 10 Year Plan.mxd

DATE: Sep 23, 2011 PREPARED BY: R. Sutcliffe SCALE: 1:6,000	Northumberland Rock Quarry Extension Project **Environmental Features and Proposed 10 Year Development Plan**	FIGURE NO.: **5.1** Stantec

5.2.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

As specified in Nova Scotia Pit and Quarry Guidelines, no active areas will be located within 30 m of the banks of all streams identified on the property (*e.g.*, stream 1,2,and 3) without prior approval from NSE. Natural vegetation will be maintained within this buffer for all identified watercourses. No Project-related vehicles will be driven through streams, stream buffers or wetland buffers. Additionally, Fisheries and Oceans Canada (DFO) has developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all development and industrial projects, both large and small, in or near watercourses that could harmfully alter, disrupt, or destroy (HADD) fish habitat by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. Any future Project-related alteration of the productive capacity of fish habitat will require DFO approval including habitat compensation to ensure no net loss. A provincial Water Approval under the Activities Designation Regulations would also be required for any watercourse alteration.

Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition downgradient, particularly during periods of heavy rainfall or snow melt. These activities will also result in a reduction of evapotranspiration and a corresponding increase in surface runoff, which in turn increases potential for sediment erosion and deposition in all three watercourses identified on the Project property. In the event of a watercourse crossing, it is anticipated that a culvert will be installed to facilitate the construction of the access road. Any culvert will be installed in accordance with all regulatory requirements depending on size of culvert and time of year to be installed (*e.g.*, Water Approval) and best construction practices (*e.g.*, erosion and sedimentation control).

The use of properly sized flow retention structures are expected to mitigate erosion and sedimentation effects in all identified watercourses resulting from clearing, grubbing, topsoil stripping and culvert installation activities. Additionally, as the quarry site develops, exposed soil and stockpiles capable of producing sediment laden-runoff will be stabilized.

Additional retention capacity will be created as the quarry extends and additional settling pond volume will be installed, as needed. The water quality of the effluent exiting the settling pond will meet parameters as stated in the facility's current Industrial Approval and future amendments.

The use of explosives will follow the guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. A blast management plan will be provided to NSE, if requested.

Based on the results of the surface water assessment including the fish habitat survey and the mitigation proposed including riparian buffers, there is a moderate to low potential for quarry operations to interact with the surface water environment. Significant Project-related effects on surface water resources, in particular fish and fish habitat, are not likely to occur.

5.3 RARE AND SENSITIVE FLORA

The site was surveyed by Stantec botanists on June 16th – 17th and during August 31st – September 3rd, 2010. A vascular plant inventory of the Project area was compiled during each of the surveys and habitat descriptions were performed. Multiple surveys were conducted so as to assist in the identification of species which mature at different times throughout the growing season. All habitat types present on the Property were surveyed, but particular attention was given to wetlands and other water features, such as shorelines and streams, because these habitats are generally known to have a relatively high likelihood of harboring rare plants. Additionally, a rare plant modeling exercise was performed to identify which species could potentially inhabit the site and to provide information on the appropriate timing of field surveys.

5.3.1 Description of Existing Conditions

The Project area supports a number of vegetation cover types including stands of deciduous, mixedwood, and coniferous upland forest, intact and cut-over treed swamps, a rocky coastline, streams, anthropogenic ponds and other disturbed habitats. The vegetative condition of the Property has been strongly influenced by past anthropogenic activities. In particular, the Property is regenerating from historical agricultural practices and both the composition and structure of its vegetation reflects this legacy. More recent human activities have also had an important effect on the vegetation, particularly tree harvesting and associated disturbances.

The majority of the Project area is comprised of upland forest but much of this has been recently cut-over and that which hasn't strongly reflects its historical condition as pasture. Mixedwood and deciduous stands comprise the majority of the regenerated forests, but some conifer-dominated areas are also present. Varying amounts of quaking aspen (*Populus tremuloides*), white spruce (*Picea glauca*), white ash (*Fraxinus americana*), and paper birch (*Betula papyrifera*) comprise the tree canopy within these forests and also provide a diffuse shrub layer. The understory is comprised of scattered forbs (many of which are not native to the province), including rough-leaf goldenrod (*Solidago rugosa*), gypsy-weed (*Veronica officinalis*), hawkweeds (*Hieracium spp*.), and bracken fern (*Pteridium aquilinum*). Recently cut-over stands are dominated by a number of early-successional shrubs such as red raspberry (*Rubus idaeus*), fire cherry (*Prunus pensylvanica*), and paper birch, whereas the forb rough-leaf goldenrod and old-pasture graminoids such as colonial bentgrass (*Agrostis capillaris*) and red fescue (*Festuca rubra*) comprise the herbaceous layer. Upland forest stands within the Project Area that have not been recently cut-over approximate FEC Vegetation Types OF1 (White spruce / Aster – Goldenrod / Shaggy moss) and OF5 (Trembling aspen – Grey birch / Rough goldenrod – Strawberry), as identified by NSDNR's Forest Ecosystem Classification for Nova Scotia (Neily et al. 2011).

The coastline is represented by a quick transition from upland forest to the rocky intertidal zone of the Northumberland Strait. The southwest portion of the Project area is characterized by a steep forested hill, dominated by white spruce snags and red elderberry (*Sambucus racemosa*), which descends down to the coastline and gives way to a precipice that falls to the rocky seashore. At the tops of the rock face are some small patches of black crowberry (*Empetrum*

nigrum) and on the cliff face itself are scattered some coastal plants such as creeping saltbush (*Atriplex prostrata*). The more easterly portion of the Property coastline is comprised of a cobbly shoreline and provides some habitat for scattered halophytic coastal plants, including American searocket (*Cakile edentula*).

Nineteen wetlands are found within the Project area, the large majority of which are treed swamps. The overstory canopy of these swamps is primarily comprised of quaking aspen and white ash, although balsam fir (*Abies balsamea*) is also often dominant. The shrub layer within these swamps varies from diffuse to dense and is comprised of black holly (*Ilex verticillata*), willow (*Salix spp.*), and the aforementioned trees. A well-developed herbaceous layer is dominated by the forbs sensitive fern (*Onoclea sensibilis*), dwarf red raspberry (*Rubus pubescens*), cinnamon fern (*Osmunda cinnamomea*) and a variety of graminoids including fowl manna-grass (*Glyceria striata*), hoary sedge (*Carex canescens*), little prickly sedge (*Carex echinata*), and in some areas the exotic sedge *Carex panicea*. The vegetation within the treed swamps approximates FEC Vegetation Types WD1 (White ash / Sensitive fern – Christmas fern) and / or WD7 (Basam fir – White ash / Cinnamon fern – New York fern / Sphagnum), as identified by the Forest Ecosystem Classification for Nova Scotia (Neily et al., 2011). Many of the swamps towards the southern end of the Property have been recently cut-over and are therefore in an early successional state. Although they lack an overstory canopy due to recent harvesting activities, the tree species quaking aspen, white ash, paper birch, and red maple (*Acer rubrum*) are prominent within the shrub layer. However, the cut-over swamps are currently dominated by graminoids, with fowl manna-grass (*Glyceria striata*), yellow sedge (*Carex flava*), and soft rush (*Juncus effusus*) being particularly abundant. Other prominent herbaceous species include the forbs flat-top fragrant-golden-rod (*Euthamia graminifolia*), hairy willow-herb (*Epilobium ciliatum*), red raspberry (*Rubus idaeus*), cinnamon fern (*Osmunda cinnamomea*), and the graminoids cottongrass bulrush (*Scirpus cyperinus*) and broad-leaf cattail (*Typha latifolia*). Of notable exception to this generalized description, Wetland 15 contains an open area dominated by graminoids – particularly blue cattail (*Typha x glauca*). Other common herbs within this habitat include sensitive fern, fowl manna-grass, and the exotic forb creeping butter-cup (*Ranunculus repens*). Additionally, a tiny graminoid marsh is present on the steep hill which descends to the Northumberland Strait at the Property's northern end. This small seepage area is dominated by a diversity of graminoids such as soft rush, yellow sedge, water sedge (*Carex nigra*) and a number of forbs, including the non-native colt's foot (*Tussilago farfara*).

Three watercourses are present on the Property as are a couple of anthropogenic ponds. Except where they flowed through wetland habitats, the streams provided very little riparian vegetation, being comprised of well-defined rocky channels. One anthropogenic pond with poorly vegetated muddy banks was associated with a swamp (Wetland 13) whereas the other was located along a watercourse towards the western side of the Property (located where the watercourse comes in close proximity to the quarry access road) and was devoid of any vegetation, its banks being comprised of large boulders.

The remaining portions of the Project area are anthropogenic and are associated with the current quarry operation and associated infrastructure. The quarry pit itself is devoid of

vegetation, but a fringe of disturbed area around its periphery provides habitat for a number ruderal plants, particularly exotic species such as Colt's foot (*Tussilago farfara*). Additional, a diversity of native and non-native herbs are associated with the quarry access road which dissects the Project area.

Rare Vascular Plants

All species of vascular plants encountered during the 2010 surveys were identified and their population statuses in Nova Scotia determined through a review of provincial and federal sources, including the general status ranks of wild species in Nova Scotia (NSDNR 2010a), S-ranks of the ACCDC (ACCDC 2010), designations by the provincial *Endangered Species Act* (NSDNR 2009), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2011), and the federal Species at Risk Act (SARA). Although no provincially or federally designated “Species at Risk” were encountered during the field survey, two species of conservation concern, Bebb's sedge (*Carex bebbii*) and tall hairy groovebur (*Agrimonia gryposepala*) are present. A list of the 314 vascular plants found on site during field surveys and information on their population statuses is provided in Appendix D.

Bebb’s sedge is considered to “May be at Risk” by NSDNR and is ranked “S1S2” by the ACCDC indicating that it is extremely rare to rare within the province and may be especially vulnerable to extirpation. Bebb’s sedge flowers from June to August and is generally found within wet places with calcareous or neutral soils including open wetlands, gravelly lakeshores, stream banks, swales, meadows, and forest seeps (Zinck 1998; Hinds 2000; and FNA 2003). In Nova Scotia it is considered local and rare in Hants County, Antigonish County, and central Cape Breton (Zinck 1998) but recent Stantec surveys suggest that it may be more common within the province than previously thought (*i.e.*, in addition to the specimens encountered within the Project area, Bebb’s sedge has been found at two other locations within Nova Scotia by Stantec botanists within the last few years). Within the Project area, Bebb’s sedge was observed to be scattered throughout three cut-over swamps (Wetlands 3, 4, and 5) and was also found within a small seep at its northern corner (Figure 5.1). Generally being associated with open habitats, the abundance of this species within the cut-over swamps may have been promoted by the removal of their canopy. Additionally, an infilled area upslope of these swamps was observed to contain gypsum and likely benefits the local population of Bebb’s sedge on the Property by improving soil conditions (*i.e.*, by increasing their pH).

The population of tall hairy groovebur is considered “Secure” by NSDNR but is given a ranking of “S3” by the ACCDC indicating that it is uncommon within the province. Tall hairy groovebur is a tall perennial herb that is typically associated with thickets, the margins of rich woods, intervals, and slopes (Zinck 1998). Within the Project area, it was encountered within Wetland 5, a cut-over swamp (Figure 5.1).

In addition to the field surveys, a rare plant modeling exercise was performed to determine the likelihood of presence of uncommon-rare plants within the RoW. As part of the modeling exercise, all records of vascular plant species listed by NSDNR (2010a) to be “At Risk”, “May be at Risk”, “Sensitive” to human activities or natural events, or ranked as “S1”, “S2”, or “S3” by the

ACCDC within a radius of 100 km from the center of the property were compiled by means of an ACCDC data search. The habitat requirements of these species were then compared to the range of environmental conditions present on the Property to determine if suitable habitat was present. The seasonal aspects and ease of identification of each of the species potentially present in the Project area were also incorporated into the model in order to determine when the rare or sensitive taxa would be best identified.

A total of 217 uncommon – rare vascular plants species have been recorded within 100 km of the center of the Project area. Based on the results of the habitat model, there is potential for 83 of these species to be found on the Property. In addition, two rare non-vascular plants (*i.e.*, mosses and lichens) have been recorded within 100 km of the Project area. However, the habitat requirements and / or distributions of these species do not suggest that they are likely to be present on the site. The results of the modeling exercise indicate that all of the habitat types present on the Property could potentially harbour rare species. However, because many of the uncommon – rare plants were associated with wetlands and other water features (shorelines, streams, etc.), these habitats were considered to be most likely to harbour plants of conservation concern. Appendix E lists the species identified during the modeling exercise as being potentially present within the Project area as well as information on their population status, habitat preference, and phenology.

The phenologies of the uncommon – rare vascular plants highlighted by the model suggest that species of conservation concern may be identified at all times during the growing season. Although many of the species have restricted flowering periods, most are readily identified by other morphological features throughout the growing season, such as their seeds or leaf shape. As such, the field surveys conducted during June and August / September 2010 are considered sufficient to allow detection for the large majority of species identified by the model.

5.3.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The Project has the potential to influence the populations of plant species by causing direct habitat loss and indirectly through changes in habitat conditions, such as may be brought about by altered hydrological regimes.

Of particular conservation concern is the population of Bebb's sedge which is considered to "May be at Risk" by NSDNR. This species was found in two general areas of the Property – including several wetlands at its southern end and a small seepage area in the northern corner of the site. The small population at the northern end of the Property will not be directly impacted by Project activities which are to be restricted to the western side of the watercourse found within the same area. Additionally, wetlands towards the southern end of the Property which contain Bebb's sedge (Wetland 3, 4, and 5) will be avoided by Project activities as there is no intent to quarry in or near these wetlands within the next 10 years. If after that time, quarry development is proposed within 50 m of these wetlands appropriate approvals will be sought from NSE and NS DNR.

Should alteration of the wetlands be unavoidable in the future it would be necessary to apply for a wetland alteration approval from NSE, an important component of which is an evaluation of wetland functional attributes. The ability of wetlands to provide habitat for rare or sensitive plants and other wildlife is an important functional attribute considered during the application process, and the effects of the Project on any such populations would therefore be evaluated at that time.

Standard mitigative measures to minimize the environmental effects of the Project on plant communities include the use of seed mixtures free of noxious weeds during site reclamation. Wherever practical, native plants should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species which are well established in Nova Scotia and which are not aggressive weeds in the wetland and forest plant communities present in the area are to be used for reclamation.

In summary, assuming recommended mitigative measures; significant Project-related effects on rare and sensitive flora are not likely to occur.

5.4 WILDLIFE

5.4.1 Description of Existing Conditions

Information regarding use of the Project area by wildlife was derived from several sources including field surveys and a review of existing data. Field surveys were conducted by ecologists on two occasions, June 16th – 17th and during August 31st – September 3rd, 2010. During these surveys, information was collected regarding the presence of birds, mammals and herpetiles (amphibians and reptiles). Additional references, including an ACCDC data search, the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992, MBBA 2009), Amphibians and Reptiles of Nova Scotia (Gilhen 1984), and the Nova Scotia Significant Habitat Mapping Database (NSDNR 2007a), were consulted to provide records of wildlife in the vicinity of the study area and to help direct field surveys.

The ACCDC data were incorporated into a wildlife model to determine the likelihood that rare or sensitive wildlife species might inhabit the Project area. As part of the modeling exercise, all records of wildlife species listed by NSDNR (2010a) as being “At Risk”, “May be at Risk”, “Sensitive” to human activities or natural events, or ranked as “S1”, “S2”, or “S3” by the ACCDC within a radius of 100 km from the center of the Project area were compiled by means of an ACCDC data search. The habitat requirements and distribution of these species were compared to the conditions and location of the Project area to determine if it provided suitable habitat for these species.

The Project area provides moderate habitat diversity for wildlife. The majority of the Property is comprised of upland forest, including deciduous, mixed, and conifer stands. Much of the upland forest has been recently cut-over and that which hasn’t strongly reflects its historical condition as pasture land. Wetland habitat is common throughout the Property and is primarily comprised of treed swamps and their cut-over equivalents. Graminoid marsh and wet meadow also provide minor components of wetland habitat. The Property borders coastal habitat provided by the

rocky intertidal zone of the Northumberland Straight on its northwestern edge. The coastline is characterized by a quick transition from upland to marine habitat and includes rock outcrops and cobble shorelines. Some limited aquatic habitat is provided within the Property by three streams which generally have well-defined rocky channels, and by a couple of poorly vegetated anthropogenic ponds. The northwestern corner of the Property is currently being utilized for quarry operations and has limited value for wildlife.

Birds

Information on the distribution and abundance of birds within the Project area was primarily obtained during a breeding bird survey. This survey was conducted by two observers (working independently) who are both proficient visual and auditory birders and took place during the morning of June 17th between the hours of 05:30 and 11:00, with additional observations being made on June 16th and during August 31st – September 3rd, 2010. Due to the relatively small size of the Property in relation to the time dedicated for the breeding bird survey, observers were able to conduct a thorough search of the property and visit all of the identified habitat types. During this time, all birds heard or observed were recorded and their breeding status was determined with the criteria used by the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992). “Possible” breeders are generally those birds that have been observed or heard singing in suitable nesting habitat. “Probable” breeders include those that exhibited any of the following: courtship behavior between a male and female; visiting a probable nest site; displaying agitated behavior; and/or male and female observed together in suitable nesting habitat. “Confirmed” breeders are those birds that exhibited any of the following: nest building or adults carrying nesting materials; distraction display or injury feigning; recently fledged young; occupied nest located; and/or adult observed carrying food or fecal sac for young.

Several sources of information on the distribution and activity of birds within the vicinity of the Project area were also reviewed. In particular, data from the Maritimes Breeding Bird Atlas (MBBA) was used to help identify species of conservation occur that could potentially occur on site, as well as their breeding status. The MBBA database (Erskine 1992, MBBA 2009) provides information on the distribution and abundance of birds within 10 km X 10 km census squares across the Maritime Provinces of Canada. The MBBA square in which the Project is located (20NR77) was used to compile a list of breeding birds that have been recorded within the vicinity of the site. The breeding status of each species obtained from these data sources were determined using the criteria outlined by the Atlas of Breeding Birds of the Maritime Provinces. In addition, the ACCDC modeling results were also consulted to identify any additional birds that could potentially inhabit the site.

The population statuses of each species identified by the field surveys and the additional sources were determined using up-to-date sources. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2010a), Species at Risk in Nova Scotia (NSDNR 2009), and the ACCDC (ACCDC 2010). The statuses of nationally rare species were obtained from COSEWIC (2011).

A total of 96 bird species have been identified by the MBBA and the field surveys within the vicinity of the Project area. Of these, 93 have been recorded by the MBBA and 48 were encountered during the 2010 field surveys. Of those encountered during the field surveys, the breeding status of five was confirmed, five identified as probable, 29 classified as possible, and an additional nine species were observed which exhibited no indication of breeding. Appendix F lists all bird species identified within the breeding bird atlas square and the field surveys, as well as information on their breeding and population statuses. One federally designated Species at Risk, olive-sided flycatcher (*Contopus cooperi*), was encountered on the property during field surveys. Additionally, a number of other bird species of conservation concern were recorded, including common Loon (*Gavia immer*), rose-breasted grosbeak (*Pheucticus ludovicianus*), ruby-crowned kinglet (*Regulus calendula*), spotted sandpiper (*Actitis macularius*), and yellow-bellied flycatcher (*Empidonax flaviventris*).

Olive-sided flycatcher was assessed as “Threatened” by COSEWIC and is listed as such under Schedule 1 of SARA, indicating that it is provided legal protection within Canada. As a migratory species, the Olive-sided Flycatcher is also protected under the MBCA and associated regulations. Olive-sided flycatchers are considered “Threatened” at the federal level because they have shown a widespread and consistent population decline over the last 30 years. In particular, populations in Canada declined by 79% from 1968 to 2006 and by 29% from 1996-2006 and there is no evidence that the decline has ceased (COSEWIC 2007). Unfortunately, the causes of this decline are uncertain. Within Nova Scotia, the olive-sided flycatcher is currently assigned a rank of “S3B,S4N” by the ACCDC indicating that breeding populations are uncommon but non-breeding occurrences are fairly common. Olive-sided flycatchers are typically associated with open forested areas which contain tall trees or snags for perching. Open areas may be created by either natural or anthropogenic features formed by wetlands, burns, logging activities, or other disturbances whereas the forest habitat is generally of either coniferous or mixed content (COSEWIC 2007). However, there is evidence that the breeding success of birds nesting in harvested habitats is lower than the breeding success of birds nesting in natural (e.g., burned) openings. Harvested landscapes harbor more nest predators resulting in significantly greater egg and nestling loss for birds nesting in these areas and can therefore act as an ‘‘ecological trap’’ by attracting Olive-sided Flycatchers to a relatively poor-quality habitat (Robertson and Hutto 2007). Olive-sided flycatchers were recorded within the Project area during two instances but are believed to be of the same individual and / or breeding pair. An individual was observed calling from a snag at the edge of a recent cut and shortly thereafter a male was heard singing (bird calls are typically used as alarms or for keeping members of a flock in contact whereas songs are used for courtship and mating). Based on these observations, the olive-sided flycatcher is considered to be a possible breeder on the Property. Although data are scarce, Olive-sided Flycatchers may have strong breeding site fidelity (COSEWIC 2007). However, their nests are hard to find, making breeding confirmation difficult (COSEWIC 2007) and they are known to feed at considerable distances from their nest (i.e., several hundred meters).

Common loons are considered to “May be at Risk” by NSDNR and are given a ranking of “S3B,S4N” by the ACCDC indicating that breeding populations are uncommon but non-breeding

occurrences are fairly common within the province. Loons are associated with large areas of open water and nest on the shores of lakes and occasionally large rivers, generally on small islands where their nests are safe from predators. They are sensitive to a variety of human activities, particularly around their breeding sites and recent declines in their abundance may be attributed to a variety of factors including mercury contamination, ingestion of lead sinkers, swamping of nests by power boat traffic, acidification of lakes, and residential development around lakes. During field surveys, a single common loon was observed flying over the Northumberland Strait but is not expected to utilize the Property for breeding purposes.

Rose breasted grosbeaks are considered to be “Sensitive” to human activities or natural events by NSDNR and are given a ranking of “S3S4B” by the ACCDC indicating that breeding populations are uncommon to fairly common within the province. Rose breasted grosbeaks typical inhabit open deciduous woods and recent declines in their populations have been attributed to forest fragmentation. Within the Project area, a single male rose breasted grosbeak was heard singing in a swath of mature mixedwood which ran along the road edge at the Property’s southern edge. Based on the character of the observation, the rose breasted grosbeak was classified as a possible breeder on the site.

Ruby-crowned kinglets have just recently been ranked as “Sensitive” by NSDNR and are given a rank of “S4B” by the ACCDC indicating that they are fairly common throughout their range in the province, but are of long-term concern. Although its population within Canada as a whole has remained relatively stable, this species has shown a steady decline in Nova Scotia (for reasons unknown) during the last several decades (CWS 2009). A single male ruby-crowned kinglet was observed singing within the mixed woods adjacent to the Project area and was therefore classified as a possible breeder during the surveys. However, this species was not encountered within the Project area itself.

Spotted sandpipers are considered to be “Sensitive” by NSDNR and are regarded as “S3S4B” by the ACCDC indicating that breeding populations are uncommon to fairly common within the province. They are typically associated with the edges of freshwater features such as ponds, lakes, wetlands, or streams but are also known to breed along coasts throughout the province. Although still relatively common, spotted sandpipers have exhibited a general decline in abundance. A single spotted sandpiper was observed on the edge of the existing quarry operation and did not exhibit any evidence of breeding within the Project area.

Yellow-bellied flycatchers have also been recently assigned a status of “Sensitive” by NSDNR. In addition, they are assigned a rank of “S3S4B” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with a variety of habitats, including swamps and damp coniferous woods and was observed singing within the immature mixed woods of the Project area on one occasion. The sensitive ranking assigned to this species by NSDNR conveys its decline within the province which may be attributed to factors such as a loss of lowland coniferous forest and possible long term loss of coniferous forest habitat as a result of climate change.

A number of other species of conservation concern have been recorded in the vicinity of the Project area, as evidenced by the MBBA data. One federally-designated "Species at Risk", Canada warbler (*Wilsonia canadensis*) has been recorded in the MBBA square in which the Project is located (20NR77). This species has been assessed as "Threatened" by COSEWIC, is listed under Schedule 1 of the SARA, and may utilize either upland and wetland habitats for nesting purposes provided that they have an open tree canopy with a dense understory and a structurally complex forest floor. Although the wetlands of the Project Area do provide some suitable habitat for this species, Canada warbler was not encountered during field surveys and is therefore unlikely to utilize the Property. Similarly, four species considered to "May be at Risk" by NSDNR, including bank swallow (*Riparia riparia*), blue-winged teal (*Anas discors*), gray catbird (*Dumetella carolinensis*), and pine grosbeak (*Pinicola enucleator*) have been recorded within the MBBA square in which the Project area is located. Although the Project area provides suitable habitat for some of these species (e.g., gray catbird), none of these were encountered during any field visits to the Project area and it is therefore unlikely that they utilize the site. The biologists responsible for the breeding bird surveys as well as wetland and rare plant inventories are familiar with these species and are proficient visual and auditory birders. Common nighthawk and chimney swift have been recorded in adjacent MBBA squares and are ranked as "Threatened" and "Endangered" under the Nova Scotia *Endangered Species Act* (NS ESA), respectively. Field surveys did not identify evidence for either of these species within the Project Area. Common nighthawks nest in open habitats where the ground is devoid of vegetation and such opportunities on the Property would be limited to the edges of the existing quarry. However, activities associated with these areas would likely discourage nesting behavior and although these habitats were visited during the breeding bird survey area, no common nighthawks were encountered. Furthermore, the Property was not observed to contain suitable Chimney Swift nesting or roosting sites (i.e., chimneys or large hollow trees) and it is therefore unlikely that this species would inhabit the Project Area.

The MBBA data identified 14 bird species which are ranked as "Sensitive" by NSDNR as having been recorded in the vicinity of the Project area; including American bittern (*Botaurus lentiginosus*), barn swallow (*Hirundo rustica*), bobolink (*Dolichonyx oryzivorus*), common tern (*Sterna hirundo*), eastern bluebird (*Sialia sialis*), eastern kingbird (*Tyrannus tyrannus*), eastern phoebe (*Sayornis phoebe*), golden-crowned kinglet (*Regulus satrapa*), gray jay (*Perisoreus canadensis*), great cormorant (*Phalacrocorax carbo*), greater yellowlegs (*Tringa melanoleuca*), pine siskin (*Carduelis pinus*), Tennessee warbler (*Vermivora peregrine*), and tree swallow (*Tachycineta bicolor*). In addition to being ranked as "Sensitive" by NSDNR, both bobolink and barn swallow have recently been assessed as "Threatened" by COSEWIC. None of the aforementioned species were recorded during field surveys and they are therefore unlikely to inhabit the property of interest. Furthermore, the habitat conditions available within the Project area are unsuitable for many of them (e.g., bobolink and barn sallow).

The ACCDC modeling exercise identified a total of 46 rare or sensitive birds that have been recorded within 100 km of the Project area. Of these, 11 are currently considered "Species at Risk" by either COSEWIC or the Province of Nova Scotia; including piping plover (*Charadrius melodus melodus*), red knot rufa ssp (*Calidris canutus rufa*), roseate tern (*Sterna dougallii*),

Barrow's goldeneye (*Bucephala islandica*), harlequin duck, (*Histrionicus histrionicus*), rusty blackbird (*Euphagus carolinus*), savannah sparrow princeps ssp (*Passerculus sandwichensis princeps*), short-eared owl (*Asio flammeus*), Bicknell's thrush (*Catharus bicknelli*), bobolink (*Dolichonyx oryzivorus*), and whip-poor-will (*Caprimulgus vociferous*). However, due to a lack of appropriate habitat conditions none of these species were identified by the modeling exercise as being potentially present within the Project area. Results of the model did, however, identify ten bird species of conservation concern for which the Project area was considered to provide potentially suitable habitat, including baltimore oriole (*Icterus galbula*), black-billed cuckoo (*Coccyzus erythropthalmus*), eastern bluebird (*Sialia sialis*), eastern phoebe (*Sayornis phoebe*), great crested flycatcher (*Myiarchus crinitus*), Philadelphia vireo (*Vireo philadelphicus*), scarlet tanager (*Piranga olivacea*), vesper sparrow (*Pooecetes gramineus*), warbling vireo (*Vireo gilvus*), and wood thrush (*Hylocichla mustelina*). However, none of these species was encountered during field surveys and they are therefore unlikely to utilize the site.

Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the vicinity of the Project area was derived from field surveys and a review of the Nova Scotia significant habitat mapping data base (NSDNR 2007a). Results from field surveys include those conducted during June 16th – 17th and from August 31st – September 3rd, 2010. The field surveys provide a good indication of the presence of large mammal species in the Project area but knowledge of the distribution of small mammals is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements which can be used to predict areas where they are likely to be found.

Ten mammals were recorded in or adjacent to the Project area during the field surveys. These species are generally typical of woodland habitats and include American red squirrel (*Tamiasciurus hudsonicus*), black bear (*Ursus americanus*), bobcat (*Lynx rufus*), eastern chipmunk (*Tamias striatus*), meadow jumping mouse (*Zapus hudsonius*), American porcupine (*Erithizon dorsatum*), short-tailed shrew (*Blarina brevicauda*), snowshoe hare (*Lepus americanus*), white-tailed deer (*Odocoileus virginianus*), and woodchuck (*Marmota monax*). All of these species are common throughout Nova Scotia and have populations that are considered “Secure” by NSDNR.

ACCDC records indicate that a total of seven rare or sensitive mammal species have been recorded within 100 km of the Project area. Three of these species, moose (*Alces americanus*), Canada lynx (*Lynx canadensis*), and American marten (*Martes americana*) are considered “Endangered” by the Province of Nova Scotia. The remaining species are all considered “Sensitive” by NSDNR and are given rankings which vary from “S1” to “S2” by the ACCDC, indicating that they are all rare within the province. These species include fisher (*Martes pennant*), northern long-eared bat (*Myotis septentrionalis*), long-tailed shrew (*Sorex dispar*), and rock vole (*Microtus chrotorrhinus*). Information on the distribution and habitat requirements of these species suggest that the Project area is unlikely to provide important habitat for any of them.

Moose are associated with wilderness boreal and mixedwood habitats. Their preferred food are the twigs, stems and foliage of young deciduous trees and shrubs, as may be found within forest landscapes recently disturbed by fire, wind, disease or timber harvesting activities. In summer, moose prefer habitats interspersed with wetlands that allow access to submerged and emergent aquatic vegetation. Landscapes which support recently disturbed mixed forests for food and adjacent mature conifer cover for escape and shelter are preferred in winter (Parker 2003). Mainland moose populations within Nova Scotia have drastically declined since European settlement as a result of a multitude of complex and often poorly understood factors, including disease and parasites, poaching, habitat loss and fragmentation, forest practices, acid rain and climate change (NSDNR 2007b). Although they have been recorded in very close proximity to the Project area (*i.e.*, ACCDC records indicate that this species has been observed 1 ±10 km from the site) the Property is outside the Antigonish - Guysborough core moose distribution area which has been estimated to include approximately 40 individuals (Parker 2003). Therefore, although the Project area would provide some suitable browsing opportunities, it is unlikely that it is frequented by moose or that it otherwise serves as important habitat for this species. Furthermore, no evidence of moose was observed during field surveys.

Canada lynx live deep in coniferous forests near rocky areas, bogs and swamps. Although lynx may have historically occupied parts of mainland Nova Scotia, they are now restricted to the Cape Breton Highlands and to areas of higher elevation in central and eastern Cape Breton (Parker 2001). The nearest ACCDC record of Canada lynx is 61 km from the Project area. Due to the current absence of this species from the mainland, the Project area would not have potential to provide habitat for this species.

American marten are associated with large contiguous patches of mature softwood or mixedwood forest but also use mature hardwood forest as winter habitat in some portions of their range. Two distinct marten populations are recognized in the province and are found in the Cape Breton highlands and in southwestern Nova Scotia. The nearest known sighting of this species was made at approximately 77 km's from the Project area. Because the Project area is outside of the known distribution of marten within the province, this species is very unlikely to utilize the site.

Fishers were previously extirpated from Nova Scotia as a result of over trapping and habitat loss but a small population has become established through reintroduction efforts. They are currently ranked as "S2" by the ACCDC indicating that they are rare within the province. Fishers prefer large tracts of mature coniferous or mixedwood forest. Although they will also make use of second growth forests they generally avoid areas of human habitation and early successional stands. Within Nova Scotia, fishers are primarily found in the eastern mainland area (particularly Cumberland, Colchester and Pictou counties) with another small population being located in the interior of western Nova Scotia (Sabean 1989). The closest known fisher record is approximately 95 km away from the Project area and the character of the Property's forest (*i.e.*, highly fragmented, abundance of second growth deciduous and early-successional stands) does not provide ideal fisher habitat.

Northern long-eared bats are known to occur at several locations within Nova Scotia but have an apparently wide distribution in other Atlantic provinces. Both males and females roost and forage in the forest interior during the summer but females require considerable larger areas for both activities (Broders *et al.* 2006). Northern long-eared bats migrate to their hibernating grounds in the fall, including caves and abandoned mine shafts. ACCDC records include a single record of northern long-eared bat was made at approximately 50 km from the Project area. Whereas the bedrock of the Project area is unlikely to provide appropriate wintering opportunities (*i.e.*, the Neoproterozoic diorite – gabbro is not conducive to cave formation) the surrounding landscape could provide some hibernaculum sites. In particular, areas having bedrock comprised of the Carboniferous Windsor Group are located within the vicinity of the site, with the closest occurrence being approximately 9 km from the Project area. Reference to the Nova Scotia Abandoned Mine Openings Database (NSDNR 2010b) indicate that some closer hibernating opportunities may be available as a number of abandoned mine shafts are located in proximity to the Project area, with the closest being approximately 2 km away. Although it is not known if any of these mines are occupied by hibernating bats, it is unlikely that any onsite quarry activities would cause disturbance to them given their distance from the Project area. Additionally, the fragmented and immature nature of the Property's forests would not provide ideal foraging or roosting habitat for the northern long-eared bat, which are generally associated with mature interior forest areas during the summer. However, if hibernating bats are present in close proximity to the site, there would be potential for them to be present in the Project area during the spring and autumn as regional populations leave and return to hibernaculum sites.

Long-tailed shrews are typically associated with talus slopes and rock slides in deciduous or coniferous forests and may rarely inhabit man-made artificial talus. The nearest known record of long-tailed shrew is approximately 83 km from the Project area. Although some small areas of talus exist within the Project area, these are anthropogenic in nature (from previous quarry activities) and are devoid of vegetation. As such, it is very unlikely that long-tailed shrews inhabit the site.

Rock voles inhabit damp, mossy, rocky talus slopes under cliffs or frost-fracture rock outcrops in the forest (Banfield 1974). In Nova Scotia they are known from Cape Breton Island and ACCDC records indicate that the nearest known record of the rock vole is approximately 83 km from the Project area. Because the Property is well outside of the known range of the rock vole within the province and does not provide appropriate talus conditions, it is very unlikely that rock voles would inhabit the site.

A review of the NSDNR significant habitat mapping database (NSDNR 2007a) did not reveal the presence of any rare or sensitive mammal species in the immediate vicinity of the Project area or critical habitat such as deer wintering areas. All of the habitats present in the Project area are commonly encountered throughout the province and are unlikely to provide unique habitat for rare small mammal species.

Herpetiles

Information regarding the presence of amphibians and reptiles within the Project area was also collected during field surveys on June 16th – 17th and from August 31st – September 3rd, 2010. Six herpetile species were encountered during the surveys, including common garter snake (*Thamnophis sirtalis*), green frog (*Rana clamitans*), northern spring peeper (*Pseudacris crucifer*), redback salamander (*Plethodon cinereus*), and wood frog (*Rana sylvatica*). All of these species are common throughout Nova Scotia where their populations are considered secure. However, a review of the ACCDC data search indicates that two rare or sensitive herpetiles have been recorded within 100 km from the Project area: wood turtle (*Glyptemys insculpta*) and four-toed salamander (*Hemidactylium scutatum*).

Wood turtles are listed as "Threatened" by COSEWIC and SARA, "Vulnerable" under the Nova Scotia Endangered Species Act, "S3" by the ACCDC, and "Sensitive" by NSDNR. Wood turtles are typically associated with watercourses and the riparian habitats associated with them. They nest on sandy or gravelly river banks but will also make use of features such as sand pits and road embankments near water courses that provide a sandy or gravelly substrate. Deep pools in larger rivers are often used as hibernaculum sites during the winter. Riparian habitats along watercourses are typically used as feeding sites. ACCDC records indicate that the closest known record of wood turtle is approximately 19 km from the Project area. However, the Project area is not located within any of the watersheds that are known to provide habitat for wood turtles, as identified by the provincial stewardship plan for this species (MacGregor and Elderkin 2003). Furthermore, the character of the watercourses within the Project area do not support typical wood turtle habitat (*i.e.*, they do not contain deep water pools or have sandy or gravelly banks) and because they are headwater streams that drain into the Northumberland Strait they are not hydrologically connected to larger watercourses which could support wood turtles.

5.4.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Migratory birds are protected under the federal *Migratory Birds Convention Act* (MBCA, 1994). As such, it is illegal to kill migratory bird species or destroy their eggs or young. Other bird species not protected under the federal act, such as raptors, are protected under the provincial *Wildlife Act* (1989). In order to avoid contravening these regulations, clearing of areas to be used for the Project will be conducted outside of the breeding season of most bird species (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed.

