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Environmental Assessment Registration for the Hants County Aggregate Quarry Extension Project

Municipal Enterprises Ltd.
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File: 121510261

July 2010

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1.0 PROPONENT AND PROJECT IDENTIFICATION

1.1 PROPONENT INFORMATION

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

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Signature

July 26, 2010
Date

1.2 PROJECT INFORMATION

Name of the Undertaking:	Hants County Quarry Extension Project
Location of the Undertaking:	Windsor, Hants County, NS

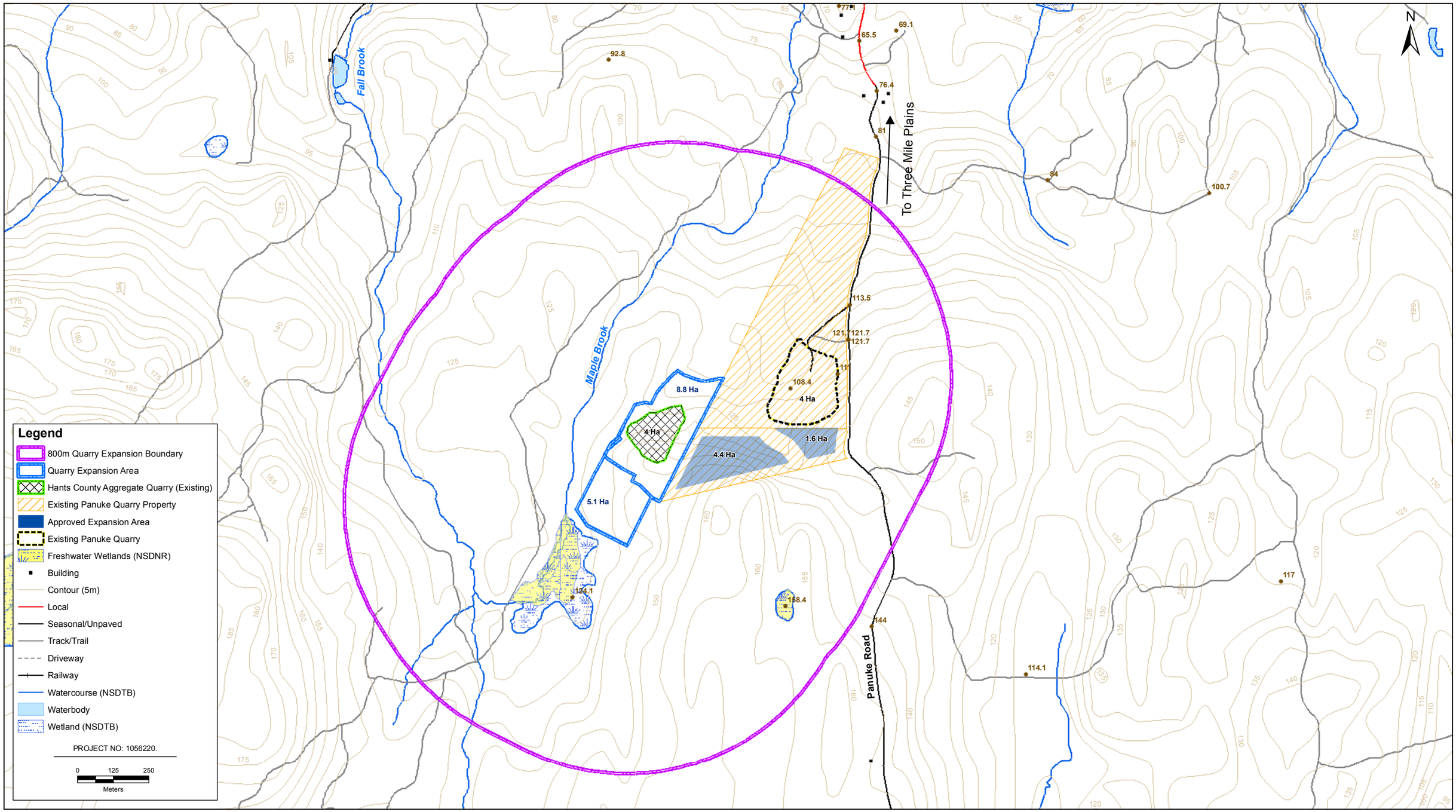
2.0 PROJECT INFORMATION

2.1 DESCRIPTION OF THE UNDERTAKING

Municipal Enterprises Limited (MEL, the Proponent) owns and operates a quarry, located at 700 Panuke Road in Three Mile Plains, Hants County, Nova Scotia, called the Panuke Quarry. MEL is currently proposing to purchase and extend an adjacent quarry, the Hants County Aggregate Quarry, and incorporate its operations as a component of the existing Panuke Quarry by amending the existing Approval permit. Both quarries are located in the West Hants Municipal District (Figure 1). The existing Panuke Quarry is operating under an Industrial Approval (No. 2001-019700-A01), pursuant to Division V of the Activities Designation Regulations, issued by Nova Scotia Environment and Labor (NSEL), effective until September 9, 2011. This permit allows for construction and operation of a quarry on property parcel number 45270493. A copy of the Approval permit is appended to this report (Appendix A).

MEL is proposing to combine the operations of the Hants County Aggregates Quarry with the existing Panuke Quarry. The current operation at Hants County Aggregates is 3.9 hectares (ha) in area. The proposed extension of the existing Hants County Aggregates Quarry will incorporate land north, south and southwest of the existing quarry to increase the total size of the operation to approximately 13.9 ha (not including the adjacent Panuke quarry). Blasting, crushing and stockpiling of aggregate currently takes place at the Hants County Aggregate site and this is not expected to change. The quarried material at this site is primarily used for Nova Scotia Transportation and Infrastructure Renewal (NSTIR) projects; but after amalgamation with Panuke Quarry, the intent is that the Hants County Aggregates site will be used for both NSTIR contracts and general contracts. The existing Panuke quarry is approximately 4.0 ha in area and has an approved extension area of 6 ha. It is primarily used as a source of aggregate in the making of asphalt. The combined operations will cover an area of 23.9 ha. The proposed activities will take place over a period of time until the material is exhausted. Based on current estimates, there are over 1 million tonnes of rock reserves on both properties. The extended Hants County Aggregate site could therefore sustain aggregate production for approximately 10 years.

Proposed project activities will be consistent with current quarry operations at the Hants County Site. Aggregate production includes drilling and blasting, which is conducted by a licensed blasting contractor. Blasting takes place approximately one to two times per year. After blasting, portable crushing equipment is brought to the site to process the blasted rock. Various products (*i.e.,* various aggregate sizes) are 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 estimated truck traffic will be consistent with current truck volume at the existing quarry and will only increase, for a short period of time, if a large aggregate supply contract were awarded.



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 1**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**PROJECT LOCATION**	Stantec

The anticipated average production rate at the Hants County site is approximately 60,000 to 100,000 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 quarry will be open nine months of the year, however the portable crushing equipment is only on site two to three times a year for duration of ten days to two weeks a time. This proposed schedule is consistent with the current operating schedule.

2.2 GEOGRAPHIC SETTING

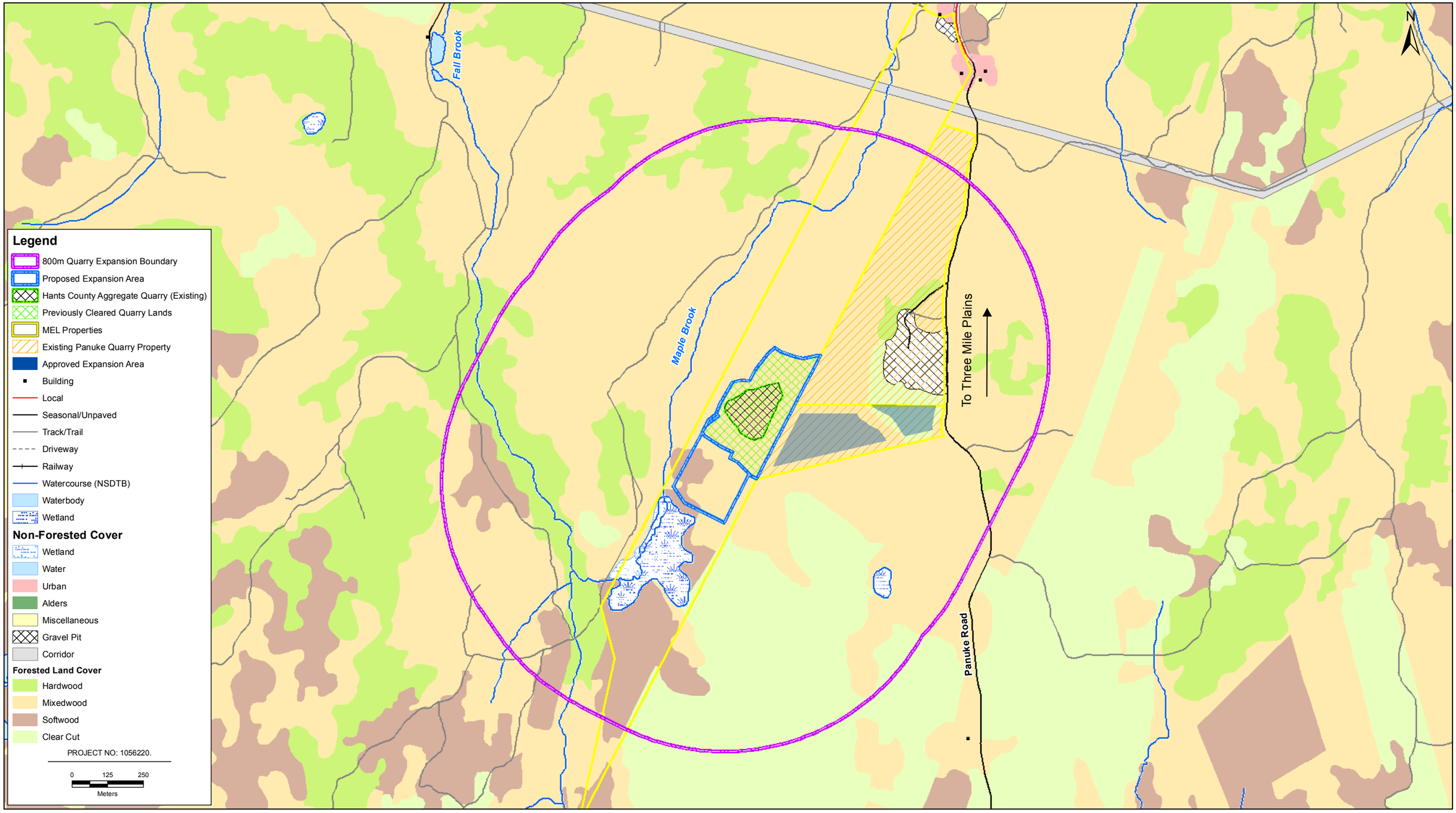
Hants County Aggregate is in the small community of Three Mile Plains, Hants County, Nova Scotia (Figure 1). It is located at the following geographic coordinates: 414006 E and 4976415 N. The Project property is bounded at its northeast extent by the Panuke Quarry and at its southwest extent by a major wetland complex, and the existing quarry operation is accessed via a private road extending off Panuke Road. The existing Panuke Quarry is situated on lands that are owned by the Proponent that have undergone various stages of clearing. MEL proposes to purchase and extend the existing Hants County Aggregate operation and amend the Panuke Quarry's existing Approval permit to include the Hants County Aggregate Quarry.

The surrounding lands are mostly undeveloped. The eastern half of the Project area has been highly modified by human activities. This area is primarily occupied by the existing quarry pit as well as by land that has been cleared and grubbed of its vegetation. Recently clear-cut (within approximately five years) forest surrounds the southern and western ends of this highly disturbed area (Figure 2). The western half of the Project area is forested and primarily comprised of immature mixedwood. The mixedwood forest grades into a stand of immature hardwood within the northern end of the Project area. There is one major wetland and a brook located southwest of the existing Hants County Aggregate Quarry and extension area. The Proponent has redesigned the Project to avoid interactions with the wetland and watercourse identified onsite.

Residential development in the immediate vicinity of the Project is relatively low, with no structures unrelated to the quarry within 800 m. A local road with a low distribution of residential development extends east of the proposed extension area, approximately 3 km, to Trunk 1 (Figure 1). The zoning of the land area is General Resource.

2.3 PROJECT COMPONENTS

The existing quarry operations at the Hants County Aggregate site consist of a laydown area for the portable crushing equipment, various aggregate stockpiles, quarry floor and working face, settling pond, scale and scale house, and access road. 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. Fuel oil is stored on site in temporary above ground storage containers. These materials are currently handled in accordance with existing regulations and this will continue following the extension. No new fuel storage or dangerous goods will be associated with the proposed extension.



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 2**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**LAND CLASSIFICATION**	Stantec

Overburden that has been stripped prior to drilling and blasting is stored on site for subsequent use during site reclamation. The piles have been hydroseeded to reduce potential for erosion and sedimentation. This, or similar practices will continue throughout the development and operation of the proposed extension area.

The laydown area is located on the quarry floor. The crushing equipment is transported to the site as required (*i.e.,* after blasting). Aggregate stockpiles are currently located at a dedicated location within the quarry limits, as space allows. As the quarry extends, no additional stockpile areas will be established and the existing stockpile area will be used. Surface runoff and quarry drainage are collected on the quarry floor, which has the capacity to hold a significant quantity of water. Currently, overflow from the quarry floor drains to a settling pond located directly in front of the quarry face. Additional settling pond volume will be developed with the extension of the Hants County Aggregate operations, as required (as indicated in the hydrology study Appendix B). Details regarding the amount of additional settling pond volume required for proposed quarry operations will be further refined at the Industrial Approval amendment stage.

The nearest residence is located greater than 800 m from the boundary of the proposed quarry extension limits. As shown in Figure 1, there are no businesses located within 800 m. The general direction of quarry advancement will be southwest from the existing quarry face.

2.4 SITE PREPARATION AND CONSTRUCTION

The existing quarry has been in operation for over 35 years. Access to the existing quarry development is along existing roads. To minimize the potential for erosion and sedimentation, grubbing and removal of overburden will be conducted on an as needed basis, to accommodate drilling and blasting activities. Currently approximately 8.8 ha of the extension area has already been cleared and overburden removed. 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. Overflow from the quarry floor is currently directed to a settling pond located directly in front of the quarry face. Additional pond volume will be developed as the extension proceeds, as required (Appendix B). Water from the settling ponds will be used to provide a water supply for dust suppression during crushing in dry periods.

2.5 OPERATION AND MAINTENANCE

The proposed Project activities (*i.e.,* the quarry extension) will be consistent with the current quarry operations, and will be in accordance with the Pit and Quarry Guidelines (NSEL 1999) and any future issued approvals. The Pit and Quarry 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 the clearing of the site, followed by the removal of overburden. The next step in the process is the drilling and blasting of the rock. It is anticipated that blasting will occur one to two times a year. 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 in the application for Industrial Approval. Where appropriate, consideration will be given to recommendations provided in *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998). Excavation of aggregate in quarry operations will not take place below the groundwater table; the benched face height will be determined during the industrial approval process.

