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Environmental Assessment Registration Document

Name of Project:
Rhodena Quarry Expansion Project
Location: Rhodena, Inverness County, Nova Scotia
Proponent: Zutphen Resources Inc.
10442 Route 19,
Southwest Mabou, Nova Scotia, Canada
B0E 1X0

Report Prepared by:

McCallum Environmental Ltd.

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Date: June 2017

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EXECUTIVE SUMMARY

Zutphen Resources Inc. (Zutphen) currently owns and operates the Rhodena Quarry, operating under a Nova Scotia Environment (NSE) Industrial Approval (NSE Approval #92-049). This quarry has been active since 1992 (25 years). Zutphen plans to expand the existing Rhodena Quarry, which requires a Provincial Environmental Assessment (EA) registration (Class I undertaking). The purpose of the proposed quarry expansion is to continue to have quarry reserves available to serve the local market, Nova Scotia Transportation and Infrastructure, Ideal Concrete and local contractors.

The proposed expansion is located on private land [PID 50193390 and 50297316] within the community of Rhodena, Cape Breton, Nova Scotia. This Project encompasses a total proposed expansion area of 17 hectares (including the 4 hectare area for the current operating quarry). A broader 25-hectare Study Area was identified for the purposes of the provincial EA process.

The field data, regulatory consultation, and subsequent conclusions of this assessment indicate there are no expected significant residual environmental effects resulting from the Rhodena Quarry Expansion Project once all appropriate mitigation and monitoring has been implemented and completed. Standard construction mitigation methods will be implemented to ensure there are no significant impacts of the Project on VECs.

Six wetlands were observed within the Study Area and three watercourses are present (two previously mapped, and one additional field identified ephemeral stream). Watercourses 1 and 3 (the mapped watercourses) will be avoided and were both identified as Type I fish habitat (potential spawning). Watercourse 2 will require alteration to support the quarry expansion. This watercourse is a first order stream, and was determined to be Type IV fish habitat and ephemeral in nature. Wetland and watercourse alteration permitting will be necessary to support project expansion.

Species at risk inventories within the Project revealed that no flora or fauna species at risk were identified across the Study Area.

Due to the Project location (Cape Breton) and on-site habitat suitability, it is possible that Canada Lynx (a SAR) could use the Study Area. However, the Study Area is not located near the primary areas in Cape Breton where the lynx has been known to reside. The small size of the Project results in low residual impact to the Canada Lynx should it exist at this location.

Bird usage within the Study Area was determined to be low to moderate, with more bird activity during the breeding season then observed during the spring and fall migration periods. A significant portion of the Study Area was already harvested prior to the field surveys; so suitable habitat for many birds was limited. Across all survey seasons a total of six (6) priority species were observed either during dedicated survey periods or incidentally: Boreal Chickadee, Olive-sided Flycatcher, Red-breasted Nuthatch, Ruby-crowned Kinglet, Swainson's Thrush and Yellow-bellied Flycatcher. Of these priority birds, one species at risk (SAR) was observed, the Olive Sided Flycatcher (incidentally during the breeding season). The EA process has determined that residual environmental effects on birds are low, post-mitigation.

There is no evidence that current quarrying activities have interacted with the groundwater table (no observed seepages through the exposed rock face of build up of water on the quarry floor). Zutphen does not intend to work below the watertable during quarry expansion. However, should this be necessary, prior to any excavation below the watertable, a hydrological study will be completed and submitted to NSE.

During the field reconnaissance, a probable nineteenth and twentieth century farmstead was identified within the southwest of the Study Area. Stone piles and two stone foundations without cellars and a narrow stone-lined well were identified at this location. It is recommended that a 20m buffer be established around the archaeological site. To ensure that the buffer is maintained, it is recommended to flag the 20m buffer.

There are no adverse effects anticipated on health and socio-economic conditions, physical and cultural heritage areas, traditional land use, and traditional structures or sites as a result of environmental changes from the Project.

Zutphen has exceeded residential setbacks associated with the Pit and Quarry Guidelines with the closest residential receptor being located approximately 1.72 km from the closest boundary of the Rhodena Quarry Expansion Study Area.