Further efforts to minimize effects to migratory birds include the use of appropriate lighting and stockpiling of sediments. As outlined in Section 2.6, light emissions will be minimal as there is no source of power on site and there are therefore no spotlights or floodlights associated with roads or parking lots. When required during the evening or nighttime, lighting will be provided via portable lights, for the safety of employees, and will be directed downwards to avoid attracting birds. Furthermore, quarry personnel will turn off any lighting observed to act as an attraction to migratory activity until the birds have cleared the area. Some species of migratory birds (e.g., bank swallows) may nest in stockpiles if they provide vertical faces in which they can excavate burrows. As such, operators on site will ensure that vertical faces do not form on piles

consisting of fine-grained sediments by knocking down any such features during Project activities.

Field surveys indicate that one federally designated Species at Risk, Olive-sided Flycatcher, is a possible breeder on the site. The area in which this species was observed will not be encroached upon during the proposed ten year quarry extension plan, as indicated by Figure 5.1 (*i.e.*, quarry activities within this time period are to be restricted to the western side of Wetland 15 whereas the olive-sided flycatcher was encountered on the eastern side of this feature). The Olive-sided Flycatcher is a migratory bird and aforementioned practices related to compliance with the MBCA will act to avoid impacts to this species.

A number of other bird species of conservation concern were recorded during field surveys, including common loon, rose-breasted grosbeak, ruby-crowned kinglet, spotted sandpiper, and yellow-bellied flycatcher. However, only rose-breasted grosbeak and yellow-bellied flycatcher are considered to be possible breeders on the site and all observations for these species were made well outside of the area encompassed by the proposed ten year quarry extension plan. As such, no species-specific mitigative initiatives are currently recommended. However, the Project proponent is open to further discussions with NSDNR and NSE regarding mitigative measures for specific species should they be required.

The field surveys did not reveal the presence of any rare or sensitive mammal or herpetile species within the Project area and none are expected to inhabit the Project area due to inappropriate habitat conditions and/or limitations in range distributions. Furthermore, the habitats present in the Project area are common throughout the province and are unlikely to provide habitat for rare small mammal species. No critical areas for mammals such as deer wintering areas or critical herpetile habitats are known to exist within the Project area.

In summary, in consideration of the aforementioned mitigative measures; significant Project-related effects on wildlife are not likely to occur.

5.5 WETLANDS

5.5.1 Description of Existing Conditions

A total of 19 wetlands were identified within the Project area during field surveys conducted August 31st – September 3rd, 2010 (Figure 5.1). The technical approach used for wetland identification and delineation during the surveys was based on principles described in the US Army Corps of Engineers Wetlands Delineation Manual (1987) using vegetation, soil, and hydrology as wetland indicators. Prior to field surveys, information on the distribution and location of known and prospective wetlands within the Project area was obtained using data from the Nova Scotia Wetland Inventory Database (NSDNR 2007c).

An assessment of each of the wetlands was performed during August / September site visits and was supplemented with information collected during June 16th – 17th, 2010. The assessment included a classification of each of the wetlands following guidelines outlined in the

Canadian Wetland Classification System (Warner and Rubec 1997), a characterization of their hydrological condition using designations for landscape position, landform, and water flow path as outlined by Tiner (2003), directed studies of their wildlife, and other observations pertaining to their character, including the affects of past anthropogenic activities. Wildlife surveys included inventories of vascular plants, birds, mammals, reptiles and amphibians which were observed to inhabit or utilize the wetlands as well as habitat descriptions and assessments.

Wetland classification and habitats

The Canadian Wetland Classification System is a hierarchical system that identifies three general levels of wetland features – class, form, and type. Wetland classes (*e.g.*, swamp, marsh) are based on the properties of the wetland that reflect their origin and the nature of the wetland environment. This level may be used to group wetlands at their most general scale. Wetland forms are subdivisions of each wetland class (*e.g.*, basin swamp, slope marsh) and are based on their morphology, surface pattern, water type, and the morphological characteristics of the underlying soil. Many wetland forms apply to more than one wetland class whereas others are more specific. When used in conjunction with information on the physiognomic characteristic of vegetation (*e.g.*, graminoid, treed), data on wetland class and form constitute the wetland types (Warner and Rubec 1997). Table 5.2 provides information on the wetland types within the Project area.

Table 5.2 Wetland type and information on landscape position, landform, and water flow path

Wetland ID	Area (ha)	Wetland Type[1]	Landscape Position	Landform	Surface Water Flow Path (Groundwater Flow Path[2])
1	0.002	Graminoid Slope Marsh	Terrene	Slope	Isolated
2	0.283	Treed (Mixed / Cut-over) Drainageway Swamp	Terrene	Slope	Isolated (Inflow)
3	0.442	Treed (Cut-over) Drainageway Swamp	Terrene	Slope	Artificial Throughflow (Outflow)
4	0.058	Treed (Cut-over) Basin Swamp	Terrene	Basin	Isolated
5	0.089	Treed (Cut-over) Drainageway Swamp	Terrene	Slope	Artificial Throughflow (Outflow)
6	0.010	Treed (Mixed) Drainageway Swamp	Terrene	Slope	Outflow
7	0.056	Treed (Mixed) Riverine Swamp	Lotic Stream	Slope	Throughflow
8	0.041	Treed (Cut-over) Basin Swamp	Terrene	Basin	Isolated
9	0.066	Treed (Mixed) Drainageway Swamp	Terrene	Slope	Isolated (Inflow)
10	0.047	Treed (Deciduous) Drainageway Swamp	Terrene	Slope	Isolated (Outflow)
11	0.139	Treed (Cut-over) Drainageway Swamp	Terrene	Slope	Isolated (Outflow)
12	0.133	Treed (Cut-over) Basin Swamp	Terrene	Basin	Isolated (Inflow)
13	0.402	Treed (Deciduous) Riverine & Basin Swamp + Anthropogenic Pond	Lotic Stream	Slope & Basin	Throughflow
14	0.301	Treed (Deciduous) Riverine Swamp	Lotic Stream	Slope	Throughflow

Table 5.2 Wetland type and information on landscape position, landform, and water flow path

Wetland ID	Area (ha)	Wetland Type[1]	Landscape Position	Landform	Surface Water Flow Path (Groundwater Flow Path[2])
15	0.841	Treed (Deciduous) Basin & Drainageway Swamp	Terrene	Basin & Slope	Isolated
16	0.012	Treed (Deciduous) Basin Swamp	Terrene	Basin	Isolated
17	0.101	Treed (Mixed) Drainageway Swamp	Terrene	Slope	Isolated
18	0.165	Treed (Deciduous) Basin & Drainageway Swamp	Terrene	Basin & Slope	Outflow
19	0.068	Treed (Mixed) Drainageway Swamp	Terrene	Slope	Outflow

[1] Designations for wetland type based on guidelines outlined by the Canadian Wetland Classification System (Warner and Rubec 1997)
[2] Designations for landscape position, landform, and water flow path follows Tiner (2010), groundwater flow paths only identified where obvious

The vast majority of wetlands within the Project area are swamps. Swamps are mineral wetlands or peat lands and characteristically have tall woody vegetation (Warner and Rubec 1997). Their water table is generally at or near the surface of the swamp and is commonly present in the form of either stagnant or flowing pools or channels. Swamps generally have some internal water movement originating from their margins or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat.

Basin, drainageway, and riverine swamp forms are represented within the wetlands of the Project area. Basin swamps (Wetlands 4, 8, 12, 16, and parts of 13, 15, and 18) occur in topographically defined basins where the water is derived locally and by drainage from other parts of the watershed. Their edges are typically well-defined by the sides of the basin and the surrounding mineral soil uplands. Drainageway swamps (Wetlands 2, 3, 5, 6, 9, 10, 11, 17, 19 and parts of 15, and 18) have a sloping surface and are found in confined drainageways or water tracks. Water movement is generally as unilateral sheet flow but intermittent channels are often present. Riverine swamps (Wetlands 7, 14, and part of 13) occur along the banks of perennial and / or intermittent watercourses and their water table is maintained by the level of these features. Although Wetlands 6 and 18 are positioned along a watercourse, they have not been classified as riverine swamps because their hydrological character is only minimally influenced by water levels within the watercourse (*i.e.*, they feed into the watercourse rather than being fed by it).

The swamps of the Project area are primarily dominated by mixed and deciduous treed vegetation but many have been recently cut-over. The vegetation within those which have not been recently cut-over approximate FEC Vegetation Types WD1 (White ash / Sensitive fern – Christmas fern) and / or WD7 (Basam fir – White ash / Cinnamon fern – New York fern / Sphagnum), as identified by the Forest Ecosystem Classification for Nova Scotia (Neily et al., 2011). Although the overstory canopy of the treed swamps varies with regards to the relative abundance of the constituent species, quaking aspen, white ash, and balsam fir comprise the dominant species. Their shrub layer varied from diffuse to dense and is comprised of black

holly, willow, and the aforementioned tree species. A well-developed herbaceous layer was dominated by the forbs sensitive fern, dwarf red raspberry, cinnamon fern, and a variety of graminoids including fowl manna-grass, hoary sedge, little prickly sedge, and in some areas the exotic sedge *Carex panicea*. Cut-over swamps are prominent within the southern end of the Project area and although they lacked an overstory canopy due to recent harvesting activities, their shrub layer was primarily comprised of quaking aspen and white ash. Other prominent shrubs within these habitats included paper birch, red raspberry, and red maple. The cut-over swamps were currently dominated by graminoids however, with fowl manna-grass, yellow sedge, and soft rush being particularly abundant. Other prominent herbaceous species include the forbs flat-top fragrant-golden-rod, hairy willow-herb, cinnamon fern, and the graminoids cottongrass bulrush, and broad-leaf cattail. Of notable exception to the above generalized description, a section of Wetland 15 was relatively open and was dominated by blue cattail along with sensitive fern, fowl manna-grass, and the exotic forb creeping butter-cup.

In contrast to the other wetland habitats within the Project area, Wetland 1 is best characterized as a graminoid slope marsh under the Canadian Wetland Classification System. Slope marshes occupy wet seepage areas where groundwater discharges and are generally found on lower elevation slopes (Warner and Rubec 1997). Wetland 1 is a tiny (<0.002 ha) seepage area located towards the bottom of the steep slope at the northern end the Property and is dominated by graminoids, including soft rush, yellow sedge, and water sedge, as well as the non-native forb colt's foot. Although marshes are typically inundated periodically by standing or slow flowing water, the sloping nature of Wetland 1 and the small size of the seeps which feed it are unlikely to result in complete inundation at any time of year.

Landscape Position, Landform, and Water Flow Path

Designations for landscape position, landform, and water flow path were assigned to each of the wetlands following guidelines outlined by Tiner (2003). Although wetlands were typically assigned their dominant condition, multiple designations were maintained for those comprised of more than one major landscape position, landform, and / or water flow path (Table 5.3).

Landscape position represents the relationship between wetlands and waterbodies / watercourses. Two wetland landscape positions were identified in the Project area: terrene and lotic (Table 5.3). Wetlands 7, 13, and 14 are considered to have a lotic landscape position because they are found along watercourses and are periodically flooded at least during high discharge periods. The remaining wetlands have been designated a terrene landscape position. Terrene wetlands may be either isolated or headwater wetlands, fragments of former isolated or headwater wetlands that are now connected to downslope wetlands via drainage ditches, and wetlands that are on broad, flat terrain cut through by stream but where overbank flooding does not occur (*i.e.*, hydrologically decoupled from streams) (Tiner, 2008). Although Wetlands 6 and 18 are adjacent to watercourses, they are classified here as having a terrene landscape position because they are not subject to overbank flooding by these features.

Landform is the physical form of a wetland or the predominant land mass upon which it occurs. Two wetland landforms were recognized within the Project area: slope and basin (Table 5.3).

Wetlands which occur on slopes of >2% are considered to have a “slope” landform. This landform type represents the majority of wetlands within the Project area (Wetlands 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 14, 17, 19, and parts of 13, 15, and 18), a reflection of its location on a large hill. The basin landform designation is given to those wetlands which occur on slopes of <2% and that are in distinct depressions that are primarily formed by the surrounding upland habitat (Wetlands 4, 8, 12, 16, and parts of 13, 15, and 18).

Water flow paths reflect hydrological relationships among wetlands as well as watercourses and / or waterbodies and are typically based on surface water connections because these are more readily identified than groundwater linkages. Four types of water flow paths were identified for wetlands within the Project area: isolated, outflow, throughflow, and artificial throughflow (Table 5.3). Additionally, groundwater flow paths were identified where obvious, and include inflow and outflow designations. Wetlands 1, 2, 4, 8, 9, 10, 11, 12, 15, 16, and 17 are considered to be “isolated” from a surface water perspective. Isolated wetlands are essentially closed (“geographically isolated”) depressions or flats where water comes from direct precipitation, localized surface water runoff, and/or ground water discharge. From the surface water perspective, these wetlands are “isolated” from other wetlands since they lack an apparent surface water connection. Isolated wetlands may, however, be subject to overflow during extreme precipitation or snowmelt events, and some evidence of overflow channelization was observed for several wetlands within the Project Area (*e.g.*, Wetlands 3, 10, and 11). Isolated wetlands may also be hydrologically linked to other wetlands and waterbodies via groundwater (Tiner 2008) and evidence of groundwater connectivity was observed amongst Wetlands 2 & 3, 11 & 12, and 9 &10. In contrast to isolated wetlands, those with a “throughflow” system have surface water that flows through them, as may be promoted by the presence of a watercourse or another type of wetland above and below them. Wetlands 7, 13, and 14 are positioned along watercourses and are therefore throughflow systems. In addition, Wetlands 3 and 5 have anthropogenic channels (*i.e.*, ditches) dug out through their extent and are therefore considered here to have “artificial throughflow” water flow paths. However, in the absence of these human alterations, these wetlands would likely have had an “isolated” water flow path. Wetlands 6, 18, and 19 are considered to have “outflow” water flow pathways because they lack surface inflow but have water leaving them and moving downstream via a watercourses.

Wetland Functions

Data collected during the wetland assessments was used to evaluate their importance for providing a suite of key hydrogeomorphological and wildlife-related functions. The identification and evaluation of key functions follows guidelines outlined by NovaWET (Tiner 2010) but is supplemented with additional information. Functions which are considered by the evaluation included surface water detention, coastal storm surge detention, streamflow maintenance, nutrient transformation, carbon sequestration, sediment and other particulate retention, shoreline stabilization, fish habitat , waterfowl and waterbird habitat, other wildlife habitat, and socioeconomic value. Designations of “high”, “moderate”, “low”, or “negligible” were assigned to each wetland to represent their expected relative potential for providing the given functions. These rankings were assigned using predicted relationships among their landscape position,

landform, water flow pathways, and other structural attributes, as outlined by Tiner (2010), but have been modified based on additional data collected during field surveys and desktop analyses of the Project area. Although the small size of many of the wetlands within the Project area would impose important limitations with respect to their capacity to provide the aforementioned functions, their area this has not been directly factored into the interpretations provided here.

Table 5.3 Potential wetland functions

Wetland ID	Surface Water Detention	Coastal Storm Surge Detention	Streamflow Maintenance	Nutrient Transformation	Carbon Sequestration	Sediment and Other Particulate Retention	Shoreline Stabilization	Fish Habitat	Waterfowl and Waterbird Habitat	Other Wildlife Habitat	Socioeconomic Value
1	Low	Negligible	Low	Moderate	Low	Low	Negligible	Negligible	Negligible	Moderate	Low
2	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
3	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	High	Low
4	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Low	High	Low
5	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	High	Low
6	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	Low	Negligible	Moderate	Low
7	Low - Moderate	Negligible	Moderate	Moderate - High	Moderate	Moderate	High	Low	Negligible	Moderate	Low
8	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Low	Moderate	Low
9	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
10	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
11	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
12	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
13	Moderate - High	Negligible	Moderate	Moderate - High	Moderate	High	High	Low	Low	Moderate	Low
14	Low - Moderate	Negligible	Moderate	Moderate - High	Moderate	High	High	Low	Negligible	Moderate	Low
15	Low	Negligible	Low	Moderate - High	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
16	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Low	Moderate	Low
17	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Negligible	Negligible	Moderate	Low
18	Low	Negligible	Moderate	Moderate	Moderate	Low	Moderate	Low	Negligible	Moderate	Low
19	Low	Negligible	Low	Moderate	Moderate	Low	Negligible	Low	Negligible	Moderate	Low

Surface Water Detention

Few of the wetlands within the Project area have much potential for providing surface water detention. In particular, the sloped nature of many of the wetlands prevents them from retaining surface water to any significant degree (Tiner 2010). Although several of the wetlands contain flat basins which could act to detain surface water, most of their water is likely groundwater related and they are unlikely to have much standing water on them at any time of the season (little to no surface water was observed within the wetlands during the site visits). Of exception, Wetland 13 is considered to have “moderate” potential to contribute to surface water detention because it contains a basin component and is fed (in part) by an intermittent stream. Wetlands 7 and 14 are rated as having “low – moderate” potential for surface water detention because, although they occur on slopes, they are regularly inundated by overflow from watercourses which flow through them.

Coastal Storm Surge Detention

None of the wetlands are located along the coastline of the Northumberland Strait and they therefore do not contribute to the function of coastal storm surge detention.

Streamflow Maintenance

Wetlands have potential to moderate stream flow by slowing the flow of water and by temporarily storing surface water. Headwater wetlands (those along first and second order streams) that are not ditched are generally considered to have high potential for providing streamflow maintenance (Tiner 2010). Although Wetlands 6, 7, 13, 14, and 18 are headwater wetlands, they are considered here to have moderate potential for streamflow maintenance because the watercourses along which they are located quickly empty into the Northumberland Strait, thereby limiting their potential to provide this function.

Nutrient Transformation

Many wetlands have high potential to provide important biogeochemical processes by way of nutrient transformation. For example, under low-oxygen (*i.e.*, anaerobic) conditions they convert certain elements (*e.g.*, nitrogen, iron, manganese, sulfur, and carbon) from their oxidized to reduced forms, and in doing so contribute to important nutrient transformation functions, such as denitrification (Tiner 2005). However, because many of the wetlands found within the Project area are likely to be only seasonally saturated (*i.e.*, high water tables for extended periods during the year, usually from late fall into spring, opposed to permanently flooded) and / or temporarily flooded (*i.e.*, inundated for brief periods usually at the beginning of the growing season as opposed to seasonally or semipermanently flooded), their potential to perform important nutrient transformation functions are likely to be lessened (Tiner 2010). As such, most wetlands within the Project area are considered to have “moderate” potential to provide this function, while those which are expected to be saturated and / or flooded for greater periods of time (*i.e.*, Wetlands 7, 13, 14, and 15) are considered to have “moderate - high” potential.

Although certain wetland plants, (*e.g.*, alders) have nitrogen –fixation capabilities which act to convert nitrogen gas to a form that may be taken up by plants or transported by water, such species were not considered dominants within any of the wetlands.

Carbon Sequestration

Wetlands can act as both sinks and sources for green house gases. Peatlands such as bogs and fens can be important carbon sinks by storing large volumes of organic matter in the form of peat. Marshes and swamps that remain saturated throughout the year also tend to accumulate peat and act as carbon sinks. Wetlands with large seasonal water level fluctuations are typically poor at sequestering carbon since exposure of the substrate to air during draw down periods promotes rapid decomposition of organic matter deposited in the sediment. Observations made during site visits indicate that because most of the swamps have considerably large seasonal water fluctuations and minimal peat development they do not have high value in terms of carbon sequestration. However, with the exception of Wetland 1 (a slope marsh), all wetlands on the Property are either dominated by woody plants or are regenerating with such (following tree harvesting activities) and this characteristic would contribute to their potential to sequester carbon. As such, most of the wetlands are considered to have “moderate” potential to provide this function.

Sediment and Other Particulate Retention

Some wetlands are quite effective at removing sediments and other particulate matter from surface water. The ability of a wetland to perform this function is dependent on various factors, including the degree of flow channelization through the wetland. In general, seasonally flooded wetlands that are located on the banks of waterbodies or watercourses are considered to have high value for retention of sediments and other particulate matter whereas those that are only temporarily flooded are regarded as having moderate value for performing this function (Tiner 2010). Wetlands 13 and 14 are considered to have relatively “high” value for retaining sediment and other particulate matter because they are lotic systems, were observed to have some braided channeling, and because at significant amounts of sediment were distributed over their surface at the time of visitation (the presence of which reflects the effect of upstream gravel roads and other anthropogenic features). Wetland 7 is considered to have “moderate” potential for performing this function on account of being a lotic system.

Shoreline Stabilization

Some wetlands provide effective protection from shoreline erosion by absorbing energy from waves, tides and flowing water without experiencing extensive damage to vegetation or wetland substrates. Wetlands that are located on the shores of waterbodies or watercourses are generally considered to have high value in this regard whereas headwater wetlands are regarded as having moderate value (Tiner 2010). Following this rationale, Wetlands 7, 13, and 14 are considered to have relatively “high” potential to contribute to shoreline stabilization whereas Wetlands 6 and 18 are regarded as having “moderate” potential.

Fish Habitat

The value of wetlands for providing fish habitat is generally related to their connectivity with deepwater habitats. As such, wetlands are generally considered to have high value for fish if they provide spawning/nursery habitat or refuge for native fish species in adjacent estuaries, lakes, rivers or streams (Tiner 2010). Additionally, wetlands may intermittently support populations of certain fish species as a result of colonization during flood events and some isolated, but permanently flooded, wetlands can support native populations of species such as minnows. Additionally, those that do not directly support fish may still be important for maintaining their habitat by improving the quality of downstream water - for example, by providing shade to maintain water temperature in adjacent water bodies or watercourses. Wetlands that are isolated and are not permanently flooded do not generally support fish populations.

The value of wetlands for providing fish habitat was evaluated by assessing the degree to which they were contiguous with a permanent waterbody or watercourse which was either known or expected to be capable of supporting native fish species. The majority of wetlands within the Project area are isolated from waterbodies or watercourses and are therefore considered to have negligible value with regards to fish habitat. Although Wetlands 6, 7, 13, 14, 18, and 19 are located adjacent to watercourses, barriers to fish passage along these features prevent them from providing habitat for fish. However, watercourses within the Project area feed directly into the Northumberland Strait (which is important habitat for fish) and the wetlands along them provide some benefits in terms of their water quality. As such, wetlands situated along watercourses are considered to have “Low” value for fish habitat.

Waterfowl and Waterbird Habitat

The ability of wetlands to provide habitat for waterfowl and other water birds varies according to their position relative to waterbodies and watercourses, the presence and character of open water, and the availability of appropriate vegetation for foraging and nesting opportunities. Because of relationships to certain habitat features, certain wetland types (*e.g.*, salt marshes, lentic marshes, lotic river marshes) are generally considered important for waterfowl and other waterbird habitat whereas others have little or no capacity to provide this function (Tiner 2010).

The wetlands of the Project area have minimal potential to provide habitat for waterfowl and other waterbird habitat. Although several of the wetlands were located adjacent to watercourses, these features did not contain sufficient amounts of open water to support waterfowl and / or other waterbirds. Wetland 13 contains an anthropogenic pond and therefore has some capacity to support waterfowl. However, the value of the pond as such is compromised by its small size, lack of fish, and the absence of vegetative cover along its borders. No waterfowl or other species of waterbird were encountered within or in association with wetlands of the Project area during field surveys.

Other Wildlife Habitat

In addition to those wildlife functions previously discussed (*i.e.*, fish, waterfowl, and waterbird habitat), wetlands provide important habitat for a variety of species; including those whose populations are considered either at risk or of conservation concern. Summarized here are the general results of the wildlife surveys conducted within the wetlands. Wetlands which are known to provide habitat for species which are of conservation concern (Wetland 3, 4, and 5) are considered here to have “high” value for wildlife. The remainder of the wetlands are well vegetated and may therefore be considered to have “moderate” value for providing wildlife habitat, as identified by Tiner (2010).

A total of178 plant species were encountered within wetlands of the Project area, including two species of conservation concern, Bebb's sedge and tall hairy groovebur. Bebb’s sedge is considered to “May be at Risk” by NSDNR, is ranked “S1S2” by the ACCDC, and was found within three cut-over swamps of the area: Wetlands 3, 4, and 5. This species is generally associated with open habitats and its presence within the cut-over swamps may have been promoted by the removal of their canopy. Additionally, an infilled area upslope of these swamps was observed to contain gypsum and likely benefits the local population of Bebb’s sedge on the Property by improving soil conditions (this species is associated with alkaline soil conditions). Tall hairy groovebur is considered “Secure” by NSDNR but is given a ranking of “S3” by the ACCDC indicating that it is uncommon within the province. Tall hairy groovebur is a tall perennial herb that is typically associated with thickets, the margins of rich woods, intervals, and slopes (Zinck 1998). On the current Property of interest it was encountered within Wetland 5 - a cut-over swamp. Table G-1 in Appendix G provides information on the vascular plants found within each of the wetlands during field surveys and information on their population statuses.

A total of 16 bird species were encountered within wetlands of the Project area during field surveys. None of the birds encountered within or in association with these wetlands are considered of conservation concern. However, although expected to be utilizing the ecotone formed by the intact and cut-over upland forest areas, there is some potential for the olive-sided flycatcher to utilize nearby forested wetlands (*e.g.*, Wetland 17 and 19). Table G-2 in Appendix G provides information on the identities of birds observed in association with specific wetlands of the Project area.

Three herpetiles were encountered within wetlands of the Project area, including green frog, northern spring peeper, and wood frog. None of these species are considered of conservation concern within the province. Table G-3 in Appendix G provides information on the identities of herpetiles observed in association with wetlands of the Project area.

Evidence of six mammals were encountered within wetlands of the Project area, including American red squirrel, black bear, bobcat, eastern chipmunk, short-tailed shrew, and white-tailed deer. None of these species are considered of conservation concern within the province. Table G-3 in Appendix G provides information on the identities of mammals observed in association with wetlands of the Project area.

Socioeconomic Value

The wetlands have little socio-economic value. Apart from several of the wetlands having been recently subject to forest management activities and subject to other anthropogenic disturbances (*e.g.*, ditching) there is no evidence to indicate that they are currently being used for recreational, agricultural, cultural, or business purposes. None of the wetlands are part of any protected area such as a national or provincial park, national wildlife area, federal migratory bird sanctuary, ecological reserve, provincial wildlife management area, wildlife refuge, or game sanctuary.

5.5.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The Project has the potential to result in the complete or potential loss of many of the wetlands located within the Project area. However, of the 19 wetlands found on the property, seven are located either completely or partly inside the watercourse or boundary buffers. As such, direct impacts to these wetlands are to be avoided or minimized. Direct disturbance of Wetlands 3, 4, and 5 will avoided and a 50 m buffer will be respected around these wetlands to avoid impacts to their populations of Bebb's sedge over the 10 year development plan. If after that time, quarry development is proposed within 50 m of these wetlands appropriate approvals will be sought from NSE and NS DNR. No wetlands are located within or immediately down slope of the area encompassed by the proposed ten year quarry extension plan. ,Wetland 15 will be separated from quarry activities during the 10 year quarry extension plan to minimize potential influences of downslope mining on its hydrological character during this period (i.e., which could result from increased ground water flow and a reduction in lower slope water retention). Based on the aforementioned avoidance efforts, wetland habitat is not expected to be affected by Project activities during the ten year quarry extension period.

In Nova Scotia, wetlands are protected under the Activities Designation Regulations made pursuant to the provincial *Environment Act.* Any loss of wetland habitat either through direct infilling or indirectly through alteration of wetland hydrology requires preparation of a wetland evaluation to establish the functional attributes of the wetland and wetland alteration approval. If NSE grants permission to infill or alter the hydrology of any wetland in the Project area, it will be necessary to develop a wetland habitat compensation plan to replace the wetland functions lost as a result of damage to or loss of the wetland.

Wetlands may be indirectly influenced by quarry activities through changes in hydrology, nutrients, or sediment input. However, mitigative measures will be taken during Project activities to prevent cutting off any watercourses that flow into to the wetlands or see them become repositories of significantly increased water flow, nutrients, or sediments. This will be accomplished through the use of flow retention structures and energy dissipation measures. Because downslope mining could increase ground water flow and reduce lower slope water retention, thereby increasing upslope wetland drainage rates and volume, buffers will also be established around wetlands, where applicable.

In summary, assuming the application of proposed mitigation measures, including maintaining existing site drainage conditions and providing habitat compensation for loss of wetland functions, significant Project-related effects on net wetland function are not likely to occur.

5.6 GROUNDWATER RESOURCES

Groundwater is an integral component of the hydrologic cycle, originating from the infiltration of rain, snowmelt, and/or surface water into the sub-surface. Infiltrating water fills void space within soil and/or rock. The top of the saturated zone, where all of the void space is filled with water, is called the water table. The water table intersects the ground surface at lakes, streams and springs. At these locations, an interaction between groundwater and surface water occurs. Groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where it exits the sub-surface as springs, streams and lakes. There is a dynamic interaction between groundwater and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. In some cases, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

An aquifer is a geological formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. The yield of dug or drilled water wells can vary greatly, depending on the hydraulic properties of the aquifer in which the well is constructed. Natural groundwater quality is directly influenced by the geochemical composition of the aquifer materials through which it passes, and the time the water resides within that material.

The groundwater resource is a VEC because it provides potable water to approximately half of the total population of Nova Scotia, including almost all unserviced rural residences.

Spatial boundaries for the assessment of groundwater resources are based on a combination of aquifer hydraulic properties, expected groundwater flow directions, and the distance between the proposed quarry extension and wells that may be affected by quarry activities. For example, the area of influence or capture area of a typical low-yield domestic water well is usually less than 100 m, and generally in a direction hydraulically upgradient of the well. A quarry that is excavated below the water table behaves in a similar manner to a large well, with groundwater draining into the quarry and influencing water levels in the area immediately surrounding the exaction. The size of the zone of influence is proportional to the size of the quarry. In this case, the Northumberland Rock extension will not be excavated below the water table.

Project-related contamination (*e.g.* petroleum hydrocarbon spills from machinery, spills related to blasting chemical storage and/or handling, etc.) could theoretically impact groundwater at the quarry site and downgradient of the quarry site, thereby impacting the quality of water in downgradient potable supply wells. However, it is anticipated that most of the potential hazards should be contained within the quarry dewatering system. The potential effects of accidental spills are considered for all wells located hydraulically down gradient of the proposed quarry extension. In general, the extent of the area potentially affected is dependent on the size and type of release, surface drainage and surficial geology and the bedrock hydrogeology. In areas

with measureable surficial cover, effects can extend 200 m in sand and gravel and up to 50 m in till overburden. In areas of exposed bedrock, such as occur at the base of major rock quarries, effects may be measured at several 100s of meters down gradient of a release.

Vibration damage to a drilled or dug well is generally a function of the distance between the energy source and the receptor well, and the seismic properties of the intervening aquifer materials. With respect to rock type, risk of water well damage is greater for fractured crystalline bedrock than for overburden wells or soft bedrock (*e.g.* sandstone or shale) wells. To our knowledge, no specific blast damage research has been done to date on fractured crystalline bedrock in Nova Scotia. Studies of blasting effects on wells in softer overburden, sandstone and shale bedrock (Phillip R. Berger & Associates Ltd., 1983; Vogwill, 1979) suggest no measurable effects beyond 200 m. Based on Stantec's professional experience, the risk from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 m to 200 m, and minimal beyond 200 m. The most common reported effect is temporary siltation or discoloration of water. Loss of well yield or well collapse is rare, with most well damage cases attributed to blasting tending to occur within 30 m of the blast site, and typically involved unstable or very low yield wells. Vibration effects caused by blasting are conservatively considered for drilled wells within 800 m of the proposed quarry extension (*i.e.* the minimum distance from structures allowed for blasting without owner permission specified by the NSE Pit and Quarry Guidelines, 1999).

5.6.1 Description of Existing Conditions

The following discussion of local groundwater resources and hydrogeology is based on a desktop study including a review of relevant geological maps and records in the NS Well Logs Database (2010). A field study to identify well types and to confirm the locations of properties with water supply wells was not conducted for this EA. This investigation did not include any water well inspection, groundwater sampling and analysis or groundwater depth measurements, and is intended to provide a conceptual description of expected local groundwater conditions.

Project Location, Topography and Drainage

The proposed quarry extension is situated approximately 1.75 km southwest of the community of Georgeville, west of Highway 337 and immediately east of the existing Northumberland Rock quarry (Figure 2.1).

The site is located in the Pictou-Antigonish Highlands physiographic region of the Avalon Uplands, along the Northumberland Strait shoreline. Ground elevations in the project area range from approximately 0 m at the shoreline to 96 m above sea level at the most inland edge of the site. The project area slopes downward to the northwest towards the Northumberland Strait shoreline, and the existing quarry site.

The nearest water courses include MacNeils Brook, located approximately 300 m southwest of the existing quarry site, and an unnamed water course located approximately 400 m northeast of the existing quarry site. Both MacNeils Brook and the unnamed water course drain generally

to the northwest, and discharge to the Northumberland Strait (Figure 2.1). A number of wetlands are also identified on the Project Site (see discussion in Section 5.5).

Surficial Geology

The surficial geology in the Project area (Figure 5.2) consists primarily of glacially scoured bedrock overlain by a thin, discontinuous veneer of glacial till. A thicker deposit of till (Eatonville-Lawrencetown Till) is present on the southeast side of the proposed quarry extension area, and is described generally as silty sand till, derived from both local and distal bedrock sources (Stea *et al*., 1992).

Bedrock Geology

Based on the available bedrock geology mapping for the area (Keppie, 2000), the Project Site is situated over the Greendale Complex, consisting of Neoproterozoic (Precambrian) aged diorite-gabbro (Figure 5.3). The Greendale Complex is surrounded by the Neoproterozoic aged Morar Brook and Chisholm Brook Formations. The Morar Brook Formation consists of mudstone, minor wacke, chert and limestone and the Chisholm Brook Formation consists of tholeiltic and calcalkaline mafic flows and tuffs, marble and mudstone. All of these rock types are characterized as very hard, poorly permeable, fractured meta-crystalline bedrock. The Greendale Complex would be expected to hydrogeologically resemble granite.

Groundwater Flow

The proposed quarry extension is situated on a west/northwest sloping parcel of land that extends from elevation 96 m on the southeast corner to sea level along the northwest boundary. Since groundwater in Nova Scotia generally reflects topographic surface, it is anticipated that the groundwater flow is directed west/northwest across the site, towards the Northumberland Strait, under an average horizontal hydraulic gradient of 10%.

Regional groundwater recharge is anticipated to occur both locally and from the highlands (at elevations of 175 m and greater) located 900 m to the southeast of the proposed quarry extension southeast boundary. The depth to the water table in bedrock is anticipated to be on the order of 10 m below grade near the southeast corner of the site, to an elevation approximating or slightly above mean sea level on the northwest site boundary, along the Northumberland Strait shoreline. Local discharge zones and springs may be present along the shoreline and to the northeast, where the unnamed brook is present along a portion of the northeast proposed quarry extension boundary.

In addition, it is anticipated that local perched water table conditions are present in overburden in poorly drained areas (*e.g.* wetland depressions, refer to Figure 5.1 for location of field and NSDNR identified wetlands).

Project Features

- Proposed Quarry Extension Area
- Existing Quarry
- Building/Structure
- Primary Access Road
- Local Road
- Resource Access
- Track/Trial/Abandoned Road
- Watercourse
- Waterbody
- Wetland (NSTDB)
- Wetlands (NSDNR)
- Property Boundary (PID)

Surficial Geology (NSDNR)

- Pre-Quaternary, Bedrock, Bedrock of various types and ages; glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till
- Pre-Quaternary, Residuum, Fragmented rock consisting of angular blocks and finer interstitial debris; overlain by thin, discontinuous veneer of till
- Quaternary, Alluvial Deposits, Gravel, sand, mud; bedded, coarse at base, finer at top, stream channels generally gravelly sand, floodplains sand
- Quaternary, Glaciofluvial Deposits (Kames and Eskers), Gravel, sand and silt, diamicton layers, poorly to well bedded, horizantal to angular beds, faulting and collapse features common
- Quaternary, Glaciofluvial Deposits (Outwash Fans), Gravel and sand; massive to horizontally stratified, coarse to fine gradation within sections and deposits
- Quaternary, Organic Deposits, Sphagnum moss, peat, gyttja, clay
- Quaternary, Silty Till Plain (Ground Moraine), Silty, compact, material derived from both local and distant sources
- Quaternary, Stony Till Plain (Ground Moraine), Stony, sandy matrix, material derived from local bedrock sources

Project No.: 121510482

0 500 1,000 1,500 2,000

Metres

N

Horseshoe Turn Brook
Browns Brook
Georgeville Brook
Georgeville
PID - 01204072
Georgeville Brook
MacNeils Brook
MacDonald Brook
North Lake Stream
Chisholm Brook
Loch Brook
Greendale Loch
Malignant Cove
Malignant Cove Pond
Malignant Cove
Arbuckle Brook

V:\1215\active\121510\xxx\121510482\geomatics\Mapping\MXD\ReportFigures\SurficialGeology.mxd

DATE: June 07, 2011 PREPARED BY: R. Sutcliffe SCALE: 1:35,000	Northumberland Rock Quarry Extension Project **Surficial Geology**	FIGURE NO.: **5.2** Stantec

Project Features

- Proposed Quarry Extension Area
- Existing Quarry
- Building/Structure
- Primary Access Road
- Local Road
- Resource Access
- Track/Trial/Abandoned Road
- Watercourse
- Wetlands (NSDNR)
- Waterbody
- Wetland (NSTDB)
- Property Boundary (PID)

Bedrock Geology (NSDNR)

Devonian - Early Carboniferous
- D-ECH: Horton Group: northern mainland

Silurian
- Beechhill Cove, Ross Brook, French River, McAdam, Moydart and Stonehouse Formations

Ordovician - Silurian
- Bears Brook Formation

Neoproterozic - Cambrian - Ordovician
- Black John, Little Hollow and Ferrona Formations

Neoproterozic - Middle Cambrian
- 3M3M: Malignant Cove and Arbuckle Brook Formations

Neoproterozoic
- 3Gcb: Chisholm Brook Formation
- 3dg: Neoproterozoic diorite - gabbro
- 3Gm: Morar Brook Formation

Project No.: 121510482

0 500 1,000 1,500 2,000

Metres

N

Horseshoe Turn Brook
Browns Brook
Georgeville Brook
Georgeville
PID - 01204072
MacNeils Brook
MacDonald Brook
Chisholm Brook
Malignant Cove
Malignant Cove Pond
Malignant Cove
Arbuckle Brook
North Lake Stream
Loch Brook
Greendale Loch

3Gm
3Gcb
3dg
D-ECH
OSAb
SA
3COl
3MCM

V:\1215\active\121510\xx\121510482\geomatics\Mapping\MXD\ReportFigures\BedrockGeology.mxd

DATE: June 7, 2011 PREPARED BY: R. Sutcliffe SCALE: 1:35,000	Northumberland Rock Quarry Extension Project **Bedrock Geology**	FIGURE NO.: **5.3** Stantec

Groundwater Usage

A water well field survey was not conducted as part of this project. As such, review of available mapping information was conducted to determine the probable locations of water wells within 800 m of the Project area. A search of the Service Nova Scotia and Municipal Relations' Property Online database was also conducted to determine address and property ownership information for the area. The results of this search were used to match well logs from the NS Well Logs Database (2010) for wells constructed between 1940 and 2009, and to determine well construction information for groundwater wells within the project area. A number of individual domestic water supply wells are located within 800 m of the Project area, and are associated with residential dwellings along Highway No. 337. Domestic water supplies in the surrounding area are derived primarily by privately owned drilled and dug wells.