The blasted rock will be processed by portable crushing equipment that will be on site two to three times a year, for duration of ten days to two weeks at a time. Aggregate product will be stockpiled in designated areas within the quarry boundaries. 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 Panuke Road. The number of trucks hauling aggregate is expected to remain unchanged although this may fluctuate periodically due to local market conditions.

The anticipated average production rate is approximately 60,000 to 100,000 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 may be 10 hrs/day, 5 days/week, 36 weeks/year or more, depending on the demand for aggregates. This proposed schedule is consistent with the current operating schedule.

The existing quarry currently employs one seasonal employee in the scale house; however, there are up to ten employees during aggregate production. This number is 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 sound, 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 is then directed to a settling pond. Details regarding the increase in size of the settling pond 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, will be monitored and sampled according to the Pit and Quarry Guidelines and conditions stipulated in the future Industrial Approval to ensure total suspended solids levels do not exceed the approved final effluent discharge limits. 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. A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval application process.

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 generated from road and parking lot lighting, exterior decorative lighting, such as spotlights or floodlights with a function of highlighting features of buildings *etc.*., and for the safety of employees. Emissions will be minimized by shielding lights to shine down only where it is needed, without compromising safety. Road and parking lot lighting will also be shielded so that little escapes into the sky and it falls where it is required. Generally, exterior decorative lights such as spotlights or floodlights with a function of highlighting features of buildings, *etc.* will be avoided, or the time of their operation restricted to where only necessary to ensure safety of employees.

As there will not be permanent office or buildings 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.

Details of any monitoring programs required by NSE (*e.g.,* surface water, noise, dust) will be developed in consultation with NSE and outlined in the Industrial Approval amendment application.

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. There is one above ground diesel tank located on the Panuke Quarry site that is contained within a berm and used as a back-up fuel source should regular fuel delivery be disrupted.

A qualified company will be contracted to conduct regular maintenance of equipment. Used oil and filters are currently removed from the site and this practice will continue with the proposed extension.

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

MEL 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. All areas affected by quarry activities, including the quarry floor, will be eventually rehabilitated. The subsoil, topsoil and root mat of this area 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 this site is under sporadic work schedules, the Proponent shall strive to ensure all overburden is piled in an area that will eliminate and control any surface water runoff. Stockpiles of overburden not necessary for site development may possibly 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 2.5:1) or rock slopes (max 2:1), 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 MEL to extend the existing Hants County Aggregate quarry footprint and amalgamate its operations with the existing Panuke Quarry. The quarry is currently operated according to the Pit and Quarry Guidelines for TIR contracts.

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 Hants County Aggregate 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. The extension is occurring in an area that has been previously disturbed and is already exposed to mining/quarrying activities. 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 (Appendix B). 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 fulfils the primary requirements for project registration under this legislation, and includes revisions made as a result of government comments on the Draft EA document, which was submitted to NSE in March 2010. A summary table presenting all received government comments and comment responses has been included in Appendix H.

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, policies and guidance include the *Fisheries Act*, *Species at Risk Act, the Migratory Birds Convention Act* and Environmental Canada Guidance Related to the Environmental Assessment of Aggregate Pit Mines and Quarries in the Atlantic Provinces (2008a).

There are no known requirements for an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) associated with the proposed quarry extension. No federal land or funding is required for the Project. There are no requirements for federal permits or authorizations under the CEAA Law List Regulation currently projected.

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 (NSEL 2008) was also used to determine/focus the scope of the assessment. Landowners adjacent to the quarry were contacted (see Section 4.0) for the purpose of issues identification. The Proponent also contacted representatives of the Confederacy of Mainland Mi'kmaq, the Native Council, the Mi'kmaq Rights Initiative, and the Union of Nova Scotia Indians.

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

On February 19, 2010, 105 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 immediately adjacent 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 Mi'Kmaq Rights Initiative, and the Union of Nova Scotia Indians to encourage the submission of comments, concerns, and questions regarding the Project (Appendix C).

In early June 2010, representatives of MEL met with members of the community liaison committee, previously established for the Paunke Quarry, to discuss issues of concern. The company agreed to address most concerns and subsequent meetings are to be held.

4.2 STAKEHOLDER COMMENTS AND STEPS TAKEN TO ADDRESS ISSUES

To date, no comments have been received in relation to the information sent to the First Nations or aboriginal organization representatives.

Two local residents commented on the Public Information Sheet that was submitted on February 19, 2010. The concerns raised by these individuals and proposed resolutions are summarized in Table 4.1.

Table 4.1 Summary of Stakeholder Comments and Concerns

Stakeholder	Issue/Concern	Response/Proposed Resolution
Local Resident	1. Concerned with the potential effects that the Project could have on the nearby watershed area. 2. Concerned with the anticipated increase in traffic on Panuke Road.	1. No watercourses are expected to be affected by quarry extension. Surface runoff at the site will be managed through settling ponds and other measures and will comply with Pit and Quarry Guidelines as well as permit conditions for water quality. 2. Truck traffic will not increase as a result of the proposed Project.
Local Resident	1. Concerned with how the combining of operations (*i.e.,* Panuke and Hants quarries) will affect residents living on Panuke Road. 2. Concerned with traffic on Panuke Road.	1. The quarries are combining in the sense that there will be only one operator, that of Municipal Enterprises, for both quarries (*i.e.,* Municipal is acquiring the Hants County Aggregate Quarry). Production rates and quarry activities will remain the same. 2. Truck traffic will not increase as a result of the proposed Project.

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

5.1 ASSESSMENT METHODS

Field studies were conducted by Stantec, between September 26 and October 7, 2009, to investigate and establish the existing conditions 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 qualified biologists employed by Stantec Consulting Ltd. (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 (NSTIR), and the Nova Scotia Department of Natural Resources (NSDNR).

Temporal and spatial assessment 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.

5.2 SURFACE WATER RESOURCES

Surface Water was selected as a VEC because of the potential for Project activities to interact with the freshwater environment. Indicators of the VEC include aquatic life, fish habitat and surface water quality, as well as potential water uses for agriculture, recreation, industry or potability. There are no watercourses located within the Project Area proposed for quarry extension under the current EA. Maple Brook runs in close proximity to the Project property, coming closest to the property at its southwest corner. The Proponent has redesigned the Project to avoid interactions with this watercourse. However given its proximity to the Project property, the aquatic environment of Maple Brook was assessed under this EA.

There are no known agricultural, recreational, industrial or potable uses of Maple Brook. Maple Brook is anticipated to connect to the St. Croix River eventually, via several tributaries. While the St. Croix River may be used for recreational purposes, Maple Brook is of insufficient size to support navigation and is not known to be used for other recreational activities. Agricultural land use does occur in the area (*e.g.,* Three Mile Plains) but is not anticipated to be influenced by

Maple Brook specifically. A Protected Water Area (*i.e.,* PWA - Mill Lakes Watershed) is located in close proximity to the Project but does not encompass Maple Brook (Figure 3). The Mill Lakes Watershed PWA has been designated as such under the *Water Act* because it surrounds a public water supply source ((N.S. Reg. 264/86 2009)). Existing legislation protects all lands and watercourses within the PWA from a wide range of activities by either prohibiting or restricting certain uses and practices within the PWA. Since Maple Brook falls outside the PWA boundaries, it is not affected by the land use restrictions enforced within the PWA. Fall Brook is the next closest watercourse that does fall within the PWA. The surface water carried by Maple Brook is not known to connect with Fall Brook either within or downstream of the Project Property area (Figure 3).

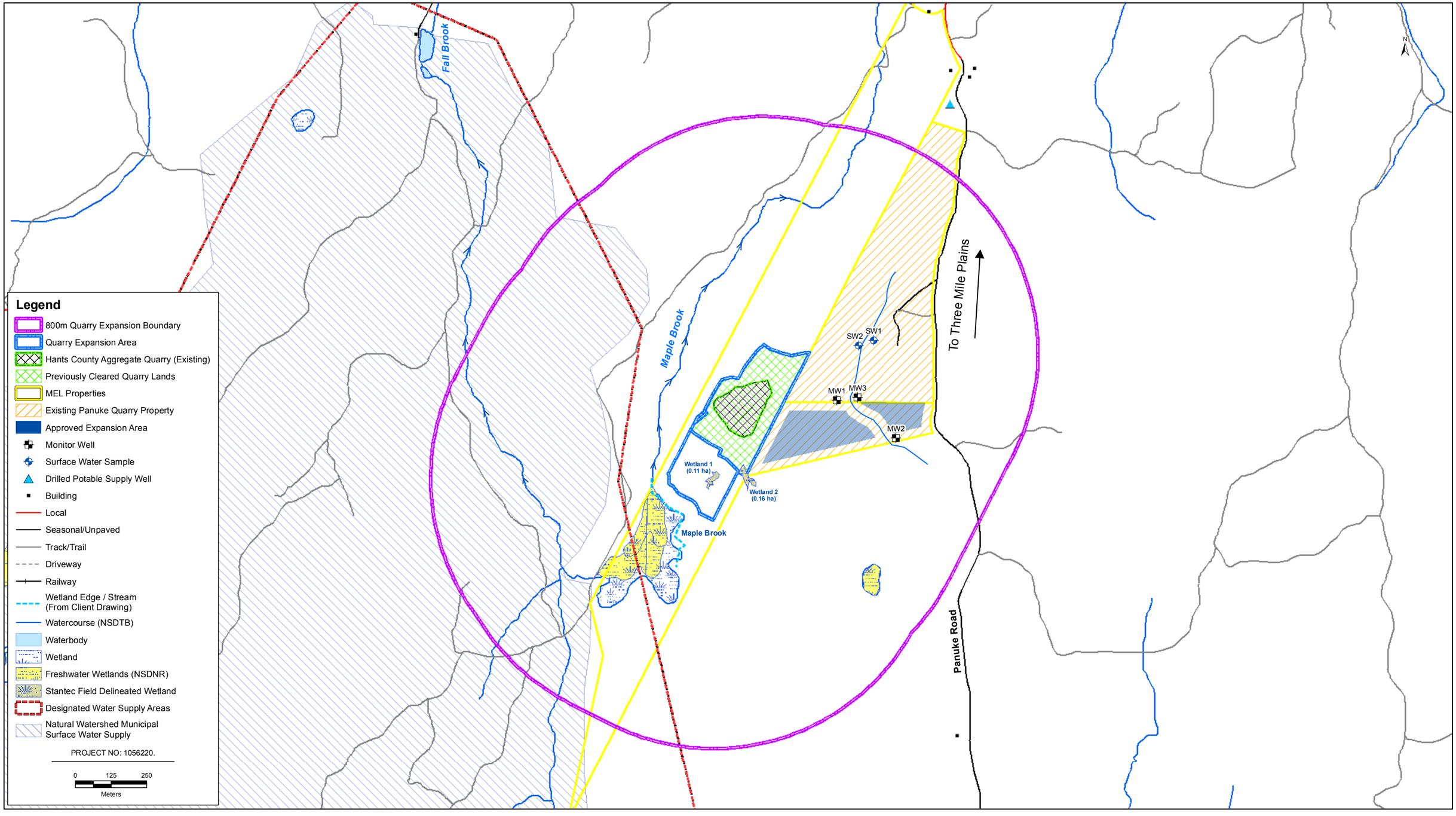
The St. Croix River and the Mill Lakes PWA are located outside the Project property. However, mitigation is suggested in the following sections to prevent downstream effects from Maple Brook on downstream aquatic environments, including the St. Croix River. The remainder of the Surface Water VEC discussion will focus on surface water quality, aquatic life and fish habitat within Maple Brook.

5.2.1 Description of Existing Conditions

Fieldwork was conducted on October 7, 2009 by two Stantec aquatic scientists. The field-based stream assessment included a fish habitat survey and *in-situ* water quality sampling within the one watercourse appearing on 1:10,000 mapping (Nova Scotia Digital Topographic Database) in the vicinity of the proposed quarry extension boundaries. As described above, the one watercourse, Maple Brook, does not cross the currently proposed extension area, but runs very close to the proposed boundary. Therefore, the watercourse was assessed and mitigation suggestions are presented. Maple Brook is expected to feed into the St. Croix River eventually via one of several tributaries to the St. Croix River, including the Lebreau Creek Brook and the Avon River (*i.e.,* Pesaquid Lake).

The habitat surveys were conducted using internal Stantec sampling protocol. The internal protocol used was based on multiple existing protocols including the Environment Canada CABIN protocol (Canadian Aquatic Biomonitoring Network; Reynoldson *et al*. 2007), and 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 and width of the stream were also taken and the presence of existing anthropogenic impacts was noted.

Watercourse descriptions are provided below for the one stream assessed, Maple Brook. This information details the watercourse survey results and characterizes the stream. By characterizing the watercourse, the Hants County Aggregate Quarry can ensure that appropriate mitigation is implemented. Additionally, any site-specific concerns that may require special mitigation can be identified.



DATE: 25/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 3**
PREPARED BY: G. MESHEAU	**ENVIRONMENTALLY SENSITIVE AREAS**	Stantec
MUNICIPAL ENTERPRISES LIMITED		

Key *in-situ* water quality results are outlined for Maple Brook, as well. 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 the 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. These parameters experience natural variation on a seasonal and annual basis. The results presented in the current report represent the surface water quality in the watercourse at a single point in time.

No electro-fishing was conducted during this survey as DFO regulations prohibit electro-fishing in the St. Croix River and its tributaries. Photographs were taken along the stream to document habitat (see Appendix D).

Watercourse Description

Maple Brook is a well defined stream running outside the western edge of the existing Hants County Aggregate Quarry property boundaries and flows north. The watercourse falls within the Hants County Aggregate Quarry property boundaries and comes closest to the quarry extension area at the southern end of the currently proposed extension boundary (Figure 3). It is expected that the watercourse eventually drains into the St. Croix River through one of several potential tributaries to that river, although connectivity to these downstream tributaries was not confirmed during the field assessment. The stream can be characterized as a heavily tea stained, perennial stream supporting multiple substrate types and flow patterns. The stream water quality is influenced by the wetlands in the area.

At the time of the survey, the stream supported high flows following a substantial rain event (approximately 50 mm) 24-48 hours prior to the field-based assessment. The stream characteristics varied from wide, relatively shallow stream with a rocky, cobble-dominated substrate surrounded by mixed forest (see photos 1-2, Appendix D) to a progressively narrower, deeper stream feeding through a wetland (see photos 3-6, Appendix D) closer to the proposed extension boundary. Macrophytes were present throughout the assessment area, with some sections supporting abundant aquatic vegetation. Woody debris was also present throughout the stream and in some areas could be considered abundant. In the upstream portion of the assessed stream area, close to the proposed extension boundary, the flow type was predominantly a run. In the downstream, rocky substrate section outside the Hants County Aggregate Quarry property boundary riffles and some shallow pools were also observed.