The magnitude of disturbance and risk associated with the Project are all considered minimal given the size of the Project and the mitigation techniques and technologies currently available. Furthermore, this assessment concludes there are no significant environmental concerns and no significant impacts expected that cannot be effectively mitigated through well established and acceptable practices, or ongoing monitoring and response. Residual environmental effects have been determined to be minimal or low for identified VECs.

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LIST OF ACRONYMS

ACCDC	Atlantic Canadian Conservation Data Centre
AMO	Abandoned mine opening
AQHI	Air Quality Health Index
ASL	Above Sea Level
CEAA	Canadian Environmental Assessment Act
CEO	Chief Executive Officer
CCME	Canadian Council of Ministers of the Environment
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DNR	Department of Natural Resources
DOE	Department of Environment
EA	Environmental Assessment
EC	Environment Canada
GDP	Gross domestic product
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
GS	General Status
HA	Hectares
IBA	Important Bird Area
IA	Industrial Approval
KM	Kilometer
LPM	Litres Per Minute
MBBA	Maritime Breeding Bird Atlas
MEL	McCallum Environmental Ltd.
MW	Mixed Wood
NAD83	North American Datum of 1983
NO_2	Nitrogen dioxide
NS	Nova Scotia
NSCCH	Nova Scotia Communities, Culture & Heritage
NSDEL	Nova Scotia Department of Environment and Labour
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSESA	Nova Scotia Endangered Species Act
NSTIR	Nova Scotia Transportation and Infrastructure Renewal
O_3	Ozone
PC	Point Counts
PID	Property Identification Number
SAR	Species at Risk
SARA	Species at Risk Act
SOCI	Species of Conservation Interest
S-rank	Status rank

SSHD	Significant Species and Habitat Database
TH	Tolerant Hardwood
UTM	Universal Transform Mercator
VEC	Valued Ecosystem Components
WC	Watercourse
WL	Wetland

1.0 GENERAL INFORMATION

Table 1. Project Summary

General Project Information	Zutphen Resources Inc. (Zutphen) intends to expand the existing Rhodena Quarry (NSE Approval #92-049), located on PID 50193390 and 50297316.
Project Name	Rhodena Quarry Expansion Project (the "Project")
Proponent Name	Zutphen Resources Inc.
Proponent Contact Information	10442 Route 19, Southwest Mabou, Nova Scotia, Canada B0E 1X0 Business: (902) 945-2300 Facsimile: (902) 945-2087 email: peter@zutphen.ca
Proponent Project Director	Peter Archibald Project Manager
Project Location	• The Project lands are located within the boundaries of PID 50193390 and 50297316 • The Project lands are located approximately 2.5 km southeast from the community of Rhodena, and located 10.5 km north of Port Hastings in Inverness County, Nova Scotia • The Project lands are located entirely within Inverness County, Nova Scotia; and, • The approximate centre of the Project lands is located at 625535 m E and 5066942 m N.
Landowner(s)	The project lands are located on freehold (private) land owned by Zutphen Resources Inc.
Closest distance from the quarry to a residence	The closest residence is located 1.72km to the southeast of the Study Area.
Federal Involvement, Permits and Authorizations	No federal departments are providing funding. No Canadian Environmental Assessment Act triggers (*Section 5, CEAA*) occur or are expected. No federal permits or authorizations are anticipated at this time.
Provincial Authorities issuing Approvals	Nova Scotia Environment (NSE)

Required Provincial Permits & Authorizations	The following permits, authorizations and/or approvals may be required for this Project which will allow for the construction and operation of the Project 1. *Environmental Assessment Approval.* Approved pursuant to Section 40 of the *Environment Act* and Section 13 (1)(b) of the *Environmental Assessment Regulations* in Nova Scotia, Canada; 2. *Industrial Approval* pursuant to Activities Designation Regulations, Division V, Section 13(f) 3. *Wetland and Watercourse Alterations* Pursuant to Activities Designation Regulations, Division I, Section 5A(2)
Provincial Regulatory Authorities Consulted during EA and Project Development Process	Nova Scotia Environment (NSE), Policy & Corporate Services: • Bridget Tutty, Environmental Assessment Officer Nova Scotia Department of Natural Resources: • Mark Elderkin, Species at Risk Biologist Office of Aboriginal Affairs: • David Mitchell, Consultation Advisor
Municipal Authorities	Inverness County
Required Municipal Permits & Authorizations	None
Environmental Assessment Document Completed By:	McCallum Environmental Ltd. Meghan Milloy, MES Tessa Giroux, BNRS. Melanie MacDonald, MREM **McCallum Environmental Ltd.** Suite 115, 2 Bluewater Road Bedford, N.S. B4B 1G7