The nearest residential water supply wells, within the 800 m area, are associated with residences northeast of the site along Highway No. 337. One well log was retrieved, NSE Well No. 042208 at 9584 Highway No. 337. The well was reportedly drilled in 2004 as a domestic supply well to a depth of 62.5 m below grade. The well is reported to have a 6.1 m 152 mm diameter well casing, and an air lifted yield of 1.25 Imperial gallons per minute (igpm). The stratigraphy as reported on the well driller's log is approximately 3.4 m of glacial till underlain by bedrock to the completion depth of 62.5 m.

To date, there has been no reported interaction between existing Northumberland Rock quarry activities and local water supply wells. In both current and future quarry operations, it is our understanding that there is to be no excavation of materials below the water table.

To provide a general description of aquifer properties in the vicinity of the project area, a summary of domestic well records for the nearest community of Georgeville (located to the northeast of the project site), is provided in Table 5.4. Only one of the wells could be confirmed to be located within 800 m of the Project area (located approximately 390 m from the Project area); however, it is anticipated that additional domestic supply wells (either drilled or dug type) may be located within 800 m of the Project area due to the presence of several residential dwellings within this distance, particularly to the northeast of the Project area.

Table 5.4 Summary of Domestic Water Well Records for Georgeville, NS

NSE Well No. (Inferred Civic Address of Well)	Well Depth (m)	Overburden Thickness (m)	Casing Length (m)	Estimated Air Lifted Yield (Igpm)	Depth to Static Water (m)	Estimated Distance to Project Site Boundary (m)
042208 (9584 Hwy No. 337, Georgeville)	62.5	3.3	6.1	1.25	-	390 m
731119 (Civic No. Unknown, Georgeville)	59.5	3.7	5.5	0.5	12.2	Unknown
811767 (Civic No. Unknown, Georgeville)	99.1	3.1	6.7	0.2	-	Unknown
901296 (Civic No. Unknown, Georgeville)	61.0	7.6	12.2	1.5	9.1	Unknown
000542 (10002 Hwy No. 337,	85.4	3.7	6.1	0.5	0.3	900 m

Table 5.4 Summary of Domestic Water Well Records for Georgeville, NS

NSE Well No. (Inferred Civic Address of Well)	Well Depth (m)	Overburden Thickness (m)	Casing Length (m)	Estimated Air Lifted Yield (lgpm)	Depth to Static Water (m)	Estimated Distance to Project Site Boundary (m)
Georgeville)						
031560 (142 Xanadu Road, Georgeville)	52.4	0	9.1	7.0	2.7	1,040 m
032645 (Civic No. Unknown, Georgeville)	79.3	1.8	6.1	0.25	-	Unknown
920551 (Civic No. Unknown, Georgeville)	99.1	5.5	6.1	0.5	-	Unknown
920880 (9923 Hwy No. 337, Georgeville)	85.4	6.7	12.2	0.7	15.2	750 m
962770 (Civic No. Unknown, Georgeville)	67.1	7.6	9.8	0.2	6.1	Unknown
011456 (9010 Hwy No. 337, Georgeville)	61.0	4.9	12.2	1.0	-	3,000 m
011981 (169 Oceanside Road, Georgeville)	80.8	6.7	12.2	1.5	9.1	2,860 m
013710 (Lot 2, Hwy No. 337, Georgeville)	86.9	5.8	11.0	0.75	-	3,380 m
Summary Statistics:						
Minimum	52.4	0.1	5.5	0.2	0.3	-
Maximum	99.1	7.6	12.2	7.0	15.2	-
Mean	75.3	4.6	8.9	1.2	7.8	-
Median	79.3	4.9	9.1	0.7	9.1	-
Number	13	13	13	13	7	-

Notes:
1. m = meters; igpm = Imperial gallons per minute
2. Information derived from the NSE Well Logs Database (2009); Inferred civic addresses and distances from proposed quarry operation boundaries obtained from Service Nova Scotia (SNS) Property Online (accessed 2010)

No pumping test information was located through the NSDNR Interactive Groundwater Map (2010) for wells completed in the Greendale Complex, or in the Georgeville area in general. It is anticipated that the transmissivities and sustainable yields will generally be low (mean 1.2 igpm, Table 5.4). Yields within individual wells are anticipated to vary depending on the presence of water bearing fractures within the bedrock unit.

Groundwater Quality

Groundwater quality potential is determined from known water quality characteristics for each hydrostratigraphic unit, including naturally occurring water quality concerns (*e.g.*, hardness, iron, manganese, uranium, salinity, and arsenic).

No existing groundwater quality data is available for wells completed in the Greendale Complex; however, it is anticipated that groundwater chemistry in the Project area would be consistent with known chemistry observed in wells completed in crystalline bedrock in Nova Scotia. Based on five pumping tests of water supply wells completed in granitic bedrock in the Nova Scotia by Stantec, the associated groundwater can generally be described as a soft to moderately hard, neutral to slightly acidic/corrosive sodium-bicarbonate to magnesium-bicarbonate-type water of

low TDS. The water quality from granite typically meets most CCME Canadian Drinking Water Quality Guidelines. The most common local exceedances of the CCME guidelines include iron and manganese, with less common exeeedances in arsenic, uranium and fluoride. For example, based on the five pumping tests, iron concentrations ranged from 25 µg/L to 640 µg/L and greater (typical mean of 340 µg/L), manganese concentrations ranged from 2.3 µg/L to 3.2 µg/L and greater (typical mean of 2.8 mg/L), and hardness ranged from 23.4 mg/L to 83.1 mg/L (mean of 53.3 mg/L). Alkalinity ranges from 32 mg/L to 89 mg/L (mean of 61 mg/L), TDS ranges from 95 mg/L to under 200 mg/L (typical mean of 105 mg/L), and pH ranges from 6.5 to 7.8 (mean of 7.2).

In addition to the naturally-occurring water quality issues described above, common problems reported by well owners with wells completed in granite include: elevated sodium and chloride from road salt application; coliform bacteria from surface sources impacting poorly constructed drilled wells; and low pH water and associated plumbing corrosion. To date, there has been no reported groundwater quality issues related to the existing Northumberland Rock quarry located on the west side of the Project site.

5.6.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The potential environmental effects on surrounding groundwater resources from a quarry operation include: water table lowering close to the quarry high wall; depressurization of downgradient springs; temporary siltation of nearby wells due to intermittent blasting or heavy equipment operation; decrease in well yield due to water table lowering or interception of recharging bedrock fractures; possible water quality deterioration at downgradient well locations from accidental releases of deleterious substances such as petroleum hydrocarbons and nitrate from blasting agents or equipment; and/or, acid drainage production if acid generating bedrock were encountered within the quarry area.

The potential impacts to domestic water wells from the above identified environmental effects are a function of distance, relative location of a well and the quarry with respect to groundwater flow directions, depth of excavation below the water table, intensity and frequency of blasting, aquifer hydraulic and seismic properties, and individual well construction methods.

Groundwater Quantity Effects

In most hard rock quarry operations, overland flow into the open excavation is controlled by perimeter drainage measures. Groundwater inflow from perched sources in overburden and shallow bedrock, and from deeper bedrock fractures typically forms only a small percentage of the total water that enters the quarry. In low permeability bedrock environments, the majority of water discharge from an open pit mine and/or quarry originates from direct rainfall on the active quarry footprint. If the quarry encounters increased groundwater seepage as it expands, water will collect within its lowest point (*e.g.*, a settling pond or sump). Water is lost from the quarry foot print by evaporation and infiltration through the quarry floor. Depending on the quarry floor elevation and the resulting amount of rainfall and groundwater encountered, and the time of

year, dewatering of the proposed quarry extension may be required should there be a significant precipitation event.

Based on a review of available well driller's logs and property information in the vicinity of the Project area, it is anticipated that properties to the northeast and southwest, along Highway No. 337 and private roadways, utilize groundwater from drilled wells to meet domestic potable water demands. Although well driller's logs could not be retrieved for all of the potential residential dwelling along Highway No. 337 and private roadways, for the purpose of this assessment, it has been assumed that all developed residential properties in the area have individual groundwater supply wells to meet potable water needs.

All drilled wells located in the vicinity of the existing quarry are inferred to be hydraulically upgradient to crossgradient of the Project site. At least two wells are located within 800 m of the Project Site, and it is anticipated, based on the presence of additional residential properties within 800 m, that additional wells may also be present within the buffer. Although groundwater quantity effects are not anticipated at these locations; in light of the inferred low well yields, it is recommended that the proponent identify and document all wells within the 800 m buffer by way of a residential well survey, and conduct groundwater sampling and confirm water levels in these wells, in advance of the extension.

Groundwater quantity effects are not anticipated at drilled wells located at distances outside of the 800 m buffer, due to a combination of the distance from the quarry operations and the generally upgradient to cross gradient location of any wells relative to the quarry operations. Stantec also understands that there are no plans in the proposed quarry area to mine below the water table. Consequently, no groundwater quantity effects are anticipated. It is also our understanding that appropriate diversion of surface water run-off and in-pit control of rainfall accumulation with sump pits and controlled overflow will be provided.

Groundwater Quality Effects

No water supplies are known to be present between the proposed operation and the coastline. Consequently, no groundwater resource quality issues are anticipated.

Changes in groundwater quality may occur as a result of excavations in the recharge area of the wells. Potential impacts include: temporary siltation from blasting, contamination of wells with from chemical releases within the quarry area (*e.g.*, petroleum hydrocarbons associated with equipment operation and maintenance, nitrate from blasting operations, and other chemicals).

In areas where sulfide-rich bedrock is present, decreased pH and/or increased dissolved solids from attenuation of acidic drainage may also be a potential impact. Acid rock drainage results from the atmospheric oxidation of sulfide-rich rocks. Earthwork activities around these sulfide-rich rocks can increase their exposure to oxygen and water, thereby increasing their acid generation potential. Not all sulphide-containing rocks end up producing acid drainage. In many cases, rocks contain enough carbonate minerals to buffer the sulphide effect, and in these instances acid rock drainage is not produced.

In Nova Scotia, acid rock drainage is most commonly associated with pyrite-rich slate from the Halifax Formation of the Meguma Group and coal bearing shales. Bedrock underlying the Northumberland Rock and the proposed extension consists of diorite-gabbro associated with the Greendale Complex, and as a result, the potential for acid drainage production in this area is considered to be low. Geological mapping indicates the possible presence of copper, zinc, iron and manganese deposits in the surrounding shales, and copper and zinc mineralization associated with the Greendale Complex (Patterson, 1993). These base minerals are often associated with sulfide-bearing rock. To our knowledge, there were no known reported acid generating rocks encountered within the existing quarry.

Mitigation of Effects

Based on the separation distance between the proposed quarry extension and the nearest water wells (390 m to the nearest confirmed domestic well, and the potential for additional domestic supply wells within 800 m of the Project Site), and the upgradient to cross-gradient location of any groundwater supply wells, the likelihood of a water quality or quantity effect on receptor domestic water supply wells from the proposed quarry operation is considered to be low. However, due to the low reported well yields for wells drilled in the area, it is recommended that the proponent identify and document all wells within the 800 m buffer by way of a residential well survey, and conduct groundwater sampling and confirm water levels in these wells, in advance of the extension to establish baseline conditions.

In the unlikely event of adverse water level lowering, mitigation may involve deepening of the well to increase well yield or provision of additional in-house storage capacity to allow peak water demands to be met. Mitigation of short-term turbidity impacts which may be cause by blasting vibration, though unlikely given the distance to off-site wells, could involve temporary provision of bottled water to impacted residents, or provision of an in-line filter to remove solids. In the unlikely event of persisting long-term degraded water quality, or a well yield loss event (*e.g.*, well collapse), the proponent should replace or repair any water supply well found to be adversely affected by the quarry operation to the satisfaction of the affected well owner.

Monitoring

It is recommended that a groundwater monitoring well be installed northeast of the proposed quarry extension area to determine depth to water table prior to the extension, and to monitor groundwater levels adjacent to the quarry extension as the operation proceeds. Monitor well should be situated between the proposed extension area and the identified domestic wells along Highway No. 337. The monitor well should resemble a typical residential water supply well, and should be incorporated into the existing Northumberland Rock environmental monitoring system. The well should be periodically monitored for water level and groundwater quality parameters.

The existing quarry and surrounding areas should be inspected for sulfide mineralization to confirm anticipated absence of acid production bedrock.

5.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.7.1 Description of the Existing Environment

Georgeville was formerly known as Cape George Parish and was settled by Scottish families around the end of the eighteenth century. Settlers names included Gillis, MacDonald, McInnis, McNeal, and McPherson. The Project area straddles two of the original land grants in the area: the north half was granted to Angus McInnis; the southern half was granted to Donald McInnis. While information on Angus is scanty, we do know that Donald married Margaret McDougall in 1862 and they had a son, Angus, in 1872.While more in-depth research was beyond the scope of this study, there is little doubt that Angus and Donald were related and were most likely brothers. The A.F. Church map (1878) shows many houses in Georgeville but they are all concentrated along the main road. There are no buildings shown along the shores of the property. The 1893 Geological Survey of Canada map shows two buildings within or near the study area. The first building, on the south side of the point, is most likely related to the original Donald McInnis occupation (Figure 2.1). This building falls just outside of the Project area. The second building, just to the north, falls within the Angus McInnis land grant. However, while this building is within the Project area it appears to have been destroyed by the current quarry operations, if not before.

There are no recorded First Nation's archaeological sites within the Borden squares BlCm, BkCm, and BkCn. There are no recorded historic archaeological sites within the Borden squares BlCm, BkCm, and BkCn.

5.7.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

The potential for a site to contain First Nations archaeological resources is generally determined by the presence of resources that the Mi'kmaq people depended upon, such as food and water, as well as proximity to watercourses that were large enough to be used as a transportation route or were used to access such a route. There is a watercourse at the north end of the Project area Stream 2), which seems to originate from a swampy area just to the southeast. The watercourse flows northwest down a relatively steep-sided ravine into the Northumberland Strait. While this watercourse would not have been used for travel, it could have been a source of fresh water for the Mi'kmaq. While there is a low probability that there is an archaeological site around this small stream, a 30 m buffer has been placed around it to protect the stream habitat (15 m on either side) and that should be sufficient to protect any archaeological resources that may be there.

It would appear that the only area with any archaeological potential would be the area along the shore, although the active erosion along the steep banks would probably have negatively impacted any First Nation's resources that were there. Given the lack of exploitable resources within the study area and the high rate of erosion along the banks, the overall potential for First Nation's archaeological resources should be considered low with moderate potential at the mouth of Stream 2.

Given this knowledge, the potential for historic archaeological resources to be within the study area should be considered low.

The background research suggests that the potential for First Nation's archaeological resources to be located within the study area is low, with the exception of the mouth of Stream 2, which is considered to have moderate potential. The watercourse includes a 30 m buffer around it at present, which should be sufficient to protect any archaeological resources that may be there. The potential for historic resources within the study area is considered to be low. Given the results of the background research, it is recommended that the proposed Project proceed as planned without the need for further archaeology.

5.8 ATMOSPERHIC ENVIRONMENT

The Atmospheric Environment examines issues related to potential Project effects on air quality and sound quality.

5.8.1 Description of Existing Conditions

The Project area and Nova Scotia in general, has good air quality due to the combination of maritime climate and relatively small population and industrial bases (NSDOE 1998). Climatic conditions provide good dispersion of air contaminants. The ambient air quality also benefits from the infusion of relatively clean polar and arctic air masses. Occasionally, however, long-range transport of air masses from central Canada or the eastern seaboard may transfer contaminants into the area, causing occasions of poorer air quality.

Ambient air quality is monitored in Nova Scotia with a network of 13 sites, operated by NSE and Environment Canada. Motor vehicles, electrical power generation, pulp and paper processing and oil refining are the major local sources of air pollutants in the province Common air pollutants monitored regularly are SO_2, total particulate matter (TPM), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), particulate matter less than 10 microns in diameter (PM_{10}), carbon monoxide (CO), ground-level ozone (O_3), nitrogen dioxide (NO_2), hydrogen sulphide (H_2S) and total reduced sulphur (TRS). The closest NSE monitoring site to the Project site is located in Port Hawkesbury at the old Post Office. In 2005 and 2006 sulphur dioxide was the only contaminant measured. The annual average for 2005 (based on 10 months of data) was 2.8 ppm and the average for 2006 was also 2.8 ppm (Environment Canada 2008b).

In June of 2009 the Government of Nova Scotia, in collaboration with Environment Canada and other non-government organizations, introduced a new air quality health tool, the Air Quality Health Index (AQHI), in six communities in Nova Scotia, Halifax, Greenwood, Kentville, Sydney, Port Hawkesbury and Pictou. The AQHI measures the current levels of outdoor air pollution and related human health risks using a scale of 1 to 10 representing low to very high risk levels. Three air pollutants are measured in order to calculate the AQHI and include ground-level ozone (O_3), particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) (Government of Nova Scotia 2010).

The Northumberland Rock Quarry is located in a rural setting with little to no industrial development nearby. It is not anticipated that the common air pollutants are exceeded at the quarry location due to the separation distance from any large urban centre. Limited residential development can be found within 1 km of the site.

Ambient air quality in Nova Scotia is regulated by the provincial government. The federal government has set objectives for air quality, which are taken into account by federal agencies in a project review. These objectives form the basis for the air quality regulations of several provinces, including Nova Scotia. The Nova Scotia regulated limits correspond to the upper limit of the Maximum Acceptable category for air quality, which are set under the *Canadian Environmental Protection Act (CEPA)*. These guidelines may have also been used as a reference by provincial or federal regulators. The air quality guidelines of tolerable, acceptable, and desirable, as defined under *CEPA*, will be used in the evaluation of significance. The maximum tolerable level denotes a concentration beyond which appropriate action is required to protect the health of the general population. The maximum acceptable level is intended to provide protection against effects on soil, water, vegetation, visibility, and human wellbeing. The maximum desirable level is the long-term goal for air quality.

Sound Quality

The sound quality surrounding the Project is of a concern due to the potential for Project related noise emissions to have an effect on sensitive receptors. Noise is defined as unwanted sound and is measured in the same way as any sound, as a sound pressure level (SPL) in decibels. To reflect the sensitivity of the human ear across the audio spectrum, SPL readings are sometimes given in what is termed as the “A” weighted scale and denoted as dB_A.

Humans are exposed to a broad range of sound pressure levels. A level of 0 dB_A is the least perceptible sound by a human. A change in 3 dB_A represents a physical doubling of the SPL but is barely perceptible as a change, whereas most people clearly notice a change of 5 dB_A and perceive a change of 10 dB_A as a doubling of the sound level. Typically, conversation occurs in the range of 50 to 60 dB_A. Loud equipment and trucks passing on a busy road are responsible for noise levels above 85 dB_A. Very quiet environments, such as a still night, typically fall below 40 dB_A.

The sound quality in an area can be degraded by the presence of unwanted sound (*i.e.,* noise). For the most part noise is a nuisance that detracts from the enjoyment of a quiet acoustic environment. In severe cases noise can cause sleep disturbance, anxiety and consequent health effects. It can also disturb wildlife and wildlife habitat.

The existing ambient sound levels in and surrounding the Project area would be characteristic of the existing quarry activities and natural background sounds (*e.g.,* wind).

Boundaries

The spatial boundary for the assessment of the Atmospheric Environment is the approximate zone of influence affected by the quarrying activities. This zone lies within close proximity to the community of Georgeville, Nova Scotia.

Temporal boundaries for the assessment of the Atmospheric Environment have been developed in consideration of those time periods during which Project air and sound emissions have the potential to degrade ambient air and sound quality. In general, emissions that could affect air and sound quality will be relatively short-term from such operations as blasting and crushing; however, emissions from such sources as vehicles and construction equipment will be fairly regular.

Other temporal considerations for atmospheric emissions include variations in meteorological conditions, which are related to the capacity for contaminant and sound transport. Sensitivity of receptors to certain atmospheric contaminants (*e.g.,* dust) may also vary by season (*i.e.,* more sensitive in warm weather with increased outdoor activities).

5.8.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Air Quality

Quarrying activities can generate dust (*i.e.,* particulate emissions) which has the potential to be transported offsite. There are a variety of activities that can lead to the generation of particulate matter on the construction site. The primary potential sources of TSP include:

- Exhaust gas emissions due to incomplete combustion from diesel compression engine;
- Road dust;
- Wind erosion on storage piles;
- Removal of overburden;
- Blasting activities;
- Crushing operations;
- Material handling;
- Material transport; and
- Truck loading / truck unloading.

Some of the more pertinent contributors are discussed in detail in the following paragraphs:

- Blasting can result in a concentrated plume of particulate matter, but the volume and time duration of such plumes are constrained. Even when blasts result in a visible plume, the contribution to 24-hour averages, as in the Air Quality Regulations, will be negligible. Much of the material in the initial plume is larger than the aerodynamic diameter of particles that can remain suspended in the air, and deposit within a relatively short distance (*e.g.,* 100 m) of the blast site.

- Crushing is a mineral extracting operation that involves the generation of particulate emissions. Uncontrolled processing operations like these can produce nuisance problems and can have an effect upon attainment of ambient particulate standards.
- Material handling activities can result in the generation of particulate matter primarily through the vertical drop of material movement. As the fine material passes through the air, the finest material may become windblown and travel downwind.
- Storage piles and exposed areas are often left uncovered due to the need for frequent material transfer, which can lead to considerable dust generation. Dust emissions can take place during several points in the storage cycle, including material loading onto the pile, disturbances by strong wind currents, and removing loads from the pile. The potential drift distance of particles caused by wind is determined by the initial injection height of the particle, the terminal settling velocity of the particle, and the degree of atmospheric turbulence.
- Particulate emissions can occur whenever vehicles travel over both paved and unpaved surfaces. Particulate emissions from paved roads are caused by direct emissions from vehicles such as exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. Resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface.
- Although there are also emissions of combustion gases and products of incomplete combustion from the exhaust of the on-site vehicles and equipment, these are considered nominal.

Efforts to minimize the generation of dust at the site include covering work and laydown areas with blasted materials, and covering stockpiled topsoil with seed and hay. Fugitive dust emissions will be controlled as necessary with the application of water obtained from the quarry floor with the use of a water truck. Monitoring of particulate emissions (dust) will be conducted at the request of NSE.

Dust generated by truck movement will be minimized by speed control, proper truck loading, application of water for dust suppression, proper construction of on-site roads, and/or other means as required by NSE. Details of any required monitoring will be included in the Industrial Approval amendment application.

Exhausts emissions from equipment and vehicles will be mitigated by ensuring vehicles are maintained in good working order to ensure efficient operation and minimization of emissions. Consideration will be given to methods to reduce idling, as feasible.

Sound Quality

Quarrying activities will produce noise from equipment operation and blasting. Approximately 2 buildings are located within 800 m of the Project property.

Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry as permitted by NSE (Approval No. 96-032), in accordance with the Pit and Quarry Guidelines (NSE 1999), with a frequency similar to past operations at

the site and during daytime hours only. Blasting will be conducted in accordance with the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). It is understood that additional blast monitoring activities and/or reporting may be required by NSE.

Efforts to minimize sound emissions related to the operation of equipment include the use of mufflers on all engines and vehicles and adhering to strict maintenance policies. The scheduling of any potential noisy activities as well should be done so during daytime hours.

As per the requirements of the current operating Industrial Approval and standard provincial guidelines, sound levels from the operation in the extension area will be maintained at a level not to exceed by the provincial guidelines as stated in Section 2.5. Sound monitoring will be conducted at the request of NSE. Details of any required monitoring will be included in the Industrial Approval application.

Summary

The air and sound quality impacts related to the extension of the Northumberland Rock Quarry can be controlled with standard mitigation practices and therefore the Project is not likely to have a significant adverse effect on the Atmospheric Environment.

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

The existing Northumberland Rock Quarry is located in Georgeville, Antigonish County, Nova Scotia. The quarry property is in the Municipality of the County of Antigonish. The quarry and proposed extension area are situated in a rural setting. Approximately one residence is located within 800 m of the existing quarry site. This residence is also located within 800 m of the proposed Project (*i.e.*, quarry extension) along with an additional six buildings (Figure2.1). The population in the general area (*i.e.*, Antigonish County) is 18,836 (Statistics Canada 2006). The population in this area has decreased by 3.8% between 2001 and 2006. The employment rate in the County is 59.5% and the unemployment rate is 9.5% (Statistics Canada 2006). Over half of the experienced labour force consists of sales and service occupations (23%); trades, transport and equipment operators and related occupations (16%); and business, finance and administration occupations (14%). Occupations unique to the primary industry are the County's fifth largest employment category (10%) (Statistics Canada, 2006).

The closest town to the Project is Georgeville, which is located in Census Subdivision A of Antigonish. Between 2001 and 2006, the subdivision's population increased 0.4% to 7,730 residents (Statistics Canada 2006). The employment rate in the region is 62% and the unemployment rate is 9.4%. The labour force consists of sales and service occupations (18%);

trades, transport and equipment operators and related occupations (17%); and occupations in social science, education, government service and religion (15%).

The existing quarry currently employs a minimum of five people year-round. The number of employees increases to 10 during aggregate production. Drilling and blasting activities require additional resources; these activities are sub-contracted to a professional blasting company. Transporting materials from the quarry also involves additional resources and is typically arranged through the customers. Hauling activity can vary according to market demand, but an average of 150 truck-loads of aggregates is transported from the quarry per day. The quarried material is typically used for local construction projects, such as road building and municipal, residential, and commercial developments.

Land Use

There are a number of current land uses within 800 m of the Project site including other pits and quarries and residential areas. These land uses are not expected to interfere with or be interfered by the extension of the Project. The parcel on which the proposed quarry extension will be situated is currently owned by the Proponent.

The quarry property is not located within the boundaries of any of the Eastern District Planning Commission's (EDPC) designated Plan Areas for Antigonish County and is therefore not subject to any municipal zoning requirements.

Mining

A review of the NSDNR Abandoned Mine Openings Database indicates that there are no mine shafts within the 800 m radius of the boundaries of the Project property. The nearest two mine shafts are 2 km southeast and 2.4 km northeast of the proposed quarry. These shafts are located in the following areas:

- Georgeville Brook (Gold); and
- Greendale (Silver).

Agriculture

Intensive agriculture operations have not been identified in the region within and surrounding the Project area

Forestry

The Project lands have been used for timber harvesting in the past.

Transportation

Northumberland Rock Quarry is located along the Nova Scotia Route 337. The existing quarry operation is accessed via a private road. This private road will continue to provide access to the proposed quarry extension area.

The average number of trucks hauling aggregates from the extended quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry. Truck traffic could increase, for a short period, if a large aggregate supply contract were awarded.

A transportation assessment was not conducted in support of this environmental registration. Such a study was not deemed necessary given that the roads surrounding the Project property are in good repair and the Project is not anticipated to result in any significant increase in the volume of truck traffic on public roads compared to current levels.

Recreation and Tourism

There are no recreational or tourism sites within 800 m of the proposed Project boundary. Malignant Cove beach is the closest site located approximately 5 km from the Project property boundary. Livingstone Cove beach is located approximately 8.5 km from the proposed property boundary. Cape George Day Park is located 10 km from the property boundary and provides walking and hiking trails, birds and wildlife and Antigonish North Shore Lookoffs. As well, the Lismore to Pomquet Harbour kayak route travels along the Northumberland Strait to St. Georges Bay.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality. Air quality is addressed in Section 5.8.

5.9.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

Population and Employment

The quarry produces valuable products that support development and infrastructure, and the growth of the region's economy. The direct and indirect employment associated with current operation of Northumberland Rock Quarry may be considered a beneficial to the regional economy. Employment levels at the quarry are not anticipated to change as a result of the Project. Project-related employment effects may therefore be considered neutral.

Extension of the Northumberland Rock Quarry to allow for continued operation will result in an overall positive effect on the regional economy. The availability of additional local supply to the market place should encourage a more stable price for aggregate. In some cases (*i.e.,* markets in close proximity to quarries) the overall price for aggregates will be lower since cost of

aggregate largely reflects the distance it has to be hauled. This, in turn, can significantly reduce costs of construction, which, in the case of public infrastructure such as highways, communities, public works agencies, and taxpayers, should result in financial benefits (NSDNR 2006).

Land Use

Due to the existing industrial activity in the vicinity of the Project area (*i.e.,* the Northumberland Rock Quarry and adjacent quarries and the distance of the proposed Project from residences, impacts on existing and future adjacent land uses are not expected. All activities at the existing quarry and the proposed extension site will be conducted in accordance with the Pit and Quarry Guidelines and all setback distances (or waiver requirements) specified in the Guidelines will be maintained. Mitigation and monitoring measures to control potential nuisances associated with quary operations (e.g., dust and noise) are addressed in Section 5.8 and other sections of this Registration and will be stipulated in conditions to the environmental assessment and Part V (Industrial) approvals issues by NSE.

Transportation

The Project is not anticipated to result in a significant increase in truck traffic on public roads above that associated with the existing Northumberland Rock Quarry operation. Future hauling practices will remain consistent with current practices.

Recreation and Tourism

The Project is not anticipated to interfere with local recreational and tourism sites.

Human Health

Human health related issues pertaining to air quality are discussed in Section 5.8. The Project is not expected to result in any significant impacts with respect to the safety of travelers, as it is not anticipated to meaningfully affect traffic on public roads. The health and safety of nearby residences is not expected to be affected by the Project.

In summary, assuming effective application of mitigative measures (*e.g.,* Pit and Quarry Guidelines, dust suppression) significant adverse Project-related effects on the socio-economic environment is not likely to occur. Continued operation of the quarry will result in economic benefits, including ongoing employment and business opportunities.

5.10 OTHER UNDERTAKINGS IN THE AREA

5.10.1 Description of the Existing Environment

There is one other pit and/or quarry located in the immediate vicinity of the proposed quarry site. As the proposed extension does not include an increase in production, and assuming the

effective application of mitigative measures, significant adverse Project-related effects regarding other undertakings in the area (e.g., cumulative environmental effects) are not likely to occur.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Activities associated with the proposed quarry extension and operation will be conducted in accordance with terms and conditions of the existing Industrial Approval for Alva's existing quarry operation, as well as future amendments to the Approval, the Environmental Assessment Approval and the Pit and Quarry Guidelines. Environmental effects of the quarry extension will include the loss of terrestrial habitat (including migratory bird habitat) within the proposed quarry extension area for the period of time prior to quarry reclamation and revegetation. There were three watercourse identified in the study area. Stream 1 flows adjacent to the existing quarry road into the Northumberland Strait; Stream 2 flows from a wetland into the Northumberland Strait; and Stream 3 flows into Stream 1. There were 19 wetlands identified within the study area based on a desktop assessment of wetland mapping from NSDNR and field verification.

It is unlikely that watercourses and wetlands will be approached by Project activities in the near future of the development of the quarry extension. However, if avoidance of watercourses and wetlands is not possible in the future, approval to alter these habitats must be granted under the Nova Scotia Activities Designation Regulation and habitat compensation provided to ensure no net loss of these habitats.

Although groundwater quantity effects are not anticipated, considering the inferred low well yields, it is recommended that the proponent conduct groundwater sampling and confirm water levels, in advance of the extension. A spill response plan and surface water monitoring plan will be submitted as part of the quarry development plan during the Industrial Approval application process to further reduce any residual concern in respect to this issue.

Minor, localized impacts on air quality can be expected through the formation of airborne particulate matter. These impacts are readily controlled through standard mitigative measures (*e.g.,* dust suppression) and follow-up monitoring as necessary.

Assuming the mitigative measures specified in this report are implemented, and the quarry is operated according to existing provincial guidelines and approvals, no significant adverse residual environmental effects are likely.

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The definition of an environmental effect often includes any change to the project that may be caused by the environment. In the case of a quarry operation, potential effects of the environment on the Project are limited to climate and meteorological conditions, specifically precipitation. Precipitation and runoff may cause temporary delays in quarry construction, operation, and rehabilitation activities. Wet weather or snow may also affect hauling of material from the site.

On a national basis, Canada shows a warming and cooling pattern with a higher overall warming trend of approximately 1.1 ºC since 1895. The Atlantic Region, however, shows a warming trend from 1895 which peaked in the mid 1950s followed by a cooling trend in the 1990s. The overall warming trend of 0.4 ºC in Atlantic Canada since 1895 is not statistically significant. With respect to precipitation, the Atlantic Region shows an overall increasing trend in precipitation since 1948, with an increasing trend in the number of daily precipitation events above 20 mm and a very slightly increasing trend in the number of daily snowfall events above 15 cm (Lewis 1997).

There is a number of planning, designs, and construction strategies intended to minimize the potential effects of the environment on the Project so that the risk of damage to the Project or interruption of service can be reduced to acceptable levels. Mitigation measures include, but are not limited to, designing and installing erosion and sediment control structures to accommodate appropriate levels of precipitation, and considering weather conditions when scheduling activities, including scheduling of activities to accommodate weather interruptions. All Project activities will be taking place out-of-doors and thus weather has been and will be factored into all Project phases and activities. The Proponent proposes that the quarry remain operational 40 weeks per year or more, weather permitting, and will consider severe winter weather conditions when planning activities. Heavy snowfalls and significant snow accumulation will have an impact on the quarry's ability to remain open.

In summary, climate and meteorological conditions, including climate change, are not anticipated to significantly affect the operation of the quarry over its proposed lifetime.

8.0 OTHER APPROVALS REQUIRED

As stated in Section 2.0, the Proponent is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. Other relevant provincial regulations include the Activities Designation Regulations, which requires an amendment to the existing Industrial Approval from NSE for operation of the Project; and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the *Pit and Quarry Guidelines* (NSDOE 1999).

9.0 FUNDING

The proposed extension will be 100 percent privately funded.

10.0 Additional Information

No additional information is provided in support of this document.

11.0 REFERENCES

Atlantic Canada Conservation data Center (ACCDC). 2010. Species Ranks. Obtained from the ACCDC June 2010.

Banfield, A.W.F. 1974. The Mammals of Canada. University of Toronto Press. Toronto, Ontario.

Broders, H.G., G.J. Forbes, S. Woodley, 2006. Range extent and stand selection for roosting and foraging in forest-dwelling northern long-eared bats and little brown bats in the Greater Fundy Ecosystem, New Brunswock. The Journal of Wildlife.

Canadian Council of Ministers of the Environment. 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME-FAL), 2007 update.

Canadian Wildlife Service (CWS). 2009. Migratory Birds Conservation Monitoring and Reporting. Available at: http://www.cws-scf.ec.gc.ca/mgbc/trends/index. Last updated August 2009 (accessed January 2010).

Church, Ambrose F. 1878. Topographical Township Map of Antigonish County, Nova Scotia. A.F.Church and Co.: Bedford.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007. COSEWIC assessment and status report on the Olive-sided Flycatcher Contopus cooperi in Canada. Ottawa. vii + 25 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2011. Canadian Wildlife Species at Risk. Wildlife Species Search. Web site: http://www.cosewic.gc.ca/eng/sct1/searchdetail [accessed August 2011].

Department of Justice Canada. 1994. Migratory Birds Convention Act. Available at: http://laws.justice.gc.ca/en/M-7.01/. Last updated September 2009 [accessed September 2009].

Environment Canada. 2008a. Guidance Related to the Environmental Assessment of Aggregate Pit Mines and Quarries in the Atlantic Provinces.

Environment Canada. 2008b. National Air Pollution Surveillance Network, Annual Data Summary for 2005 and 2006.

Erskine, A. J. 1992. Atlas of Breeding Birds of the Maritime Provinces. Nimbus Publishing and the Nova Scotia Museum.

Fisheries and Oceans Canada (DFO). 1986. Policy for the Management of Fish Habitat. Ottawa, ON: DFO Fish Habitat Management Branch.

Flora of North America (FNA). 2003. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, Cambridge, MA. Internet Publication: http://www.efloras.org

Geological Survey of Canada. 1893. Province of Nova Scotia (Antigonish County) Pomquet Sheet No. 31. Ottawa.