Additional physical habitat features are summarized for the watercourse in Table 5.1. These measurements were collected at a single point in time and as such will experience natural variation seasonally.

Table 5.1 Summary of Stream Assessment at Hants County Aggregate Quarry

Date & Time	**7-Oct-09**
Site Coordinates	**413228E 4975963N**
Site Description Site Measurements and Characteristics	Maple Brook
Precipitation Previous 24 hours	None (~50 m rain from 24 – 48 hours previous to assessment)
Wetted Width average (m)	2.2
Bankfull Width average (m)	2.2
Depth (min. - max. range) (cm)	50
Woody Debris (range throughout site)	Present - abundant
Macrophytes (range throughout site)	Present - abundant
Algae	Present
Canopy Cover (%) (range throughout site)	0 - 80
Riparian Vegetation (Dominant)	Mixed Forest and Wetland
Water Quality	
DO (mg/L)	6.88
DO (%)	62.6
Water Temperature (˚C)	11.18
pH	5.49

Generally, the water clarity was good, with no signs of turbidity. A section along the north side (down gradient) of the existing quarry is protected by a silt fence. The *in situ* water quality results collected in the stream (Table 5.1, above) confirm that Maple Brook has the potential to support aquatic life when compared to the CCME-FAL guidelines. As is often observed in various areas in Nova Scotia, the pH level measured in Maple Brook was somewhat acidic (5.49). The pH fell below the CCME guidelines of 6.5-9.0 but is within the range known to support aquatic life in Nova Scotia. Low pH or acidic waters are common in various areas of the province. Acidification can be caused by a variety of combinations of anthropogenic and natural soil composition conditions such as high sulfur content, which, once becoming oxidized leaches into the ground and surface water, lowering pH (Goodwin, 2004). The dissolved oxygen (DO) recorded in the stream at the time of the survey met the CCME guidelines for the lowest acceptable DO concentration for early and other life stages of aquatic life.

None of the watercourses identified on the Project Property are known to interact with drinking water supplies or other protected surface waters, although the Mill Lakes Watershed PWA is in the vicinity, as discussed above. The assessment presented below concerning hydrogeology and groundwater on the site (*i.e.,* Section 5.6.2), discusses a water well review for the Project Property. Available mapping information was reviewed to determine the probable locations of water wells within 800 m of the Project area. No wells were found to be located within the 800 m Project Area. Further consideration of water wells and hydrogeology in the general area is presented in Section 5.6.2 below.

With implementation of the mitigation described herein to protect on-site surface water and prevent effects downstream in the Avon River, St. Croix River, and their tributaries, no impact to surface waters is anticipated to result from the proposed Project Activities.

Fish Survey Results

Maple Brook was not electrofished during the stream survey. DFO regulations prohibit electrofishing in the St. Croix River and its tributaries, which Maple Brook is anticipated to drain into. Electrofishing is prohibited in these and other inner Bay of Fundy (iBoF) waters because the iBoF populations of Atlantic salmon (*Salmo salar*) are listed as endangered on Schedule 1 of the federal *Species at Rick Act* (*SARA*). The water quality, varying flow patterns and diverse substrate types observed with the surveyed area during the field based stream assessment confirm that Maple Brook has the potential to support small bodied and large bodied fish species at various stages of their life history (*e.g.,* migration and feeding). However, no iBoF Atlantic salmon spawning habitat (*i.e.,* well aerated gravel beds) was observed within the assessed section of the stream survey. Therefore, neither iBoF Atlantic salmon nor other species of salmonids are expected to spawn within with section of the stream located in proximity to the proposed extension area. Appropriate mitigation must nevertheless be undertaken to prevent potential downstream effects on fish and fish habitat, including potential salmonid habitat elsewhere in the drainage system.

Summary

During the October sampling period, one watercourse was confirmed on the Hants County Aggregate Quarry site, Maple Brook. The watercourse exhibited clear, flowing, tea-stained water and instream habitat capable of supporting aquatic life at the time of the survey. The water from Maple Brook is anticipated to drain into the St. Croix River downstream through one of the River's several tributaries. Therefore, fish sampling was not carried out. No salmonid spawning habitat was observed within the section of stream assessed, in the vicinity of the proposed quarry extension area. The potential for downstream effects within the St. Croix River, the Avon River, and their tributaries must be mitigated.

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

Potential Surface Water Quality and Aquatic Habitat Effects

The primary potential effects on the surface water VEC from quarry activities result from erosion and sediment control. Erosion and sedimentation can occur whenever soil is exposed. Sedimentation (increased sediment load in stream water and deposition in downstream sediments) is perhaps the most common environmental effect of quarry activities on fish and aquatic habitat, including water quality. The environmental effects of sedimentation are well studied and understood; therefore, detailed mitigation measures to protect watercourses from these effects have been developed. Sedimentation can result in physical changes to the aquatic environment, including the accumulation of fines on stream substrate. Sedimentation and siltation of surface water can also degrade surface water quality (e.g. oxygen levels, light penetration, water temperature, water chemistry such as organics and metals) leading to potential changes in primary production and food availability (Anderson *et al.* 1996 and Trow Consulting Engineers Ltd. 1996).

Other potential environmental effects on surface water quality that may occur during quarry activities include increases in total suspended sediments (*i.e*., increased turbidity), a change in hydrologic conditions, and changes in pH from runoff. These changes in surface water quality can lead to effects on the benthic invertebrate community, in addition to potential physical effects resulting from sedimentation and siltation. There are no known reported acid generating rocks in the existing quarry, so it is unlikely that acid drainage from mineralized zones will occur from the quarry activities. Acid drainage affects the pH of surface water systems by increasing the acidity of the water and as such is very detrimental to aquatic life.

An accidental release of deleterious substances associated with quarry site activities (*e.g.*, nitrates from blasting agents and petroleum hydrocarbons from heavy equipment) also have the potential to affect water chemistry down gradient of the accidental release site if the deleterious substance is not controlled. Nitrates have the potential to cause nutrient enrichment in freshwater systems and petroleum hydrocarbons can cause general contamination of the water and aquatic habitat.

The following mitigation discussion focuses on the prevention and control of erosion, sedimentation and accidental releases during quarry activities. Mitigating for potential effects of erosion and sedimentation serves to protect aquatic habitat, fish resources and water quality simultaneously.

Mitigation of Effects

No active quarry components will be located within 60 m of the banks Maple Brook without prior government approval. No Project-related vehicles will be driven through streams. Natural vegetation will be maintained within this buffer. If avoidance of the watercourse is not possible in the future, approval to alter the watercourse must be granted under the Nova Scotia Activities Designation Regulation. Prior to filing a Watercourse Alteration Approval application, a site visit may be needed to update the stream habitat assessment. Streams are dynamic environments subject to physical and chemical change over time and as such should be reassessed if more than two years have passed since the initial assessment. Alteration of Maple Brook is currently not planned during the life of the quarry extension.

In addition to provincial regulations, any alteration of Maple Brook would also have to be approved by Fisheries and Oceans Canada (DFO). The surveyed area of Maple Brook showed diverse habitat and good water quality anticipated to support fish. DFO has developed the Policy for the Management of Fish Habitat (DFO 1986), which applies to all development and industrial projects in or near watercourses that could harmfully alter, disrupt, or destroy fish habitat by chemical, physical, or biological means *(i.e.,* HADD). The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. Appropriate mitigation is required to prevent effects on fish and fish habitat within Maple Brook as well as further downstream in the drainage system.

Clearing, grubbing, and topsoil stripping activities can increase the potential for sediment erosion and deposition down gradient, 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.

The placement of free-draining material (*i.e.,* blasted rock) over disturbed areas and the use of properly sized flow retention structures are expected to mitigate erosion and sedimentation effects. As the quarry develops, exposed soil capable of producing sediment laden-runoff will be stabilized with blasted rock, and stockpiles of topsoil and overburden will be stabilized with hydroseed or root mat. Additional retention capacity on the quarry floor will be created as the quarry develops and a settling pond will be installed, if required. A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval amendment application process.

Accidental release events associated with the Project have potential to result in environmental effects. Precautions and preventative measures will be taken to minimize potential for the occurrence of accidental events that may occur during the life of the Project and to reduce the impacts of any associated environmental effects. It is difficult to predict the precise nature and severity of accidental events. However, the probability of serious accidental events or those causing significant adverse environmental effects is low, particularly when construction and operation procedures incorporate environmental protection and contingency and emergency response plans. Spills of petroleum, oils, lubricants or blasting material may occur during quarry activities during refuelling of machinery, maintenance activities, and failure of hydraulic lines or storage containers. These spills are usually highly localized and readily cleaned up by onsite crews using standard spill remediation equipment.

Based on the results of the watercourse assessment and the mitigation proposed, there is very low potential for quarry activities to interact with the aquatic environment and significant Project-related effects on Maple Brook or other surface water resources are not likely to occur.

5.3 RARE AND SENSITIVE FLORA

5.3.1 Description of Existing Conditions

The site was surveyed by Stantec botanists on September 26, 2009 and during June 7, 2010. A vascular plant inventory of the Project area was compiled during the surveys and habitat descriptions were performed. The Project area supports a number of upland habitat types including immature mixedwood, softwood and hardwood forest, clear-cut, and disturbed area. Two wetlands are also present within the Project area. Whereas both of these are mixedwood treed swamps, a large portion of one is at an early stage of successional development following tree harvesting activities.

The eastern half of the Project area has been highly modified by human activities. This area is primarily occupied by the existing quarry pit as well as by land that has been cleared and grubbed of its vegetation. Recently clear-cut (within approximately five years) forest surrounds

the southern and western ends of this highly disturbed area. Tree cover within the clear-cut portions of the site is negligible, but regenerating red maple (*Acer rubrum*) and large-tooth aspen (*Populus grandidentata*) form a prominent shrub layer. Red raspberry (*Rubus idaeus*) is abundant within this habitat as are a number of herbaceous taxa, including bristly sarsaparilla (*Aralia hispida*), dwarf dogwood (*Cornus canadensis*), bracken fern (*Pteridium aquilinum*), and poverty oat-grass (*Danthonia spicata*).

The western half of the Project area is forested and primarily comprised of immature mixedwood. Tree cover within this habitat is dominated by red maple and balsam fir (*Abies balsamea*), although other species, such as quaking aspen (*Populus tremuloides*) are present. A moderate shrub layer is dominated by balsam fir and red spruce (*Picea rubens*), with lesser amounts of red maple and sheep-laurel (*Kalmia angustifolia*) also being present. The herbaceous layer is comprised of a diversity of species, including bracken fern, dwarf dogwood, goldthread (*Coptis trifolia*), whorled aster (*Oclemena acuminata*), eastern hay-scented fern (*Dennstaedtia punctilobula*), and clinton lily (*Clintonia borealis*). An intermittent moss cover is provided by three-lobed bazzania (*Bazzania trilobata*) and red-stemmed moss (*Pleurozium schreberi*).

The mixedwood forest grades into a stand of immature hardwood within the northern end of the Project area. Tree cover within this habitat is comprised of a diversity of species, including large-tooth aspen, red maple, white ash (*Fraxinus americana*), balsam fir, and sugar maple (*Acer saccharum*). An intermittent shrub layer is primarily formed by balsam fir and white ash along with scattered occurrences of American fly-honeysuckle (*Lonicera canadensis*). Common herbaceous species within the mixedwood forest include clinton lily, wild lily-of-the-valley (*Maianthemum canadense*), violet (*Viola sp*.), and spinulose shield fern (*Dryopteris carthusiana*).

A pocket of immature softwood forest is present within the northwestern corner of the Project area. This habitat has a dense overstory canopy comprised of balsam fir, red maple, red spruce (*Picea rubens*), and scattered eastern white pine (*Pinus strobus*). Balsam fir and red spruce also form a moderate shrub layer within this habitat. A minimal herbaceous layer is comprised of scattered occurrences of wild lily-of-the-valley, clinton lily, partridge-berry (*Mitchella repens*), and painted trillium (*Trillium undulatum*). The well-shaded forest floor has a well-developed moss layer consisting primarily of red-stemmed moss, stair-step moss (*Hylocomium splendens*), three-lobed bazzania, and broom moss (*Dicranum sp*.).

The mixedwood treed swamps are located within the western half of the Project area. Tree cover within these wetlands is comprised of red maple, white ash, quaking aspen, as well as lesser amounts of balsam fir and black spruce (*Picea mariana*). These tree species also form an intermittent shrub layer within the swamps. The composition of herbaceous vegetation varies considerably within the wetlands and is dominated by both forbs and graminoids including three-seed sedge (*Carex trisperma*), dwarf dogwood, fowl manna-grass (*Glyceria striata*), and New York fern (*Thelypteris noveboracensis*). The hummocky character of these swamps is expressed by the moss layer which is comprised of a patchy arrangement of peatmoss (*Sphagnum spp*.) interspersed with species that are more characteristic of upland conditions, including stair-step moss and red-stemmed moss.

Approximately half of one of the swamps has been recently (within approximately five years) clear-cut. This habitat is characterized by extensive coverage of cottongrass bulrush (*Scirpus cyperinus*). A number of other graminoids are also common however, including brownish sedge (*Carex brunnescens*), rough bentgrass (*Agrostis hyemalis*), and Canada manna-grass (*Glyceria canadensis*). New York fern is also an important component of the herbaceous layer. A well-developed shrub layer is present within portions of the cut-over swamp and is comprised of a mixture of species, including red maple, quaking aspen, gray birch (*Betula populifolia*), red raspberry, and white ash.

Rare Vascular Plants

Prior to field surveys, a rare plant modeling exercise was performed to determine the likelihood of presence of rare or sensitive plants within the Project area. As part of the modeling exercise, all records of vascular plant species considered by the Nova Scotia Department of Natural Resources (NSDNR) to be "at risk", "may be at risk" (*i.e.,* Red listed) or "sensitive" to human activities or natural events (*i.e.,* Yellow listed) within a radius of 100 km from the Project area were compiled by means of an Atlantic Canada Conservation Data Center (ACCDC) data search (these records were originally obtained by Jacques Whitford (2008) as part of an EA on the adjacent Panuke Quarry property). The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within the Project area was determined through field visits. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present within the Project area. 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 189 Red or Yellow-listed vascular plant species have been recorded within 100 km of the Project area. Based on the results of the habitat model, 50 of these could potentially be present within the Project area, including 25 Red-listed and 25 Yellow-listed species. One "species at risk" protected by the *Nova Scotia Endangered Species Act* (NSESA), northern white cedar (*Thuja occidentalis*), was identified as being potentially present within the Project area. This species is listed as "vulnerable" by the province and was considered to potentially inhabit the swamps of the Project area. No federally designated "species at risk" were identified as being potentially present. The results of the model suggested that there was potential for all habitats in the Project area to support rare or sensitive vascular plant species. Because many of the plants highlighted by the modeling exercise were associated with wetlands and intact mixed/deciduous forests, these habitats were considered to be most likely to harbour rare or sensitive taxa. 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.