2.0 PROJECT INFORMATION

2.1 Proponent Profile

Zutphen Resources Inc. (Zutphen) currently owns and operates the Rhodena Quarry, operating under the Nova Scotia Environment (NSE) *Industrial Approval* (NSE Approval #92-049). This quarry has been

active since 1992 (25 years). Zutphen plans to expand the existing Rhodena Quarry, which requires a Provincial EA registration (Class I undertaking). The purpose of the proposed quarry expansion is to continue to have quarry reserves available to serve the local market, Nova Scotia Transportation and Infrastructure, Ideal Concrete and local contractors.

Zutphen Resources Inc. Executive Management Team consists of:

- Leonard van Zutphen, President
- Martha Campbell, Chief Executive Officer (CEO)
- Peter Archibald, B. Eng, CSS, Director and Project Manager

The Environmental Assessment Project Team is:

- Meghan Milloy, MES, McCallum Environmental Ltd.
- Robert McCallum, P.Biol., McCallum Environmental Ltd.
- Melanie MacDonald, MREM, McCallum Environmental Ltd.
- Tessa Giroux, BNRS, McCallum Environmental Ltd.
- Laura de Boer, Professional Archeologist, Davis McIntyre & Associates

2.2 Project Location

The EA Study Area is located within PID 50193390 and PID 50297316, both owned by Zutphen Resources Inc. and encompasses the existing quarry footprint of 3.90 hectares. The Study Area is 25 hectares (inclusive of 3.9 hectare area of existing quarry).

The Study Area is centered between the communities of Rhodena to the north, Queensville to the southeast and Creignish Rear, to the southwest. The Study Area is located 10.5 km north of Port Hastings in Inverness County, Cape Breton Island, Nova Scotia (Figure 1, Appendix A). The Study Area is located on PID 50193390 and PID 50297316, located on Rhodena Road off Highway 105 (Figure 2, Appendix A). The approximate centre of the Study Area is located at 625535 m E and 5066942 m N. Brileys Lake is located approximately 1.2 km northwest of the Study Area. Highway 105 is located 2.5 km east of the Study Area. The Atlantic Ocean is located approximately 5.5 km west of the Study Area.

The existing Rhodena Quarry is located directly west of Rhodena Road at the intersection of the Creignish Mountain Road. Physical access to the environmental assessment Study Area is west of the current quarry footprint. Construction of additional access roads is not required to support the expansion of this quarry.

The Study Area is situated in a rural setting. There are no residences within 1.5 km from the Study Area. The closest residence to the Study Area and the only residence within 2km of the Study Area, is located 1.72 km to the southeast on Blueridge Road (Figure 3, Appendix A). Apart from the existing Rhodena Quarry, the Study Area contains a combination of intact coniferous and mixed wood forests and recent timber harvesting.

The Rhodena Quarry Study Area is not located in close proximity to any protected or conservation areas within federal, provincial, or municipal jurisdiction. Figure 4 (Appendix A) shows the Study Area and surrounding protected or conservation areas. A mapped NSDNR Significant Habitat for Species at Risk is present within the Study Area (wood turtle habitat within mapped watercourses). A mapped NSDNR Significant Habitat for Deer Wintering Area is located 4.2km southeast of the Study Area. The closest Protected Area is the River Inhabitants Nature Reserve, located 10.3 km SE of the Study Area.

2.3 Site Preparation and Construction

The proposed expansion of the Rhodena Quarry will occur over 20 years. Zutphen has identified a proposed expansion Working Area, which is 17 hectares in total size (which includes the existing footprint of the current quarry). Figure 5 (Appendix A) shows the expansion (working) area and larger Study Area for EA purposes.

The quarry expansion is planned for a 20-year period. Figure 6 (Appendix A) shows the proposed development plan in terms of quarry expansion. The local market for aggregate is very project dependent, and this is Zutphen's best estimate for timing of quarry expansion and development based on current usage of rock from this location. However, this development plan could change if a large project was to occur in close proximity to this quarry resulting in an increased need for aggregate.