Gilhen, J. 1984. Amphibians and Reptiles of Nova Scotia. Nova Scotia Museum. Halifax, Nova Scotia.

Government of Nova Scotia (GNS). 2010. Air Quality Health Index (AQHI). Available online: http://www.weatheroffice.gc.ca/airquality/pages/nsaq-005_e.html

Hinds, H.R. 2000. Flora of New Brunswick. Biology Department, University of New Brunswick, Fredericton, N.B.

Jones, C., K.M. Somers, B. Craig, and T.B. Reynoldson. 2005. Ontario Benthos Biomonitoring Network Protocol Manual. Version 1.0. 48 pp.

Keppie, J.D. 2000. Geological Map of the Province of Nova Scotia, Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 2000-1, scale 1:500,000.

MacGregor, M. and Elderkin, M. 2003. Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia. Biodiversity Program, Wildlife Division, Nova Scotia Department of Natural Resources.

Maritimes Breeding Bird Atlas (MBBA). 2009. Available online at: http://www.mba-aom.ca/english/index.html (accessed December 2010).

Neily, P., Basquill, S., Quigley, E., Stewart, B., Keys, K. 2011. Forest Ecosystem Classification for Nova Scotia. Part I: Vegetation Types. Nova Scotia Department of Natural Resources. Report for 2011-1.

Nova Scotia Department of Environment and Labour (NSEL). 1999. Pit and Quarry Guidelines. Revised May 1999. Nova Scotia: NSEL.

Nova Scotia Department of Natural Resources (NSDNR). 2006. Nova Scotia Abandoned Mine Openings Database: Mine Openings from DP ME 10, Version 3, 2006. Nova Scotia: Minerals and Energy Branch, NSDNR.

Nova Scotia Department of Natural Resources (NSDNR). 2007a. Significant habitat mapping database. Available at: http://www.gov.ns.ca/natr/wildlife/Thp/disclaim.htm. Last updated November 2007 (accessed January, 2011).

Nova Scotia Department of Natural Resources (NSDNR). 2007b. Recovery Plan for Moose (Alces alces Americana) in Mainland Nova Scotia.

Nova Scotia Department of Natural Resources (NSDNR). 2007c. Nova Scotia Wetland Inventory Database. Available at: http://www.gov.ns.ca/natr/wildlife/habitats/wetlands.asp

Nova Scotia Department of Natural Resources (NSDNR). 2009. Species at Risk in Nova Scotia. NS Endangered Species Act: Legally Listed Species as of 2007. Available at://www.gov.ns.ca/natr/wildlife/biodiv/specieslist.htm. Last updated October 2009 [accessed January 2011].

Nova Scotia Department of Natural Resources (NSDNR). 2010a. General Status Ranks of Wild Species in Nova Scotia. Obtained from the Atlantic Conservation Data Center in May 2010. Otherwise available at: http://www.gov.ns.ca/natr/wildlife/genstatus/ranks.asp.

Nova Scotia Department of Natural Resources (NSDNR). 2010b. The Nova Scotia Abandoned Mine Openings (AMO) Database – Online Interactive map. Available at: http://www.gov.ns.ca/natr/meb/links/amolinks.asp.

Nova Scotia Environment (NSE). 2008. Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia. Nova Scotia: NSE (Revised September 2008).

Nova Scotia Environment, Pumping Test Inventory, 2009

Nova Scotia Environment, NS Well Logs Database, 2010

NSDNR Interactive Groundwater Map, July 1, 2010 (last update), accessed online at: http://gis4.natr.gov.ns.ca/website/nsgroundwater/viewer.htm

Parker, G. 2001. Status report on the Canada Lynx in Nova Scotia, Loup-Cervier (Lynx canadensis (Kerr 1792)). Nova Scotia Species at Risk Working Group. Available at: http://www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/statusreports/sr_lynx.pdf.

Parker, G. 2003. Status report on the Eastern Moose (Alces alces americana Clinton) in mainland Nova Scotia. Committee on the Status of Endangered Wildlife in Canada. Available at: www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/statusreports/StatusReportMooseNSComplete.pdf.

Patterson, J.M. 1993. Metalliferous Environments in Nova Scotia (Base Metals), Nova Scotia Department of Natural Resources, Mineral Resources Branch, Information Series ME 22.

Phillip R. Berger & Associates Ltd. 1983. Survey of Blasting Effects on Groundwater Supplies in Appalachia. Part II. Bureau of Mines Open File Report, 188-83. August 1982.

Province of Nova Scotia. 1989. Wildlife Act - an act to provide for the protection, management and conservation of wildlife and wildlife habitats. Available at: http://www.gov.ns.ca/legislature/legc/statutes/wildlife.htm. Last updated February 2002 [accessed September 2009].

Province of Nova Scotia. 1994. Environment Act - an act to reform the environmental laws of the Province and to encourage and promote the protection, enhancement and prudent use of the environment. Available at: ttp://www.gov.ns.ca/legislature/legc/statutes/envromnt.htm [accessed September 2009].

Robertson, B. A. and R. L. Hutto. 2007. Is selectively harvested forest an ecological trap for Olive-sided flycatchers? Condor 109:109-121.

Sabean, B. 1989. The Fisher in Nova Scotia. Nova Scotia Department of Natural Resources Available at: http://www.gov.ns.ca/natr/wildlife/conserva/fishers.asp.

Service Nova Scotia. 2005. Property Online. Available at: http://www.gov.ns.ca/snsmr/property/default.asp?mn=282.46.1064. Accessed January 2011.

Statistics Canada. 2006. 2006 Population Census: Community Profiles. Available online at http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E (modified December 2010, accessed January 2011).

Stea R.R., Conley, H, Brown, Y. 1992, Surficial Geology of the Province of Nova Scotia, Nova Scotia Department of Natural Resources, Mines and Energy Branches, Map 92-3, scale 1:500,000.

Tiner, R. 2005. In Search of Swampland: A Wetland Sourcebook and Field Guide. Rutgers University Press. New Brunswick, New Jersey.

Tiner, R. 2010. NovaWET – A Landscape-level and rapid onsite evaluation technique for assessing wetland conditions and functions in Nova Scotia. (Version 2.0).

Tiner, R.W. 2003. Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Northeast Region, Hadley, MA. 44 pp.

Tiner. R. 2008. Background on LLWW and Preliminary Wetland Functional Assessment. Available at: http://www.aswm.org/swp/mapping/background_llww_123008.pdf.

U.S. Army Corps of Engineers, 1987. Wetlands Delineation Manual. Technical Report Y-87-1.

Vogwill, R.I.J. 1979. An Evaluation of the Effects of Seismic Detonations on Water Wells. Alberta Research Council Research Division. April 1979.

Warner, B. and C. Rubec. 1997. The Canadian Wetland Classification System. Second Edition. Wetlands Research Centre. University of Waterloo.

Wright, D.G. and G.E. Hopky. 1998. Guidelines for the use of Explosives In or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107. Science Directorate, Central and Arctic Region and Habitat Management and Environmental Science, Directorate, DFO.

Zinck, M. 1998. Roland's Flora of Nova Scotia. Nimbus Publishing & The Nova Scotia Museum. Halifax, NS.

12.0 Appendices

APPENDIX A	Registry of Joint Stocks and Industrial Approval
APPENDIX B	Northumberland Rock Quarry Hydrology Study
APPENDIX C	Project Information Bulletin
APPENDIX D	Vascular Plants and Wildlife Identified in the Study Area in the Field
APPENDIX E	Vascular Plants and Wildlife Identified in the Study Area during Modelling
APPENDIX F	Breeding and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square
APPENDIX G	Plants and Wildlife Recorded within Wetlands
APPENDIX H	Response to Government Comments

APPENDIX A

Registry of Joint Stocks and Industrial Approval

NOVA SCOTIA
Environment
Environmental Monitoring and Compliance

155 Main Street
Suite 205
Antigonish, Nova Scotia
Canada B2G 2B6

902 863-7389 T
902 863-7411 F
www.gov.ns.ca

Our File Number: 92100-30

May 25, 2011

Mr. AG MacDonald, P.Eng.
15 Heritage Dr
Antigonish, NS
B2G 2H8

Dear Mr. MacDonald:

RE: Approval to Construct and Operate - Quarry
Approval No. 2010-075166-R01
PID # 1204072

Enclosed please find Approval # 2010-075166-R01 issued to Alva Construction Limited to construct and operate the Quarry at Georgeville, Antigonish County, Nova Scotia. Please ensure that you forward the original Approval to Alva Construction Limited

Strict adherence to the attached terms and conditions is imperative in order to validate this approval.

Despite the issuance of this Approval, the Approval Holder is still responsible for obtaining any other authorization which may be required to carry out the activity, including those which may be necessary under provincial, federal or municipal law.

Should you have any questions, please contact Sean Gillis, Northern Region, Antigonish Office at (902) 863-7389.

Yours Truly

Paul J. Keats, B.Tech(Env), Eng.Tech., CET
District Manager

cc Jay Brenton
Alan Bond

Eimas #: 2010-075166-R01

NOVA SCOTIA
Environment

APPROVAL

Province of Nova Scotia
***Environment Act*, S.N.S. 1994-95, c.1**

APPROVAL HOLDER: **Alva Construction Ltd.**

SITE PID: **1204072**

APPROVAL NO: **2010-075166-R01**

EXPIRY DATE: **April 11, 2021**

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Construction and operation of a Quarry, and associated works, at or near Georgeville, Antigonish County in the Province of Nova Scotia.

Administrator _____

Effective Date May 24th /2011

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder:	Alva Construction Limited
Project:	Quarry
Site:	Georgeville, Antigonish County PID # 1204072
Approval No:	2010-075166-R01
File No:	92100-30
Map Series:	11E16
Grid Reference:	E574270 N5074282

Reference Documents:

- Application dated December 9, 2010 and attachments.
- Survey Plan, Dated April 28, 2011
- Consent Form, 9612 Hwy 337, Antigonish Co.
- Approval 96-032

1. **Definitions**

a) "Abandonment" means cessation of production of aggregate for a period of twelve (12) months.

b) "Act" means the *Environment Act* S.N.S. 1994-1995, c.1 and includes all regulations made pursuant to the Act.

c) "Active Area" means the area required to operate a quarry and includes the working face and associated works.

d) "Associated works" means any building, structure, processing facility, pollution abatement system or stockpiles of aggregate.

e) "Department" means the Northern Region, Antigonish Office, of Nova Scotia Environment located at the following address:

Nova Scotia Environment
Environmental Monitoring and Compliance Division
Northern Region, Antigonish Office
155 Main Street
Suite 205
Antigonish, NS B2G 2B6

Phone: (902) 863-7389
Fax: (902) 863-7411

f) "Disturbed Area" means any area on a quarry site that has been stripped of vegetation and is susceptible to erosion.

g) "Facility" means the Quarry and associated works.

h) "Minister" means the Minister of Nova Scotia Environment.

l) "Rehabilitation" means restorative work performed or to be performed in accordance with the rehabilitation plan.

j) "Structure" includes but is not limited to a private home, a cottage, an apartment building, a school, a church, a commercial building or a treatment facility associated with the treatment of municipal sewage, industrial or landfill effluent, an industrial building, infrastructure or construction, a hospital, and a nursing home, etc.

2. Scope of Approval

a) This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to construct and operate the Facility, situated at or near Georgeville, Antigonish County (the "Site").

b) The Facility shall be constructed and operated as outlined in the application for industrial approval dated December 9, 2010 and supporting documentation.

c) The Site shall not exceed the area as outlined in the application and supporting documentation.

d) Should the work authorized by this Approval not be commenced within a year, this Approval shall automatically be null and void, unless extended in writing by an Administrator.

3. General Terms and Conditions

a) The Approval Holder shall construct, operate and reclaim its Facility in accordance with provisions of the:

   I) *Environment Act* S.N.S. 1994-1995, c.1, as amended from time to time;
   ii) Regulations, as amended from time to time, pursuant to the above Act;

b) The Approval Holder is responsible for ensuring that they operate the Facility on lands which they own or have a lease or written agreement with the landowner or occupier. The Approval Holder shall be responsible for ensuring that the Department has, at all times, a copy of the most recent lease or written agreement with the landowner or occupier. Breach of this condition may result in cancellation or suspension of the Approval.

c) If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.

d) The Minister or Administrator may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.

e) This Approval is not transferable without the consent of the Minister or Administrator.

f) (I) If the Minister or Administrator determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister or Administrator may cancel or suspend the Approval pursuant to subsections 58(2)(b) and 58(4) of the Act, until such time as the Minister or Administrator is satisfied that all terms and conditions have been met.

   (ii) Despite a cancellation or suspension of this Approval, the Approval Holder remains subject to the penalty provisions of the Act and regulations.

g) The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Facility, including the active area, process changes or waste disposal practices which are not granted under this Approval. An amendment to this Approval will be required before implementing any change. Extensions or modifications to the Facility may be subject to the Environmental Assessment Regulations.

h) Pursuant to Section 60 of the *Act*, the Approval Holder shall submit to the Administrator any new and relevant information respecting any adverse effect

that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.

i) The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.

j) The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

k) Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.

l) Unless written approval is received otherwise from the Administrator, all samples required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.

m) The Approval Holder shall submit any monitoring results or reports required by this Approval to the Department. Unless specified otherwise in this Approval, All monitoring results shall be submitted within 30 days following the month of monitoring.

n) The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the Facility operation are made fully aware of the terms and conditions which pertain to this Approval.

o) The Approval Holder will be required to register their project under Part IV of the *Environment Act* should the Facility and associated works including access roads exceed an area of four (4) hectares.

4. Construction of Facility

a) Erosion and sedimentation controls are to be in place prior to construction at this facility. Additional controls shall be implemented if Site runoff exceeds the discharge limits contained herein.

b) Erosion and sedimentation controls are to be maintained and remain in place until the disturbed areas are stabilized.

c) The Approval Holder shall ensure that the following discharge limits are met for any water which is discharged from the Site to a watercourse or wetland:

Clear Flows (Normal Background Conditions):

i) Maximum increase of 25 mg/l from background levels for any short term exposure (24 hours of less)
ii) Maximum average increase of 5 mg/l from background levels for longer term exposure (inputs lasting between 24 hours and 30 days)

High Flow (Spring Freshets and Storm Events)

i) Maximum increase of 25 mg/l from background levels at any time when background levels are between 25 mg/l and 250 mg/l
ii) Shall not increase more than 10% over background levels when background is > 250 mg/l

d) Signage including emergency telephone numbers and contacts are to be posted at the entrance to the Facility.

e) The use of used oil as a dust suppressant is strictly prohibited. The generation of dust from the Site shall be suppressed as required.

5. **Particulate Emissions (Dust)**

a) Particulate emissions shall not exceed the following limits at or beyond the Site property boundaries:

Annual Geometric Mean	70 $\mu g/m^3$
Daily Average (24 hr.)	120 $\mu g/m^3$

b) The use of used oil as a dust suppressant is strictly prohibited. The generation of dust from the Site shall be suppressed as required.

c) Monitoring of particulate emissions shall be conducted at the request of the Department. The location of the monitoring station(s) for particulate will be established by a qualified person retained by the Approval Holder and submitted to the Department for approval, this may include point(s) beyond the property boundary of the Site.

d) When requested, suspended particulate matter shall be measured by the EPA standard; EPA/625/R-96/010a; Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM_{10}. Using High Volume (HV) Sampler.

6. **Sound Levels**

a) Sound levels measured at the Site property boundaries shall not exceed the following equivalent sound levels (Leq):

Leq 65 dBA 0700-1900 hours (Days)
60 dBA 1900-2300 hours (Evenings)
55 dBA 2300-0700 hours (Nights)

b) Monitoring of sound levels shall be conducted at the request of the Department. The location of the monitoring station(s) for sound will be established by a qualified person retained by the Approval Holder and submitted to the Department for approval, this may include point(s) beyond the property boundary of the Site.

7. **Surface Water**

a) The site shall be developed and maintained to prevent siltation of the surface water which is discharged from the property boundaries into the nearest watercourse or beyond the property boundary. Additional controls shall be implemented if site runoff exceeds the discharge limits contained herein.

b) No authority is granted by this Approval to enable the Approval Holder to discharge surface water beyond the property boundary and onto adjoining lands without the authorization of the affected landowner(s). It is the responsibility of the Approval Holder to ensure that the authorization of said landowner(s) is current and valid. Failure to maintain said authorization will result in this Approval being null and void. The Approval Holder shall provide, to the Department, proof of the continued authorization of the adjoining landowner(s) when the current agreement has expired.

c) Erosion and sedimentation control devices shall be installed prior to any excavation of material.

d) The Approval Holder shall ensure the following liquid effluent levels are met and that the effluent is monitoring at the frequency and locations indicated.

i) **Total Suspended Solids**

Clear Flows (Normal Background Conditions):

1) Maximum increase of 25 mg/l from background levels for any short term exposure (24 hour or less)
2) Maximum average increase of 5 mg/l from background levels for longer term exposure (inputs lasting between 24 hours and 30 days)

High Flow (Spring Freshets and Storm Events):

1) Maximum increase of 25 mg/l from background levels at any time when background levels are between 25 mg/l and 250 mg/l
2) Shall not increase more than 10% over background levels when background is > 250 mg/l

ii) **pH**

1) Maximum 5 to 9 in grab sample
2) Maximum 6 to 9 as a Monthly Arithmetic Mean

iii) **Monitoring Locations**

1) The Approval Holder shall sample at the locations, identified by the department if surface water discharges develop:

iv) **Sampling Frequency**

1) The Approval Holder shall sample at the following frequency: When surface water discharges develop and quarterly after the development of surface water discharge points.

e) If it becomes necessary to drain the Site, the wastewater shall be treated to meet the suspended solids limits outlined in this Approval.

f) All wash water systems shall be arranged in closed circuit.

g) Additional monitoring stations for liquid effluent may be specified as required by the Department.

h) A monthly summary of results of monitoring shall be submitted to the Department.

8. **Groundwater**

a) The Approval Holder shall replace at their expense any water supply which has been lost or damaged as a result of extracting aggregate.

b) The Approval Holder shall secure from the Administrator an approval amendment prior to excavating below the watertable.

9. **Separation Distances**

a) The Approval Holder shall not locate the Active Area of the quarry within:

i) 30 m of the boundary of a public or common highway.

ii) 30 m of the bank of any watercourse or ordinary high water mark.

iii) 30 m of the boundary of the quarry property.

b) The Approval Holder shall not blast within:

i) 30 m of the boundary of a public or common highway.

ii) 30 m of the bank of any watercourse or ordinary high water mark.

iii) 800 m of the foundation or base of a structure located off site, unless a waiver is signed by the owner.

iv) 15 m of the property boundary when a structure on the abutting property is not involved.

10. **Blasting**

a) The Approval Holder shall have a technical blast design prepared by a qualified person which ensures the ground vibration and air concussion limits in this Approval can be achieved.

b) The Approval Holder shall conduct a pre-blast survey including a water quality analysis of all structures within 800 metres of the Facility. The survey shall be conducted in accordance with the Department's 'Procedure For Conducting a Pre-Blast Survey" and the results of this survey sent to the Department prior to any blasting on the Site. Water quality parameters will be determined by NSE staff.

c) The Approval Holder shall call the nearest weather office, to assess the climatic conditions prior to conducting any blasting. No blasting will be permitted if a thermal inversion is anticipated at the time of the proposed blast.

d) No blasting shall occur on Sunday, on a statutory holiday prescribed by the Province, or on any day between 1800 and 0800 hours.

e) The Approval Holder shall ensure that all blasts are monitored for concussion and ground vibration to ensure that the limits in Table 2 are not exceeded:

Table 2

Blasting Limits

Parameters	Maximum	Monitoring Frequency	Monitoring Station
Concussion (Air Blast)	128 dBL	Every Blast	Within 7 m of the nearest structure not located on the Site
Ground Vibration	0.5 in/sec (12.5 mm/s)	Every Blast	Below grade or less than 1 m above grade in any part of the nearest structure not located on the Site

f) The monitoring station for blasting shall be as indicated in Table 2. Additional monitoring stations for blasting may be specified as required by the Department.

g) A monthly summary of results of monitoring shall be submitted to the Department.

11. Rehabilitation

a) The Approval Holder has posted a security in a form acceptable to the Department in the amount of $52,000.00.

b) The Approval Holder has submitted a rehabilitation plan to the Department. The rehabilitation plan shall be revised and updated every three years and submitted for review. The rehabilitation plan shall include the estimated total cost for labour, equipment, supplies and services of a third party contractor to undertake the following activities:

i) surface contouring

ii) establishing proper drainage
iii) revegetation work
iv) any work necessary to reclaim the quarry

c) Before the expiry of the security, the Approval Holder shall renew security which shall be calculated using the rehabilitation plan and factors in item b) above. The security shall be revised every three years in accordance with the revised rehabilitation plan.

d) The Approval Holder shall rehabilitate the Site within twelve (12) months of abandonment and in accordance with the rehabilitation plan submitted by the Approval Holder in 11 (b) or other terms as specified by the Department,

e) Nova Scotia Environment shall release the security to the Approval Holder after final rehabilitation of the Site has been completed to the satisfaction of the Minister or Administrator. The Approval Holder shall notify the Department when rehabilitation has been completed.

f) The Approval Holder shall ensure that any security posted for rehabilitation be kept valid for the term of the Approval.

12. **Site Specific Conditions**

a) The boundaries of the Site will be cut out and kept reasonably clear of new growth and the corner boundaries shall be clearly marked with permanent markers no less than four feet high.

b) The Approval Holder shall notify the Department if surface water is discharged from the site or to a watercourse.

Profile

Printer Version

Profile Info | People Info | Activites Info | Related Reg's Info

PROFILE - ALVA CONSTRUCTION LIMITED - as of: 2011-06-07 10:56 AM

Business/Organization Name:	ALVA CONSTRUCTION LIMITED
Registry ID:	2244933
Type:	N.S. Limited Company
Nature of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	5600 LOCHABER ROAD ANTIGONISH NS Canada B2G 2L6
Mailing Address:	P.O. BOX 1193 ANTIGONISH NS CANADA B2G 2L6

PEOPLE

Name	Position	Civic Address	Mailing Address
A.G. MACDONALD	Director	15 HERITAGE DRIVE ANTIGONISH NS B2G 2T6	
ALLISTER N. MACDONALD	Director	12 NICHOLSON COURT ANTIGONISH NS B2G2V4	
ALLAN MACDONALD	Director	38 PONDEROSA DRIVE ANTIGONISH NS B2G 2R5	
ALLISTER MACDONALD	PRESIDENT		
A.G. MACDONALD	SECRETARY		
ALLAN MACDONALD	VICE-PRESIDENT		
		15 HERITAGE DRIVE	PO BOX 1193

A.G. MACDONALD	Recognized Agent	ANTIGONISH NS B2G 2T6	ANTIGONISH NS B2G 2L6

ACTIVITIES

Activity	Date
Annual Renewal	2011-01-11
Annual Statement Filed	2011-01-11
Annual Renewal	2010-01-27
Annual Renewal	2009-01-12
Annual Renewal	2008-01-21
Special Resolution	2007-06-21
Special Resolution	2007-06-21
Filed Document	2007-06-21
Filed Document	2007-06-21
Annual Renewal	2007-01-29
Annual Renewal	2006-03-28
Special Resolution	2005-07-29
Annual Renewal	2005-02-22
Annual Renewal	2004-02-27
Annual Renewal	2003-01-20
Annual Statement Filed	2003-01-20
Annual Renewal	2002-01-24
Annual Renewal	2001-02-26
Annual Renewal	2000-02-08
Address Change	1999-02-26
Annual Statement Filed	1999-02-26
Annual Renewal	1999-01-25
Annual Renewal	1998-02-26
Annual Renewal	1997-03-20
Annual Statement Filed	1997-03-19
Filed Debenture	1996-11-07

Annual Report Filed	1996-02-09
Change of Directors	1996-02-09
Special Resolution	1996-01-30
Registered Office Change	1993-02-23
Agent Filed	1993-02-23
Incorporated	1993-02-22
Registered	1993-02-22

Show All Collapse

RELATED REGISTRATIONS

This Company ...	
COLIN R. MACDONALD CONSTRUCTION	Registered

APPENDIX B

Northumberland Rock Quarry Hydrology Study

Stantec Consulting Ltd.
102 – 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

Hydrology Study – Northumberland Rock Quarry Extension Project

Alva Construction Limited
P.O. Box 1193
5600 Lochaber Road
Antigonish, NS B2G 2L6

File: 121510482

June 2011

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 Introduction

A hydrologic study was conducted to support the Environmental Assessment Registration Document for the proposed Northumberland Rock Extension Project, located on the existing Northumberland Rock Quarry near Georgeville, Antigonish County, Nova Scotia. The purpose of this hydrologic study was to determine potential changes on the local hydrologic regime of the project site and on downstream hydrologic elements due to the proposed extension of the quarry.

1.1 OBJECTIVES

The main objectives of this hydrologic study are:

1. To provide a general description of the hydrological conditions and water quantity and quality for all surface waters in the vicinity of the quarry development as indicated on the Guide to Preparing an EA Registration for Pit and Quarry Developments in Nova Scotia (Nova Scotia Environment, 2008)
2. To estimate the total change in surface water runoff amounts for the existing and full development conditions.
3. To estimate the total required capacity for the detention/siltation facilities (i.e. detention pond) for the existing and proposed conditions (i.e. full quarry extension).
4. To assess any potential impacts of the proposed quarry extension on downstream hydrologic elements with respect to water quantity and quality and propose mitigation measures to minimize any potential effects.

1.2 SITE DESCRIPTION AND BACKGROUND

The proposed quarry extension land (referred to as the “site”) is located near Georgeville, Antigonish County, Nova Scotia. The proposed extension project is situated within the same property of the existing Alva Construction Limited Northumberland Quarry (PID 01204072). The entire property has a total area of 54.48 Ha and is shown on Figure 1.1.

The parcel of land is irregular in shape with its longest dimension extending from NW to SE. The existing quarry encompasses an area of 4.81 Ha and has been operating since the year 1996. The aggregates from the quarry are extracted by blasting, crushing and stockpiling of material on site which is primarily offered to the local construction market. It is expected that the operation of the proposed quarry extension will be the same as the existing quarry.

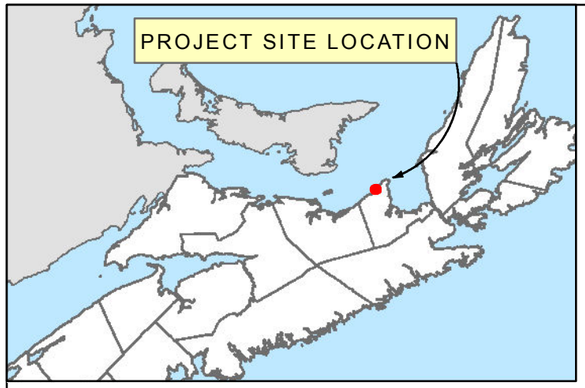
Existing site topography slopes to the NW on the western section which ultimately drains to the ocean (Northumberland Strait). Surface water is conveyed by three small streams that collect runoff water onsite. According to the information provided by Mr. Greg MacDonald from Alva Construction (email dated Nov. 8, 2010 to Gillian Asche from Stantec), existing drainage ditches convey water away from the quarry face and ultimately drain to the ocean, there is also one

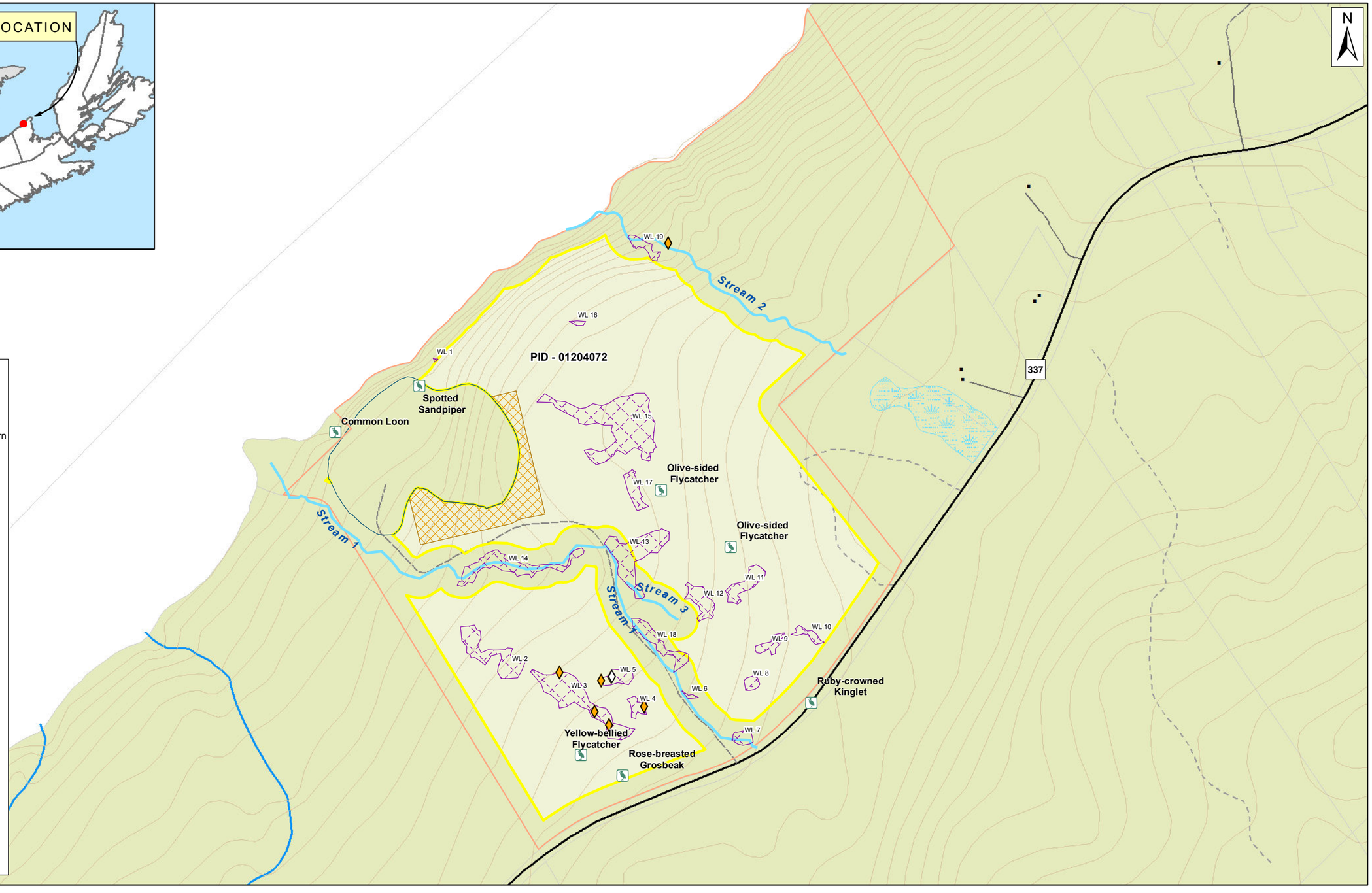
detention pond in the site to help control sedimentation and to provide water for any washed product that is produced**.** Therefore, it is assumed that as the quarry footprint expands more runoff from the property will be collected within the quarry area until ultimately most of the site runoff will be collected in the quarry (with the exception of the buffer areas and other features that drain to the streams.

During two separate site visits, by Stantec representatives, three surface streams and a small number of unmapped wetlands were identified within the site. The streams were mapped with a GPS tracker and labelled Stream 1, 2 and 3.

Based on available stream and contour mapping (5 m resolution) the site was divided into two subwatersheds. Both subwatersheds drain to the sea and will be analyzed as a single entity. A series of wetlands were also identified based on provincial mapping and the data collected during the site visit. Their approximate locations are also shown on Figure 1.1.

The proposed quarry extension is intended to be carried out over the next 50 plus years until complete extraction of the material is achieved. Therefore this hydrologic study was based on full development scenario from the existing condition. A 30 m buffer zone around each stream and property boundaries was included to comply with existing regulations. Therefore, the total quarry extension area will be approximately 39.8 Ha. The proposed extension area considering full development is shown in Figure 1.1.





Project Features

- Bebb's Sedge
- Tall Hairy Groovebur
- Bird Species of Conservation Concern
- Field Identified Wetland
- Proposed Quarry Extension Area
- Existing Quarry
- Proposed Quarry Development Area 10yr
- Proposed Quarry Extension Area including Buffers
- Primary Access Road
- Local Road
- Resource Access
- Track/Trial/Abandoned Road
- Contour (5m)
- Field Delineated Stream
- Watercourse
- Wetlands (NSDNR)
- Project Property Boundary (PID)
- Property Boundaries NSGC (2007)

Data from NSGC (NSTDB Series) unless otherwise noted.

Project No.: 121510482

0 50 100 150

Metres

V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\addendumletter\Site Plan, Main Hydrologic Features and Proposed Quarry Extension Area.mxd

DATE: March 8, 2011 PREPARED BY: R. Sutcliffe SCALE: 1:6,000	Northumberland Rock Quarry Extension Project **Site Plan, Main Hydrologic Features and Proposed Quarry Extension Area (10 year and full development)**	FIGURE NO.: **1.1** Stantec

2.0 METHODOLOGY

2.1 MEAN ANNUAL SITE RUNOFF ESTIMATION

The change in the mean annual runoff volume for the existing and proposed conditions was calculated by developing a mean annual water balance for the property. The data required to calculate the mean annual water balance is included in the Climate Normals for the area, which were obtained from the Environment Canada database.

As the quarry expands its footprint, it is assumed that both the vegetative cover and topsoil layers will be removed gradually from the site, which will cause an increase in site runoff due to a decrease in evapotranspiration and infiltration. Ultimately the entire property will be developed as a quarry with the exception of the required buffer areas. This scenario also assumes that ultimately the quarry floor will have a very flat surface (assumed to have a slope of 0.2%).

2.2 FLOW DETENTION AND SILTATION TREATMENT SIZING

The discharge capacity and dimensions of the required flow detention and siltation structures for the total quarry extension were calculated with the hydrologic model HEC-HMS version 3.5. HEC-HMS is a hydrologic model developed by the US Army Corp of Engineers and is widely accepted and utilized by engineers and scientists around the world.

The parameters required for calculations were obtained from different sources. Annual precipitation data was obtained from Climate Normals from Station 8201000 (Collegeville) operated by Environment Canada. Station 8201000 is located approximately 37 km to the south of the site and is the nearest station with available data. The surface slope, area and other physical parameters were approximated using GIS tools. The time of concentration was estimated with the Uplands Method included in the National Engineering Handbook, Part 630, Chapter 4 (Natural Resources Conservation Service, 1993).

The required volume capacity for the flow detention and siltation structures was estimated based on a 24 hour duration rainfall with an associated Annual Exceedance Probability (AEP) of 4%, which is a rainfall event with an associated return period of 25 years. The maximum discharge capacities for the hydraulic discharge structures were based on the 24 hour 1% AEP storm (1:100 year return period rainfall event). Rainfall Intensity-Duration-Frequency (IDF) curves were obtained from Station 8201716 (Eddy Point), operated by Environment Canada. This station is the nearest station with available data and is located approximately 60 km southeast of the Project site.

3.0 Results

3.1 MEAN ANNUAL SITE RUNOFF ESTIMATION

Based on Climate Normals (1971-2000) from station 8201000 (Collegeville), the average annual precipitation at the site is in the order of 1384.3 mm. This includes rainfall and snowfall amounts.

Total annual potential evapotranspiration in the area has been estimated using the Thornthwaite Equation. Annual evapotranspiration is therefore in the order of 553.9 mm, or 40% of the average annual precipitation. Infiltration is assumed to be in the order of 14% of the average annual precipitation based on infiltration estimates for Nova Scotia included in Kennedy et al (2010). The annual infiltration is therefore in the order of 193.8 mm.

The remaining 46% of the average annual precipitation can contribute to surface runoff and corresponds to 636.6 mm per year. It has been estimated that surface runoff from the site will increase by 20% as a result of the quarry extension; this takes into account an equivalent decrease in evapotranspiration and infiltration and an increase in runoff.

Although it is difficult to accurately determine the effects of climate change within the next century, there is general agreement that the magnitude of precipitation events will likely increase. Since the site will be developed over a long period of time (>50 years) it is advisable to account for climate change effects, and therefore an extra 10% increase in mean annual precipitation was assumed (Jacques Whitford, 2008). Therefore, the annual effective precipitation at the site is assumed to be 840.3 mm.

The existing and post development surface runoff volumes were estimated by multiplying the estimated annual precipitation by its corresponding catchment area. The results are presented on Table 3.1.

Table 3.1 Existing and Post Development Surface Runoff Volume Estimations

Scenario	Area (Ha)	Effective annual Precipitation (mm)	Runoff Volume (m^3)	Average Annual Flow Rate (m^3/s)
Existing condition	4.81	636.8	30,654.9	0.00097
Full Development	39.8	840.6	334,471.4	0.0106

Therefore, the average annual site runoff volume due to the proposed full quarry extension is expected to increase from 30,654.9 m^3 to 334,471.4 m^3 or a 991% increase from the existing condition.

The average annual flow rates for the existing and proposed conditions were also estimated using a proration method by area from Station 01DR003 (Rights River Near Antigonish) located approximately 19 km to the south from the site. The average annual flow rate for the entire

record (1979-1990) at Station 01DR003 is 1.94 m^3/s. When prorated by area, the average annual flow rates for the existing and proposed conditions are 0.0014 m^3/s and 0.012 m^3/s. These are within the same order of magnitude as the estimated flow rates shown in Table 3.1.

3.2 FLOW DETENTION AND SILTATION TREATMENT SIZING

A summary of the hydrologic model setup and the parameters used is provided in Table 3.2.