All species of vascular plants encountered during the 2009 – 2010 surveys were identified and their population statuses in Nova Scotia determined through a review of the species rankings

prepared by NSDNR (NSDNR 2010), ACCDC (ACCDC 2010), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2009), and those protected by the provincial *Endangered Species A*ct (NSDNR 2007b). No rare or sensitive taxa, as identified by COSEWIC, the provincial *Endangered Species Act*, or NSDNR were encountered during the field survey. However, two provincially uncommon taxa, as identified by the ACCDC were encountered. A list of the 191 vascular plant taxa found on site during field surveys and information on their population status is provided in Appendix F.

Although considered secure in the province by NSDNR, the populations of two orchids, large roundleaf orchid (*Platanthera orbiculata*) and hooker orchis (*Platanthera hookeri*) are given a ranking of "S3" by the ACCDC indicating that they are uncommon and are of long-term concern. Large roundleaf orchid is scattered throughout the province in damp, shaded forests (Zinck 1998). Thirty-one individuals of this species were encountered within the hardwood and mixed wood stands of the Project area. Hooker orchis is typically associated with mixed woods (Zinck 1998) and was observed at two locations on the property during the spring plant survey.

The timing of the spring and fall plant surveys was appropriate for identifying the list of species highlighted during the rare plant modeling exercise. Although some of the rare or sensitive plants would have flowered outside the timing of the survey, most are readily identified by their seeds and/or general morphological characteristics, such as leaf shape. Furthermore, botanical inventories of the adjacent Panuke Quarry property (JWL 2008), conducted on July 7 and August 8, 2006; and June 20 and August 18, 2007, did not reveal the presence of any Red or Yellow listed species.

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. However, no federally or provincially designated "species at risk" or rare or sensitive plants, as identified by NSDNR (2010) were found within the Project area. Additionally, previous botanical inventories conducted on the adjacent Panuke Quarry property (JWL 2008) did not encounter any rare or sensitive vascular plants. Although two provincially uncommon species were encountered within the Project area (roundleaf orchid and hooker orchis), it is not expected that Project activities will cause a significant adverse effect on their populations and specific mitigative measures are not necessary for these taxa.

Other mitigation employed in the extension of the quarry will include the use of progressive reclamation and the use of native plant species wherever possible in the reclamation process. In the progressive reclamation process only the area needed for quarry extension in any one year would be grubbed. The subsoil, topsoil and root mat of this area would be placed in a portion of the pit that is no longer in use. Topsoil and root mat would be stockpiled temporarily (no more than one year) until the subsoil was placed. The topsoil would then be placed over the subsoil and dressed with the root mat. The root mat would provide a source of native plant species propagules in the form of buried seeds, roots, shoots and rhizomes as well as soil

micro-organisms, however, hydroseeding stockpiles is an acceptable alternative to utilizing root mats. 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 wetland and forest plant communities which are present in the area should 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. A field survey of the project area was conducted concurrently with the plant inventory during September 26, 2009 and recorded information on the presence of birds, mammals, and herpetiles (amphibians and reptiles). Following this, a breeding bird survey was conducted during June, 2010, along with additional wildlife observations. Results from field surveys performed on the adjacent Panuke Quarry property as part of a previous EA (JWL 2008) were also reviewed. In addition, 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 also consulted to provide records of wildlife in the vicinity of the Project area.

The ACCDC data search was conducted to determine if any rare or sensitive wildlife species have been recorded in the vicinity of the Project area. The ACCDC records were originally obtained by Jacques Whitford as part of an EA on the adjacent Panuke Quarry property (JWL 2008).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 as “at risk” or “may be at risk” (i.e., Red listed) or “sensitive” to human activities or natural events (i.e., Yellow listed) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the habitat descriptions compiled for the Project area to determine if suitable habitat was present. In instances where appropriate habitat was present for a particular species, it was considered to be potentially present.

The Project area provides moderate habitat diversity for wildlife. Its eastern half is primarily occupied by the existing quarry pit as well as by land that has been cleared and grubbed of its vegetation. These disturbed habitats are surrounded by recently clear-cut forest along their southern and western ends. The western end of the Project area is comprised of immature

forest. Although primarily mixedwood, stands of softwood and hardwood forest are also present. Additionally, two marginal wetlands are present within the Project area. Whereas both of these are mixed treed swamps, half of one has been recently clear-cut. Neither of these wetlands had any surface water at the time of visitation but evidence of ephemeral flooding was present.

Birds

Information on the distribution and abundance of birds within the Project area was primarily obtained during a breeding bird survey. This survey took place during the evening of June 7th and in the morning of June 8th, 2010 between the hours of 07:00 and 11:00. During this time, representative habitats on the property were visited by a birder with 20 years experience and all birds heard or observed were recorded. Additional observations of bird activity within the Project area were made on September 26, 2009. The breeding status of each species observed during these visits was determined with the criteria used in 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 are those birds that have 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 reviewed prior to the breeding bird survey. In particular, data from an existing EA for an adjacent property (JWL 2008) and from the Maritimes Breeding Bird Atlas (MBBA) were used to help identify species of conservation occur that could potentially occur on site, as well as their breeding status. The breeding bird survey on the adjacent Panuke Quarry property was conducted by Jacques Whitford Limited on July 7, 2006 and June 20, 2007 between the hours of 06:00 and 12:00. The 2006 breeding bird survey included areas within the central and western portions of the current Project area. The Maritimes Breeding Bird Atlas (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 (20MQ17) 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 status of each species identified by the field surveys and additional sources was 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 2010), Species at Risk in Nova Scotia (NSDNR 2007b), and the ACCDC (ACCDC 2010). The statuses of nationally rare species were obtained from COSEWIC (2009).

A total of 82 bird species have been identified by the MBBA and the field surveys within the vicinity of the Project area. Of these, 68 have been recorded by the MBBA, 32 were encountered during 2006 - 2007 field surveys in the vicinity of the site, and 34 were identified during 2009 - 2010 surveys of the current Project area. Of those recorded by the MBBA, the breeding status of 22 was confirmed, 31 identified as probable, 15 classified as possible, and one species was observed which exhibited no indication of breeding. The species recorded during the 2006 – 2007 field surveys included four which were confirmed breeders, 11 that were identified as probable, and 21 which were classified as possible breeders. Field surveys of the Project area itself during 2009 – 2010 identified six species as probable breeders, 27 as possible, and one additional species was observed which exhibited no indication of breeding. Appendix G 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.

Of the species recorded during the 2009 – 2010 surveys of the Project area, five may be considered to be of conservation concern. Although not protected by the NSESA or the federal *Species at Risk Act* (SARA), the populations of eastern wood-pewee (*Contopus virens*), golden-crowned kinglet (*Regulus satrapa*), gray jay (*Perisoreus canadensis*), ruby-crowned kinglet (*Regulus calendula*), and yellow-bellied flycatcher (*Empidonax flaviventris*) are all considered "sensitive" within the province by NSDNR (2010). The sensitive rankings assigned to these species reflects a decline in their Nova Scotian populations, as brought about by many factors within both their winter and summer grounds; including habitat loss, fragmentation, anthropogenic climate change, and other stressors.

Eastern wood-pewees have just recently been ranked as sensitive by NSDNR. In addition, they are currently assigned a rank of "S3S4B" by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province but are of long-term concern. Within Nova Scotia, eastern wood pewees are typically associated within and at the edges of forests, particularly those with a moderate to high hardwood component. During the 2010 breeding bird survey, two male eastern wood pewees were observed singing in the Project area, where they were associated with both hardwood and mixed wood stands. The population of eastern wood pewee has shown widespread decline, especially in central North America, including Nova Scotia (CWS 2009). Although the cause of this decline is largely unknown, one potentially contributing factor has been identified as an overpopulation of white-tailed deer in eastern forests. That is, in areas with high deer density, the intermediate forest canopy is disturbed by browsing which affects the foraging space of the eastern wood pewee.

Golden-crowned kinglets have also just recently been assigned a status of "sensitive" by NSDNR. The ACCDC assigns a rank of "S4" to this species indicating that although they are fairly common throughout their range in the province, they are of long-term concern. Golden-crowned kinglets are typically found in dense coniferous stands of the province where they are year-round residents. Two males were heard singing within the mixed woods of the Project area during the 2010 breeding bird survey and this species is therefore classified as a "possible" breeder on the site. An individual was also observed on the property during the site visit in September of 2009, suggesting that this species is a year-round resident of the Project area.

The golden-crowned kinglet is one of the most commonly encountered forest songbirds in the province but has been assigned a “sensitive” ranking due to perceptions that its population is declining and that it is sensitive to logging initiatives.

Gray jays are considered sensitive by NSDNR and are ranked “S3S4” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province but are of long-term concern. Gray jays are year-round residents of Nova Scotia and are associated with coniferous woodlands where they build their nests in spruce or fir trees. A pair of gray jays was observed within the mixed / conifer dominated forests at the western end of the Project area during the 2009 site visit. As a result of being observed within suitable breeding habitat, they have been classified as “possible” breeders within the Project area. However, their absence from the Project area during the 2010 breeding bird survey suggests that the earlier observation may have been of individuals passing through the site rather than utilizing it for more intensive purposes. Gray jays have shown a slight decline in abundance in Nova Scotia during the last few decades. Due to their association with boreal habitat conditions, they are particularly sensitive to anthropogenic climate change at the southern end of their range (which includes Nova Scotia).

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. A male ruby-crowned kinglet was observed singing within the mixed woods of the Project area (it’s typical habitat within the province) and is therefore classified as a possible breeder. For reasons unknown, the population of this species has shown a steady decline in Nova Scotia during the last several decades (CWS 2009).

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 mixed woods of the Project area. The sensitive ranking assigned to this species by NSDNR is expected to reflect a general decline in its abundance within the province, as may be brought about by a number of interacting factors.

Although no federally or provincially designated “species at risk” were observed during recent field surveys of the Project area, the 2006 – 2007 field surveys conducted for the adjacent Panuke Quarry EA identified both common nighthawk (*Chordeiles minor*) and Canada warbler (*Wilsonia canadensis*) as occurring in the vicinity of the Project area.

Common nighthawks are classified as “threatened” by both COSEWIC and the province of Nova Scotia. In addition, they are regarded as “at risk” by NSDNR and are given a ranking of “S3B” by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Common nighthawks nest on the ground usually in cut-over and burned forests or on the flat roofs of buildings in urban areas (Erskine 1992). This species has undergone moderate population declines particularly among the urban nesting

populations. A single common nighthawk was flushed from a clear-cut on the adjacent Panuke Quarry property during the 2007 breeding bird survey. Based on the common nighthawk being observed in suitable nesting habitat, it was classified as a possible breeder. Although the presence of recently cleared forest within the Project area provides some potential habitat for this species to inhabit the site, it was not observed during the 2010 breeding bird survey and is therefore not expected to currently utilize the site.

Canada warblers have recently been assigned a "threatened" status by COSEWIC, but are not listed as a "species at risk" under the *Nova Scotia Endangered Species Act*. They are, however, considered "at risk" by NSDNR and are ranked as "S3B" by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Canada Warbler is a forest interior species and is usually found in the dense understory vegetation of wet mature to mid-age hardwood and mixed forests (Erskine 1992). Although this species has undergone significant population declines, it is still fairly common in Nova Scotia. A Canada warbler was recorded within the mixedwood forest of the Project area during the 2006 field survey (although field surveys focused on the adjacent property, some effort was undertaken within the Hants County property during this year). Although generally associated with interior forest conditions, the observation was made within close proximity to the anthropogenic edges of the adjacent Panuke Quarry and the existing quarry within the Project area. Because this bird was heard singing in suitable nesting habitat, it has been classed as a possible breeder within the Project area. Canada warbler was not encountered during the 2010 breeding bird survey, and as such, it is not expected to currently occupy the site.

A number of other species of conservation concern have been recorded in the vicinity of the Project area. Bank swallow (*Riparia riparia*), gray catbird (*Dumetella carolinensis*), and common loon (*Gavia immer*) are considered to "may be at risk" by NSDNR and have all been recorded within the MBBA square in which the Project area is located. However, the MBBA is of limited usefulness because its data is recorded in 10 km X 10 km census squares, making it difficult to determine whether a particular species has been observed in close proximity to the Project area. Given that none of the aforementioned "may be at risk" species were encountered during any field visits to either the current Project area or the adjacent Panuke Quarry property, it is unlikely that they utilize the site. Similarly, a number of bird species ranked as "sensitive" by NSDNR; including barn swallow (*Hirundo rustica*), American bittern (*Botaurus lentiginosus*), black-backed woodpecker (*Picoides arcticus*), bobolink (*Dolichonyx oryzivorus*), tree swallow (*Tachycineta bicolor*), eastern kingbird (*Tyrannus tyrannus*), and eastern phoebe (*Sayornis phoebe*); have been recorded in the MBBA squares but are not expected to utilize the current site of interest because they were not recorded during any field surveys within or adjacent to the Project area and also because the habitat conditions available within this property are unsuitable for many of these taxa. Although two additional "sensitive" species; spotted sandpiper (*Actitis macularius*) and killdeer (*Charadrius vociferous*); had been classified as "probable" breeders during 2006 – 2007 surveys of the adjacent Panuke Quarry property neither are expected to utilize the current Project area due to limitations in the habitat conditions that are present. That is, spotted sandpipers are typically found in association with ponds, lakes, or

marshes and killdeer are associated with shores and grassy fields but none of these habitats are represented within the Project area.

An ACCDC modeling exercise, conducted in 2009 to help direct field surveys, identified a total of 30 Red or Yellow-listed avian species that have been recorded within 100 km of the Project area. Of these, seven are presently considered "species at risk" by either COSEWIC or the Province of Nova Scotia; including piping plover (*Charadrius melodus*), roseate tern (*Sterna dougallii*), American peregrine falcon (*Falco peregrinus anatum*), rusty blackbird (*Euphagus carolinus*), short-eared owl (*Asio flammeus*), bobolink, and whip-poor-will (*Caprimulgus vociferous*). However, the modeling exercise identified only two species, boreal chickadee (*Poecile hudsonica*) and whip-poor-will as being potentially present within the Project area. However, neither 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 on the adjacent Panuke Quarry property during July 7 and August 8, 2006; and June 20 and August 18, 2007 (JWL 2008), as well as those made by a visit to the Project area on September 26, 2009. Whereas the 2007 surveys were restricted to the adjacent property, those conducted in 2006 also included areas within the Hants County quarry extension area. The field surveys provide a good indication of the presence of large mammal species in the Project area. Knowledge of the distribution of small mammals in the Project area 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.