Table 3.2 Summary of Hydrologic Parameters used in HEC-HMS

Parameter	Existing Condition	Proposed Condition
Initial and Constant Loss Method	Initial Loss: 2.5 mm Constant Rate: 1.5 mm/hr Imperviousness: 70%	Initial Loss: 2.5 mm Constant Rate: 1.5 mm/hr Imperviousness: 70%
Clark Unit Hydrograph Routing Method	Concentration Time: 0.57 hr	Concentration Time: 1.53 hr
Included Storms	24 hour 1:25 year return period 24 hour 1:100 year return period	24 hour 1:25 year return period 24 hour 1:100 year return period
Subcatchment Area	0.048 km^2	0.398 km^2
Baseflow	Not considered	Not considered
Attenuation effects due to channel storage	Not considered	Not considered
Modeling interval	5 min	5 min

The parameters used in the hydrologic model to size the flow detention and discharge structures for the two extension scenarios are included on Table 3.3.

Table 3.3 Model Parameters used in HEC-HMS

Scenario	Area (Ha)	Flow Path Length (m)	Slope (m/m)	Concentration Time (min)
Existing	4.8	280	0.002	34.2
Proposed	39.8	750	0.002	91.6

For all calculations it was assumed that all surface runoff originating from the upstream regions of the catchment area located off-site will be diverted around the proposed quarry extension, and therefore no off-site area will contribute to on-site surface runoff. This assumption was confirmed by Mr. Greg MacDonald from Alva Construction.

Flow hydrographs developed for the 1:25 and 1:100 year storms are shown in Figures 3.1 and 3.2 below for the existing and proposed conditions respectively.

Figure 3.1 Flow Hydrographs Existing Condition - 1:25 and 1:100 year events

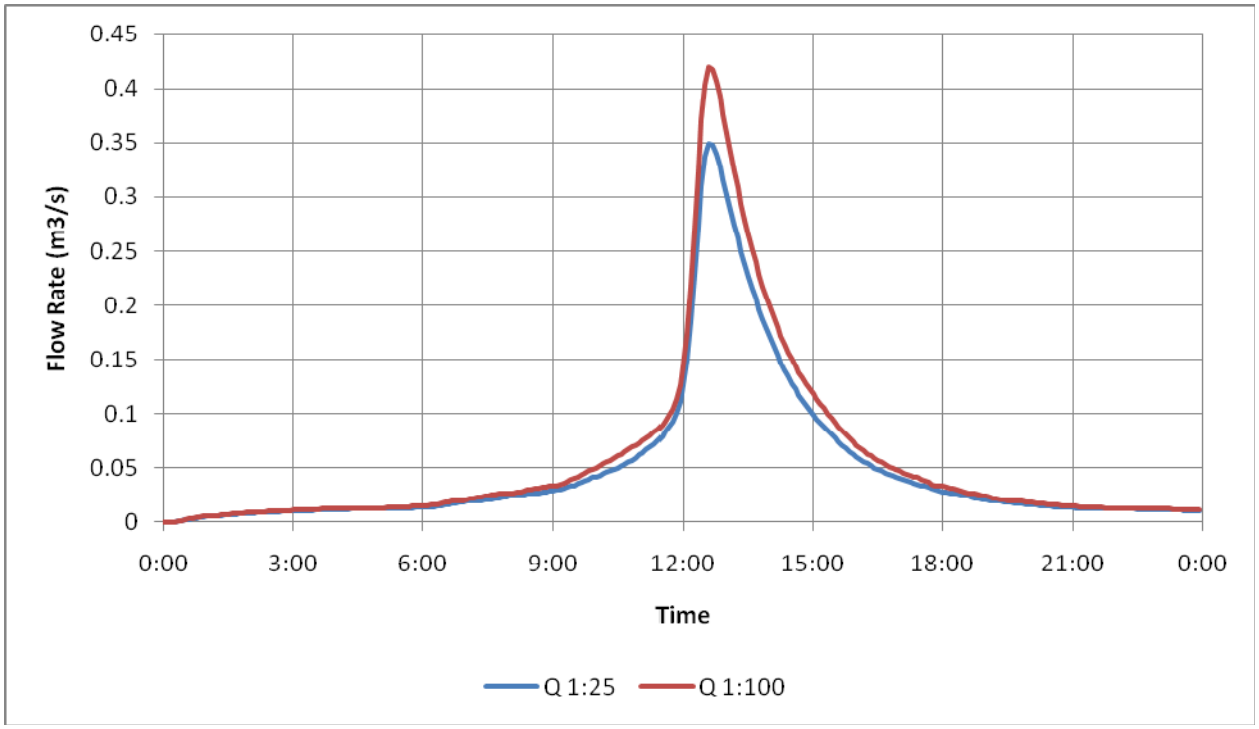
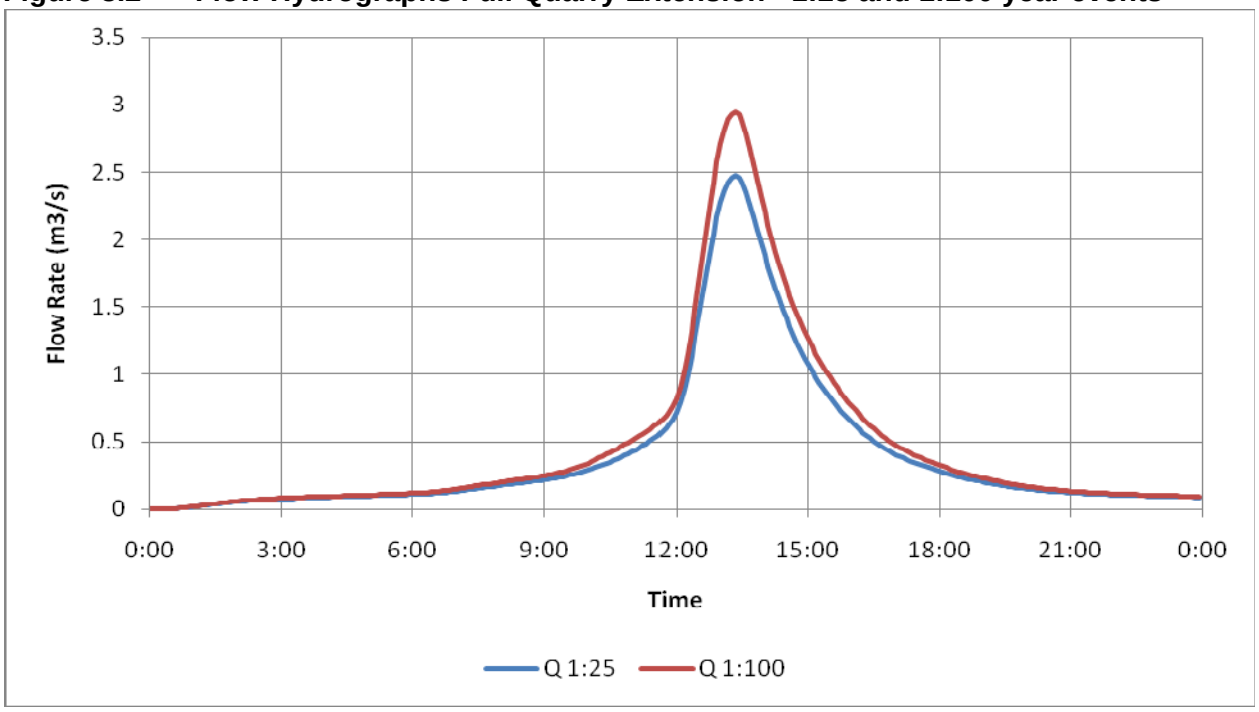


Figure 3.2 Flow Hydrographs Full Quarry Extension - 1:25 and 1:100 year events



Model estimations for the 24 hour 1:25 year and 1:100 year rainfall events are shown in Table 3.4.

Table 3.4 Change in Runoff Volume Existing and Proposed Condition

Extension Stage	Return Period	Peak Flow (m^3/s)	Volume (m^3)
Existing quarry	1:25	0.35	4,245
	1:100	0.42	4,951
Full quarry extension	1:25	2.47	34,958
	1:100	2.95	40,782

It is recommended to size the flow detention pond to detain the volume from the 24 hour 1:25 year rainfall event. Therefore, the detention pond should be sized to store 34,958 m^3 of runoff. This volume is required only after full extension; the volume of the pond should be increased gradually over time as the quarry footprint is extended.

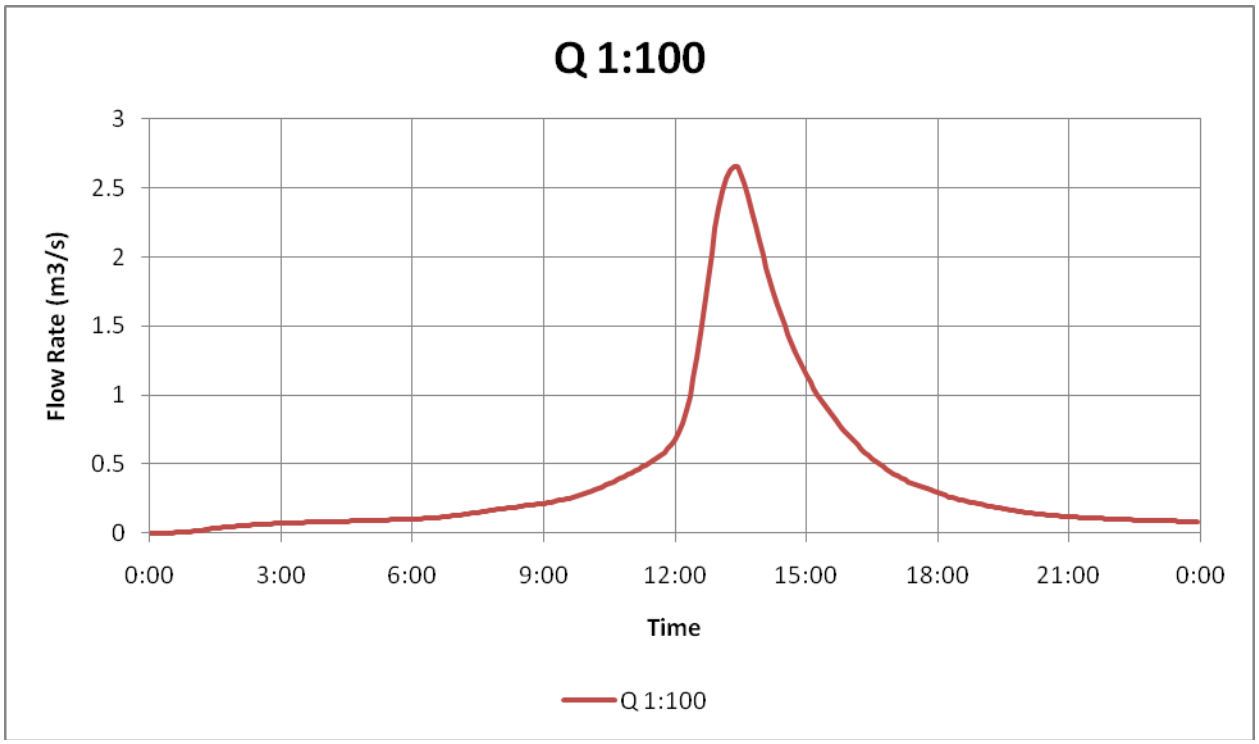
Based on the simulations completed for the 24 hour 1:100 year event, the peak flows for the existing and proposed conditions are estimated to be in the order of 0.42 m^3/s and 2.95 m^3/s, respectively. Therefore, the discharge structures at the exit of the detention pond should be designed to accommodate as a minimum the excess discharge between the 1:25 and the 1:100 year rainfall events.

The difference in flow hydrographs between the 1:25 and 1:100 year rainfall events for the existing and proposed conditions are shown on Figure 3.3. As indicated, the weir structure should be sized to accommodate a minimum of 2.65 m^3/s.

Drawdown of water levels from the 1:25 year rainfall event to the permanent pool detention level should be estimated based on a detention time that will improve water quality. A recommended drawdown period of 24 hours is expected to decrease suspended sediment concentrations by as much as 80%. Based on the low flow threshold of 24 hour discharge for runoff events equal or smaller that the 1:25 year rainfall event, the mean discharge capacity should be 400 L/s. As a result, an appropriately designed weir or orifice is recommended as the most suitable discharge structure which is expected to control peak discharge volumes reducing the risk of downstream erosion and extending the discharge time to downstream hydrologic features.

Maintenance of the detention structures may be warranted over time as sediment particles deposit at the bottom reducing active storage. The sediment must be collected and disposed of following all applicable regulations.

Figure 3.3 Excess flow rate from the 1:100 year rainfall event with storage attenuation



3.3 EFFECTS ON DOWNSTREAM FLOWS AND WATER QUALITY

The full quarry development is anticipated to increase the total mean annual runoff at the site to 303,816.5 m^3. This is mostly due to a decrease in pervious surfaces and the removal of vegetative cover and the organic top soil cover. The mean annual runoff will likely be directed to a single exit within the site.

As mentioned previously, there are a number of identified wetlands on the site that are not indicated on provincial mapping, it is assumed that the full development of the site as a quarry will result in the removal of a number of these wetlands. Although it has not been quantified, the elimination of these wetlands may also increase peak flows by reducing storage capacity. However, this is considered negligible when compared to other factors that influence flow routing and peak flow generation.

It is important to mention that control measurements must be implemented to minimize the impact on the receiving environment, which in this case is the ocean. All surface water runoff that is being discharge to downstream receptors must meet all applicable guidelines (i.e., NS Pit and Quarry Guidelines) and as specified in the existing Industrial Approval as well as future amendements to this Approval..

It is anticipated that the largest potential for water quality impacts due to the quarry extension and operation would be erosion and an associated increased in sediment loads. There are certain measures that can be adopted to reduce these impacts, including check dams along collection ditches and the placement of free draining cover materials over disturbed areas. The proper design of the detention ponds should include the capacity to remove sediment as required to maintain the required active volume and extend the life of the structures, or the addition of extra volume to accommodate sediment loads. Even with this measure, maintenance would likely be required over the course of the quarry operation to clean the detention pond.

Buffers have been maintained around each stream and along the property boundaries. Surface runoff from the site should not be sent to the streams before being stored in the detention pond and the surface water runoff should comply with existing guidelines to protect the aquatic environment. The streams are not likely to experience major changes in the flow regime as there are upstream areas of the subwatersheds that can contribute to flow. However, a monitoring program for water quality and/or quantity may be warranted if major modifications to the aquatic regime are observed and corrective measures may be necessary to ensure a good aquatic environment near the site.

Section V of the Nova Scotia Department of the Environment Pit and Quarry Guidelines (1999) establish Liquid Effluent Discharge Limits that must be maintained from storm runoff leaving a pit or quarry operation. The guidelines indicate that the maximum grab sample at any given time shall not exceed 50 mg/L, and that the maximum arithmetic monthly average for suspended solids shall not exceed 25 mg/L. These guidelines must be followed at all times and sampling may be warranted to ensure their compliance, especially during and/or after large precipitation events.

4.0 Conclusions

The following conclusions are offered based on the desktop hydrology study for the proposed Northumberland Rock Quarry Extension Project.

The existing mean annual runoff is estimated to be in the order of 30,654.9 m^3.

The total increase in the mean annual runoff for the site resulting from the proposed extension (full quarry development) is in the order of 303,816.5 m^3 or a 991% increase from the existing condition.

The flow detention structures for the proposed quarry extension should be able to accommodate a volume of 34,958 m^3 for full development, which corresponds to the 24 hour 1:25 year rainfall event. The dimensions of the proposed detention ponds will depend on site characteristics, as an example, a single detention pond able to accommodate 34,958 m^3 should have approximate dimensions of 132 m x 132 m x 2 m.

The outlet structures for each detention pond should be able to accommodate a total discharge of 2.65 m^3/s which corresponds to the difference in flows between the 1:25 and the 1:100 year rainfall events.

Based on a recommended detention time of 24 hours for any precipitation event equal or smaller than the 1:25 year event, the required weir(s) should be designed to conform to a discharge capacity of 400 L/s. The maximum discharge capacity should be maintained as indicated previously.

Flow detention structures should be placed immediately downstream of the quarry facilities to capture all surface runoff before it is conveyed towards the receiving environment. This will also help to attenuate peak flows, reduce the slope of the recession limb and to some extent maintain pre-development conditions.

Drainage features should be constructed with appropriate erosion and sediment control measures to direct and convey site surface runoff to their corresponding flow detention and sediment control structures.

The surface water runoff from the site should comply with the applicable guidelines and approvals issues by NSE..

5.0 Closure

This report has been prepared on behalf of and for the exclusive use of Alva Construction Limited. This report represents the conditions of the property at the time of the assessment. The conclusions presented in this report represent the best judgment of the assessor based on current environmental standards. Stantec Consulting Ltd. attests that to the best of our knowledge the information presented in this report is accurate.

6.0 References

Atmospheric Environment Services, Environment Canada. Intensity-Duration-Frequency Curves, Station 8201716, Eddy Point, 1972-1985.

Environment Canada. Canadian Climate Normals and Averages 1971-2000. Data accessed online at http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html

Jacques Whitford Limited. Environmental Assessment Registration, Panuke Quarry Extension Project. Dartmouth, Nova Scotia, 2008.

Kennedy, G.W. et al. Estimation of Regional Groundwater Budgets in Nova Scotia. Nova Scotia Dept. of Natural Resources, Open File Illustration ME 2010-2. Halifax, NS, 2010.

Natural Resources Conservation Service. National Engineering Handbook, Part 630, Chapter 4. Washington, USA, 1993.

Nova Scotia Department of the Environment. Guide to Preparing an EA Registration for Pit and Quarry Developments in Nova Scotia. Halifax, Nova Scotia, 2008.

Nova Scotia Department of the Environment. Pit and Quarry Guidelines. Revised Version May 1999. Halifax, Nova Scotia.

APPENDIX C

Project Information Bulletin

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

February 3, 2011
File: 121510482

Native Council
324 Abenaki Road
PO Box 1320
Truro, NS B2N 5N2

Attention: Mrs. Grace Conrad

Dear Mrs. Conrad:

Reference: Northumberland Rock Quarry Expansion Project

This letter is to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act.*

Please find enclosed the Project Information Sheet and corresponding Figure, which provide further details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

February 3, 2011
File: 121510482

Kwilmu'kw Maw-klusuaqn
Mi'kmaq Rights Initiative
851 Willow Street, Truro, NS
B2N 6N8

Attention: Ms. Twila Gaudet

Dear Ms. Gaudet:

Reference: Northumberland Rock Quarry Expansion Project

This letter is to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act.*

Please find enclosed the Project Information Sheet and corresponding Figure, which provide further details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

February 3, 2011
File: 121510482

Confederacy of Mainland Mi'kmaq
57 Martin Crescent
P.O. Box 1590
Truro, NS, B2N 5V3

Attention: Mr. Donald M. Julien

Dear Mr. Julien:

Reference: Northumberland Rock Quarry Expansion Project

This letter is to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act.*

Please find enclosed the Project Information Sheet and corresponding Figure, which provide further details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

February 2, 2011
File: 121510482

Union of Nova Scotia Indians
47 Maillard Street
Membertou, NS B1S 2P5

Attention: Mr. Joe B. Marshall

Dear Mr. Marshall:

Reference: Northumberland Rock Quarry Expansion Project

This letter is to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act.*

Please find enclosed the Project Information Sheet and corresponding Figure, which provide further details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

February 3, 2011
File: 121510482

Chief and Council
Paq'tnkek First Nation
R.R. #1
Afton, Antigonish County, N.S.
B0H 1A0

Attention: Chief Michael Gerard Julian and Council

Reference: Northumberland Rock Quarry Expansion Project

This letter is to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act.*

Please find enclosed the Project Information Sheet and corresponding Figure, which provide further details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

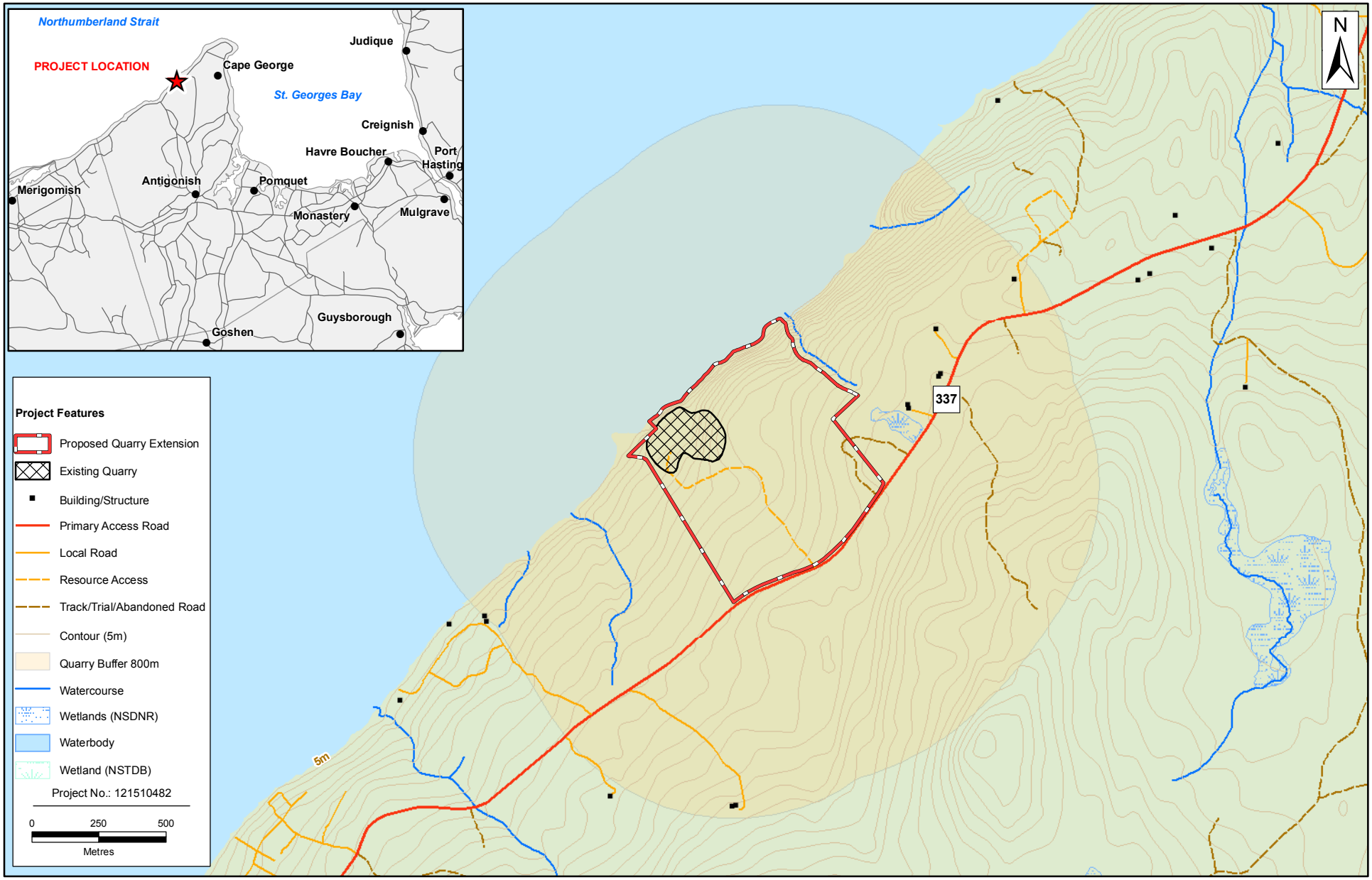
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

August 23, 2011
File: 121510482

Confederacy of Mainland Mi'kmaq
57 Martin Crescent
P.O. Box 1590
Truro, NS, B2N 5V3

Attention: Mr. Donald M. Julien

Dear Mr. Julien:

Reference: Northumberland Rock Quarry Expansion Project

In February 2011 an information letter, to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia, was sent to you for review and comment.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*. The information package that was originally sent has been attached to this letter for reference.

The draft Environment Assessment document has been submitted to Nova Scotia Environment for review and comments have been received. The document is now being prepared in final form. If you have any outstanding questions or concerns please contact the undersigned or the contact listed on the Project Information Sheet.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

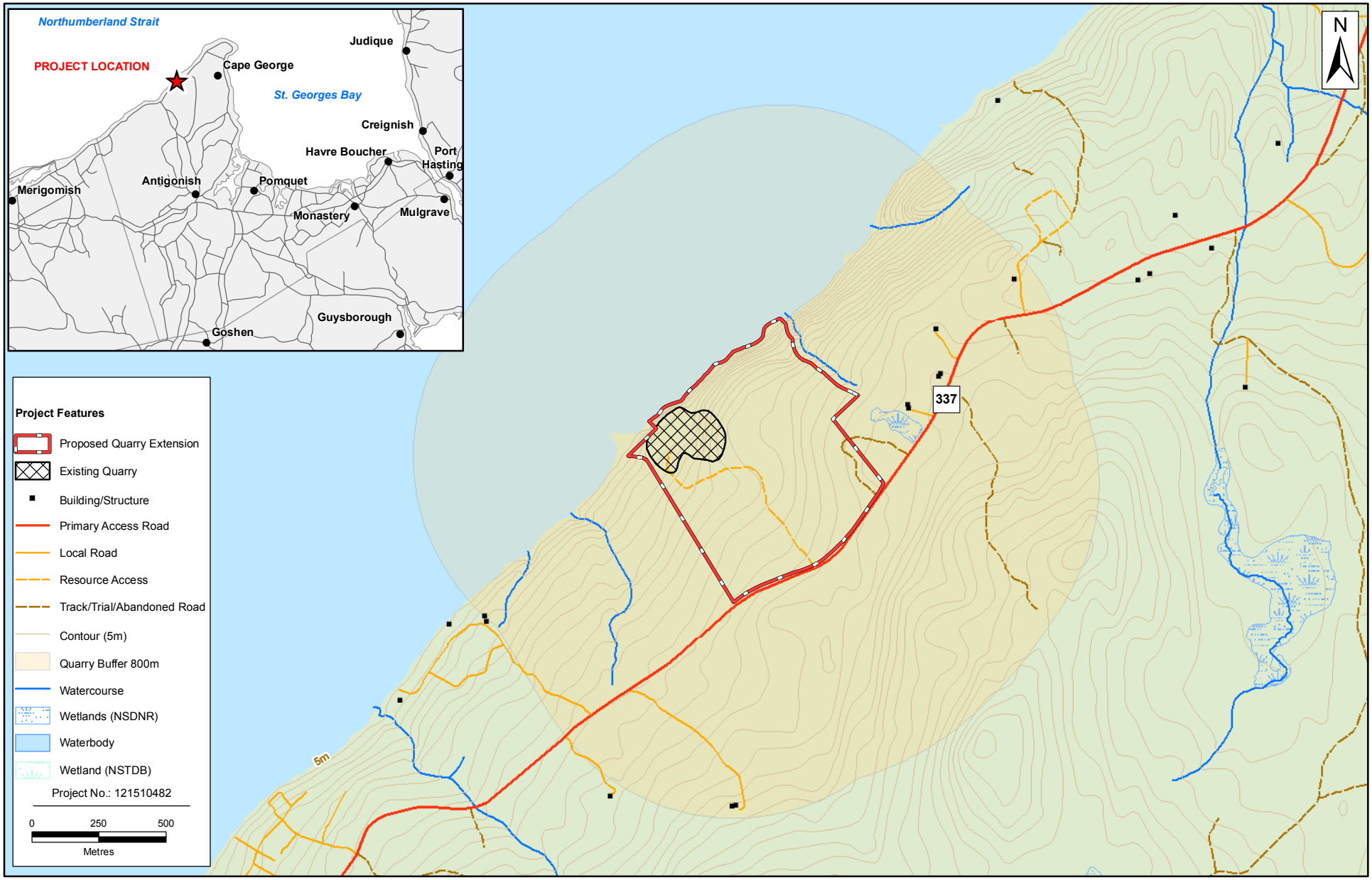
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

Stantec

August 23, 2011
File: 121510482

Kwilmu'kw Maw-klusuaqn
Mi'kmaq Rights Initiative
851 Willow Street, Truro, NS
B2N 6N8

Attention: **Ms. Twila Gaudet**

Dear Ms. Gaudet:

Reference: **Northumberland Rock Quarry Expansion Project**

In February 2011 an information letter, to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia, was sent to you for review and comment.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*. The information package that was originally sent has been attached to this letter for reference.

The draft Environment Assessment document has been submitted to Nova Scotia Environment for review and comments have been received. The document is now being prepared in final form. If you have any outstanding questions or concerns please contact the undersigned or the contact listed on the Project Information Sheet.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

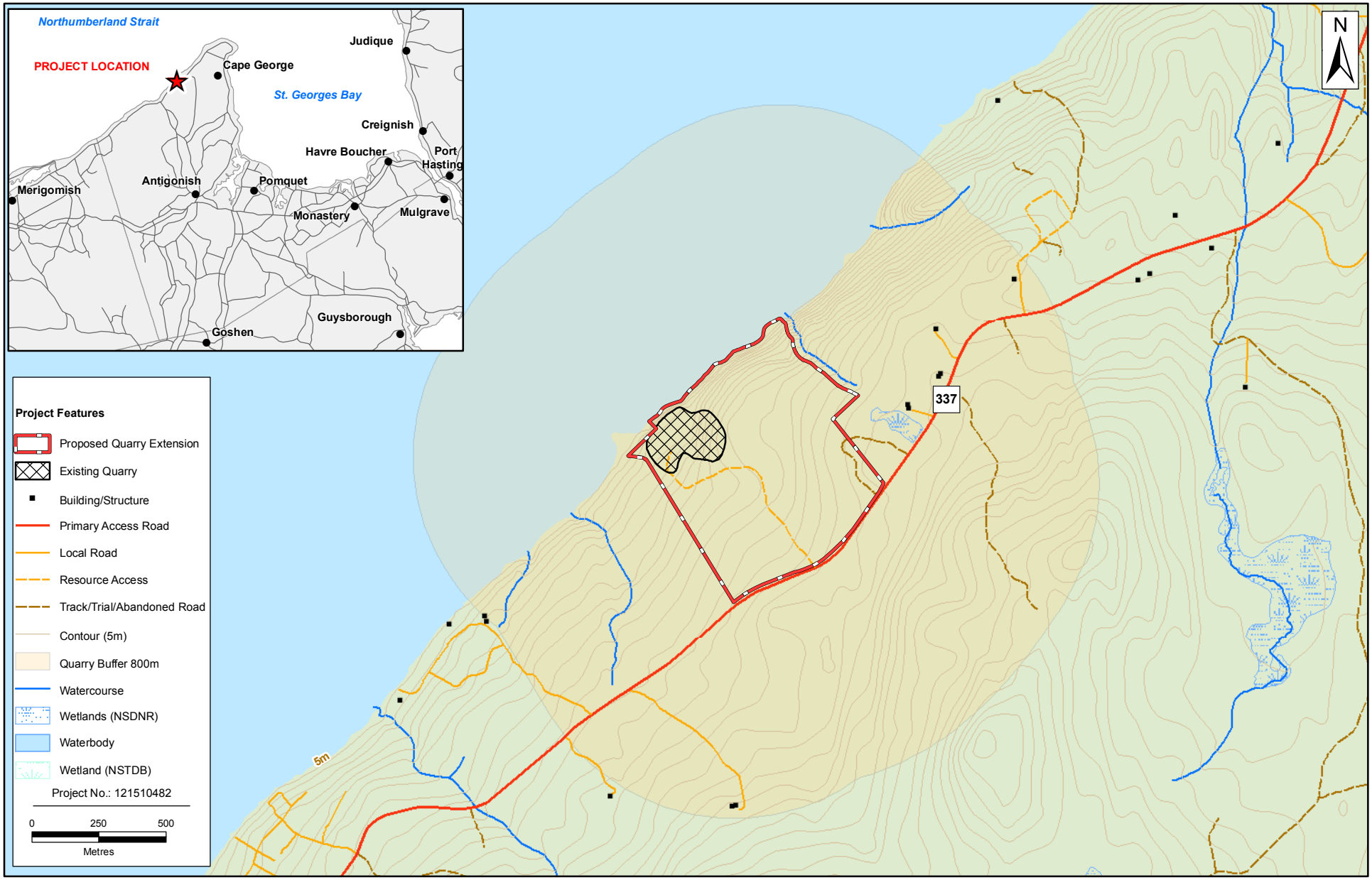
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

August 23, 2011
File: 121510482

Native Council
324 Abenaki Road
PO Box 1320
Truro, NS B2N 5N2

Attention: Mrs. Grace Conrad

Dear Mrs. Conrad:

Reference: Northumberland Rock Quarry Expansion Project

In February 2011 an information letter, to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia, was sent to you for review and comment.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*. The information package that was originally sent has been attached to this letter for reference.

The draft Environment Assessment document has been submitted to Nova Scotia Environment for review and comments have been received. The document is now being prepared in final form. If you have any outstanding questions or concerns please contact the undersigned or the contact listed on the Project Information Sheet.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

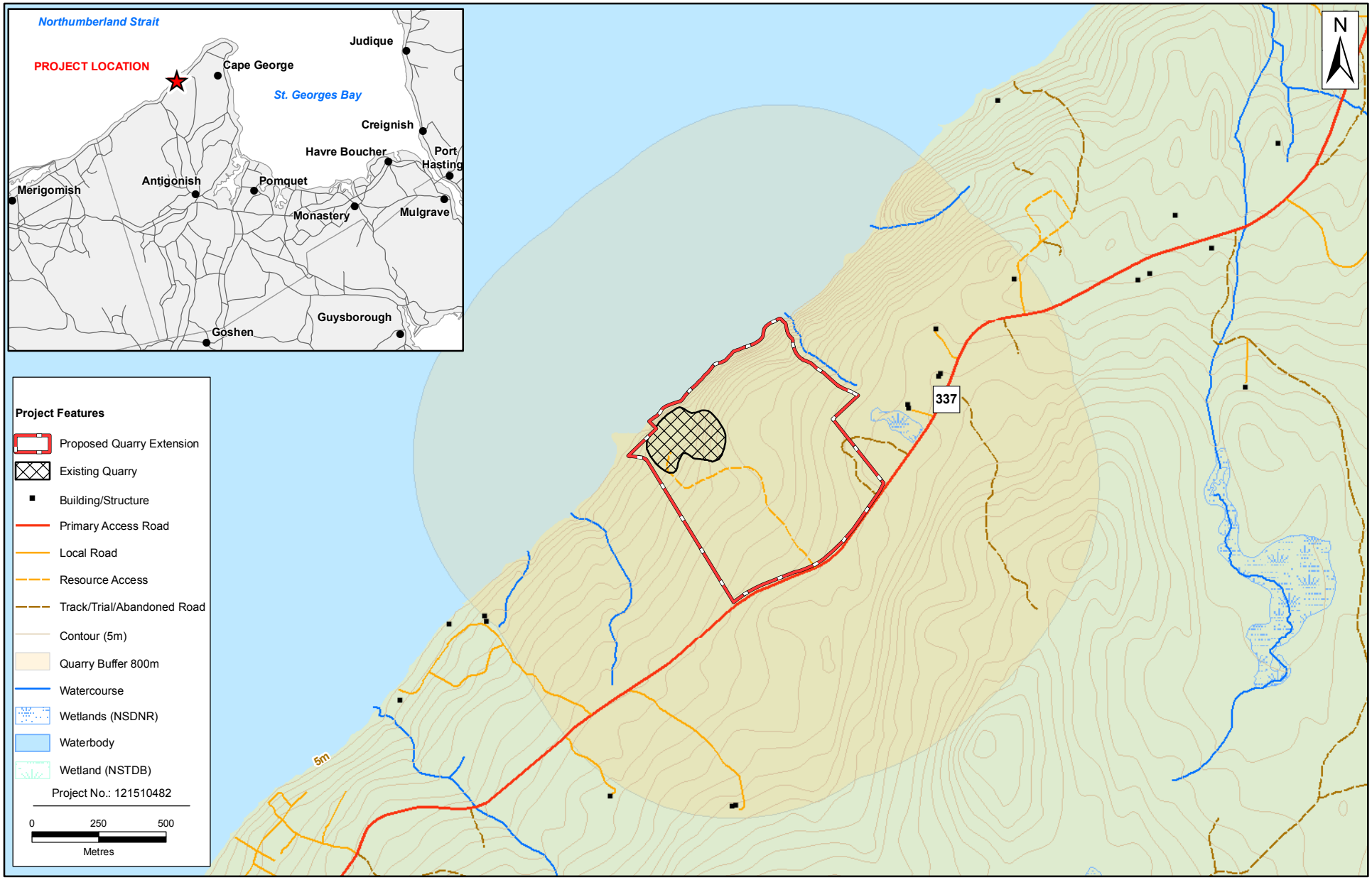
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

August 23, 2011
File: 121510482

Union of Nova Scotia Indians
47 Maillard Street
Membertou, NS B1S 2P5

Attention: Mr. Joe B. Marshall

Dear Mr. Marshall:

Reference: Northumberland Rock Quarry Expansion Project

In February 2011 an information letter, to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia, was sent to you for review and comment.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act.* The information package that was originally sent has been attached to this letter for reference.