Nine 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*), eastern chipmunk (*Tamias striatus*), snowshoe hare (*Lepus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), American black bear (*Ursus americanus*), raccoon (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), and southern red-backed vole (*Myodes gapperi*). None of these species are Red or Yellow listed, or considered "at risk" by provincial or federal sources.

A total of six Red or Yellow-listed mammal species have been recorded within 100 km of the Project area. Two of these species, Canada lynx (*Lynx canadensis*) and moose (*Alces americanus*) are ranked as "endangered" by the Province of Nova Scotia and are considered at risk by NSDNR. The remaining species are all considered sensitive by NSDNR, and include eastern pipistrelle (*Perimyotis subflavus*), fisher (*Martes pennant*), long-tailed shrew (*Sorex dispar*), and southern flying squirrel (*Glaucomys volans*). Due to absence of appropriate habitat within the Project area and / or limitations in their range distribution, it is highly unlikely that the site would provide important habitat for any of these taxa.

Canada lynx is ranked as “endangered” by the province. Within Nova Scotia they live deep in coniferous forests near rocky areas, bogs and swamps. Although the lynx may have historically occupied parts of the mainland, it is 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 78 km from the Project area and was made in 1978. Due to the current absence of this species from the area, the property would not have potential to provide habitat to this species.

Moose are commonly 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 submerge 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). The Project area is located approximately 50 km from the closest core moose distribution area on the Chebucto Peninsula (Parker 2003) and the closest observation of moose is approximately 19 km away. Whereas the clear-cut, mixedwood, and hardwood forests of the Project area could offer some suitable browsing habitat, the Project area is outside the range of moose populations in Nova Scotia and it is unlikely that they frequent the property. Furthermore, no evidence of moose was observed during the field surveys.

The eastern pipistrelle is a hibernating bat that reaches the northern limit of its range in Nova Scotia. They are considered sensitive within Nova Scotia and are ranked as “S1?” by the ACCDC indicating that they are extremely rare within the province, but that there is some uncertainty regarding their population status. This species typically hibernates in caves or abandoned mines from October to May. During the rest of the year it forages in open forests, along the edges of rivers and streams, and roost in caves, rock crevices, attics, and trees. This species is most vulnerable at its hibernation sites where large proportions of the regional population may gather in a single location. The Project area is several kilometers away from Windsor Group gypsum bedrock which could offer some potential hibernaculum sites and is approximately 6 km away from the nearest known abandoned underground mine (NSDNR 2006a). Although eastern pipistrelle has been recorded within approximately 2 km from the Project area and could frequent the Project for foraging opportunities, no suitable hibernation sites are believed to be present within or immediately adjacent to the site. As such, it is unlikely that Project will have an important interaction with this species. Furthermore, eastern pipistrelles are profound hibernators and are not easily aroused while hibernating. As such, individuals that might be hibernating in caves or mines near the study area are unlikely to be adversely affected by noise and vibration from blasting.

Fishers are considered sensitive within Nova Scotia and are ranked as “S2” by the ACCDC indicating that they are rare within the province. Although previously extirpated from Nova Scotia as a result of over trapping and habitat loss, a small population has become established through reintroduction efforts. 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 forests. Fishers have large home ranges and typically travel along regular hunting circuits which may be up to 16 km in diameter. Although no evidence of fishers was encountered during the field surveys, their large ranges would inhibit considerable amounts of spoor in any particular area, and evidence of this species could therefore be easily missed. Whereas the closest known fisher record is approximately 43 km away, the mixedwood and coniferous forests of the Project area have some potential to provide habitat for this species. However, given the large home ranges of fishers and the small size of the proposed quarry extension area, loss of suitable habitat as a result of project activities is unlikely to cause an important adverse effect on this species.

Long-tailed shrews are considered sensitive by NSDNR and are ranked as “S1” by the ACCDC indicating that they are extremely rare within the province. This species is 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 66 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 unlikely that long-tailed shrews inhabit the site or that Project activities will interact with this species.

Southern flying squirrels are considered sensitive by NSDNR are ranked as “S2S3” by the ACCDC indicating that they are rare to uncommon within Nova Scotia. They are restricted to southwestern counties of the province where they are typically associated with pine and hardwood stands that provide suitable foraging and nesting habitat. The closest observation of this species to the property is 27 km away. Although the hardwood stands of the Project area do provide some potentially suitable habitat for this species, the site is outside the normal range of flying squirrel and it is unlikely that this species would inhabit the area.

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 amphibians and reptiles within the Project area was also collected during the field surveys. Results from field surveys include those conducted on the adjacent Panuke Quarry property during July 7 and August 8, 2006; and June 20 and August 18, 2007 (JWL 2008), as well as those made by a visit to the Project area on September 26, 2009. Whereas the 2007 surveys were restricted to the adjacent property, those conducted in 2006 also included areas within the current Project area.

Eight herpetile species were encountered during the surveys: American toad (*Bufo americanus*), common garter snake (*Thamnophis sirtalis*), mink frog (*Rana septentrionalis*), northern spring

peeper (*Pseudacris crucifer*), pickerel frog (*Rana palustris*), redback salamander (*Plethodon cinereus*), redbelly snake (*Storeria occipitomaculata*), and wood frog (*Rana sylvatica*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by NSDNR or the ACCDC.

A review of the ACCDC data search indicates that three rare or sensitive herpetiles have been recorded within 100 km from the Project area: Blanding's turtle (*Emydoidea blandingii*), eastern ribbon snake (*Thamnophis sauritus* pop. 3), and wood turtle (*Glyptemys insculpta*). All of these herpetiles are considered “species at risk” by either COSEWIC or the Province of Nova Scotia. Due to absence of appropriate habitat within the Project area and / or limitations in their range distribution, it is highly unlikely that the site would provide habitat for any of these taxa.

Blanding’s turtle is listed as endangered under both SARA and the Nova Scotia Endangered Species Act. In addition, it is Red-listed by NSDNR and ranked as “S1” by the ACCDC indicating that they are extremely rare within the province. This species is typically found in still-water streams, swamps, marshes and bogs in south central Nova Scotia. Blanding’s turtles prefer water bodies with slow flowing water and muddy bottoms that support dense aquatic vegetation. Between early June and early July female Blanding’s turtles move to gravelly or sandy lake shores to lay their eggs. In the fall, Blanding’s turtles move to aquatic habitats where they hibernate underwater. The nearest known record of Blanding’s turtle is approximately 78 km from the current Project area of interest. Although two wetlands are present within the Project area, their surface water characteristics are not ideal for Blanding’s turtle and they are not connected via watercourses to other appropriate Blanding's turtle habitat. Additionally, the Project area is also located outside of the known range of Blanding’s turtle, which is restricted to the Mersey and Medway watersheds (The Blanding’s Turtle Recovery Team 2003).

The eastern ribbon snake is listed as a threatened species under SARA and the Nova Scotia Endangered Species Act. In addition, it is regarded as sensitive by NSDNR and is assigned a ranking of “S2S3” by the ACCDC indicating that it is rare to uncommon within the province. This species is associated with sluggish streams, marshes, swamps, bogs and lake shores and is typically found within 30 m of open water. They prefer areas that have a heavy cover of aquatic vegetation that provides cover for them and the amphibians and small fish that they feed on. The nearest known record of eastern ribbon snake is approximately 80 km from the Project area. The Project area is located outside of the known range of eastern ribbon snake in Nova Scotia, which is restricted to the Mersey, Medway, and Pleasant River watersheds (Smith 2002) and does not provide suitable habitat for this species.

Wood turtles are considered threatened under SARA, vulnerable under the Nova Scotia Endangered Species Act, are ranked as S3 by the ACCDC, and are regarded as 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. Wood turtles have been recorded in close proximity to the Project area (approximately 2 km) but are not likely to inhabit the Project site due to the absence of watercourses.

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

Migratory birds are protected under the *Migratory Birds Convention Act* (MBCA). As such, it is illegal to kill migratory bird species not listed as game birds 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*. In order to avoid contravening these regulations, clearing of areas to be used for the Project will preferentially 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. 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 MBCA.

Five “sensitive” birds species, as identified by NSDNR, have been recorded as “possible” breeders within the Project area, including eastern wood-pewee, golden-crowned kinglet, gray jay, ruby-crowned kinglet, and yellow-bellied flycatcher. Although the populations of these species may be experiencing declines within Nova Scotia, this is attributable to a variety of interacting stressors taking place within both their winter and summer grounds, including habitat loss, fragmentation, and climate change. 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. Due to the proximity of Maple Brook to the Project area however, a 60 m buffer extending from the edge of Maple Brook to the edge of the Project area (Figure 3) has been incorporated into the site plan at the request of NSDNR in consideration of potential wood turtle habitat.

In summary, assuming recommended mitigative measures are applied significant Project-related effects on wildlife are not likely to occur.

5.5 WETLANDS

5.5.1 Description of Existing Conditions

Two wetlands are present on the property (Figure 3); both are mixed treed swamps, as identified by the Canadian Wetland Classification System (Warne and Rubec 1997). Information

for each wetland, obtained during a site visit on September 26 2009, is presented in the following sections.

Wetland 1:

Wetland 1 is a small (0.11 ha) marginal mixedwood treed swamp surrounded by immature mixed forest. The wetland receives surface water runoff from the surrounding upland forest following high precipitation or snowmelt events but does not have any prominent inflow or outflow channels. Peat depths are shallow within the swamp and average 15 – 20 cm in depth. The marginal nature of the wetland is expressed by the infusion of upland hummocks throughout its extent.

The swamp has a moderate tree cover provided by red maple, white ash, quaking aspen, and balsam fir. Balsam fir, as well as lesser amounts of red maple also forms a moderate shrub layer within the wetland. The cover of herbaceous vegetation is low and comprised of scattered forbs and graminoids, including brownish sedge, dwarf dogwood, whorled aster, and white-edge sedge. Moss coverage is also intermittent, and is dominated by peatmoss, stair-step moss, and red-stemmed moss.

The vegetation surveys conducted in the wetland revealed the presence of 32 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon by either provincial or national sources (ACCDC 2009; COSEWIC 2009; NSDNR 2010; and NSDNR 2007b).

Relative to the surrounding upland forest, the wetland is of moderate value for wildlife. Although no herpetiles were observed within the wetland, the ephemeral waters of the wetland could provide some suitable amphibian breeding habitat. The wetland would not provide suitable waterfowl habitat and does not contain an abundance of any plant species that are known to be an especially important food source for wildlife. During the 2009 site visit, evidence of both snowshoe hare and white-tailed deer were observed within the swamp.

The swamp receives water inputs from the surrounding upland habitats via surface water drainage but no well-defined inflow or outflow surface channels are present. Although no surface water was observed during the September survey, large amounts of water-stained (blackened) leaves throughout the wetland indicate that it is sometimes inundated. Following high precipitation or snow melt events, the wetland may provide some function in relation to flood water storage. In doing so, it may also contribute to water quality through a combination of physical processes and interaction with vegetation. However, the small size of the wetland limits its importance for providing these hydrological and biogeochemical functions within the watershed.

The wetland has little socio-economic value. There is no evidence to indicate that it is currently being used for recreational, agricultural, cultural, or business purposes. The wetland is not 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.

Wetland 2:

Wetland 2 is a small (0.16 ha) mixedwood treed swamp. Approximately half of the wetland is located within the Project area and has been recently clear-cut (within approximately 5 years). The wetland is located on a slight slope and receives surface water runoff from the surrounding upland habitat, particularly at its southern end. The swamp lacks any prominent inflow or outflow channels and has shallow peat depths (approximately 20 cm). The margins of the wetland are not well defined and upland hummocks are abundant throughout the wetland, comprising approximately 15 % of its area.

Due to recent tree harvesting practices, the wetland has two main vegetation types: an intact treed component and a cut-over section. The uncut half of the wetland has a moderate tree cover comprised predominantly of red maple. Balsam fir, white ash, and black spruce are also common species within the overstory. An intermittent shrub layer is formed by a variety of species including red maple, white ash, yellow birch (*Betula alleghaniensis*), American witch-hazel (*Hamamelis virginiana*), and red spruce. A well-developed herbaceous layer is comprised of a diversity of species, with fowl manna-grass, New York fern, three-seed sedge, softleaf sedge (*Carex disperma*), and dwarf red raspberry (*Rubus pubescens*) being particularly abundant. The cut-over section of the swamp is characterized by extensive coverage of cottongrass bulrush and an absence of overstory tree coverage. A number of other graminoids are also common within this portion of the wetland, including brownish sedge, rough bentgrass, and Canada manna-grass. Additionally, New York fern is also an important component of the herbaceous vegetation. A well-developed shrub layer is present within portions of the cut-over swamp and is comprised of a mixture of species, including red maple, quaking aspen, gray birch, red raspberry, and white ash.

The vegetation surveys conducted in the wetland revealed the presence of 79 species of vascular plants. None of these species are considered at risk, sensitive, rare, or uncommon by either provincial or national sources (ACCDC 2009; COSEWIC 2009; NSDNR 2010; and NSDNR 2007b).

Relative to the surrounding upland forest, the wetland is of moderate value for wildlife. Although no herpetiles were observed within the wetland, it would provide some suitable amphibian breeding habitat. The wetland would not provide suitable waterfowl habitat and does not contain an abundance of any plant species that are known to be an especially important food source for wildlife.

The swamp receives water inputs from the surrounding upland habitats via surface water drainage but no well-defined inflow or outflow surface channels are present. Although surface water was negligible at the time of visitation, patches of exposed and blackened substrate indicate that portions of the swamp are frequently inundated. The wetland may provide some function in relation to flood water storage following high precipitation or snow melt events. In doing so, it may also contribute to water quality through a combination of physical processes

and interaction with vegetation. However, the small size of the wetland limits its importance for providing these hydrological and biogeochemical functions within the watershed.

The wetland has little socio-economic value. There is no evidence to indicate that it is currently being used for recreational, agricultural, cultural, or business purposes. The wetland is not 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 the two wetlands located within the Project area. 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 compensation plan to replace the wetland functions lost as a result of damage to or loss of the wetland.

An important functional attribute of wetlands is the provision of habitat for wildlife and/or rare plant species. Because botanical and wildlife inventories conducted within wetlands were performed late in the growing season (September) they were not necessarily adequate for assessing this function. As such, additional plant and wildlife surveys will be performed within the wetlands during spring / early summer.

The Project has the potential to indirectly influence the wetlands 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.

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

5.6 GROUNDWATER RESOURCES

Groundwater, an integral component of the hydrologic cycle, originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The upper surface of the saturated zone is called the groundwater table. The groundwater table intersects the surface at springs, lakes and streams where interaction between the groundwater and the surface water environment can occur. 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 resources and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

The groundwater yield of dug or drilled water wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers into which the wells are constructed. An aquifer is a geological formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. 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 supply 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 about 100 m, and generally in a direction hydraulically up-gradient of the well. A quarry that is excavated below the local groundwater table could be considered to behave like a large well, and groundwater draining into the quarry would influence water levels immediately surrounding the excavation to a distance proportional to the size of the quarry.

Project-related contamination (*e.g.,* accidental petroleum hydrocarbon spills from machinery or blasting chemicals (*i.e.,* nitrate and fuel oil)) could theoretically impact the groundwater at the quarry and potentially affect well water quality down gradient of the Project, however most potential hazards should be contained within the quarry dewatering system.

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. Based on professional experience, the risk from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 to 200 m, and minimal beyond about 200 m (Dave MacFarlane, pers. comm.).

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 Pit and Quarry Guidelines). Potential effects of accidental spills are considered for all wells 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; it can extend 200 m in sand and gravel, and up typically up to 50 m in glacial till overburden.

5.6.1 Description of Existing Conditions

The following discussion of the local groundwater resources and hydrogeology is based on a desktop study including review of relevant geological maps and records in the Nova Scotia Well Drillers Logs Database. A field study to identify well types and 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.

Project Location, Topography and Drainage

The proposed quarry extension is situated about 3 km south of the community of Five Mile Plains on the Panuke Road and west of the existing Panuke Quarry (Figure 1. The proposed quarry is approximately 700 m long by 300 m wide having an approximate area of 21 ha (Figure 1).

The site is located in the transition between the South Mountain highland and the Hants-Colchester lowland. Elevations in the Project area range from approximately 115 to 140 m above sea level. The quarry area slopes to the west and north from the proposed quarry site.

The nearest water courses include a tributary that drains Mill Lakes reservoir northwest to Lebreau Creek Brook thence northwest to the Avon River near Martock. Some maps show another brook, Sams Brook, north of the site that flows northeast to St. Croix River at Five Mile Plains (Figure 3). The Mill Lakes/Fall Brook reservoir and Water Supply Area is located 3 km to more than 5 km southwest and upstream of the Project. Due to the large distance separating project activities from this area, and inferred overland and groundwater flow directions, no impacts to the surface water supply are anticipated.

Surficial Geology

The surficial geology in the Project area (Figure 4) consists of ground moraine consisting of stony till plain and drumlins. These tills are derived from both local and distal bedrock sources (Stea, Conley, and Brown, 1992). Its thickness and composition strongly reflect the nature of the underlying bedrock and range from thin silty sand tills with gravel and boulders to thick reddish-brown clay tills. These tills are often found in beds of fluvially stratified drift. Borehole logs from domestic water wells in the region indicate that the surficial geology nearest the site is commonly estuarine clay over poorly sorted outwash sand and gravel deposits. Thickness from well drilling logs ranges from 1 to 21 m, with a median in the order of 5.2 m (Table 5.2).

Bedrock Geology

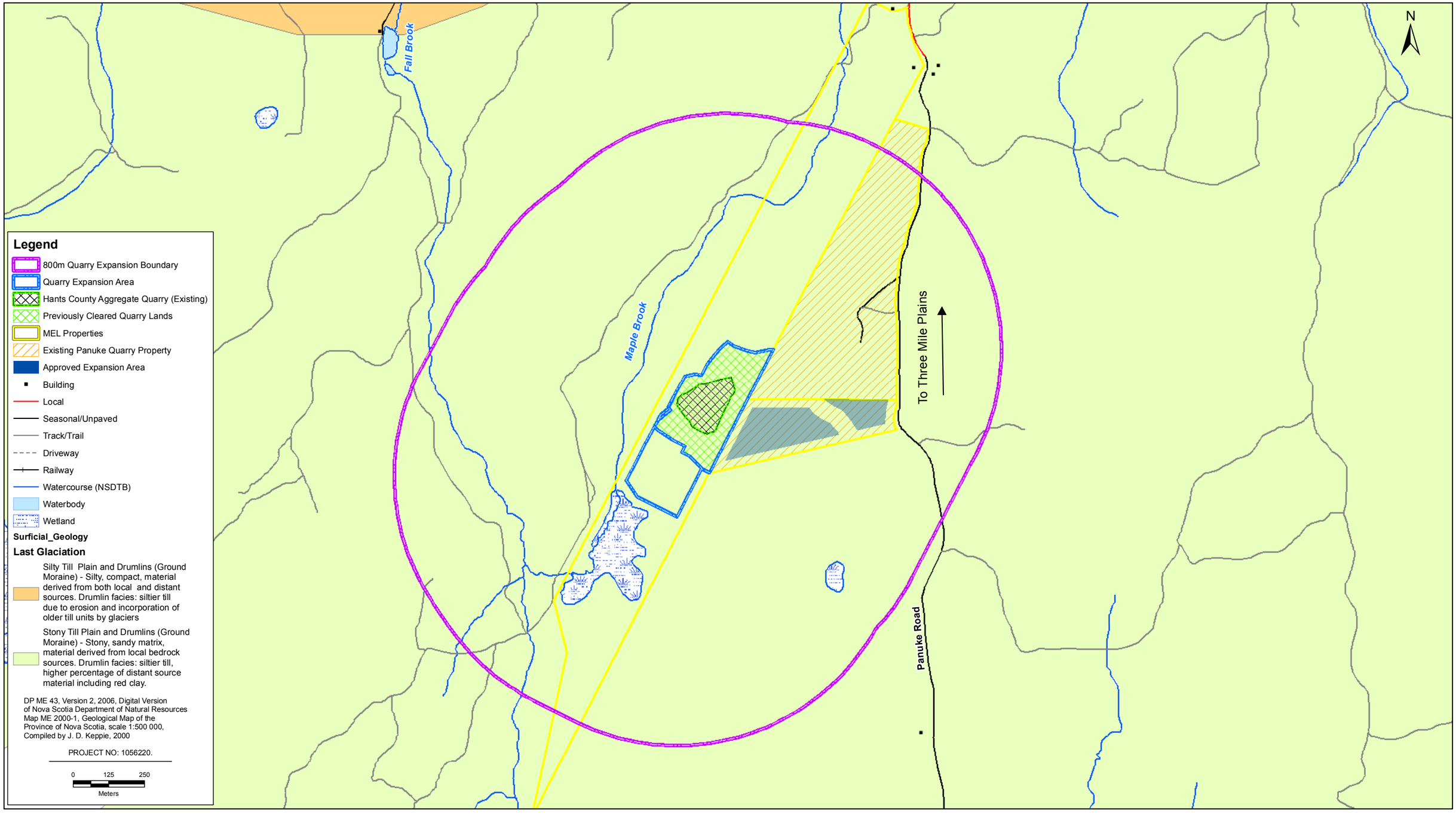
Bedrock underlying the site (Figure 5) consists of Cambrian-Ordovician aged Goldenville Formation of the Meguma Group. The Goldenville Formation comprises thickly stratified and resistant metamorphosed quartz sandstones (quartzite) interbedded with slate. The rocks have

distinct cleavage where they have been tightly folded (trending northeasterly). The permeability of these rocks to groundwater is through the numerous shallow fractures on this cleavage (Trescott 1969).

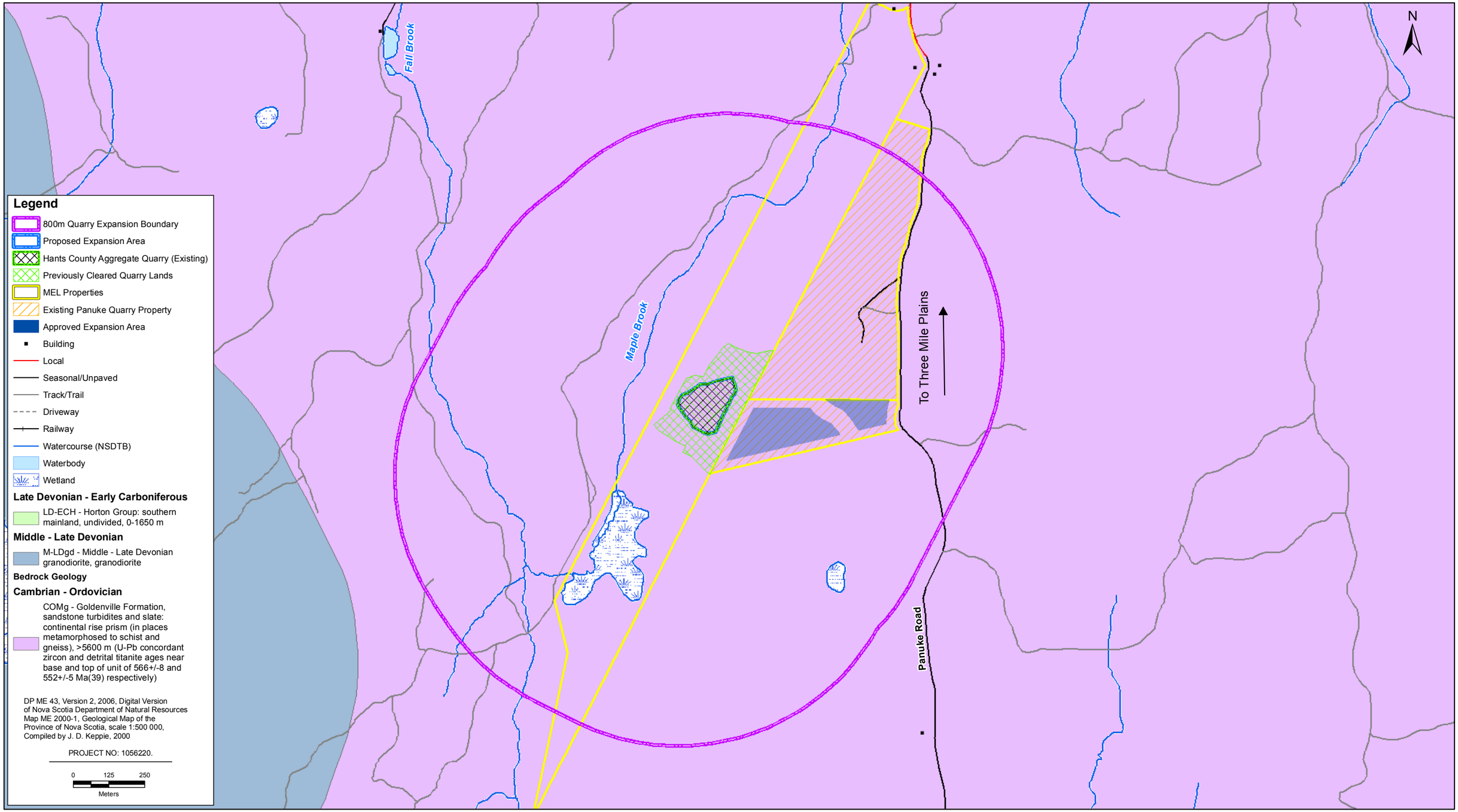
Approximately 1500 m north of the property boundary is the Late Devonian-Early Carboniferous Cheverie Formation of the Horton Group. The Cheverie Formation consists of fluvial sandstone, siltstone and conglomerate originating from the granites and quartzites of the metamorphic and igneous rock of the central interior. The Horton Group is underlain by the limestone and gypsum of the Windsor Group. A contact with Devonian aged granodiorite of the South Mountain batholith occurs about 600 m to the southwest of the quarry site. Many of the domestic water wells north and northwest of the Project area are constructed in these sedimentary bedrock units, while wells to the east and northeast are generally constructed in Goldenville Formation quartzite.

Groundwater Flow Patterns

Due to its situation with respect to the local topography, the Project is expected to lie within a local groundwater recharge area. Regional groundwater flow is inferred to be north and northwest from the South Mountain Highlands towards the Avon River and one of its principal tributaries, the St. Croix River. Locally, groundwater should follow the topography generally northwards towards wetlands and streams.



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 4**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**SURFICIAL GEOLOGY**	Stantec



DATE: 07/06/2010	Environmental Assessment of Hants County Aggregate Quarry Extension Project	FIGURE NO.: **Figure 5**
PREPARED BY: G. MESHEAU		
MUNICIPAL ENTERPRISES LIMITED	**BEDROCK GEOLOGY**	Stantec

Groundwater Resources

A water well field survey was not conducted as a 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 these areas. The results of this search were used to match well logs from the Nova Scotia Environment (NSE) Well Drillers Database for wells constructed between 1940 and 2009, and to determine well construction information for groundwater wells within the Project Area. No water wells are located within 800 m of the Project area (Figure 3). Water supplies for residences farther than 800 m from the Project area are located along Panuke Road, Highway #1, Windsor Back Road, Old Halifax Road and side roads located off these arterial roads. These water supplies are derived primarily from privately owned drilled and dug wells.

The closest residential water supply wells are associated with residences north of the property along Panuke Road and 200 m outside of the 800 m Project site buffer. One well log was retrieved, NSE Well Log No. 060165 at 462 Panuke Road. Recently drilled in 2006, this well is reportedly 55 m deep, has 6.1 m of steel 152 mm diameter well casing and has a reported air-lifted yield of 1.5 igpm. The lithology as reported on the well driller's log is approximately 3 m of sand and gravel overlying 52 m of shale.

To date, there have been no reported interactions between existing Panuke 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 aggregate below the groundwater table.

To provide a general description of aquifer properties in the vicinity of the Project, a summary of domestic well records for the closest communities of Three Mile Plains and Five Mile Plains (located north of the project site), is provided in Table 5.2. None of these wells are located within 800 m of the Project. However, the conditions encountered within these wells are indicative of the overburden conditions and bedrock aquifers located on the Project site, and within the community of Three Mile Plains. The wells are grouped based on hydrostratigraphy to better compare hydraulic properties.

Table 5.2 Summary of Domestic Water Wells Records in Three Mile Plains, Nova Scotia

Horton Group	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Minimum	3.7	3.7	0.5	1.2	1.2
Maximum	74.7	30.5	80.0	24.4	21.3
Average	28.7	13.6	15.6	9.1	9.2
Median	22.9	11.3	6.0	9.1	8.2
Number of Wells	8	8	8	5	6

Table 5.2 Summary of Domestic Water Wells Records in Three Mile Plains, Nova Scotia

Goldenville Formation	Well Depth (m)	Casing Length (m)	Estimated Yield (igpm)	Water Depth (m)	Overburden Thickness (m)
Minimum	6.9	6.1	1.5	1.8	3.0
Maximum	56.1	31.4	90.0	11.9	31.4
Average	34.7	11.8	27.8	5.0	17.2
Median	38.1	9.1	10.0	3.0	17.2
Number of Wells	7	7	7	4	2
Windsor Group	**Well Depth (m)**	**Casing Length (m)**	**Estimated Yield (igpm)**	**Water Depth (m)**	**Overburden Thickness (m)**
Minimum	15.2	8.5	1.0	1.5	2.7
Maximum	103.6	32.0	20.0	6.1	6.1
Average	37.6	15.7	7.7	3.8	4.4
Median	28.5	13.7	5.0	3.8	4.4
Number of Wells	8	8	8	2	2

Note: Information was obtained from the Nova Scotia Well Log Database including wells constructed between 1940 and 2009.