The draft Environment Assessment document has been submitted to Nova Scotia Environment for review and comments have been received. The document is now being prepared in final form. If you have any outstanding questions or concerns please contact the undersigned or the contact listed on the Project Information Sheet.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

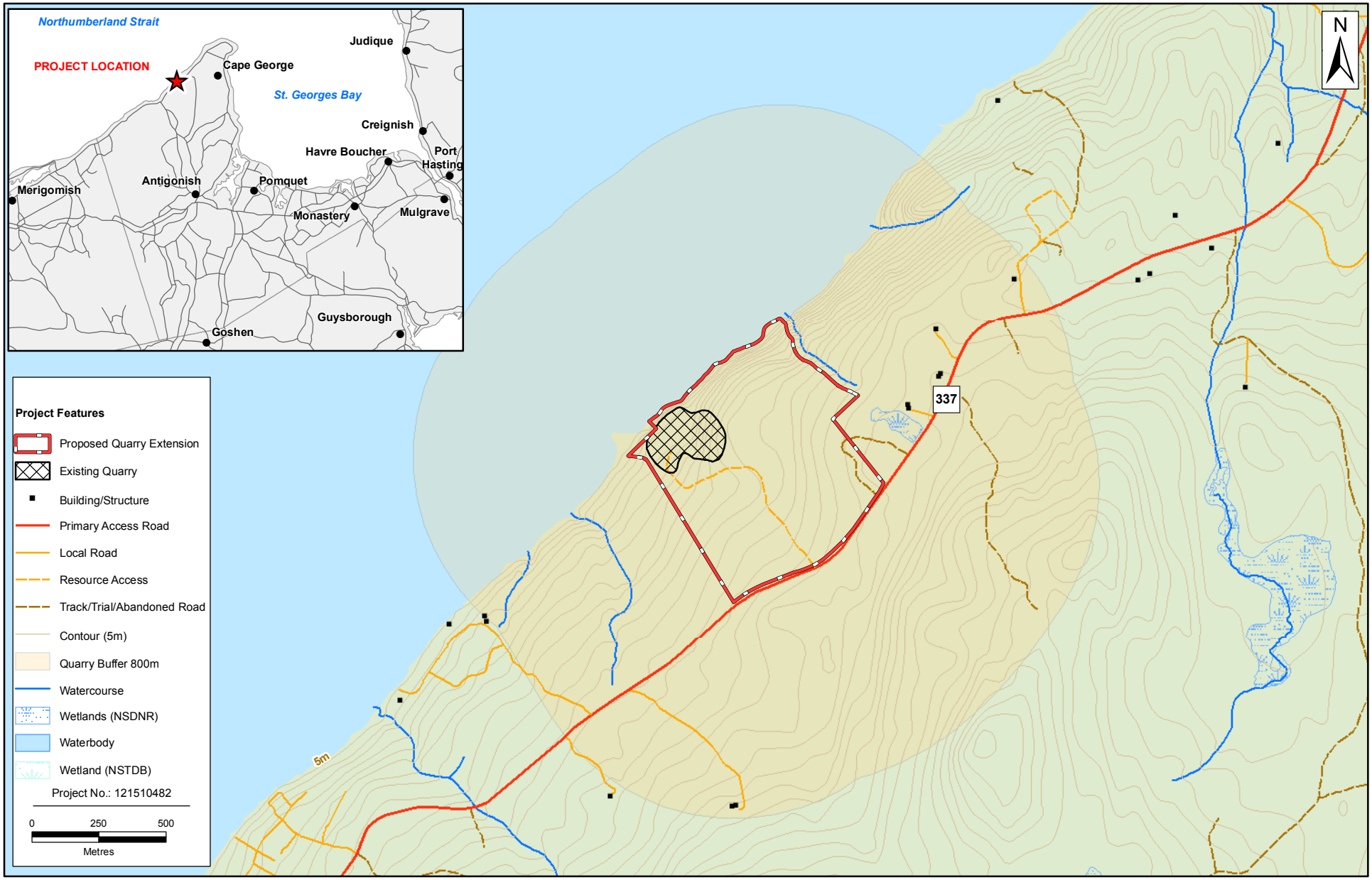
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

August 23, 2011
File: 121510482

Chief and Council
Paq'tnkek First Nation
R.R. #1
Afton, Antigonish County, N.S.
B0H 1A0

Attention: **Chief Michael Gerard Julian and Council**

Reference: **Northumberland Rock Quarry Expansion Project**

In February 2011 an information letter, to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia, was sent to you for review and comment.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*. The information package that was originally sent has been attached to this letter for reference.

The draft Environment Assessment document has been submitted to Nova Scotia Environment for review and comments have been received. The document is now being prepared in final form. If you have any outstanding questions or concerns please contact the undersigned or the contact listed on the Project Information Sheet.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

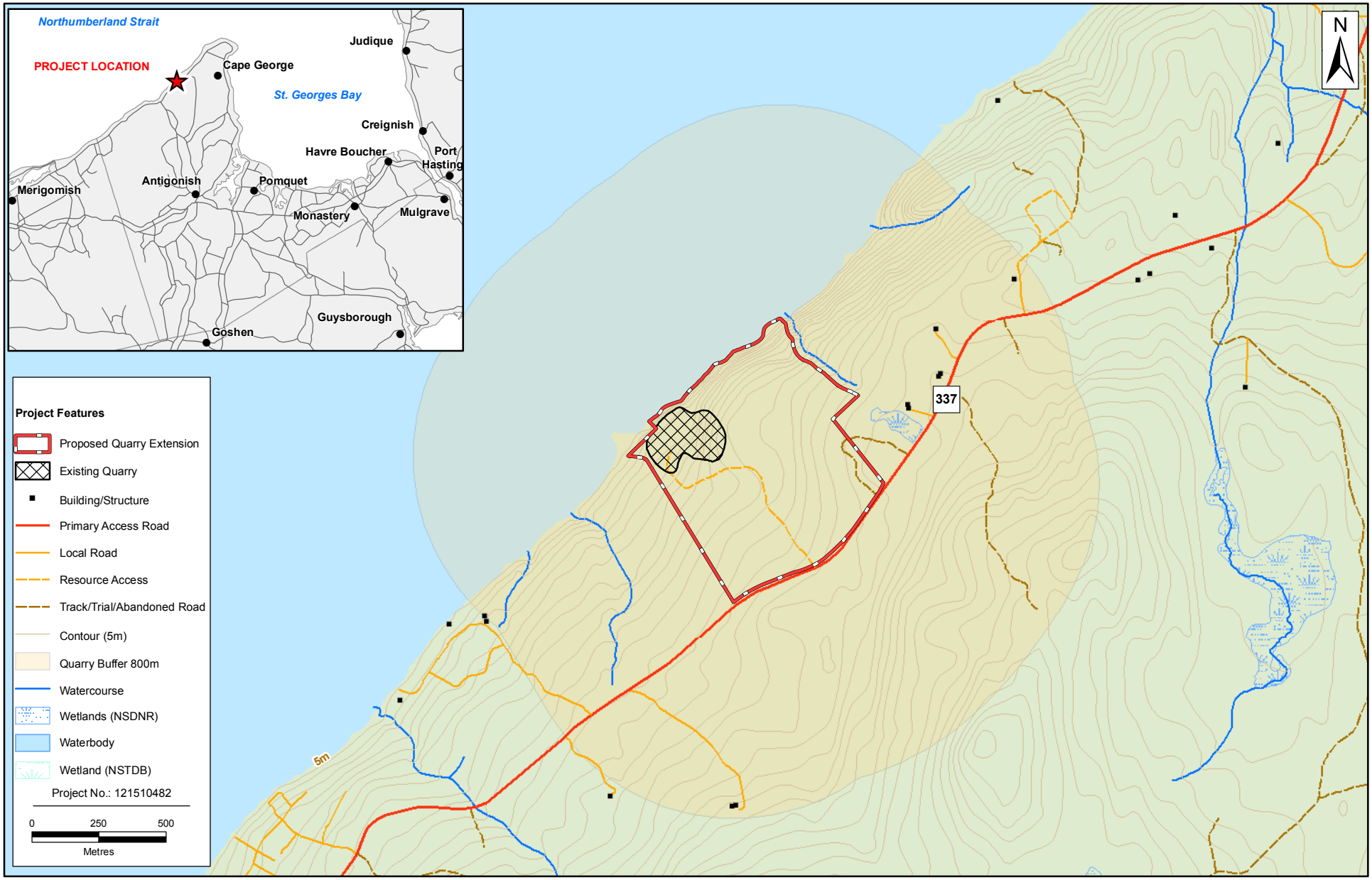
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

Stantec Consulting Ltd.
102 - 40 Highfield Park Drive
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

August 23, 2011
File: 121510482

Chief and Council
Pictou Landing First Nation
Site 6, Box 55
R.R. #2
Trenton, N.S. B0K 1X0

Attention: Chief Francis Aileen and Council

Reference: Northumberland Rock Quarry Expansion Project

This letter is to inform you of a proposed Project near Georgeville, Antigonish County, Nova Scotia.

The Project consists of an extension of quarry activities at an existing facility near Georgeville, Antigonish County, Nova Scotia. The developer, Alva Construction Limited, is proposing to extend the area of the existing Northumberland Rock Quarry while maintaining approximately the same level of production which is used primarily for local construction such as road building. Alva Construction Limited is currently preparing the documentation required to register this Project under the Environmental Assessment Regulations pursuant to the Nova Scotia *Environment Act*.

Please find enclosed the Project Information Sheet and corresponding Figure, which provide further details regarding the Project and the site location.

Please contact the undersigned or the contacts listed on the Project Information Sheet with any comments, concerns, or questions you may have regarding the project.

Sincerely,

STANTEC CONSULTING LTD.

Gillian Asche
Project Manager
Tel: (902) 468-7777
Fax: (902) 468-9009
Gillian.Asche@stantec.com

Attachment

Alva Construction Limited
Northumberland Rock Quarry Expansion Project
Project Information Sheet

Project Overview

Alva Construction Limited proposes to undertake quarry activities on lands adjacent to its existing facility at Northumberland Rock Quarry, Georgeville, Antigonish County, Nova Scotia (refer to Figure 1 on reverse). The current operation is 3.5 hectares in area. The proposed extension will incorporate land immediately adjacent to the existing quarry to increase the total size of the operation to approximately 54 hectares. Blasting, crushing and stockpiling of aggregate is proposed to take place at the expanded site. The quarried material is primarily used for local construction such as road building. Depending on market demand, the proposed activities will take place over an extended period of time until the material is exhausted. Based on current estimates, there are over 22 million tonnes of rock reserves within the proposed expansion area. The expanded site could therefore sustain aggregate production for as much as 50 years or more.

Proposed project activities will be consistent with current quarry operations on the existing adjacent site. These activities were approved by Nova Scotia Environment (NSE) and in accordance with the *Nova Scotia Pit and Quarry Guidelines* (NSE 1999). Aggregate production begins with drilling and blasting, which will be conducted by a licensed blasting contractor. Blasting will take place approximately five to seven times per year. After blasting, the rock is processed on site via portable crushing equipment. Various products (*i.e.,* various aggregate sizes) will be stockpiled at the quarry site until they are transported to local markets via tandem trucks or tractor trailer trucks via the existing truck route. The average number of trucks hauling aggregates from the quarry could be up to 150 per day, depending on market demand. This is consistent with current truck volume at the existing quarry and could increase, for a short period, if a large aggregate supply contract were awarded.

The anticipated average production rate is approximately 450,000 tonnes per year, with the possibility of a higher production rate for limited periods of time should a significant contract be awarded. Weather permitting, the potential operating schedule could be up to 24 hrs/day, 7 days/week for periods of time depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

Environmental Assessment Process

Alva Construction Limited is required to register this project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations. The environmental assessment registration is currently being prepared by environmental consultants Stantec Consulting Ltd., on behalf of Alva Construction Limited, to fulfill these regulatory requirements. Other relevant provincial regulations include the Activities Designation Regulations, which requires an Industrial Approval from Nova Scotia Environment for the quarry operation, and the General Blasting Regulations made pursuant to the Nova Scotia *Occupational Health and Safety Act* (1996). Provincial guidelines to be adhered to include the Nova Scotia Pit and Quarry Guidelines (NSE 1999).

The environmental assessment registration will evaluate potential environmental effects of the project and identify appropriate mitigation and monitoring to minimize these effects. The environmental assessment registration document will be available for public review and comment once it is filed with NSE.

Environmental Document Components

The environmental registration document focuses on those aspects of the environment that are considered to be of most concern. Components to be evaluated include:

- rare and sensitive flora;
- wildlife;
- surface water resources
- groundwater resources;
- wetlands;
- archaeological and heritage resources;
- atmospheric environment (includes dust and noise); and
- socio-economic environment.

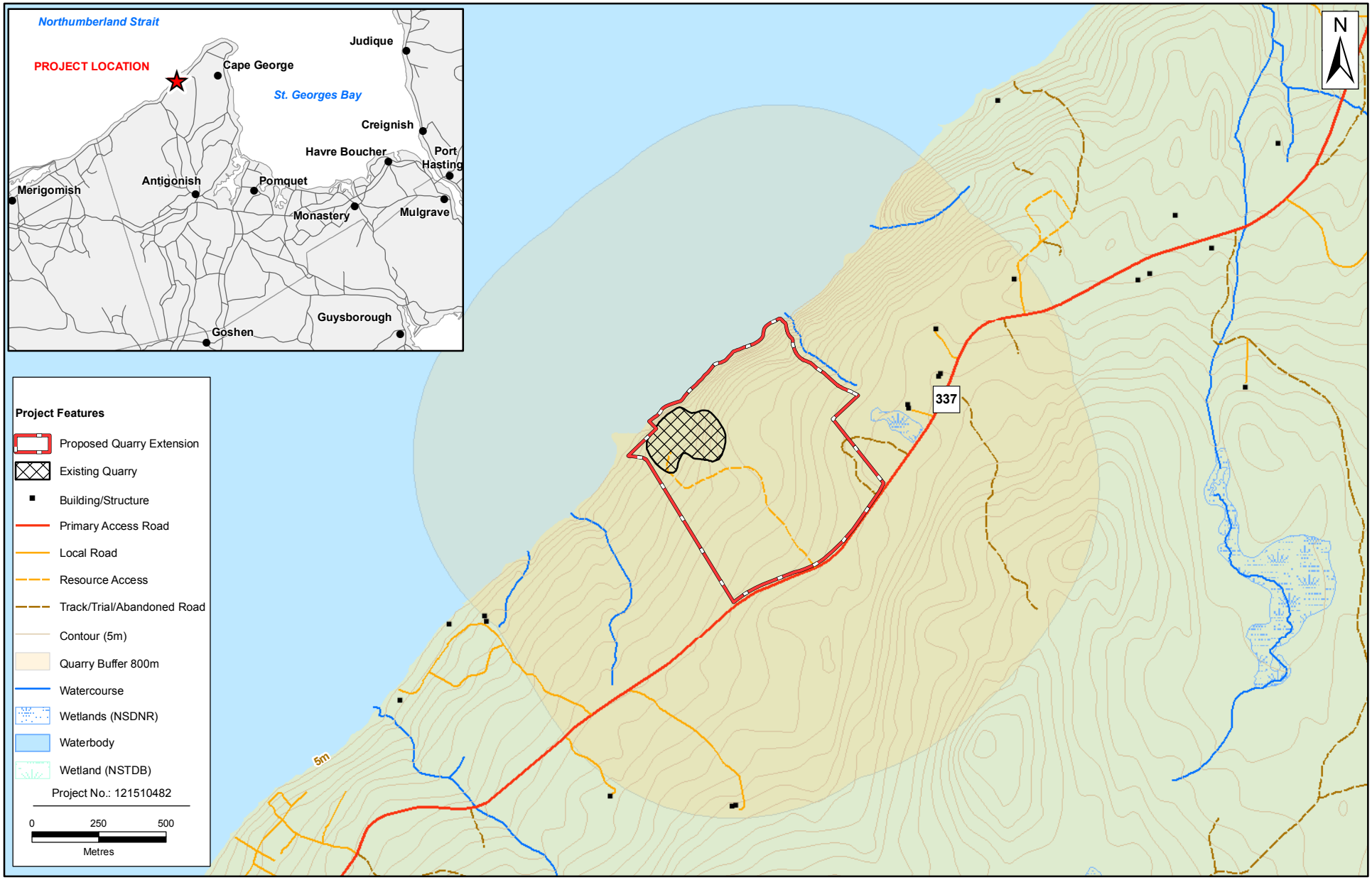
Potential effects of quarry activities on these components will be addressed in the registration document. Preliminary results of an environmental evaluation identified several watercourses and wetlands on the property as well the presence of several uncommon plant and wildlife species. Protection or mitigation and/or habitat compensation for sensitive environmental features on the site will be identified in the EA Registration. Other applicable mitigative measures and government guidelines will also be described in the EA Registration to reduce or eliminates adverse environmental and socio-economic effects.

Contacts

If you have any questions or concerns about this project please contact:

Mr. Greg MacDonald
Alva Construction Limited
P.O. Box 1193, Antigonish, NS B2G 2L6
Tel: (902) 863-6445
E-mail:greg@alva.ns.ca

Gillian Asche, Project Manager
Stantec Consulting Ltd.
40 Highfield Park Drive., Suite 102, Dartmouth, NS B3A 0A3
Tel: (902) 468-7777
E-mail: gillian.asche@Stantec.com



DATE: January 31, 2010	Northumberland Rock Quarry Extension Project	FIGURE NO: 1
PREPARED BY: C. Shupe	**Project Location**	
Scale 1:20,000		Stantec

Path: V:\1215\active\121510xxx\121510482\geomatics\Mapping\MXD\ReportFigures\Project_Location.mxd

APPENDIX D

Vascular Plants and Wildlife Identified in the Study Area in the Field

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Abies balsamea	Balsam Fir	Secure	S5
Abies balsamea	Balsam Fir	Secure	S6
Acer pensylvanicum	Striped Maple	Secure	S5
Acer rubrum	Red Maple	Secure	S5
Acer spicatum	Mountain Maple	Secure	S5
Achillea millefolium	Common Yarrow	Secure	S5
Actaea rubra	Red Baneberry	Secure	S5
Agrimonia gryposepala	Tall Hairy Groovebur	Secure	S3
Agrimonia striata	Woodland Agrimony	Secure	S5
Agrostis capillaris	Colonial Bentgrass	Exotic	SNA
Agrostis perennans	Perennial Bentgrass	Secure	S4S5
Agrostis scabra	Rough Bentgrass	Secure	S5
Agrostis stolonifera	Spreading Bentgrass	Secure	S5
Agrostis stolonifera	Spreading Bentgrass	Secure	S6
Alnus incana	Speckled Alder	Secure	S5
Alnus viridis	Green Alder	Secure	S5
Amelanchier sp.	a Serviceberry	na	na
Ammophila breviligulata	American Beachgrass	Secure	S5
Anaphalis margaritacea	Pearly Everlasting	Secure	S5
Antennaria howellii ssp. neodioica	Pussy-Toes	Secure	S5
Anthoxanthum odoratum	Sweet Vernal Grass	Exotic	SNA
Apocynum androsaemifolium	Spreading Dogbane	Secure	S5
Apocynum cannabinum	Clasping-Leaf Dogbane	Secure	S4S5
Aralia nudicaulis	Wild Sarsaparilla	Secure	S5
Arctium minus	Lesser Burdock	Exotic	SNA
Arctium sp.	Burdock	na	na
Arenaria serpyllifolia	Thyme-Leaf Sandwort	Exotic	SNA
Argentina anserina	Silverweed	Secure	S5
Artemisia absinthium	Common Wormwood	Exotic	SNA
Artemisia stelleriana	Hoary Sagebrush	Exotic	SNA
Athyrium filix-femina	Lady-Fern	Secure	S5
Atriplex patula	Halberd-Leaf Orache	Exotic	SNA
Atriplex prostrata	Creeping Saltbush	Secure	S5
Betula alleghaniensis	Yellow Birch	Secure	S5
Betula papyrifera	Paper Birch	Secure	S5
Betula papyrifera var. cordifolia	Heart-Leaved Paper Birch	Secure	S5
Betula populifolia	Gray Birch	Secure	S5
Brachyelytrum septentrionale	Bearded Short-Husk	Secure	S5
Bromus ciliatus	Fringed Brome	Secure	S5
Bromus ciliatus	Fringed Brome	Secure	S6
Cakile edentula	American Searocket	Secure	S5
Calamagrostis canadensis	Blue-Joint Reedgrass	Secure	S5
Calystegia sepium	Hedge Bindweed	Secure	S5
Cardamine pensylvanica	Pennsylvania Bitter-Cress	Secure	S5
Cardamine pratensis var. pratensis	Cuckooflower	Exotic	SNA
Carex arctata	Black Sedge	Secure	S5

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Carex bebbii	Bebb's Sedge	May Be At Risk	S1S2
Carex brunnescens	Brownish Sedge	Secure	S5
Carex canescens	Hoary Sedge	Secure	S5
Carex communis	Fibrous-Root Sedge	Secure	S5
Carex conoidea	Field Sedge	Secure	S4?
Carex crawfordii	Crawford Sedge	Secure	S5
Carex echinata	Little Prickly Sedge	Secure	S5
Carex flava	Yellow Sedge	Secure	S5
Carex flava	Yellow Sedge	Secure	S6
Carex gracillima	Graceful Sedge	Secure	S4S5
Carex gynandra	A Sedge	Secure	S5
Carex intumescens	Bladder Sedge	Secure	S5
Carex leptalea	Bristly-Stalk Sedge	Secure	S5
Carex lurida	Shallow Sedge	Secure	S5
Carex nigra	Black Sedge	Secure	S5
Carex nigra	Black Sedge	Secure	S6
Carex novae-angliae	New England Sedge	Secure	S5
Carex pallescens	Pale Sedge	Secure	S5
Carex panicea	A Sedge	Exotic	SNA
Carex pseudocyperus	Cyperus-Like Sedge	Secure	S4S5
Carex scoparia	Pointed Broom Sedge	Secure	S5
Carex sp.	a Sedge	na	na
Carex stipata	Stalk-Grain Sedge	Secure	S5
Carex trisperma	Three-Seed Sedge	Secure	S5
Carex umbellata	Hidden Sedge	Secure	S4
Centaurea nigra	Black Starthistle	Exotic	SNA
Chamaesyce maculata	Spotted Spurge	Exotic	SNA
Chamerion angustifolium	Fireweed	Secure	S5
Chelone glabra	White Turtlehead	Secure	S5
Chenopodium album	White Goosefoot	Exotic	SNA
Circaea alpina	Small Enchanter's Nightshade	Secure	S5
Cirsium arvense	Creeping Thistle	Exotic	SNA
Cirsium sp.	Thistle	na	na
Cirsium vulgare	Bull Thistle	Exotic	SNA
Cornus alternifolia	Alternate-Leaf Dogwood	Secure	S5
Cornus canadensis	Dwarf Dogwood	Secure	S5
Crataegus monogyna	A Hawthorn	Exotic	SNA
Danthonia compressa	Flattened Oatgrass	Secure	S5
Danthonia compressa	Flattened Oatgrass	Secure	S6
Danthonia spicata	Poverty Oat-Grass	Secure	S5
Daucus carota	Wild Carrot	Exotic	SNA
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	Secure	S5
Deschampsia flexuosa	Crinkled Hairgrass	Secure	S5
Dichanthelium acuminatum	Panic Grass	Secure	S5
Diervilla lonicera	Northern Bush-Honeysuckle	Secure	S5
Doellingeria umbellata	Parasol White-Top	Secure	S5

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Dryopteris carthusiana	Spinulose Shield Fern	Secure	S5
Dryopteris cristata	Crested Shield-Fern	Secure	S5
Dryopteris intermedia	Evergreen Woodfern	Secure	S5
Eleocharis obtusa	Blunt Spike-Rush	Secure	S5
Eleocharis tenuis	Slender Spike-Rush	Secure	S5
Empetrum nigrum	Black Crowberry	Secure	S5
Epilobium ciliatum	Hairy Willow-Herb	Secure	S5
Epilobium leptophyllum	Linear-Leaved Willow-Herb	Secure	S5
Epilobium palustre	Marsh Willow-Herb	Secure	S5
Epipactis helleborine	Eastern Helleborine	Exotic	SNA
Equisetum arvense	Field Horsetail	Secure	S5
Equisetum arvense	Field Horsetail	Secure	S6
Equisetum sylvaticum	Woodland Horsetail	Secure	S5
Erechtites hieraciifolia	Fireweed	Secure	S5
Eupatorium perfoliatum	Common Boneset	Secure	S5
Euphrasia stricta	Drug Eyebright	Exotic	SNA
Eurybia radula	Rough-Leaved Aster	Secure	S5
Euthamia graminifolia	Flat-Top Fragrant-Golden-Rod	Secure	S5
Festuca rubra	Red Fescue	Secure	S5
Fragaria vesca	Woodland Strawberry	Secure	S4
Fragaria virginiana	Virginia Strawberry	Secure	S5
Fragaria virginiana	Virginia Strawberry	Secure	S6
Fraxinus americana	White Ash	Secure	S5
Galeopsis tetrahit	Brittle-Stem Hempnettle	Exotic	SNA
Galium asprellum	Rough Bedstraw	Secure	S5
Galium palustre	Marsh Bedstraw	Secure	S5
Galium sp.	a Bedstraw	na	na
Galium tinctorium	Stiff Marsh Bedstraw	Secure	S5
Galium tinctorium	Stiff Marsh Bedstraw	Secure	S6
Galium trifidum	Small Bedstraw	Secure	S5
Galium triflorum	Sweet-Scent Bedstraw	Secure	S5
Geranium robertianum	Herb-Robert	Secure	S4
Geum rivale	Purple Avens	Secure	S5
Geum rivale	Purple Avens	Secure	S6
Glyceria borealis	Small Floating Manna-Grass	Secure	S5
Glyceria canadensis	Canada Manna-Grass	Secure	S5
Glyceria striata	Fowl Manna-Grass	Secure	S5
Glyceria striata	Fowl Manna-Grass	Secure	S6
Gnaphalium uliginosum	Low Cudweed	Exotic	SNA
Gymnocarpium dryopteris	Northern Oak Fern	Secure	S5
Hieracium aurantiacum	Orange Hawkweed	Exotic	SNA
Hieracium caespitosum	Meadow Hawkweed	Exotic	SNA
Hieracium canadense	Canada Hawkweed	Secure	S4S5
Hieracium lachenalii	Common Hawkweed	Exotic	SNA
Hieracium murorum	Wall Hawkweed	Exotic	SNA
Hieracium piloselloides	Tall Hawkweed	Exotic	SNA

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Hieracium sabaudum	New England Hawkweed	Exotic	SNA
Hieracium scabrum	Rough Hawkweed	Secure	S5
Hieracium sp.	a Hawkweed	na	na
Hieracium x floribundum	Smoothish Hawkweed	Exotic	SNA
Honckenya peploides	Sea-Beach Sandwort	Secure	S5
Hypericum canadense	Canadian St. John's-Wort	Secure	S5
Hypericum perforatum	A St. John's-Wort	Exotic	SNA
Ilex verticillata	Black Holly	Secure	S5
Impatiens capensis	Spotted Jewel-Weed	Secure	S5
Iris versicolor	Blueflag	Secure	S5
Juncus articulatus	Jointed Rush	Secure	S5
Juncus balticus	Baltic Rush	Secure	S5
Juncus brevicaudatus	Narrow-Panicled Rush	Secure	S5
Juncus brevicaudatus	Narrow-Panicled Rush	Secure	S6
Juncus canadensis	Canada Rush	Secure	S5
Juncus effusus	Soft Rush	Secure	S5
Juncus effusus	Soft Rush	Secure	S6
Juncus sp.	a Rush	na	na
Juncus tenuis	Slender Rush	Secure	S5
Kalmia angustifolia	Sheep-Laurel	Secure	S5
Lactuca canadensis	Canada Lettuce	Secure	S5
Lathyrus japonicus	Beach Pea	Secure	S5
Lathyrus japonicus var. maritimus	Beach Pea	Secure	S5
Leontodon autumnalis	Autumn Hawkbit	Exotic	SNA
Leucanthemum vulgare	Oxeye Daisy	Exotic	SNA
Linaria vulgaris	Butter-And-Eggs	Exotic	SNA
Linnaea borealis	Twinflower	Secure	S5
Lolium perenne	Perennial Ryegrass	Exotic	SNA
Lolium pratense	Meadow Rye Grass	Exotic	SNA
Lonicera canadensis	American Fly-Honeysuckle	Secure	S5
Lonicera villosa	Mountain Fly-Honeysuckle	Secure	S4S5
Lotus corniculatus	Birds-Foot Trefoil	Exotic	SNA
Luzula acuminata	Hairy Woodrush	Secure	S5
Luzula multiflora	Common Woodrush	Secure	S5
Lycopus americanus	American Bugleweed	Secure	S5
Lycopus uniflorus	Northern Bugleweed	Secure	S5
Lythrum salicaria	Purple Loosestrife	Exotic	SNA
Maianthemum canadense	Wild Lily-of-The-Valley	Secure	S5
Malus pumila	Common Apple	Exotic	SNA
Melilotus officinalis	Yellow Sweetclover	Exotic	SNA
Mentha arvensis	Corn Mint	Secure	S5
Mitchella repens	Partridge-Berry	Secure	S5
Moneses uniflora	One-Flower Wintergreen	Secure	S5
Morella pensylvanica	Northern Bayberry	Secure	S5
Oclemena acuminata	Whorled Aster	Secure	S5
Oenothera biennis	Common Evening-Primrose	Secure	S5

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Oenothera perennis	Small Sundrops	Secure	S5
Onoclea sensibilis	Sensitive Fern	Secure	S5
Osmorhiza claytonii	Hairy Sweet-Cicely	Secure	S4
Osmunda cinnamomea	Cinnamon Fern	Secure	S5
Osmunda cinnamomea	Cinnamon Fern	Secure	S6
Osmunda claytoniana	Interrupted Fern	Secure	S5
Osmunda regalis	Royal Fern	Secure	S5
Oxalis stricta	Upright Yellow Wood-Sorrel	Secure	S5
Packera schweinitziana	Robbins Squaw-Weed	Secure	S4
Panicum capillare	Old Witch Panic-Grass	Exotic	SNA
Panicum dichotomiflorum	Spreading Panicgrass	Secure	S5
Phegopteris connectilis	Northern Beech Fern	Secure	S5
Phleum pratense	Meadow Timothy	Exotic	SNA
Photinia melanocarpa	Black Chokeberry	Secure	S5
Picea glauca	White Spruce	Secure	S5
Picea glauca	White Spruce	Secure	S6
Picea mariana	Black Spruce	Secure	S5
Picea rubens	Red Spruce	Secure	S5
Plantago major	Nipple-Seed Plantain	Exotic	SNA
Plantago maritima	Seaside Plantain	Secure	S5
Platanthera aquilonis	Leafy Northern Green Orchis	Secure	S4?
Poa compressa	Canada Bluegrass	Exotic	SNA
Poa nemoralis	Woods Bluegrass	Exotic	SNA
Poa palustris	Fowl Bluegrass	Secure	S5
Poa pratensis	Kentucky Bluegrass	Secure	S5
Poa sp.	Blugrass	na	na
Polygonum cilinode	Fringed Black Bindweed	Secure	S5
Polygonum persicaria	Lady's Thumb	Exotic	SNA
Polygonum sagittatum	Arrow-Leaved Tearthumb	Secure	S5
Polystichum acrostichoides	Christmas Fern	Secure	S5
Populus grandidentata	Large-Tooth Aspen	Secure	S5
Populus tremuloides	Quaking Aspen	Secure	S5
Potentilla anglica	English Cinquefoil	Exotic	SNA
Potentilla argentea	Silvery Cinquefoil	Exotic	SNA
Potentilla norvegica	Norwegian Cinquefoil	Secure	S5
Potentilla simplex	Old-Field Cinquefoil	Secure	S5
Prunella vulgaris	Self-Heal	Secure	S5
Prunella vulgaris	Self-Heal	Secure	S6
Prunus pensylvanica	Fire Cherry	Secure	S5
Prunus virginiana	Choke Cherry	Secure	S5
Pteridium aquilinum	Bracken Fern	Secure	S5
Ranunculus acris	Tall Butter-Cup	Exotic	SNA
Ranunculus repens	Creeping Butter-Cup	Exotic	SNA
Raphanus raphanistrum	Wild Radish	Exotic	SNA
Rheum rhabarbarum	Rhubarb	Exotic	SNA
Rhinanthus minor	Little Yellow-Rattle	Secure	S5

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Ribes hirtellum	Smooth Gooseberry	Secure	S5
Ribes lacustre	Bristly Black Currant	Secure	S5
Ribes sp.	Currant	na	na
Rosa canina	Dog Rose	Exotic	SNA
Rosa carolina	Carolina Rose	Secure	S4S5
Rosa nitida	Shining Rose	Secure	S4
Rosa rugosa	Rugosa Rose	Exotic	SNA
Rosa sp.	a Rose	na	na
Rosa virginiana	Virginia Rose	Secure	S5
Rosa virginiana	Virginia Rose	Secure	S6
Rubus allegheniensis	Allegheny Blackberry	Secure	S5
Rubus hispidus	Bristly Dewberry	Secure	S5
Rubus idaeus	Red Raspberry	Secure	S5
Rubus idaeus ssp. strigosus	American Red Raspberry	Secure	S5
Rubus pubescens	Dwarf Red Raspberry	Secure	S5
Rubus recurvicaulis	a bramble	Secure	SNR
Rubus sp.	a Blackberry	na	na
Rumex acetosella	Sheep Sorrel	Exotic	SNA
Salix bebbiana	Bebb's Willow	Secure	S5
Salix bebbiana	Bebb's Willow	Secure	S6
Salix discolor	Pussy Willow	Secure	S5
Salix humilis	Prairie Willow	Secure	S5
Salix sp.	a Willow	na	na
Salsola kali	Russian Thistle	Exotic	SNA
Sambucus racemosa	Red Elderberry	Secure	S5
Scirpus cyperinus	Cottongrass Bulrush	Secure	S5
Scirpus microcarpus	Small-Fruit Bulrush	Secure	S5
Scutellaria galericulata	Hooded Skullcap	Secure	S5
Scutellaria lateriflora	Mad Dog Skullcap	Secure	S5
Senecio jacobaea	Tansy Ragwort	Exotic	SNA
Senecio vulgaris	Old-Man-In-The-Spring	Exotic	SNA
Sibbaldiopsis tridentata	Three-Toothed Cinquefoil	Secure	S5
Sisyrinchium montanum	Strict Blue-Eyed-Grass	Secure	S5
Solanum dulcamara	Climbing Nightshade	Exotic	SNA
Solidago canadensis	Canada Goldenrod	Secure	S5
Solidago canadensis	Canada Goldenrod	Secure	S6
Solidago flexicaulis	Broad-Leaved Goldenrod	Secure	S5
Solidago gigantea	Smooth Goldenrod	Secure	S5
Solidago nemoralis	Field Goldenrod	Secure	S4S5
Solidago puberula	Downy Goldenrod	Secure	S5
Solidago rugosa	Rough-Leaf Goldenrod	Secure	S5
Solidago rugosa	Rough-Leaf Goldenrod	Secure	S6
Solidago uliginosa	Bog Goldenrod	Secure	S5
Sonchus arvensis	Field Sowthistle	Exotic	SNA
Sonchus asper	Spiny-Leaf Sowthistle	Exotic	SNA
Sonchus oleraceus	Common Sowthistle	Exotic	SNA

Table D-1: Vascular Plant Species Encountered during 2010 Field Surveys and Information on their Population Status

Scientific Name	Common Name	NSDNR Rank	ACCDC Rank
Sorbus americana	American Mountain-Ash	Secure	S5
Sorbus decora	Northern Mountain-Ash	Secure	S4
Spiraea alba	Narrow-Leaved Meadow-Sweet	Secure	S5
Stellaria graminea	Little Starwort	Exotic	SNA
Symphyotrichum lanceolatum	White Panicled American-Aster	Secure	S4S5
Symphyotrichum lateriflorum	Farewell-Summer	Secure	S5
Symphyotrichum novi-belgii	New Belgium American-Aster	Secure	S5
Symphyotrichum novi-belgii	New Belgium American-Aster	Secure	S6
Symphyotrichum puniceum	Swamp Aster	Secure	S5
Taraxacum officinale	Common Dandelion	Exotic	SNA
Thalictrum pubescens	Tall Meadow-Rue	Secure	S5
Thelypteris noveboracensis	New York Fern	Secure	S5
Thelypteris noveboracensis	New York Fern	Secure	S6
Thelypteris palustris	Marsh Fern	Secure	S5
Toxicodendron rydbergii	Northern Poison Oak	Secure	S5
Tragopogon pratensis	Meadow Goat's-Beard	Exotic	SNA
Trientalis borealis	Northern Starflower	Secure	S5
Trifolium aureum	Yellow Clover	Exotic	SNA
Trifolium campestre	Low Hop Clover	Exotic	SNA
Trifolium pratense	Red Clover	Exotic	SNA
Trifolium repens	White Clover	Exotic	SNA
Triglochin maritima	Common Bog Arrow-Grass	Secure	S5
Trillium cernuum	Nodding Trillium	Secure	S4
Trillium undulatum	Painted Trillium	Secure	S5
Tussilago farfara	Colt's Foot	Exotic	SNA
Typha latifolia	Broad-Leaf Cattail	Secure	S5
Typha x glauca	Blue Cattail	Not Assessed	SNA
Vaccinium angustifolium	Late Lowbush Blueberry	Secure	S5
Vaccinium macrocarpon	Large Cranberry	Secure	S5
Vaccinium macrocarpon	Large Cranberry	Secure	S6
Vaccinium myrtilloides	Velvetleaf Blueberry	Secure	S5
Veronica officinalis	Gypsy-Weed	Exotic	S5
Veronica serpyllifolia	Thyme-Leaved Speedwell	Secure	S5
Veronica serpyllifolia ssp. serpyllifolia	Thyme-Leaved Speedwell	Exotic	SNA
Viburnum nudum	Possum-Haw Viburnum	Secure	S5
Viburnum opulus var. americanum	Highbush Cranberry	Secure	S5
Vicia cracca	Tufted Vetch	Exotic	SNA
Viola sp.	a Violet	na	na