Table 5.2 summarizes data for 2 dug wells (< 10 m deep) and 21 drilled wells. The depth to water table in the surrounding areas ranges from 1 to 24 m, with a median of 3 m. Based on 21 samples, drilled wells range in depth from 15 m to 104 m, averaging 32 m, with water tables of 1.5 to 24.4 m, mean 6.1 m and yield from 0.5 to 60, mean 6 igpm. Based on two samples, dug wells are typically 3.7 to 6.7 m deep, have short term yields of 80 to 90 igpm, and static water levels of 1.2 to 1.8 m below ground. Higher yields are associated with limestone (drilled wells) and overburden (dug wells). A review of 98 pumping tests for wells completed into the Goldenville formation in Nova Scotia indicates a geometric mean well yield of 4 igpm, from wells averaging 65.6 m in depth (NSDEL Pumping Test Inventory 2004).

Based on pumping test data (NSE Pumping Test Inventory), the hydraulic conductivity of the Goldenville bedrock is estimated to be in the order of 2.5E-5 cm/s (N= 32), which is an order of magnitude lower than either the Horton sandstone (3E-4 cm/s, N = 6) or the Windsor Group shales (7.8E-4 cm/s, N= 4). Groundwater seepage into the quarry would therefore be expected to be small in comparison to direct rainfall inputs.

Groundwater Quality

Water quality potential is determined from known water quality characteristics for each hydrostratigraphic unit. This includes naturally occurring water quality concerns such as hardness arsenic, uranium, salinity, iron and manganese. Except in localized mineralized zones in the Meguma terrain, quartzite bedrock is expected to provide water quality with most parameters within acceptable drinking water guidelines (Health Canada 2008). However, arsenic in excess of the 0.01 milligrams per litre (mg/L) health-based guideline can occur in the Goldenville bedrock aquifer, particularly along the crests of anticlines in designated Gold-Bearing areas. Elevated concentrations of iron and manganese in excess of respective aesthetic guidelines of 0.3 mg/L and 0.05 mg/L can occasionally occur within this formation.

Within the metamorphic Meguma Group bedrock (*i.e.,* Goldenville Formations), the waters are typically described as calcium bicarbonate and low in dissolved solids and hardness. Based on general knowledge of groundwater chemistry for these units throughout Nova Scotia, the Goldenville bedrock can locally exceed drinking water guidelines for arsenic, iron and manganese.

Just north of the Project, the groundwater of the Cheverie Formation (Horton Group) produces good quality, slightly alkaline, calcium bicarbonate groundwater low in dissolved solids, hardness and iron. However it is typically high in sulphate and dissolved solids when in association to the gypsum and limestone of the Windsor Group (Trescott 1969).

In addition to the above naturally-occurring water quality issues, common problems reported by Nova Scotia well owners include: elevated sodium and chloride from road salt; coliform bacteria from surface sources impacting poorly constructed dug and drilled wells; and low pH and/or associate plumbing corrosion in shallow wells constructed in sand aquifers or fractured crystalline bedrock (Dave MacFarlane pers. comm.). To date, there has been no reported groundwater quality issues related to the existing Panuke Quarry located to the east of the proposed extension area.

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

The potential environmental effects on surrounding groundwater resources from a quarry operation include: groundwater table lowering close to the quarry high wall, depressurization of down gradient springs, temporary siltation of nearby wells due to intermittent blasting or heavy equipment operation, decrease in well yield due to groundwater level lowering or interception of recharging bedrock fractures, and possible water quality deterioration at down-gradient wells from accidental releases of deleterious substances such as petroleum hydrocarbons and nitrate from blasting agents or equipment, or acidic drainage production if in the unlikely event that a mineralized zone is encountered within the quarry area. Potential impacts to domestic water wells 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 acoustic properties, and individual well construction methods.

Water Quantity Effects

If the quarry encounters increased groundwater seepage as it expands, water will collect within its lowest point (*e.g.,* a settling pond or sump). Depending on the floor elevation and the resulting amount of groundwater encountered, dewatering of the proposed quarry extension may be required should there be an event of significant rain. There are no plans in the proposed quarry area to mine below the groundwater table; therefore, no groundwater quantity effects are anticipated. It is our understanding that appropriate diversion of surface water runoff and in-pit control of rainfall accumulation with sump pits and controlled overflow will be provided.

Water Quality Effects

Changes in water quality may theoretically occur as a result of excavations in the recharge area of the wells. Potential impacts include: temporary siltation from blasting, oil and nitrate from blasting operations, lubricant compounds, and other chemical releases within the quarry area. A possible long term impact of well water quality is decreased pH or increased dissolved solids from attenuation of acidic drainage from exposed sulfide-rich bedrock, if present.

Acid rock drainage is the result of exposure to sulphide rich rocks to oxidizing environments such as rainwater. Earthwork activities around these sulphide rich rocks can increase the rock's exposure and thus the 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 slate from the Halifax Formation of the Meguma Group and coal bearing shales. Bedrock underlying the Hants County Aggregate and Extension area consists of Goldenville Formation sandstone. In general, Goldenville Formation is not known to be a significant acid drainage risk.

The potential for acid drainage production in this area is low; there were no known reported acid generating rocks encountered in the existing quarry. Although not expected, localized acid generating bedrock is possible within mineralized zones if encountered in the proposed quarry.

Mitigation of Effects

Due to distance to the closest well users (> 800 m), significant impacts on groundwater supplies are not anticipated due to natural attenuation primarily by dilution and dispersion along the groundwater pathways. Short-term turbidity impacts caused by blasting vibration, though highly unlikely given the distance to offsite wells, would likely involve a temporary disruption and could be mitigated by provision of bottled water to affected residents. In the unlikely event of persisting long-term degraded water quality, or a well yield loss event, the proponent will replace or repair any water supply well found to be adversely affected by their quarry operation to the satisfaction of the owner. Acid generating bedrock is not expected; however should a mineralized zone be encountered the rock will be tested for acid generating potential. If determined to be acid generating bedrock, the material will be handled as prescribed in the Nova Scotia Sulfide Bearing Material Regulations. As previously discussed, no residential water wells are located within 800 m of the Project and therefore the above potential impacts to offsite wells are not anticipated. In summary, significant Project-related effects on groundwater resources are not likely to occur.

5.7 ARCHAEOLOGICAL AND HERITAGE RESOURCES

5.7.1 Description of the Existing Environment

Background Research

Background research was conducted using the records at the Public Archives of Nova Scotia, the Nova Scotia Museum, as well as those available on the Internet. Maps consulted included those by Anson (1808), Wentworth (1827), A.F. Church (1871) and Faribault (1909).

The Nova Scotia Museum's Archaeological Site's Database shows no recorded pre-Contact archaeological sites within the study area.

The assessment of heritage resource potential within the proposed extension area incorporated sources that included archaeological site records at the Nova Scotia Museum and archival resources. 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. Given the location of the study area the potential for it containing pre-Contact archaeological resources should be considered as low. The nearest watercourse, Maple Brook, is a minor one and is located outside the quarry extension area. There do not appear to be any other features or resources within the Project area that would have attracted First Nation's settlement. It is much more likely that the Mi'kmaq settled along the Avon and St. Croix rivers to the north and the St. Croix River/Panuke Lake system to the south.

There are no recorded historic archaeological sites or heritage resources within or near the study area. There are no obvious buildings, areas of cultivation, or other settlement features evident on the modern aerial photos.

There is very little historical evidence of settlement within or close to the Project area. While land grants in the area were awarded to Joshua Mauger and others in 1759, settlement in the area really did not begin until the nineteenth century. The 1802 Anson map is interesting as it shows a short section of road that became the north end of Panuke Road, running off of what is now Highway 1. Unfortunately, it appears as if the Project area is just off the map to the southeast. Similarly, the 1827 Wentworth map stops just west of Panuke Road. The 1871 map by A.F. Church finally shows Panuke Road, basically as it appears today, running all of the way to Panuke Lake. The map does show relatively dense settlement on the northern half of the road, about 13 houses, but only a single house in the south half, on the banks of Panuke Lake. Finally, the 1909 Geological Survey of Canada map shows 26 buildings in the north half of Panuke road, but nothing in the south half.

Based on the background research the historical archaeological potential for the Project area should be considered low. The research showed that the north end of Panuke Road was subject

to moderate settlement and growth from the early to the end of the nineteenth century but that there was no historic settlement or significant activities within the Project area.

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

Certain activities associated with the Project (*i.e.,* blasting, road construction), could affect archaeological or heritage sites if they were present within the zone of surficial and subsurface disturbance. These disturbances, if unmitigated, could result in the loss of resources and the potential knowledge to be gained from its interpretation.

The Project area has low potential for identifiable human use in the pre-Contact and historic periods. No archaeological/heritage resources or areas of elevated heritage potential were identified in the Project area. Therefore, development and operation of the proposed quarry are not expected to have any adverse environmental effects on heritage resources.

If archaeological or heritage resources are discovered during development and operation of the Project, the find will be immediately reported to the Curator of Archaeology and the Manager Special Places at the Nova Scotia Museum. If the resources are thought to belong to First Nations, the Chief of the nearest Mi'kmaq band will also be contacted. In the case of suspected human remains, the RCMP will be called. The appropriate authorities will determine further actions to be undertaken which could include avoidance and further assessment.

In summary, assuming appropriate measures are undertaken in the event archaeological or heritage resources are discovered, significant Project-related effects on these resources are not likely to occur.

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

Air Quality

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 at Aylesford Mountain on Mountain Brow Road, Kings County. In 2005 and 2006 ozone (O_3) was the only contaminant measured. The annual average for 2005 and 2006 was 33 ppb and 35 ppb respectively (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 four communities in Nova Scotia, Halifax, Greenwood, Kentville and Sydney. It is intended that the AQHI will also be available in Port Hawkesbury and Pictou at a later date. 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 2009). The closest community to the Project that has this program implemented is Greenwood and the current air quality levels can be viewed online at Environment Canada.

The quarry is located in a rural setting with little industrial development within a distance of 5 km. 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)*. Air quality guidelines of tolerable, acceptable, and desirable are defined under *CEPA*. 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. Additional guidelines are under development by the Canadian Council of Ministers of the Environment (CCME), and ultimately this body will develop Canada-Wide Standards that harmonize the regulations in all jurisdictions.

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 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 dBA.

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

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).

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 airborne particulates 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.

In particular, quarrying activities potentially contributing to the production of airborne particulates are:

- 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 nuisances and/or exceedances of 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;
- Particulate emissions can occur whenever vehicles travel over both paved and unpaved surfaces; and
- 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.

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.

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/m3; and
- Daily Average (24 hrs) 120 µg/m3.

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. Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the quarry as permitted by NSE (Approval No. 2001-019700-A02), 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 quarry extension can be controlled with standard mitigation practices and therefore the Project is not likely to have a significant adverse effect on the Atmospheric Environment. Dust and noise monitoring will be conducted as required at the request of NSE with additional mitigative measures taken as necessary.

5.9 SOCIO-ECONOMIC ENVIRONMENT

5.9.1 Description of the Existing Environment

Population and Employment

Hants County Aggregate Quarry is located in Hants County, southwest of Windsor. The quarry is located in a rural setting along a local road with a low distribution of residential development extending from the eastern boundary of the proposed extension area, approximately 3 km to Trunk 1 (Figure 1). The population in the general area (*i.e.,* Hants County) is 41,182. The population in this area has increased by 1.7 % between 2001 and 2006 (Statistics Canada 2006). The employment rate in the County is 58.6% while the unemployment rate is 7.9% (Statistics Canada 2006). Sales and service occupations make up the largest proportion of experienced labour force with approximately 24.1% of experienced labour, followed by trades, transport and equipment operators (23.1%), and business, finance and administration occupations (16.1%) (Statistics Canada 2006).

The majority of the aggregates from the quarry to date have been sold to customers in the West Hants Municipality, local customers, and NSTIR, predominantly for construction projects. The closest town to the Project area is Windsor, where the population is 3,709, which is a 1.8% decrease since 2001 (Statistics Canada 2006). The employment rate in the Windsor is 47.8% while the unemployment rate is 8.0%. The sales and service industry consists of the largest percentage of the total experience labour force, comprising 30.4% of total experienced labour

force, followed by business, finance and administration occupations (18.1%) and trades, transport and equipment operators and related occupations (14.0%) (Statistics Canada 2006).

The existing quarry currently employs one employee year-round (for nine months of the year). Approximately 10 people are employed during aggregate production. Drilling and blasting activities require additional resources; these activities are sub-contracted to a professional blasting company. Hauling of materials from the quarry also involves additional labour resources; hauling (or trucking) is typically arranged through the customers.

Land Use

Mining

A review of the NSDNR Abandoned Mine Openings Database (2006b) indicates that there is one Mine Shaft within a 10 km radius of the boundaries of the Project property.

The status of this shaft is not known. However, none are in close proximity to the Project property and no interaction is predicted between the mine shaft and the proposed quarry extension.

Agriculture

The Project is not located in a region where conflict with current and future agricultural practices is anticipated. The districts which are considered very important with regards to agriculture are Upper Falmouth and Avondale-Poplar Grove, while the Hants County Aggregate is located in Three Mile Plains.

Forestry

A large part of the southern and north-eastern part of the municipality is Crown land or land owned by large forestry companies. The forested lands provide local employment, wildlife habitat and outdoor recreation opportunities, and potential future water supply sources are located in these areas (West Hants Municipal Planning Strategy 2007). The area in which Hants County Aggregate is located is zoned as general resource, which includes forest harvesting (Windsor-West Hants Joint Planning Advisory Committee).

Recreation and Tourism

West Hants has a large amount of parkland dedicated to public recreational use, including provincial parks and municipally owned parkland and facilities. In addition, there are a number of commercial recreation sites, including Martock ski hill and various golf courses and campgrounds. Hants County Aggregate Quarry is not located adjacent to these sites.

Transportation

Various products (*i.e.,* various aggregate sizes) are 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 estimated truck traffic will be consistent with current truck volume at the existing quarry and will only increase, for a short period of time, 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 Project is not anticipated to result in any significant increase in the volume of truck traffic on public roads compared to current levels. However, a transportation assessment and discussion of potential impacts was conducted by Atlantic Road and Traffic Ltd. in 2007 in support of an environmental registration for Panuke Quarry (JWL 2008). Since the existing Hants County Aggregate quarry and the existing Panuke Quarry are located adjacent to one another and accessed by the same roads, this previously conducted transportation assessment is also applicable for the currently proposed Project. A description of the existing conditions in the area, as per the 2007 study (JWL 2008), is included in the following paragraphs.

Road Descriptions

MEL has been operating the Panuke Quarry for over five years. The quarry is located on the west side of Panuke Road about three kilometers south of the Trunk 1 intersection. There is a railroad crossing with warning signals on Panuke Road immediately south of Trunk 1. The first 2.5 km section from Trunk 1 is paved (6.4 m wide pavement) with a yellow center line and gravel shoulders. The remaining approximately 0.5 km to the quarry entrance is a gravel road. While the 6.4 m wide pavement is adequate for the traffic volumes and vehicles using the road, additional care with vehicle tracking is required at a curve at the MacLeod Court intersection, as well as at reverse curves at the south end of the paved section.

The paved section of the road is of a residential character with driveways and several minor road intersections. There are approximately three residential driveways on the north end of the gravel section just south of the end of pavement. The posted speed limit on the paved section of Panuke Road is 50 km/h, in keeping with the residential character of the road.

Panuke Road intersects with the south side of Trunk 1 in Three Mile Plains. Trunk 1, which was the main highway between Halifax and Windsor previous to construction of Highway 101 about 30 years ago, has a rural cross section, including two paved lanes, gravel shoulders, and open ditches. The Panuke Road intersection is located on a relatively flat section of roadway and has adequate sight distances for both approaches for the 70 km/h posted speed limit on Trunk 1.

Traffic Volumes

While traffic volume data is not available for Panuke Road, a site visit indicated that volumes are light, possibly in the order of 500 to 1000 vehicles per day (vpd). This suggests a two-way peak hour volume of about 50 to 100 vehicles per hour (vph).

Traffic volumes on Trunk 1 just east of Panuke Road have increased from 1060 vehicles per day Annual Average Daily Traffic (AADT) in 1971 to 2040 vpd in 2007. Hourly volumes obtained by traffic count machines in 2002, 2004, and 2007, indicate 2007 AM peak hour volumes of about 100 vph and PM peak hour volumes of about 215 vph. Regression analysis of historical data indicates a low annual growth rate of about 25 vehicles per day per year for Trunk 1 volumes at this location. In 2017, the AADT volume is projected to be about 2550 vpd.

Collision Data

The relative 'safety' of an intersection is generally evaluated by review of collision data for reported collisions at or near the intersection being studied. A review of collision data for Trunk 1 did not indicate any history of collisions at the Panuke Road intersection from 2002 to 2007. Since sight distances are adequate and there have not been any reported collisions at the Trunk 1 / Panuke Road intersection, there is nothing to suggest any existing safety problems at the intersection.

There were two reported property damage collisions on Panuke Road, one in 2002 involving a four wheeler striking a vehicle backing into a driveway, and another in 2006 that occurred when an automobile exited a private driveway without yielding to another passenger vehicle traveling on the road.

Quarry Traffic

The current and projected production rate for the Hants County Aggregate quarry is approximately 60,000 to 100,000 tonnes per year. The current and anticipated operating schedule is 20 hours per day during periods of rock crushing and 10 hrs a day otherwise, weather permitting, with an average of 2000 truck loads shipped each year.

Since the quarry has been operating for over five years, and since the proposed Project is not expected to change production rates or affect the existing aggregate transport truck volumes, there should not be any noticeable impacts to the level of performance of Panuke Road as a result of the quarry extension.

Human Health

Human health related aspects and potential effects on environmental health include potential impacts on air quality (*i.e.,* particulate emissions). 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 operations at Hants County Aggregate 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.

The Project will result in an overall positive effect on the regional economy. Quarries are an important component of the natural resource sector of the economy and provide essential raw materials to the province's construction industry. The availability of local supply to the market place encourages a more stable price for aggregate. In some cases (*i.e.,* markets in close proximity to quarries) the overall price for aggregates is 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 2006b).

Another interpretation of Project-related economic effects is that they may be considered neutral. This is because the market that Panuke Quarry is supplying is not new, the products are not new, and the demand for aggregate in the local market is currently being met by existing quarries, including the existing Panuke Quarry.

Amalgamation of the two existing quarry operations will provide business development opportunities for MEL (*e.g.,* diversification of products and customers). The Project will enable MEL to produce various aggregates for NSTIR projects in addition to producing asphalt for general contracts. As an Atlantic Canadian company operating locally, the business benefits gained by MEL due to the Project can promote regional benefits. Potential future benefits may include additional local employment opportunities as well as increased contributions to provincial corporate income tax.

Land Use

Due to the existing industrial activity onsite (*i.e.,* quarry) and the distance from residences, impacts on existing and future adjacent land uses are not expected. Quarry activities will be conducted in accordance with the Pit and Quarry Guidelines and all setback distances specified in the Guidelines will be maintained.

Quarrying activities will produce noise from equipment operation and blasting. The proposed extension area is located greater than 800 m from the nearest residence. The potential for noise from the quarry site to have a significant effect on residents is minimal.

Blasting operations associated with the proposed extension will be conducted in accordance with current operations at the Hants County Aggregate Quarry, in accordance with the Pit and

Quarry Guidelines (NSEL 1999) and with a frequency similar to past operations at the site. The existing Industrial Approval for Panuke Quarry (Approval No. 2001-019700-A02) will be amended to incorporate the combined operations of the amalgamated Hants County and Panuke quarries. 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. A blast design plan and monitoring program will be developed for the application for Industrial Approval amendment.

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 the following sound levels (L_{eq}) from 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 NSEL. Details of any required monitoring will be included in the Industrial Approval amendment application.

Transportation

The following points summarize the key findings of the transportation assessment that was conducted by Atlantic Road and Traffic Ltd. in 2007 in support of an environmental registration for Panuke Quarry (JWL 2008). These findings would also be representative of the traffic from the existing Hants County Aggregate Quarry at the time of the study.

- The Panuke Road intersection is on a level section of Trunk 1 with adequate sight distances;
- Daily and peak hourly volumes on Panuke Road are estimated to be low;
- Traffic counts have indicated that daily and peak hourly volumes on Trunk 1 are low to moderate;
- Review of collision data does not indicate any history of collisions at the Panuke Road / Trunk 1 intersection; and
- There have only been two property damage collisions, neither involving heavy trucks, on Panuke Road from 2002 to 2007.

In the spring of 2007 various improvements were made by MEL to the eastern boundary of the Quarry, including the installation of a guardrail and security fence along the western side of the Panuke Road and the eastern slope of the quarry was covered with common material and graded to a stable slope of 2:1 and hydroseeded in efforts to ensure the safety of nearby individuals.

The Project is not anticipated to result in a significant increase in truck traffic on public roads above that associated with the existing Hants County Aggregate Quarry and Panuke Quarry operations. Future hauling practices will remain consistent with current practices. There should not be any noticeable impacts to the level of performance of the road network as a result of this Project.

Recreation and Tourism

Hants County Aggregate Quarry is not located adjacent to any major municipal recreation facilities or commercial recreation areas so there will be little to no impact on tourism and recreation in the area.

Human Health

Human health related issues are discussed in Section 5.8 Air Quality. 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 are not likely to occur. Continued operation of the quarry will result in economic benefits, including employment and ongoing business opportunities.

5.10 OTHER UNDERTAKINGS IN THE AREA

5.10.1 Description of the Existing Environment

The Proponent is not aware of any active pit operations licensed to operate within a 10 km radius of the Project. In addition to the adjacent Panuke Quarry, the Proponent is aware of two active quarry operations licensed to operate within a 10 km radius of the Hants County Aggregate. Both Williams and Alva Construction Limited, operate quarries in the region between Five Mile Plains and St. Croix. All operations are currently functioning without any issues, in terms of noise, dust, emissions, traffic, *etc.* Since the proposed extension of Panuke Quarry's operation through acquisition of Hants County Aggregate does not include an increase in production, significant adverse Project-related effects in conjunction with other undertakings in the area are not likely to occur, assuming the effective application of mitigative measures.

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 the Panuke Quarry operation, as well as future amendments to the Approval (including an amendment to incorporate extension and amalgamation of the Hants County Aggregate quarry), and the Pit and Quarry Guidelines.

Environmental effects of the quarry extension will include the loss of some habitat within the proposed revised quarry extension area. The Proponent has redesigned the Project to avoid interactions with the watercourse identified onsite. Field surveys conducted to date indicate that this area does not include unique habitat or known rare or sensitive species; therefore, these effects are not anticipated to be significant.

There are no structures located within 800 m of quarry activities. 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 or socio-economic effects are likely. Continued operation of the quarry will result in economic benefits, including employment and ongoing business opportunities.

A stormwater management plan will be submitted as part of the quarry development plan during the Industrial Approval amendment application process.

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, design, 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 for nine months per year, weather depending, and will consider severe winter weather conditions when planning activities. Heavy snowfalls and significant snow accumulation would 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 lifetime.

8.0 OTHER APPROVALS REQUIRED

As stated in Section 3.4, 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 Panuke Quarry Industrial Approval from NSE for amalgamation and extension of the Hants County Aggregate operation as well as approval to alter wetlands; 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). No municipal approvals are required.

There are no known requirements for an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) associated with the proposed quarry extension. No federal land or funding is required for the Project. There are no requirements for federal permits or authorizations under the CEAA Law List Regulation (*e.g.*, harmful alteration of fish habitat or onsite storage of explosives) currently projected.

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

11.1 LITERATURE CITED

Anderson, P.G., B.R. Taylor and G.C. Balch. 1996. Quantifying the effects of sediment release on fish and their habitats. Canadian Manuscript Report on Fisheries and Aquatic Sciences.

Anson, William. 1893. Plan of the Township of Windsor from an actual survey. c.1820, copy by J.A. McCallum.

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

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. Website: http://www.cws-scf.ec.gc.ca/mgbc/trends/index. Last updated August 2009 [accessed July 2010].

Church, A. F. 1871. Topographical Township Map of Hants County, Nova Scotia. A.F. Church & Co., Bedford, N.S.

COSEWIC. 2009. Canadian Wildlife Species at Risk. Committee on the Status of Endangered Wildlife in Canada. Web site: www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm [accessed September 2009].

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. 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, Halifax.

Faribault, E.R. and Fletcher, Hugh. 1909. Province of Nova Scotia. Hants County. Windsor Sheet No. 73. Ottawa: Department of Mines.

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

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

Goodwin, T.A. 2004. Bedrock, Glacial, Economic and Environmental Geology of the Halifax Regional Municipality. Open File Report ME2004-3, Mineral Resources Branch. Nova Scotia Natural Resources. Halifax.

Government of Nova Scotia (GNS). 2009. Air Quality Health Index (AQHI). Available online: http://www.gov.ns.ca/nse/aqhi/.

Health Canada, 2008. Guidelines for Canadian Drinking Water Quality Summary Table. Prepared by Federal-Provincial Subcommittee on Drinking Water of the Federal-Provincial – Territorial Committee on Health and the environment. March 2008 update.

Hooper, W. C., McCabe, L. and Robertson T. 1995. A Standardized Fisheries Stream Survey Approach of Atlantic Canada, DRAFT. Presented to 21st Annual AIC Meeting, American Fisheries Society Shelburne, New Hampshire. September 1995.

Jacques Whitford Limited (JWL). 2008. Environmental Assessment Registration: Panuke Quarry Expansion Project. Project No. 1014939. Report prepared for Municipal Enterprises Limited. Dartmouth, NS: JWL.

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

Lewis, P. J. 1997. Trends. In: Shaw, R.W. (ed.). Climate Variability and Climate Change in Atlantic Canada. Proceedings of a Workshop Halifax, Nova Scotia, 3-6 December 1996. Prepared for Environment Canada. Halifax, NS.

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

N.S. Reg. 264/86, 2009. Mill Lakes Watershed Protected Water Area Designation and Regulations made under Section 106(5) and (6) of the Environment Act S.N.S. 1994-95, c.1. (http://www.gov.ns.ca/just/regulations/regs/envpwlgd.htm). Accessed on February 5, 2010.

Nova Scotia Department of Environment (NSDOE). 1998. “The State of the Nova Scotia Environment, 1998”. Halifax, Nova Scotia.

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

Nova Scotia Department of Environment and Labour (NSEL). 2005. Guidelines for Environmental Noise Measurement and Assessment. Nova Scotia: NSEL (Originally published April 1990 by the former Nova Scotia Department of the Environment; Revised May 18, 2005).

Nova Scotia Department of Natural Resources (NSDNR). 2006a. Mineral resources Land-Use Map. Available at: http://gis4.natr.gov.ns.ca/website/mrlu83/viewer.htm. Last updated February 2006 [accessed November 2009].

Nova Scotia Department of Natural Resources (NSDNR). 2006b. 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 August, 2009).

Nova Scotia Department of Natural Resources (NSDNR). 2007b. Species at Risk in Nova Scotia. Wildlife Species Protected Under the Endangered Species Act in Nova Scotia. Available at://www.gov.ns.ca/natr/wildlife/biodiv/specieslist.htm. Accessed August, 2009.

Nova Scotia Department of Natural Resources (NSDNR). 2010. 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 Environment, NS Pumping Test Database, Microsoft Access Format (2008).

Nova Scotia Environment, NS Well Logs Database, Microsoft Access Format (2009).

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.

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].

Reynoldson, T.B., C. Logan, T. Pascoe, and S.P. Thompson (accessed via the web-site: http://cabin.cciw.ca/Main/cabin_online_resources.asp?Lang=en-ca, June 2007). CABIN (Canadian Aquatic Biomonitoring Network) Invertebrate Biomonitoring Field and Laboratory Manual. Environment Canada. 47 pp.

Service Nova Scotia, 2006. The Nova Scotia Atlas. 6th ed.. Formac Publishing Company Limited. Halifax, NS.

Smith, K. 2002. COSEWIC Status report on the Eastern Ribbonsnake (Thamnophis sauritus) in Canada, Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available at: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_eastern_ribbonsnake_e.pdf.

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=.

Stea, R.R., Conley, H., and Brown, Y., Nova Scotia Department of Natural Resources, Surficial Geology Map of the Province of Nova Scotia (1992).

The Blanding's Turtle Recovery Team. 2003. National Recovery Plan for the Blanding's Turtle (Emydoidea blandingii),Nova Scotia Population. Nova Scotia, Canada. Available at: http://www.gov.ns.ca/natr/Wildlife/BIODIV/species_recovery/recoveryplans/Blandings_Turtle_Recovery_Plan_Jan2003.pdf.

Trescott, Peter, 1969. Groundwater Resources and Hydrogeology of the Windsor-Hantsport-Walton Area, Nova Scotia. Province of Nova Scotia, Department of Mines, Groundwater Section. Report 69-2.

Trow Consulting Engineers Ltd. 1996. Instream Sediment Control Techniques Field Implementation Manual. Ontario Ministry of Natural Resources.

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

Wentworth, Henry. 1827. Windsor, Nova Scotia. Plan No. 1 Shewing the site of Fort Edward at Windsor with the Town Ground and Rivers around it.

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.

11.2 PERSONAL COMMUNICATIONS

Dave MacFarlane Principal Hydrogeologist, Stantec Consulting Ltd. November 2009.

12.0 Appendices

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