APPENDIX E

Vascular Plants and Wildlife Identified in the Study Area during Modelling

Table E-1: Rare and Sensitive Plants Identified by the Modelling Exercise as being Potentially Present in Project Area and Information on their Preferred Habitat, Phenology, and Population Status

Scientific Name	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Distance from project Area (km)
Ageratina altissima	White Snakeroot	Woods, thickets.	July to October.	S1	May Be At Risk	14 ±10
Agrimonia gryposepala	Hooked Agrimony/Tall Hairy Groovebur	Thickets, the margins of rich woods, intervales, and slopes.	July and August	S3	Secure	50 ±0
Alopecurus aequalis	Short-awned Foxtail	Muddy margins of rivers and shallow ponds, and gravel margins where competitor species are few.	Summer	S2S3	Sensitive	28 ±1
Anemone virginiana var. alba	Virginia Anemone	Intervales and streamsides. Calcareous and slaty ledges, shores and thickets.	Early July.	S1S2	Sensitive	61 ±0.1
Asclepias incarnata	Swamp Milkweed	Wet or rocky thickets, usually near a stream or lakeshore.	Flowers in early August	S3	Secure	49 ±10
Asclepias incarnata ssp. pulchra	Swamp Milkweed	Swamps, thickets and on shores.	Flowers in early August	S2S3		66 ±1
Asplenium trichomanes	Maidenhair Spleenwort	Damp shaded cliffs, and talus slopes. Acidic rock such as granite, basalt and sandstone.	Can be identified without sprangia.	S2	Sensitive	57 ±0.1
Campanula aparinoides	Marsh Bellflower	Meadows, ditches and river banks.	August	S3	Sensitive	28 ±1
Cardamine pratensis var. angustifolia	Cuckoo Flower	Meadows, moist fields, and low areas.	Late May and early June	S1	May Be At Risk	70 ±0
Carex alopecoidea	Foxtail Sedge	Moist, overgrown clear-cut woods near the coast.	Unknown for NS, found once 1992 along St. Georges Bay, east of Antigonish.	S1	May Be At Risk	28 ±0.5
Carex bebbii	Bebb's Sedge	Northern alkaline regions in poorly drained soils.	June to August	S1S2	May Be At Risk	31 ±10
Carex comosa	Bearded Sedge/ Bristly Sedge	Swamps and shallow water.	June to August	S2	Sensitive	79 ±10
Carex haydenii	Hayden's Sedge	Swamps.	July to September	S1	May Be At Risk	29 ±5
Carex hystericina	Porcupine Sedge	Swamps, swales, and along brooks.	June to October	S2	May Be At Risk	50 ±0
Carex lupulina	Hop Sedge	Mucky meadows along intervales, swales, and wet, deciduous, or treed swamps.	Flowers in June	S3	Secure	61 ±0
Carex pellita	Woolly Sedge	Swamps and bogs, often in wooded areas.	May to July	S1	May Be At Risk	59 ±0
Carex plantaginea	Plantain-Leaved Sedge	Dry, hardwood hillsides.	April to June	S1	May Be At Risk	86 ±0
Carex tenera	Tender Sedge	Meadows, woodlands, and moist, dry openings.	Late May to August	S1S2	Sensitive	41 ±5
Carex tenuiflora	Sparse-Flowered Sedge	Wet woods and bogs.	not given for NS, most members of Heleonastesgroup flower June to August	S1	May Be At Risk	89 ±1
Carex tincta	Tinged Sedge	Rich soil, at edge of mixed woods in NS. Mist meadows, roadside ditches, borders and clearings in NB.	Not given for Nova Scotia	S1	May Be At Risk	28 ±1
Carex tribuloides	Blunt Broom Sedge	Swales and wet woods.	Flowers June to September	S3?	Secure	62 ±1
Carex tuckermanii	Tuckerman's Sedge	Swales.	June to August	S1	May Be At Risk	65 ±0.1
Carex viridula var. elatior	Greenish Sedge	Sphagnous swales, gravelly and rocky shores, and low pastures near the sea. Often at the borders of brackish ponds.	June to September.	S1	May Be At Risk	69 ±0

Table E-1: Rare and Sensitive Plants Identified by the Modelling Exercise as being Potentially Present in Project Area and Information on their Preferred Habitat, Phenology, and Population Status

Scientific Name	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Distance from project Area (km)
Chenopodium rubrum	Red Pigweed	Salt marshes, seashores, and saline soils.	August to November	S1?	May Be At Risk	14 ±10
Conioselinum chinense	Chinese Hemlock-parsley	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast.	August to October	S2	Sensitive	74 ±5
Crassula aquatica	Water Pygmyweed	Brackish, muddy shores and sandy flats. The borders of muddy ponds near the coast.	July to September	S2	Sensitive	93 ±10
Cuscuta cephalanthi	Buttonbush Dodder	Low-lying ground near seashore, often parasitic on Asters.	August and September	S1	May Be At Risk	22 ±10
Eleocharis olivacea	Yellow Spikerush	Peaty muck of bogs, wet sandy shores, and swales.	June to October. Mature achenes required for identification.	S2S3	Sensitive	22 ±5
Eleocharis ovata	Ovate Spikerush	Muddy shores and ditches.	Flowers/Fruit May to October	S2?	Sensitive	90 ±0.5
Elymus hystrix var. bigeloviana	Spreading Wild Rye	Wooded bottomlands.	June to August	S1	May Be At Risk	61 ±1
Epilobium coloratum	Purple-veined Willowherb	Low-lying ground, springy slopes and similar locations.	July and October. Seeds required for identification.	S2?	Sensitive	19 ±0.5
Equisetum palustre	Marsh Horsetail	Marshes and swamps.	Not provided	S1	May Be At Risk	52 ±0
Equisetum pratense	Meadow Horsetail	Open woods and wet meadows, usually in circumneutral soils.	Identifiable throughout the growing season	S2	Sensitive	92 ±0
Equisetum variegatum	Variegated Horsetail	Streambanks, bogs, and wet thickets.	Not provided	S3	Secure	50 ±0
Erigeron philadelphicus	Philadelphia Fleabane	Old fields, meadows, and springy slopes.	Flowers June to August	S2	Sensitive	19 ±10
Fraxinus nigra	Black Ash	Low ground, damp woods and swamps.	May and June. Can be identified without flowers.	S2S3	Sensitive	22 ±10
Goodyera tesselata	Checkered Rattlesnake-Plantain	Moist, coniferous woods.	Flowers July to August	S4	Secure	67 ±0
Hedeoma pulegioides	American False Pennyroyal	Stony soil and upland pastures	August	S2S3	Sensitive	5 ±5
Hieracium kalmii	Kalm's Hawkweed	Roadsides, rough ground, clearings and thickets.	Flowers July and August	S2?		78 ±1
Hieracium kalmii var. kalmii	Kalm's Hawkweed	Roadsides, rough ground, clearings and thickets.	July to October	S2?		89 ±5
Hypericum dissimulatum	Disguised St John's-wort	On shores and damp open areas.	Not provided	S2S3	Sensitive	66 ±1
Hypericum majus	Large St. John's-wort	Wet or dry open soil.	July to September	S1	May Be At Risk	94 ±1
Iris prismatica	Slender Blue Flag	Wet ground near the coast.	Mid-July.	S1	May Be At Risk	59 ±10
Juncus dudleyi	Dudley's Rush	Marshy ground.	June to September	S2?	Sensitive	50 ±0
Juncus subcaudatus	Woodland Rush	Wet boggy woods and openings in spruce swamps.	Flowers July to October	S3	Sensitive	53 ±10
Limosella australis	Southern Mudwort	Low areas by ponds, gravel lakeshores, the muddy edges of ponds behind barrier beaches and muddy river margins.	Late June to October.	S3	Sensitive	99 ±5
Malaxis brachypoda	White Adder's-Mouth	Moss cushions and wet, mossy cliff-edges, where there is little competition from other plant species.	Late May and June.	S1	May Be At Risk	50 ±10
Montia fontana	Water Blinks	Springy or seepy slopes, wet shores and brackish spots, coastal.	Flowers June to September when most noticable	S1	May Be At Risk	58 ±1

Table E-1: Rare and Sensitive Plants Identified by the Modelling Exercise as being Potentially Present in Project Area and Information on their Preferred Habitat, Phenology, and Population Status

Scientific Name	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Distance from project Area (km)
Myriophyllum farwellii	Farwell's Water Milfoil	Ponds and slow-moving streams.	Flowers June to September	S2	Sensitive	44 ±10
Oenothera fruticosa ssp. glauca	Narrow-leaved Evening Primrose	Old fields, the edges of thickets, and roadsides. In dry,open, sandy soil.	Flowers June to August	S2		50 ±10
Parnassia palustris var. parviflora	Marsh Grass-of-Parnassus	Grassy hollows in sand dunes, and on tussocks in swamps.	July.	S2	May Be At Risk	12 ±1
Plantago rugelii	Rugel's Plantain	Damp shores, roadsides and waste places.	July to October	S2		61 ±0
Platanthera flava	Tubercled Orchid	Sandy or gravelly beaches, wet peat, and lake or river margins. Bogs, swamps, and Meadows.	May to August	S2	Sensitive	79 ±0
Platanthera flava var. flava	Tubercled Orchid	Sand or gravelly beaches, wet peat, and lake or river margins. Bogs, swamps, and meadows.	May to August.	S2	Sensitive	89 ±10
Platanthera flava var. herbiola	Tubercled Orchid	Sandy or gravelly beaches, wet peat, and lake or river margins. Bogs, swamps, and meadows.	May to August	S1S2	Secure	79 ±0
Platanthera grandiflora	Large Purple Fringed Orchid	Wet meadows and along streams.	Flowers in July	S3	Secure	22 ±5
Platanthera hookeri	Hooker's Orchid	Mixed wood, frequently under conifers. Prefers open, dry conditions.	Flowers May to August	S3	Secure	57 ±0.1
Polygala sanguinea	Blood Milkwort	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October.	S2S3	Sensitive	53 ±1
Polygonum pensylvanicum	Pennsylvania Smartweed	Roadside ditches, dyked marshes, grain fields.	Flowers July to September	S3	Secure	59 ±0
Polygonum raii	Sharp-fruited Knotweed	Coastal damp sands and gravels.	Not given, likely July to Septemb	S2S3		57 ±0.5
Potamogeton friesii	Fries' Pondweed	Quiet waters of ponds and streams.	Flowers July and September	S2	May Be At Risk	53 ±1
Potamogeton obtusifolius	Blunt-leaved Pondweed	Ponds, lakes, and slow-moving streams, often on a substrate of deep muck.	Flowers July to September	S2S3	Sensitive	29 ±10
Primula mistassinica	Mistassini Primrose	Springy stream banks and dripping ledges.	Flowers May to August	S2	Sensitive	91 ±10
Proserpinaca pectinata	Comb-leaved Mermaidweed	Wet savannas, sphagnous swales, and the sandy, gravelly, or muddy borders of lakes or ponds.	June to October. Can be identified when not in flower.	S3	Sensitive	85 ±1
Ranunculus sceleratus	Cursed Buttercup	Marshes, ditches, swampy meadows.	Not given for NS	S1S2	May Be At Risk	87 ±10
Rubus flagellaris	Northern Dewberry	Dry fields, forest openings, and the borders of thickets.	Flowers early May to June	S1?		98 ±5
Rudbeckia laciniata	Cut-Leaved Coneflower	Swales, the edges of swamps, or in gullies - in small colonies.	August, can be identified when not in flower.	S2	Sensitive	92 ±0
Rudbeckia laciniata var. gaspereauensis	Cut-Leaved Coneflower	Swales, the edges of swamps, or in gullies - in small colonies.	August, can be identified when not in flower.	S2		22 ±10
Rumex maritimus	Sea-Side Dock	Coastal.	Flowers July to October	S3	Secure	43 ±0.1
Rumex salicifolius var. mexicanus	Triangular-valve Dock	Beaches or along rivers.	Not Given, Summer	S2	Sensitive	61 ±10
Salix pellita	Satiny Willow	Streambanks and fertile thickets.	May and June.	S2S3		58 ±1
Salix petiolaris	Meadow Willow	Meadows and on wet grounds.	Flowers in May and June	S3	Secure	65 ±0

Table E-1: Rare and Sensitive Plants Identified by the Modelling Exercise as being Potentially Present in Project Area and Information on their Preferred Habitat, Phenology, and Population Status

Scientific Name	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	Distance from project Area (km)
Scrophularia lanceolata	Lance-leaved Figwort	Open woods or dryish thickets, only occasionally in open ground.	Flowers June to July	S1		57 ±10
Senecio pseudoarnica	Seabeach Ragwort	Gravelly to somewhat sandy sea beaches.	Late July to August	S2	Sensitive	59 ±1
Solidago hispida	Hairy Goldenrod	Woods and forest edges.	Summer and fall	S1?	May Be At Risk	80 ±10
Spiranthes lucida	Shining Ladies'-Tresses	Alluvial soils and rocky shores. Thickets and meadows.	Flowers early July	S2	May Be At Risk	50 ±0
Stellaria crassifolia	Fleshy Stitchwort	Spring rills and the edges of ponds	July and August	S1	May Be At Risk	62 ±1
Stellaria longifolia	Long-leaved Starwort	Damp or wet grassy places, in sandy or mucky soils.	May to June	S3	Sensitive	59 ±0
Symphyotrichum ciliolatum	Fringed Blue Aster	Open fields, lawns and the edges of woods.	August and September	S2S3	Sensitive	49 ±10
Teucrium canadense	Canada Germander	Gravelly seashores, generally at crest of beach, above direct tidal influence.	Flowers July to September when easiest to identify but identifiable from June to October	S3	Sensitive	30 ±0
Triantha glutinosa	Sticky False Asphodel	Swamps, bogs, and rocky beaches.	June to August	S1	May Be At Risk	69 ±0
Verbena hastata	Blue Vervain	Damp thickets, shores, roadsides.	Summer	S3	Secure	56 ±1
Viola nephrophylla	Northern Bog Violet	Cool mossy bogs, the borders of streams, and damp woods.	May to July.	S2	Sensitive	60 ±0

Table E-2: Results of the Wildlife Modelling Exercise

Type	Common Name	Scientific Name	Preferred Habitat	Likely Onsite?	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NSESA Rank	Distance from Project area (km)
Birds	American Coot	*Fulica americana*	Wetlands and open water bodies.	Unlikely	S1B	Undetermined	Not at Risk		68 ±5
	American Golden-Plover	*Pluvialis dominica*	Breeds on Arctic tundra, especially in low vegetation on rocky slopes. Winters in grazed grasslands. On migration found in prairie, pastures, tilled farmland, golf courses, airports, mudflats, shorelines, and beaches.	Unlikely	S3M	Sensitive			17 ±0.5
	American Three-toed Woodpecker	*Picoides dorsalis*	Coniferous forests and burnt lands; less frequently found in mixed forests.	Unlikely	S1S2	Undetermined			53 ±5
	Arctic Tern	*Sterna paradisaea*	Coastal islands, beaches and salt marshes. May occasionally nest on islands in lakes.	Unlikely	S3B	May Be At Risk			14 ±10
	Baltimore Oriole	*Icterus galbula*	Open broadleaf woods.	Possible	S2S3B	May Be At Risk			19 ±5
	Barrow's Goldeneye (Eastern pop.)	*Bucephala islandica (Eastern pop.)*	Mountain streams, large rivers.	Unlikely	S1N	At Risk	Special Concern		47 ±0.1
	Bicknell's Thrush	*Catharus bicknelli*	Regenerating clear-cuts and coastal areas with spruce-fir at low elevations.	Unlikely	S1S2B	At Risk	Threatened	Vulnerable	93 ±5
	Black-billed Cuckoo	*Coccyzus erythropthalmus*	Moist thickets in low overgrown pastures and orchards; also occurs in thicker undergrowth and sparse woodlands.	Possible	S3?B	May Be At Risk			12 ±0.5
	Black-crowned Night-heron	*Nycticorax nycticorax*	Freshwater pools, marshes, streams and estuaries.	Unlikely	S1B	May Be At Risk			14 ±5
	Bobolink	*Dolichonyx oryzivorus*	Fields with dense grass cover, particularly hay fields.	Unlikely	S3S4B	Sensitive	Threatened		1 ±5
	Boreal Owl	*Aegolius funereus*	Old-growth forests with woodpecker cavities for nesting.	Unlikely	S1B	Undetermined	Not at Risk		43 ±0.1
	Brown Thrasher	*Toxostoma rufum*	Woodlands and hedgerows.	Unlikely	S1?B	Undetermined			57 ±5
	Common Goldeneye	*Bucephala clangula*	Clear water lakes and ponds without submergent and emergent vegetation. Forested habitat with mature trees (deciduous or coniferous) suitable nesting cavities.	Unlikely	S2B,S5N	Secure			20 ±10
	Common Moorhen	*Gallinula chloropus*	Marshes and ponds.	Unlikely	S1B	Undetermined			98 ±5
	Common Tern	*Sterna hirundo*	Coastal and freshwater islands, coastal beaches and salt marshes.	Unlikely	S3B	Sensitive	Not at Risk		14 ±10
	Eastern Bluebird	*Sialia sialis*	Open woodlands, clearings, farmlands, parks, orchards, gardens, fields, along roadsides on utility wires and fences.	Possible	S3B	Sensitive	Not at Risk		1 ±5
	Eastern Phoebe	*Sayornis phoebe*	Found in woodlands and along forest edges, often near water.	Possible	S3S4B	Sensitive			19 ±5
	Great Crested Flycatcher	*Myiarchus crinitus*	Found in open deciduous forest.	Possible	S2B	May Be At Risk			66 ±5
	Greater Yellowlegs	*Tringa melanoleuca*	Freshwater ponds and tidal marshes.	Unlikely	S3B,S5M	Sensitive			14 ±5
	Harlequin Duck - Eastern pop.	*Histrionicus histrionicus pop. 1*		Unlikely	S2N	At Risk	Special Concern	Endangered	79 ±10
	Hudsonian Godwit	*Limosa haemastica*	Breeds near treeline, where tundra, open woods, and ponds come together. Typically found on marshy lakes, wet pastures, and mudflats around ponds.	Unlikely	S3M	Sensitive			17 ±0.5
	Indigo Bunting	*Passerina cyanea*		Unlikely	S1S2B	Undetermined			36 ±5

Table E-2: Results of the Wildlife Modelling Exercise

Type	Common Name	Scientific Name	Preferred Habitat	Likely Onsite?	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NSESA Rank	Distance from Project area (km)
	Long-eared Owl	*Asio otus*	Various woodland habitats as well as open habitats.	Unlikely	S2	May Be At Risk			14 ±5
	Northern Mockingbird	*Mimus polyglottos*	Open ground and shrubby vegetation, such as in parkland, cultivated land, and suburbs.	Unlikely	S3B	Secure			14 ±5
	Northern Pintail	*Anas acuta*	Salt and freshwater marshes, occasionally on Sable Island and most frequently in the Amherst region.	Unlikely	S2B	May Be At Risk			31 ±10
	Philadelphia Vireo	*Vireo philadelphicus*	Young deciduous woods.	Possible	S2?B	Undetermined			19 ±5
	Piping Plover (melodus subspecies)	*Charadrius melodus melodus*	Coastal sand and gravel beaches.	Unlikely	S1B	At Risk	Endangered	Endangered	14 ±5
	Purple Martin	*Progne subis*	Open woodlands, residential areas, and agricultural land.	Unlikely	S1B	May Be At Risk			88 ±0.5
	Purple Sandpiper	*Calidris maritima*	Breeds along low tundra near shorelines, as well as gravel beaches along rivers. Winters along rocky coastlines and man-made jetties.	Unlikely	S3N	Sensitive			54 ±0.5
	Razorbill	*Alca torda*	Coastal cliffs.	Unlikely	S1B,S4N	Sensitive			85 ±5
	Red Knot rufa ssp	*Calidris canutus rufa*	In Nova Scotia, Red Knot stopover to feed during their migration south in late summer. Found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	Unlikely	S2S3M	At Risk	Endangered	Endangered	21 ±0.5
	Red-breasted Merganser	*Mergus serrator*	Coastal ponds and inland waters.	Unlikely	S3B,S5N	Secure			19 ±5
	Roseate Tern	*Sterna dougallii*	Few islands off the Atlantic coast of Nova Scotia. Found in colonies.	Unlikely	S1B	At Risk	Endangered	Endangered	85 ±0.1
	Rusty Blackbird	*Euphagus carolinus*	Boreal forest; forest wetlands, such as slowmoving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges.	Unlikely	S2S3B	May Be At Risk	Special Concern		9 ±5
	Savannah Sparrow princeps ssp	*Passerculus sandwichensis princeps*	In NS found only on Sable Island.	Unlikely	S1B	Sensitive	Special Concern		82 ±5
	Scarlet Tanager	*Piranga olivacea*	Common in deciduous or mixed forests.	Possible	S2B	Undetermined			37 ±0.1
	Semipalmated Plover	*Charadrius semipalmatus*	Frequents sandy beaches and mudflats.	Unlikely	1S2B,S5	Secure			79 ±5
	Short-eared Owl	*Asio flammeus*	Nests on the ground in open country. An open hayfield is often chosen as a nest site.	Unlikely	S1S2	May Be At Risk	Special Concern		35 ±5
	Solitary Sandpiper	*Tringa solitaria*	Along the banks of ponds and creeks.	Unlikely	1?B,S4S5	Secure			21 ±0.5
	Vesper Sparrow	*Pooecetes gramineus*	Areas of low grass or shrubs such as pastures, blueberry fields and clearings. Most frequently found in blueberry fields in Nova Scotia.	Possible	S2S3B	May Be At Risk			19 ±5
	Virginia Rail	*Rallus limicola*	Freshwater marshes; occasionally inhabits salt marshes. Lives in dense emergent vegetation.	Unlikely	S2B	Undetermined			29 ±5
	Warbling Vireo	*Vireo gilvus*	Riparian woodlands.	Possible	S1?B	Undetermined			19 ±5

Table E-2: Results of the Wildlife Modelling Exercise

Type	Common Name	Scientific Name	Preferred Habitat	Likely Onsite?	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NSESA Rank	Distance from Project area (km)
	Whimbrel	*Numenius phaeopus*	Breeds in various tundra habitat, from wet lowlands to dry heath. In migration, frequents various coastal and inland habitats, including fields and beaches. Winters in tidal flats and shorelines, occasionally visiting inland habitats.	Unlikely	S3M	Sensitive			17 ±0.5
	Whip-Poor-Will	*Caprimulgus vociferus*	Breeds in deciduous or mixed forests with little or no underbrush. Winters in mixed woods near open areas.	Unlikely	S1?B	At Risk	Threatened		14 ±5
	Willow Flycatcher	*Empidonax traillii*		Unlikely	S2B	Sensitive			89 ±5
	Wood Thrush	*Hylocichla mustelina*	Interior as well as the edges of deciduous and mixed forests, often near water.	Possible	S1B	Undetermined			19 ±5
Mammals	American Marten	*Martes americana*	Restricted to two areas in the highlands of Cape Breton Island.	Unlikely	S1	At Risk		Endangered	77 ±10
	Canada Lynx	*Lynx canadensis*		Unlikely	S1	At Risk	Not at Risk	Endangered	61 ±10
	Fisher	*Martes pennanti*	Mixed forests with a wide variety of tree species.	Unlikely	S2	Sensitive			95 ±10
	Long-tailed Shrew	*Sorex dispar*	Colchester and Cumberland Counties.	Unlikely	S1	Sensitive			83 ±10
	Moose (mainland pop.)	*Alces americanus*	Woodlands providing both mature softwood cover and young hardwood browse. Also swamps, bogs and lakeshores, generally remote from human habitation.	Unlikely	S1	At Risk		Endangered	1 ±10
	Northern Long-eared Bat	*Myotis septentrionalis*	Heavily forested areas and in summer, this bat may occasionally be found in hollow trees, rock crevices, behind tree bark, and in buildings.	Unlikely	S2	Sensitive			50 ±1
	Rock Vole	*Microtus chrotorrhinus*		Unlikely	S2	Sensitive			83 ±10
Herpetiles	Four-toed Salamander	*Hemidactylium scutatum*	Swamps and bogs with pools surrounded by sphagnum moss.	Possible	S3	Secure	Not at Risk		45 ±10
	Wood Turtle	*Glyptemys insculpta*	Found along streams and wetlands. Gravel bars, tall shrub swamps, deep pools in wetlands.	Unlikely	S3	At Risk	Threatened	Vulnerable	19 ±10

APPENDIX F

Breeding and Population Status of Birds Recorded in the Project Area and the Breeding Bird Atlas Square

Table F-1 Birds Not Observed within the Project Area and Information on Their Population and Breeding Status

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	NSDNR Rank	ACCDC Rank	Maximum MBBA Breeding Status	Maximum Field Survey Breeding Status
American Bittern	*Botaurus lentiginosus*			Sensitive	S3S4B	Probable	Not observed
American Black Duck	*Anas rubripes*			Secure	S5	Confirmed	Not observed
American Crow	*Corvus brachyrhynchos*			Secure	S5	Confirmed	Not observed
American Kestrel	*Falco sparverius*			Secure	S5B	Confirmed	Not observed
American Wigeon	*Anas americana*			Secure	S4B	Probable	Not observed
Bank Swallow	*Riparia riparia*			May Be At Risk	S3B	Possible	Not observed
Barn Swallow	*Hirundo rustica*			Sensitive	S3B	Confirmed	Not observed
Barred Owl	*Strix varia*			Secure	S5	Probable	Not observed
Belted Kingfisher	*Megaceryle alcyon*			Secure	S5B	Probable	Not observed
Blue-winged Teal	*Anas discors*			May Be At Risk	S3B	Confirmed	Not observed
Bobolink	*Dolichonyx oryzivorus*	Threatened		Sensitive	S3S4B	Observed	Not observed
Brown Creeper	*Certhia americana*			Secure	S5	Possible	Not observed
Canada Goose	*Branta canadensis*			Secure	SNAB,S4N	Observed	Not observed
Canada Warbler	*Wilsonia canadensis*	Threatened		At Risk	S3B	Probable	Not observed
Common Merganser	*Mergus merganser*			Secure	S5	Possible	Not observed
Common Tern	*Sterna hirundo*	Not at Risk		Sensitive	S3B	Observed	Not observed
Double-crested Cormorant	*Phalacrocorax auritus*	Not at Risk		Secure	S5B	Observed	Not observed
Eastern Bluebird	*Sialia sialis*	Not at Risk		Sensitive	S3B	Probable	Not observed
Eastern Kingbird	*Tyrannus tyrannus*			Sensitive	S3S4B	Probable	Not observed
Eastern Phoebe	*Sayornis phoebe*			Sensitive	S3S4B	Confirmed	Not observed
European Starling	*Sturnus vulgaris*			Exotic	SNA	Possible	Not observed
Evening Grosbeak	*Coccothraustes vespertinus*			Secure	S4B,S5N	Probable	Not observed
Golden-crowned Kinglet	*Regulus satrapa*			Sensitive	S4	Confirmed	Not observed
Gray Catbird	*Dumetella carolinensis*			May Be At Risk	S3B	Probable	Not observed
Gray Jay	*Perisoreus canadensis*			Sensitive	S3S4	Confirmed	Not observed
Great Black-backed Gull	*Larus marinus*			Secure	S4	Observed	Not observed
Great Blue Heron	*Ardea herodias*			Secure	S4B	Observed	Not observed
Great Cormorant	*Phalacrocorax carbo*			Sensitive	S3	Observed	Not observed
Greater Yellowlegs	*Tringa melanoleuca*			Sensitive	S3B,S5M	Observed	Not observed
Lincoln's Sparrow	*Melospiza lincolnii*			Secure	S4B	Probable	Not observed
Merlin	*Falco columbarius*	Not at Risk		Secure	S5B	Confirmed	Not observed
Mourning Dove	*Zenaida macroura*			Secure	S5	Confirmed	Not observed
Northern Harrier	*Circus cyaneus*	Not at Risk		Secure	S5B	Confirmed	Not observed
Northern Parula	*Parula americana*			Secure	S5B	Probable	Not observed
Northern Saw-whet Owl	*Aegolius acadicus*			Secure	S4	Possible	Not observed
Pine Grosbeak	*Pinicola enucleator*			May Be At Risk	S3?B,S5N	Observed	Not observed
Pine Siskin	*Carduelis pinus*			Sensitive	S3S4B,S5N	Possible	Not observed
Red-breasted Nuthatch	*Sitta canadensis*			Secure	S4S5	Confirmed	Not observed
Ring-billed Gull	*Larus delawarensis*			Secure	S1?B,S5N	Observed	Not observed
Savannah Sparrow	*Passerculus sandwichensis*			Secure	S4B	Possible	Not observed
Sharp-shinned Hawk	*Accipiter striatus*	Not at Risk		Secure	S4S5B	Confirmed	Not observed
Spruce Grouse	*Falcipennis canadensis*			Secure	S5	Probable	Not observed
Swamp Sparrow	*Melospiza georgiana*			Secure	S5B	Confirmed	Not observed
Tennessee Warbler	*Vermivora peregrina*			Sensitive	S3S4B	Possible	Not observed
Tree Swallow	*Tachycineta bicolor*			Sensitive	S4B	Confirmed	Not observed
White-winged Crossbill	*Loxia leucoptera*			Secure	S4S5	Probable	Not observed
Winter Wren	*Troglodytes troglodytes*			Secure	S5B	Confirmed	Not observed
Yellow-rumped Warbler	*Dendroica coronata*			Secure	S5B	Confirmed	Not observed

Table F-2 Birds Observed (including Possible, Probable and Confirmed) within the Project Area and Information on Their Population and Breeding Status

Common Name	Scientific Name	COSEWIC Rank	NSESA Rank	NSDNR Rank	ACCDC Rank	Maximum MBBA Breeding Status	Maximum Field Survey Breeding Status
Alder Flycatcher	*Empidonax alnorum*			Secure	S5B	Probable	Observed
American Goldfinch	*Carduelis tristis*			Secure	S5	Confirmed	Possible
American Redstart	*Setophaga ruticilla*			Secure	S5B	Probable	Probable
American Robin	*Turdus migratorius*			Secure	S5B	Confirmed	Confirmed
American Woodcock	*Scolopax minor*			Secure	S4S5B	Possible	Possible
Bald Eagle	*Haliaeetus leucocephalus*	Not at Risk		Secure	S4	Observed	Observed
Black-and-White Warbler	*Mniotilta varia*			Secure	S4S5B	Confirmed	Possible
Blackburnian Warbler	*Dendroica fusca*			Secure	S4B	Possible	Possible
Black-capped Chickadee	*Poecile atricapilla*			Secure	S5	Confirmed	Possible
Black-throated Green Warbler	*Dendroica virens*			Secure	S4S5B	Possible	Possible
Blue Jay	*Cyanocitta cristata*			Secure	S5	Confirmed	Observed
Blue-headed Vireo	*Vireo solitarius*			Secure	S5B	Probable	Possible
Cedar Waxwing	*Bombycilla cedrorum*			Secure	S5B	Confirmed	Possible
Chestnut-sided Warbler	*Dendroica pensylvanica*			Secure	S5B	Confirmed	Possible
Common Grackle	*Quiscalus quiscula*			Secure	S5B	Possible	Possible
Common Loon	*Gavia immer*	Not at Risk		May Be At Risk	S3B,S4N	Possible	Observed
Common Raven	*Corvus corax*			Secure	S5	Confirmed	Observed
Common Yellowthroat	*Geothlypis trichas*			Secure	S5B	Probable	Probable
Dark-eyed Junco	*Junco hyemalis*			Secure	S4S5	Confirmed	Probable
Downy Woodpecker	*Picoides pubescens*			Secure	S5	Confirmed	Possible
Hairy Woodpecker	*Picoides villosus*			Secure	S5	Confirmed	Possible
Hermit Thrush	*Catharus guttatus*			Secure	S5B	Confirmed	Possible
Herring Gull	*Larus argentatus*			Secure	S4S5	Observed	Observed
Least Flycatcher	*Empidonax minimus*			Secure	S4B	Possible	Possible
Magnolia Warbler	*Dendroica magnolia*			Secure	S5B	Confirmed	Possible
Mourning Warbler	*Oporornis philadelphia*			Secure	S4B	Probable	Probable
Nashville Warbler	*Vermivora ruficapilla*			Secure	S5B	Possible	Possible
Northern Flicker	*Colaptes auratus*			Secure	S5B	Confirmed	Confirmed
Northern Gannet	*Morus bassanus*			Secure	SHB,S5M	Not observed	Observed
Northern Waterthrush	*Seiurus noveboracensis*			Secure	S4B	Not observed	Possible
Olive-sided Flycatcher	*Contopus cooperi*	Threatened		At Risk	S3B	Probable	Possible
Ovenbird	*Seiurus aurocapillus*			Secure	S5B	Probable	Possible
Pileated Woodpecker	*Dryocopus pileatus*			Secure	S5	Confirmed	Possible
Purple Finch	*Carpodacus purpureus*			Secure	S4S5	Probable	Possible
Red-eyed Vireo	*Vireo olivaceus*			Secure	S5B	Probable	Possible
Red-tailed Hawk	*Buteo jamaicensis*	Not at Risk		Secure	S5	Observed	Probable
Rock Dove	*Columba livia*			Exotic	SNA	Possible	Observed
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			Sensitive	S3S4B	Possible	Possible
Ruby-crowned Kinglet	*Regulus calendula*			Sensitive	S4B	Probable	Possible
Ruby-throated Hummingbird	*Archilochus colubris*			Secure	S5B	Confirmed	Possible
Ruffed Grouse	*Bonasa umbellus*			Secure	S4S5	Confirmed	Possible
Song Sparrow	*Melospiza melodia*			Secure	S5B	Confirmed	Confirmed
Spotted Sandpiper	*Actitis macularius*			Sensitive	S3S4B	Confirmed	Observed
Swainson's Thrush	*Catharus ustulatus*			Secure	S4S5B	Confirmed	Possible
White-throated Sparrow	*Zonotrichia albicollis*			Secure	S5B	Confirmed	Confirmed
Yellow Warbler	*Dendroica petechia*			Secure	S5B	Confirmed	Possible
Yellow-bellied Flycatcher	*Empidonax flaviventris*			Sensitive	S3S4B	Possible	Possible
Yellow-bellied Sapsucker	*Sphyrapicus varius*			Secure	S4S5B	Not observed	Confirmed

APPENDIX G

Plants and Wildlife Recorded within Wetlands

Table G-1: Vascular Plants Recorded within Wetlands

Scientific Name	Common name	Wetlands																	
		1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	19
Abies balsamea	Balsam Fir	P		P	P		P	P	P	P	P	P						P	
Acer rubrum	Red Maple		P		P			P	P	P	P	P	P		P		P	P	
Acer spicatum	Mountain Maple																		P
Agrimonia gryposepala	Tall Hairy Groovebur					P													
Agrostis perennans	Perennial Bentgrass						P	P			P					P	P		
Agrostis scabra	Rough Bentgrass		P	P	P	P						P		P					
Agrostis stolonifera	Spreading Bentgrass	P	P		P	P						P					P		
Alnus viridis	Green Alder							P						P				P	
Amelanchier sp.	a Serviceberry							P				P		P	P				
Aralia nudicaulis	Wild Sarsaparilla							P							P			P	
Argentina anserina	Silverweed												P						
Athyrium filix-femina	Lady-Fern				P						P	P			P			P	P
Betula alleghaniensis	Yellow Birch							P											
Betula papyrifera	Paper Birch			P		P	P		P			P	P	P	P	P	P		
Brachyelytrum septentrionale	Bearded Short-Husk						P	P											
Bromus ciliatus	Fringed Brome	P											P		P				
Calamagrostis canadensis	Blue-Joint Reedgrass					P													
Calystegia sepium	Hedge Bindweed														P				
Cardamine pensylvanica	Pennsylvania Bitter-Cress		P	P		P													
Carex arctata	Black Sedge								P										
Carex bebbii	Bebb's Sedge			P	P	P													
Carex brunnescens	Brownish Sedge						P												
Carex canescens	Hoary Sedge		P										P	P	P				
Carex crawfordii	Crawford Sedge				P				P										
Carex echinata	Little Prickly Sedge		P		P							P	P	P			P		
Carex flava	Yellow Sedge	P	P	P	P	P	P		P			P	P	P					
Carex gracillima	Graceful Sedge		P			P	P	P			P						P		
Carex gynandra	A Sedge		P	P	P		P	P			P	P		P	P				P
Carex intumescens	Bladder Sedge							P			P	P	P	P	P	P	P		
Carex leptalea	Bristly-Stalk Sedge			P		P	P	P					P	P	P		P		
Carex lurida	Shallow Sedge		P	P	P	P						P							
Carex nigra	Black Sedge	P	P				P		P	P	P	P	P			P	P		
Carex panicea	A Sedge		P										P	P					
Carex pseudocyperus	Cyperus-Like Sedge												P	P	P		P		
Carex scoparia	Pointed Broom Sedge		P	P		P			P			P	P	P			P		
Carex stipata	Stalk-Grain Sedge		P	P	P	P			P			P			P				P
Carex trisperma	Three-Seed Sedge														P				
Chamerion angustifolium	Fireweed											P							
Chelone glabra	White Turtlehead			P		P		P										P	P

Table G-1: Vascular Plants Recorded within Wetlands

Scientific Name	Common name	Wetlands																	
		1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	19
Cornus alternifolia	Alternate-Leaf Dogwood							P											
Cornus canadensis	Dwarf Dogwood		P					P	P	P					P		P		
Crataegus monogyna	A Hawthorn							P											
Danthonia compressa	Flattened Oatgrass	P																	
Danthonia spicata	Poverty Oat-Grass						P						P						
Daucus carota	Wild Carrot												P						
Diervilla lonicera	Northern Bush-Honeysuckle																	P	
Doellingeria umbellata	Parasol White-Top		P	P	P			P	P	P		P	P	P			P	P	
Dryopteris carthusiana	Spinulose Shield Fern											P			P		P		
Dryopteris cristata	Crested Shield-Fern			P								P	P						
Eleocharis obtusa	Blunt Spike-Rush			P	P								P						
Eleocharis tenuis	Slender Spike-Rush					P													
Epilobium ciliatum	Hairy Willow-Herb		P	P	P	P			P			P	P	P	P	P			
Epilobium leptophyllum	Linear-Leaved Willow-Herb				P	P			P			P	P	P					
Epilobium palustre	Marsh Willow-Herb			P					P								P		
Equisetum arvense	Field Horsetail	P					P					P	P	P				P	
Equisetum sylvaticum	Woodland Horsetail														P				
Erechtites hieraciifolia	Fireweed			P									P						
Eupatorium perfoliatum	Common Boneset		P	P	P	P						P	P	P					
Eurybia radula	Rough-Leaved Aster			P	P									P			P	P	
Euthamia graminifolia	Flat-Top Fragrant-Golden-Rod		P	P	P		P	P	P		P	P	P	P					
Festuca rubra	Red Fescue		P																
Fragaria virginiana	Virginia Strawberry	P	P	P	P	P	P	P			P	P				P		P	
Fraxinus americana	White Ash		P	P	P	P	P	P	P	P	P	P	P	P	P			P	P
Galium palustre	Marsh Bedstraw				P	P			P				P	P			P		
Galium sp.	a Bedstraw				P								P						
Galium tinctorium	Stiff Marsh Bedstraw	P																	
Galium trifidum	Small Bedstraw										P	P					P	P	
Galium triflorum	Sweet-Scent Bedstraw							P											
Geum rivale	Purple Avens	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P
Glyceria canadensis	Canada Manna-Grass		P										P	P	P		P		
Glyceria striata	Fowl Manna-Grass	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	
Gnaphalium uliginosum	Low Cudweed			P	P														
Hieracium aurantiacum	Orange Hawkweed			P															
Hieracium lachenalii	Common Hawkweed																		P
Hieracium sp.	a Hawkweed							P									P		
Hypericum perforatum	A St. John's-Wort				P	P							P	P					
Ilex verticillata	Black Holly		P		P		P	P	P		P	P	P		P	P	P	P	
Impatiens capensis	Spotted Jewel-Weed														P		P		

Table G-1: Vascular Plants Recorded within Wetlands

Scientific Name	Common name	Wetlands																	
		1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	19
Iris versicolor	Blueflag							P				P		P			P		
Juncus articulatus	Jointed Rush											P							
Juncus brevicaudatus	Narrow-Panicled Rush	P	P	P	P	P			P				P						
Juncus canadensis	Canada Rush		P		P	P						P					P		
Juncus effusus	Soft Rush	P	P	P	P	P			P			P	P	P					
Juncus sp.	a Rush													P					
Juncus tenuis	Slender Rush												P						
Kalmia angustifolia	Sheep-Laurel																P		
Leontodon autumnalis	Autumn Hawkbit												P						
Leucanthemum vulgare	Oxeye Daisy				P														
Linnaea borealis	Twinflower							P											
Lolium pratense	Meadow Rye Grass												P						
Lonicera canadensis	American Fly-Honeysuckle							P											P
Lonicera villosa	Mountain Fly-Honeysuckle													P					
Lycopus uniflorus	Northern Bugleweed		P	P	P	P						P	P						
Lythrum salicaria	Purple Loosestrife												P						
Mentha arvensis	Corn Mint		P		P	P							P	P					
Mitchella repens	Partridge-Berry							P											
Morella pensylvanica	Northern Bayberry						P						P	P					
Oenothera biennis	Common Evening-Primrose			P	P														
Oenothera perennis	Small Sundrops		P										P						
Onoclea sensibilis	Sensitive Fern				P		P	P	P	P	P	P	P	P	P	P	P	P	P
Osmorhiza claytonii	Hairy Sweet-Cicely																		P
Osmunda cinnamomea	Cinnamon Fern	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Osmunda claytoniana	Interrupted Fern						P			P			P						
Oxalis stricta	Upright Yellow Wood-Sorrel		P	P	P														
Packera schweinitziana	Robbins Squaw-Weed		P										P	P			P		
Panicum capillare	Old Witch Panic-Grass					P													
Phegopteris connectilis	Northern Beech Fern							P						P				P	
Picea glauca	White Spruce	P								P	P				P	P	P	P	
Picea mariana	Black Spruce									P			P	P					
Plantago major	Nipple-Seed Plantain												P						
Platanthera aquilonis	Leafy Northern Green Orchis			P									P	P					
Poa compressa	Canada Bluegrass		P	P		P							P						
Poa palustris	Fowl Bluegrass												P		P				
Poa sp.	Blugrass	P	P																
Polygonum cilinode	Fringed Black Bindweed			P								P							
Polygonum sagittatum	Arrow-Leaved Tearthumb		P			P							P	P	P				
Polystichum acrostichoides	Christmas Fern					P		P											

Table G-1: Vascular Plants Recorded within Wetlands

Scientific Name	Common name	Wetlands																	
		1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	19
Populus tremuloides	Quaking Aspen		P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	
Potentilla norvegica	Norwegian Cinquefoil			P	P	P						P							
Potentilla simplex	Old-Field Cinquefoil		P	P	P	P	P		P		P	P				P	P		
Prunella vulgaris	Self-Heal	P					P	P		P	P	P						P	
Prunus pensylvanica	Fire Cherry			P	P	P			P										
Prunus virginiana	Choke Cherry			P		P	P	P		P		P	P	P	P	P		P	
Pteridium aquilinum	Bracken Fern						P				P								
Ranunculus acris	Tall Butter-Cup						P	P										P	
Ranunculus repens	Creeping Butter-Cup		P	P	P	P			P	P	P	P	P	P	P	P			
Ribes hirtellum	Smooth Gooseberry		P				P			P	P		P	P		P		P	
Ribes lacustre	Bristly Black Currant						P								P		P		
Ribes sp.	Currant			P	P	P								P	P				
Rosa carolina	Carolina Rose												P		P		P		
Rosa nitida	Shining Rose						P												
Rosa sp.	a Rose			P	P									P					
Rosa virginiana	Virginia Rose	P							P	P	P	P		P		P		P	
Rubus allegheniensis	Allegheny Blackberry																	P	
Rubus hispidus	Bristly Dewberry					P													
Rubus idaeus	Red Raspberry			P	P	P						P	P	P					
Rubus idaeus ssp. strigosus	American Red Raspberry								P		P	P				P			
Rubus pubescens	Dwarf Red Raspberry		P	P		P	P			P	P	P	P	P	P	P	P	P	P
Rubus sp.	a Blackberry		P					P						P			P		
Salix bebbiana	Bebb's Willow	P								P	P	P						P	
Salix discolor	Pussy Willow																	P	
Salix humilis	Prairie Willow																	P	
Salix sp.	a Willow			P	P	P	P	P					P	P	P		P		
Sambucus racemosa	Red Elderberry								P			P							
Scirpus cyperinus	Small-Fruit Bulrush			P	P	P			P		P	P	P	P		P	P		
Scirpus microcarpus	Cottongrass Bulrush												P	P					
Scutellaria lateriflora	Mad Dog Skullcap										P				P				
Senecio jacobaea	Tansy Ragwort		P						P		P	P	P		P				
Senecio vulgaris	Old-Man-In-The-Spring					P													
Solanum dulcamara	Climbing Nightshade						P				P								
Solidago canadensis	Canada Goldenrod	P	P	P	P	P					P			P	P		P	P	
Solidago flexicaulis	Broad-Leaved Goldenrod		P	P	P	P		P				P	P	P				P	P
Solidago gigantea	Smooth Goldenrod		P		P														
Solidago rugosa	Rough-Leaf Goldenrod	P	P	P		P	P	P				P	P			P		P	
Sonchus arvensis	Field Sowthistle	P																	
Sonchus asper	Spiny-Leaf Sowthistle					P													

Table G-1: Vascular Plants Recorded within Wetlands

Scientific Name	Common name	Wetlands																	
		1	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17	18	19
Spiraea alba	Narrow-Leaved Meadow-Sweet												P	P			P	P	
Symphyotrichum lanceolatum	White Panicled American-Aster		P	P	P			P						P			P		
Symphyotrichum lateriflorum	Farewell-Summer								P	P	P	P						P	
Symphyotrichum novi-belgii	New Belgium American-Aster	P				P					P	P	P					P	
Taraxacum officinale	Common Dandelion												P	P					
Thalictrum pubescens	Tall Meadow-Rue				P	P	P	P		P		P	P	P			P	P	P
Thelypteris noveboracensis	New York Fern	P		P	P		P	P					P	P	P			P	
Thelypteris palustris	Marsh Fern		P						P		P	P	P	P	P		P		
Toxicodendron rydbergii	Northern Poison Oak			P											P				
Trientalis borealis	Northern Starflower											P							
Trifolium aureum	Yellow Clover		P																
Trifolium campestre	Low Hop Clover		P																
Triglochin maritima	Common Bog Arrow-Grass													P					
Trillium cernuum	Nodding Trillium							P											
Trillium undulatum	Painted Trillium							P											
Tussilago farfara	Colt's Foot	P	P	P	P	P			P			P	P	P					
Typha latifolia	Broad-Leaf Cattail		P	P	P	P						P	P						
Typha x glauca	Blue Cattail														P				
Vaccinium macrocarpon	Large Cranberry	P											P				P		
Veronica officinalis	Gypsy-Weed			P		P									P				
Viburnum nudum	Possum-Haw Viburnum														P				
Species richness		26	55	57	56	56	37	46	34	23	36	60	74	62	46	22	45	39	15

Table G-2: Bird Species Encountered within Wetlands

Common Name	Scientific Name	Wetlands								
		2	3	7	9	10	13	14	15	17
American Goldfinch	*Carduelis tristis*		P							
American Redstart	*Setophaga ruticilla*						P			
American Woodcock	*Scolopax minor*			P	P					
Black-capped Chickadee	*Poecile atricapilla*	P		P			P	P	P	P
Cedar Waxwing	*Bombycilla cedrorum*						P	P		
Common Raven	*Corvus corax*	P								
Hermit Thrush	*Catharus guttatus*			P			P		P	
Least Flycatcher	*Empidonax minimus*						P		P	
Northern Waterthrush	*Seiurus noveboracensis*								P	
Ovenbird	*Seiurus aurocapillus*					P			P	
Pileated Woodpecker	*Dryocopus pileatus*							P		
Red-eyed Vireo	*Vireo olivaceus*			P			P		P	
Ruby-throated Hummingbird	*Archilochus colubris*									P
Swainson's Thrush	*Catharus ustulatus*		P							
White-throated Sparrow	*Zonotrichia albicollis*							P	P	
Yellow Warbler	*Dendroica petechia*							P		

Table G-3: Mammals and hereptiles recorded within wetlands

Common Name	Scientific Name	Wetland										
		3	6	7	8	11	12	13	15	17	18	19
American Red Squirrel	*Tamiasciurus hudsonicus*		P					P				
Black Bear	*Ursus americanus*								P			
Bobcat	*Lynx rufus*											P
Eastern Chipmunk	*Tamias striatus*							P				
Green Frog	*Rana clamitans*			P						P		
Northern Spring Peeper	*Pseudacris crucifer*				P				P			
Short-Tailed Shrew	*Blarina brevicauda*						P					
White-Tailed Deer	*Odocoileus virginianus*	P				P						
Wood Frog	*Rana sylvatica*			P							P	

APPENDIX H

Response to Government Comments

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
1	Helen MacPhail, Nova Scotia Environment	The document must also include the anticipated date of when work will commence in the extension area.	Work will likely commence upon final EA approval and once the Industrial Approval has been amended.
2	Helen MacPhail, Nova Scotia Environment	Update the document to reflect the fact that a new approval has been issued.	Comment noted. The final document has been updated.
3	Helen MacPhail, Nova Scotia Environment	The EA Branch strongly recommends that a Mi'kmaq Ecological Knowledge Study be completed for this project. This project is of a larger scale and the archaeological report suggests that the potential for First Nation's archaeological resources is low, with the exception of the mouth of Stream 2, which is considered to have moderate potential.	At this time the Proponent has decided not to conduct a MEKS. The lands upon which the quarry is located are private property, having, as stated in the EA document, low potential for archeological resources, with the exception of the mouth of Stream 2, which is considered moderate. The Proponent has sent correspondence to both of the nearest bands (Pictou Landing First Nation and Paq'tnkek First Nation), the Native Council, the Confederacy of Mainland Mi'kmaq (CMM), the Union of Nova Scotia Indians (UNS) and the Kwilmu'kw Maw-klusuaqn (KMK) in February 2011 and again in August 2011. To date not comments or concerns have been brought forward.
4	Helen MacPhail, Nova Scotia Environment	The department is no longer Nova Scotia Department of Environment and Labour, we are now called Nova Scotia Environment.	All references to Nova Scotia Department of Environment and Labour have been revised to Nova Scotia Environment. This does not include reference documents that were published by the department when titled Nova Scotia Environment and Labour.
5	Helen MacPhail, Nova Scotia Environment	A concordance table showing the response to government draft review comments would be helpful.	A concordance table for all government comment responses has been prepared and included in Appendix H.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
6	Monique Breau – Environment Canada	Olive-sided Flycatcher, a species listed as Threatened on Schedule 1 of the *Species at Risk Act* (SARA), was identified in the proposed quarry extension area. It is understood that the habitat where this species was found will not be encroached during the "ten year extension plan, as indicated on Figure 5.1". The proponent states "However, should quarry activities continue beyond the eastern extent of the area outlined by the proposed ten year quarry extension plan, it will be necessary to conduct follow-up surveys to establish the use of the Property by the olive-sided flycatcher at that time" and "Should this Species at Risk be found to occupy the Project area at this time, a mitigation plan will be developed in consultation with NSDNR and the Canadian Wildlife Service before any additional quarry extension in undertaken". The “ten year extension plan” is only a portion of the "Proposed Quarry Extension Area". Please clarify if the proponent is requesting a permit for the area shown on Figure 5.1 in orange as the "Proposed Quarry Development Area 10yr" or if this project permit would apply to the entire "Proposed Quarry Extension Area". If the entire "Proposed Quarry Extension Area" is being requested, it is not clear how the NS Department of NSDNR and EC’s Canadian Wildlife Service (CWS) would be engaged for further advice. Please clarify the terms of the permit being applied for (i.e. ‘Proposed Quarry Development Area 10yr’ or the ‘Proposed Quarry Extension Area’) and conditions of approval (i.e. will there be a condition which would limit development from expanding into areas used by the Olive-sided Flycatcher until the completion of further biophysical surveys to be reviewed by NSDNR and EC’s CWS?). If it is determined that mitigation is not possible, other than avoiding the area used by the Olive-sided Flycatcher, please clarify how the habitat for this species at risk will be protected if a previous approval authorizing the entire expansion is issued.	The proponent is requesting a permit for the entire "Proposed Quarry Extension Area" and additional information has been added to Section 5.4.2 to clarify how impacts to Olive-sided Flycatcher will be avoided.
7	Monique Breau – Environment Canada	The proposed project would bring high disturbance activities closer to areas used by Olive-sided Flycatcher. The draft EIA should outline proposed mitigation measures to avoid disturbance to birds during the breeding season, as well as identify measures to monitor effects on species at risk.	Comment noted. Proposed mitigation measures are outlined in Section 5.4.2 and include avoiding vegetation clearing during the breeding season, minimization of lighting that would attract migratory species and appropriate stockpiling practices to discourage nesting activity.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
8	Monique Breau – Environment Canada	On page 5.21, the proponent concludes section 5.4 by stating that "In summary, assuming recommended mitigation measures are applied; significant Project-related effects on wildlife are not likely to occur." With regard to birds, it is not clear to which mitigation measures the proponent is referring. Currently, there are only proposed measures to comply with the *Migratory Birds Convention Act* (MBCA) and a delay of activities in areas used by Olive-sided Flycatchers mentioned in section 5.4.2. Further details should be provided on mitigation measures. It is expected that the proponent commit to any mitigation measures described in the EA and would ensure their implementation; therefore, it is not appropriate to assume that these will be applied as stated in the conclusion in section 5.4. These should be clearly outlined in the EA documentation and provided for review.	Further details on bird-related mitigation have been provided in Section 5.4.2 and include: lighting restrictions, avoidance of vegetation clearing during the breeding season, and stockpile management. Summary statement for Section 5.4.2 has been modified.
9	Monique Breau – Environment Canada	Please describe the difference between "beach" and "coastal habitat areas" in Figure 2.2.	A definition for “coastal habitat areas”, as provided by NSDNR, is provided in Section 2.2 for clarity.
10	Monique Breau – Environment Canada	Based on Figure 2.2, it appears that the extraction of beach habitat is being proposed. Please clarify activities to occur in coastal areas.	The extraction of beach habitat is not being proposed. Figure 2.2 has been updated accordingly.
11	Monique Breau – Environment Canada	The methodology of the breeding bird survey should be described. If point counts were used, these should be displayed on a map, as well as the list of birds identified and at which point they were detected. The path of the survey should also be clearly shown on a map.	Details on the methodology used for the breeding bird survey are provided in Section 5.4.1. The breeding bird survey was performed throughout the entire Property.
12	Monique Breau – Environment Canada	Page 3.2; Section 3.4; 2nd paragraph: Remove "and policies", since the *Fisheries Act*, the SARA, and the MBCA are pieces of legislation, not policies.	Text has been modified.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
13	Monique Breau – Environment Canada	Page 5.1: It is stated that "Spatial boundaries are generally limited to the immediate project area unless otherwise noted." The EA should also consider valued ecosystem components (VECs) such as migratory birds and wetlands that may be affected outside the spatial boundaries of the immediate project area. For example, migratory birds outside the spatial boundary of the project could be adversely affected by the project by high disturbance activities (e.g. blasting, drilling). Wetlands and streams downstream of the project area could be adversely affected in the event of sediment release or changes in hydrology.	Interactions between Project activities and VECs are mainly limited to the property boundaries. It is acknowledged that some species, mainly migratory birds, are subject to various influences throughout a much wider spatial range. These wider ranging effects, where known, are discussed under the relevant VEC sections (e.g., Wildlife and Atmospheric Resources).
14	Monique Breau – Environment Canada	Page 5.14 it is stated that "The statuses of nationally rare species were obtained from COSEWIC (2010)." The revised EIA report should be updated to the results of the latest COSEWIC wildlife assessment meeting (May, 2011).	The final EA report includes the results of the latest COSEWIC wildlife assessment meeting (May 2011).
15	Monique Breau – Environment Canada	Page 5.14, last paragraph, wording change: Olive-sided Flycatcher was *assessed* as Threatened by COSEWIC and is *listed* as such on Schedule 1 of SARA. Olive-sided Flycatchers are listed as Threatened at the federal level because they have shown a widespread and consistent population decline over the last 30 years.	Change made on page 5.14.
16	Monique Breau – Environment Canada	Page 5.14: It is stated that "Olive-sided flycatcher is considered "Threatened" by COSEWIC and is listed as such under Schedule 1 of SARA indicating that it is provided legal protection in Canada". It should be understood that this species is also protected under the MBCA and associated regulations. SARA however provides additional protection for this species in Canada.	Protection of the Olive-sided Flycatcher via the MBCA has been noted on pages 5.15 and 5.21.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
17	Monique Breau – Environment Canada	Page 5.16: This section should elaborate why the modeling exercise did not also consider Common Nighthawk, Canada Warbler, Barn Swallow, and Chimney Swift, which are species of conservation concern identified either in MBBA Square 20NR77 or in neighboring squares.	The list of species considered in the modeling exercise was based on those identified within MBBA Square 20NR77 or listed by ACCDC records as occurring within 100 km of the Project Area. As noted on page 5.16 and 5.17, both Canada Warbler and Barn Swallow were identified by these resources as occurring in vicinity to the Project Area but were not encountered during breeding bird surveys. Although Common Nighthawk and Chimney Swift were not identified by the aforementioned ACCDC or MBBA data, neither of these species were encountered during the field surveys (despite biologists being proficient visual and auditory birders). Furthermore, Common Nighthawk nesting opportunities on site would be primarily limited to the edges of the existing quarry, whereas no suitable Chimney Swift nesting or roosting sites (i.e., chimneys or large hollow trees) were observed.
18	Monique Breau – Environment Canada	Page 5.16: It should be noted that Bobolink and Barn Swallow are not only ranked "Sensitive" by NSDNR, but also have been assessed as “Threatened” by COSEWIC.	Recent assessments of Bobolink and Barn Swallow have been noted on Page 5.17.
19	Monique Breau – Environment Canada	On page 5.20, it is indicated that "… it is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young." This statement is a bit misleading since it is only legal to hunt game birds during the legal hunting season and within bag limits, and the eggs and young of game birds receive the same level of protection as those of non-game birds. The proponent should ensure that contractors and staff are aware that migratory birds, their eggs, nests and young are protected under the MBCA. See further details regarding the MBCA below.	Text on page 5.21 has been modified to clarify.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
20	Monique Breau – Environment Canada	On page 5.20, it is mentioned that "If clearing has to occur during the breeding season, a contingency plan will be applied including nest surveys and exclusion of activities from active nesting areas to ensure compliance with the MBCA." EC's CWS recommends that the proponent avoids activities that will result in the disturbance or destruction of active migratory bird nests. The employment of a nest surveys during the nesting season is generally not recommended. Despite the many different habitats in which bird nests can be found, it is difficult to locate most nests. Nest sites are cryptic and adult birds avoid approaching their nests in a manner that would attract predators to their eggs or chicks. The amount of habitat to be searched also often limits the success of surveys intended to locate active nests. The nests of a few species are however easier to locate, particularly in open areas, when the birds nest on isolated trees, on man-made structures, and/or in colonies. If a proponent needs to determine whether nests are present, non intrusive searching methods should be used in order to prevent disturbing migratory birds while they are nesting. For example "point counts" (a technique where singing territorial males are located) may provide a good indication of the presence of song bird nests in an area. Using active nest searching techniques must be carefully evaluated because in most habitats nest detectability remains very low while the risk of disturbing active nests is high. Flushing nesting birds increases the risk of predation of the eggs or young, or may cause the parent birds to abandon the nest. Therefore, except when nests are known to be easy to locate, active nest searches are not recommended because of the inability to locate most nests and because of the disturbance to nesting birds they are likely to cause. Thus, in most circumstances incidental take is unlikely to be avoided through active nest searches.	Text on page 5.21 has been modified to no longer include nest searches as an alternative to the avoidance of vegetation clearing during the breeding season.
21	Monique Breau – Environment Canada	Some species of migratory birds may nest in burrows in stockpiles. Some species of migratory birds may be attracted to cleared areas for nesting. Adaptive management measures should be identified in the EA to protect birds and nests should these scenarios occur.	Measures have been identified on page 5.21 to minimize likelihood of birds (e.g., bank swallows) nesting in stockpiles.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
22	Monique Breau – Environment Canada	If quarry activities are to take place 24 hours/day, the EA should describe measures taken by the proponent and staff to avoid the attraction of birds to operational lights at night.	Page 5.21 updated to reflect measures which will be taken to avoid the attraction of birds to operational lights at night.
23	Monique Breau – Environment Canada	Section 6.0, the effects of the Project on migratory birds should be described (e.g. loss of habitat, disturbance).	Text added to Section 6.0
24	Monique Breau – Environment Canada	Table F-1: It is recommended that the list of birds observed at the site during field surveys and the list of species not observed be presented separately.	Table F-1 has been spilt into two tables.
25	Lorne M. Crozier, Nova Scotia Department of Agriculture	Kevan Bekkers and I have reviewed the Draft Report: Assessment Registration for Northumberland Rock Quarry Extension Project. We agree with the findings of the report that this expansion will have little or no impact on agricultural activities in the surrounding area. The Department of Agriculture therefore has no concerns regarding this project from an agricultural perspective.	Comment noted.
26	Darrell Taylor, WWW Branch, NSE	There are 3 streams and 7 wetlands identified inside the project boundary area. Although the streams are deemed by the consultant not to be fish bearing waters all watercourses and wetlands should be protected with appropriate avoidance or mitigative measures employed.	It is agreed that all watercourses and wetlands should be protected with appropriate avoidance or mitigative measures. For example, as stated in Section 2.6, sediment and erosion guidelines will be applied on site and runoff will be direct to a settling pond.
27	Darrell Taylor, WWW Branch, NSE	DFO should be consulted re definitive assessment of whether fish populations exist in identified streams - regardless of presence of barriers in streams. Resident populations of fish have been known to exist even where fish passage to the ocean has blockages.	An onsite stream assessment was conducted as a component of this EA. The results of this assessment are presented in Section 5.2 of the EA. The stream assessment looked at a number of parameters in addition to barriers, including water quality and potential for fish habitat.
28	Darrell Taylor, WWW Branch, NSE	Proposed mitigative measures appear appropriate to address potential sources of impact and if applied suitably should serve to protect surface water resources in the area.	Comment noted.
29	Beata Dera, Nova Scotia Office of Aboriginal Affairs	Contact with the Mi'kmaq - the report indicates that information letters were sent to the KMK, CMM, UNSI, Native Council and Paqntkek FN but no responses were received. The Proponent, however, does not indicate, whether any effort was made to follow up on these letters.	In February 2011 information letters were sent to the KMK, CMM, UNSI, Native Council and Pagntkek and no comments or responses were received by Stantec or Alva Construction. In August 2011 a follow-up letter was also sent to each of the groups identified above as well as an information letter was sent to the Chief of the Pictou Landing First Nation. To date no comments or concerns were received by Alva or Stantec.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
30	Beata Dera, Nova Scotia Office of Aboriginal Affairs	There is no mention of the closest First Nation communities - in this case it is IR 31 Merigomish Harbour, approximately 40 km southwest of the project as well as Paqntkek First Nation, located approx. 30km southeast.	An information letter was sent to the nearest First Nation community, Pagntkek First Nation, in February of 2011, as described on page 4.1 of the EA document. Upon review of the regulatory comments on the draft EA document a Project information letter was also sent to the Chief of the Pictou Landing First Nation (Merigomish Harbour) in August 2011.
31	Paul Keats, ?	We have looked at the proposed draft and we do not have any major concerns. All things like 800 m sign-offs will be captured in the IA application if they were to apply for an amendment. Where there is an existing quarry permit in place most of our concerns are covered through that permit.	Comment noted.
33	Jennifer McKeane, Nova Scotia Economic and Rural Development and Tourism	The proposed expanded area is closer to the road, which is also signposted as the Sunrise trail, promoted in some literature as a tourist route. We would recommend for the proponent to get information on usage of this road by vehicle and motor-cycling and bicycle traffic and analyze the impact of additional truck traffic on this route in terms of safety and visitor experience.	No additional truck traffic is anticipated with the expansion of the quarry. As shown in Figure 5.1, a decrease in the distance of the 10 year quarry footprint to the roadway is very small and therefore the increase in visibility from the roadway within a 10 year planning horizon is expected to be negligible. Any potential issues related to the presence of the quarry upon further expansion can be addressed in the context of the Industrial Approval renewal process which is expected to occur at least within every 10 years.
34	Jennifer McKeane, Nova Scotia Economic and Rural Development and Tourism	Tourism has invested in this area in look-offs, hiking routes etc. and we would be looking for analysis on the impact (mainly visual) of this expanded quarry on this tourism and recreation infrastructure.	There does not appear to be any official public trails within a 10 km radius of the Project http://www.trails.gov.ns.ca/SharedUse/antigonish.html An active quarry is currently present at the site and an expansion will occur only slowly and incrementally; the visual change in the quarry footprint is expected to be negligible (including from any public trails) within a 10 year planning horizon. The quarry lands are privately owned and public access is not permitted. .
35	Jennifer McKeane, Nova Scotia Economic and Rural Development and Tourism	A good contact would be: Antigonish Hiking and Biking Trails Association re: hiking and cycling in the area.	Comment noted. See response to previous comment.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
36	Jennifer McKeane, Nova Scotia Economic and Rural Development and Tourism	We would be interested in the impact on tourism operators (accommodations and boat tour operators) in the area and suggest that you specifically get in touch with Coastal Breeze Chalets in Malignant Cove and June's B&B by the Sea, also in Malignant Cove. Zappa Charters in Ballantyne's Cove may have some comments on this proposed expansion. Operators in the greater area may also have an interest in commenting and should be made aware of the proposed expansion.	As noted in Section 4.1, information bulletins were sent to nearby land owners and no comments were received. Additionally any interested members of the public will be able to provide comments on the EA Registration document during the public commentary period as required by the provincial legislation. The 10 year quarry footprint will have a relatively small visual effect, if any, from any vantage point (including from land and sea).
37	Bill Rideout, Nova Scotia Health and Wellness	We've completed our preliminary review of the above-noted EA with respect to potential project impacts on public health. We have no comments at this time.	Comment noted.
38	Angela Swaine, Nova Scotia Department of Infrastructure and Renewal	NSTIR has reviewed the draft EA registration document for the Northumberland Rock Quarry Extension Project. We have no comments at this time.	Comment noted.
39	John Drage, Water & Wastewater Branch, Nova Scotia Environment	The draft EA includes a thorough description of local groundwater resources, potential impacts associated with the proposed quarry extension, as well as monitoring and mitigation programs. As such, I have just two suggestions to be considered for the final document. 1. In Section 5.6.1 (as well as several other Sections in the EA), reference is made to the "NSE Well Drillers Database (2009)" as a source of information on water wells in the province. Note that this database is published each year with updated water well records and the 2009 version was superceded in 2010. The newer 2010 database is the most current version and can be downloaded or searched on-line at the following location: http://www.gov.ns.ca/nse/groundwater/welldatabase.asp. Also, the database is normally referred to as the "NS Well Logs Database", to reflect that it includes both drilled and dug well records.	The EA has been updated to include the most recent version of the NS Well Logs Database.
40	John Drage, Water & Wastewater Branch, Nova Scotia Environment	Section 6, paragraph 3. There is a typographic error in "...pill response plan...", which should read "...spill response plan..."	The text has been revised.
41	Hugh Gillis, Nova Scotia Department of Natural Resources	Minor spelling error in Table of Contents. See word 'identified' in description for Appendix D & E. Reads: "Vascular Plants and Wildlife Indentified in the Study Area in the Field"	The text has been revised.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
42	Hugh Gillis, Nova Scotia Department of Natural Resources	Section 5.2.2 indicates: "*No Project-related vehicles will be driven through streams*." We suggest that this sentence should be amended to read: 'No project-related vehicles will be driven through streams, stream buffers, or wetland buffers'.	The text has been revised.
43	Hugh Gillis, Nova Scotia Department of Natural Resources	Section 5.3.1 states: "*The Project area supports a number of habitat types including stands of deciduous, mixedwood, and coniferous upland forest, intact and cut-over treed swamps, a rocky coastline, streams, and anthropogenic ponds*." We suggest that these classes are land and vegetation cover types, not habitat types. DNR considers 'habitat' a term used to ecologically define the area or environment where a particular species or group of species live (it is a species-specific concept). If these vegetation cover classes are being used to coarsely describe rare plant habitat, then we suggest they be referred to as 'plant habitat types'.	Text in Section 5.3.1 has been modified to describe "vegetation cover types".
44	Hugh Gillis, Nova Scotia Department of Natural Resources	We request that geo-locations for species of conservation concern (Carex bebbii and Agrimonia gryposepala) should be sent to DNR.	Geo-locations for species of conservation concern (*Carex bebbii* and *Agrimonia gryposepala*) will be sent to NSDNR.
45	Hugh Gillis, Nova Scotia Department of Natural Resources	We request that the descriptions of terrestrial upland forest conditions (Section 5.3.1) and wetland forest conditions (Section 5.5) include reference to wet and flooded vegetation types defined in Volume 1 of the Nova Scotia Forest Ecosystem Classification, where appropriate. The document is available from the Forestry or Wildlife Divisions of DNR.	Approximate FEC Vegetation Types present on the Property have been identified in Sections 5.3.1. and 5.5.1.
46	Hugh Gillis, Nova Scotia Department of Natural Resources	Minor grammatical note: verb tense in section 5.5.1 varies between past and present.	Comment noted.
47	Hugh Gillis, Nova Scotia Department of Natural Resources	Section 5.5.2 states: "*Additionally, no wetlands are located within or down slope of the area encompassed by the proposed ten year quarry extension plan. As such, wetland habitat is not expected to be impacted by Project activities during this period*." We suggest that downslope mining activities could influence wetlands in the area. Downslope mining could increase ground water flow and reduce lower slope water retention, thereby increasing upslope wetland drainage rates and volume.	Section 5.5.2 updated to reflect potential of downslope mining activities, as noted.
48	Hugh Gillis, Nova Scotia Department of Natural Resources	Section 5.5.2 also states: "*In summary, assuming the application of proposed mitigation measures, including maintaining existing site drainage conditions and providing habitat compensation for loss of wetland functions, significant Project-related effects on wetland functions are not likely to occur*." We suggest revising the last phrase in this sentence to read 'significant project-related effects on net wetland function are not likely to occur'.	Section 5.5.2 updated.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
49	Hugh Gillis, Nova Scotia Department of Natural Resources	In general, we suggest the proponent is underplaying the potential for indirect wetland impact. We suggest a 50 meter buffer is required around wetlands proximate to the proposed 10 year quarry development. In the near term, this would involve wetland 15.	The area covered by the proposed ten year quarry development plan has been revised (refer to Figure 5.1) and provides additional buffer area surrounding wetland 15.
50	Hugh Gillis, Nova Scotia Department of Natural Resources	The author's of the Draft EA note the following with regards to potential impacts from this undertaking on Bebb's sedge populations on the site: "*Of particular conservation concern is the population of Bebb's sedge which is considered to "May be at Risk" by NSDNR. This species was found in two general areas of the Property - including several wetlands at its southern end and a small seepage area in the northern corner of the site. The small population at the northern end of the Property will not be directly impacted by Project activities which are to be restricted to the western side of the watercourse found within the same area. Wetlands towards the southern end of the Property which contain Bebb's sedge (Wetland 3, 4, and 5) are outside of the area encompassed by the proposed ten year quarry extension plan and will therefore not be impacted by Project activities during this period*." Wetlands No. 3, 4, and 5 should be completely avoided and not considered for this type of development given potential for negative, adverse effects. Moreover, we suggest a buffer around the perimeter of these wetlands should be developed to ensure that drainage to them remains unaltered by the adjacent quarry activities. Other habitats where the species occurs within the development footprint should also be avoided with appropriate protective buffers, to be determined with DNR and NSE.	As noted in comment 49, the proposed ten year quarry development plan has been revised. There is no intent to quarry in or near wetlands 3, 4 or 5 within the next 10 years. If after that time, quarry development is proposed within 50 m of these wetlands appropriate approvals will be sought from NSE and NS DNR.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
51	Guy Robichaud, Fisheries and Oceans	To reduce potential impacts to fish and fish habitat we recommend that the following mitigation measures be included into your plans: • During the construction of the road access and the installation of culverts, all mitigation measures in relation to this project, stated in the Nova Scotia Department of Environment Watercourse Alteration Specification and Watercourse will have to be followed. • As per the Nova Scotia Department of Environmental Watercourse Alteration specification and Watercourse and as per Nova Scotia Pit and Quarry guideline, we require that the land management plan includes a minimum 30 meters buffer zone between the new proposed quarry and the two unnamed brooks that drain into Northumberland Strait. • A detailed sediment and erosion control plan and an emergency response plan should be prepared and implemented by the proponent for all project works to prevent the release of sediment, sediment laden water, or other deleterious substances into the environment, specifically into any waterbody (i.e. watercourse, drainage channel, etc.). We would be pleased to review these documents when they are prepared. • Any machinery should be free from loose petroleum fluid or lubricants harmful to the aquatic environment. No fuel or lubricants should be stored in proximity of any watercourse. • During construction, erosion control structures should be installed to prevent the release of sediment and/or sediment laden water from any on-land works into any waterbody. The structures should be maintained by repairing structural problems after storm events and by removing accumulated sediment at regular intervals and disposing it at an approved location.	The provided lists of mitigation measures have been reviewed and Section 5.2.2 of the EA document has been revised. Note that an access road already exists on site and there will be no need to construct a new road.

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
		• The proponent is required to meet all other federal and provincial regulations pertaining to the undertaking. The water quality at the effluent of any sedimentation pond or drainage waters coming from the quarry will have to respect the suspended soilid levels, and water chemistry levels as outlined in the *CCME guidelines for the Protection of Aquatic Life*. During the exploitation of the quarry, the water quality coming out from the quarry should be monitored and should be within the limits of the baseline water quality results set prior to the quarry operation. As recommended in the CCME guideline, the maximum increase of the suspended solids in the water column should not be higher than 25 mg/L from background levels at any time. When background levels are between 25 and 250 mg/L, the level of suspended solid should not increase more than 10% of background levels when background is >250 mg/L. • An explosive management pan should be prepared and provided to us for review prior to the commencement of the works. The explosive management plan should follow the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. For more information about the use of explosive nearby waters please visit http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/water-eau/explosives-explosifs/index_e.asp Provided that the additional mitigation measures described above are incorporated into the proposed plans, DFO has concluded that the proposal is not likely to result in impacts to fish and fish habitat.	

Table H-1 Summary Table

Comment No.	Comment Issuer	Comment Received	Comment Response
52	Guy Robichaud, Fisheries and Oceans	The proponent will not need to obtain a formal approval from DFO in order to proceed with the proposal. In addition, the Oceans and Habitat Area Chief, Mr. Charles MacInnis, DFO, Antigonish, should be notified 48 hours prior to the commencement of any project works. Mr. MacInnis can be reached at 902-863-5670. If the plans have changed or if the description of the proposal is incomplete the proponent should contact this office to determine if the advice in this letter still applies.	Comment noted.