Vegetation has been largely removed through recent harvesting activities across the majority of the EA Study Area. Additional clearing and grubbing to support quarry expansion will be completed as necessary and will be limited to maximum area of 2 years development (as shown on Figure 6, Appendix A) at a time to minimize exposed soil and potential for erosion. Topsoil and overburden removed during this process will be added to existing stockpiles present in the south-eastern portion of the Study Area.

During the first 2 years of expansion, two small isolated wetlands will require alteration. Provincial wetland alteration permitting processes will be followed for these habitats and compensation will be completed to off-set the loss of wetland habitat. A third wetland, also isolated, will require wetland alteration permitting to support quarry development between five and ten years of quarry expansion. Additional wetland and watercourse permitting will be required to support quarry expansion beyond ten years. No new stream crossings or lake dewatering is required to support this quarry expansion. The intermittent watercourse system (and associated wetland habitat) present within the west central portion of the Study Area will require a permit for watercourse and wetland alteration (10-20 year development timeline).

The Rhodena Quarry, as proposed, when fully expanded will be 17 hectares in size (working area as shown on Figure 5). The closest separation distance from the boundaries of this working area to public highways is 2.69 km (Highway 105). The expansion working area will not encroach within 30m of an adjacent property boundary. Two watercourses (WC1 and WC3- MacMaster Brook) will be avoided during project expansion. These two watercourses, WC1 and WC3, are 45m and 60m from the boundaries of the proposed working area, respectively, over the 20 year development timeline.

2.4 Existing and Planned Project Components

The existing Rhodena Quarry operations consist of a laydown area on the quarry floor, aggregate stockpiles, grubbings and overburden stockpiles, a closed loop wash system, scale and a scale house. The closed loop wash system allows for water recycling through the re-use of rinse water after aggregate washing. This rinse water is collected in a settling pond to be clarified and then drains into a source pond for re-use. This closed loop system is located near the western extent of the current quarry area.

The Rhodena Quarry's working face is oriented towards the west and is planned, over the next 20 years, to continue westerly, as well as south from the current location. The proposed maximum operational depth of the quarry is expected to be approximately 20 m. The proposed expansion working area will be approximately 17 ha. The laydown area, including the location for the portable crushing equipment and the closed loop wash system, will be situated on the quarry floor. Existing aggregate piles are currently located at various locations within the existing quarry limits. The scale and the scale house are, and will continue to be located adjacent to Rhodena Road.

An entrance driveway (gated) to the quarry from Rhodena Road is located within the eastern central portion of the Study Area and will continue to be used to access the quarry post expansion. No new road construction will be required to support the quarry expansion.

2.4.1 Drilling and Blasting

It is anticipated that blasting will occur once or twice a year and occasionally more frequently based on the need for aggregate in the local market. This is consistent with current approved operations within the Rhodena Quarry. A qualified blasting company will be sub-contracted to undertake the drilling and blasting operations in accordance with the *General Blasting Regulations* contained in the *Nova Scotia Occupational Health and Safety Act* (1996). The qualified blasting company will be responsible for blast design, methods, monitoring and activities consistent with the Nova Scotia Department of Environment and Labour (NSDEL) *Pit and Quarry Guidelines* (NSDEL 1999). Pre-blast surveys will be completed for any structures within 800m of the point of blast and will follow the Nova Scotia Department of Environment (NSDOE) *Procedure for Conducting a Pre-Blast Survey* (NSDOE 1993).

Weather conditions including high humidity or cloud cover, can cause the levels of overpressure and noise to appear more severe for surrounding residents than on a day when the humidity is low and there is lack of cloud cover. When possible, Zutphen and its sub-contractors will avoid blasting when weather conditions include significant temperature inversions, strong winds, foggy, hazy or smoky conditions with little or no wind, or still, cloudy days with a low cloud ceiling.

2.4.2 Processing Activities

Specific processing activities including crushing, screening and washing will be determined based on need. The portable processing equipment will be transported to site as required, typically after drilling and blasting activities. Various aggregate products will be produced based on need and stockpiled in designated areas within the quarry. Aggregate stockpiles, topsoil and overburden piles will be located in designated areas within the quarry. Stockpiles will be built and material hauled and moved within the quarry with a front-end loader. An excavator will also be used for material handling.

2.4.3 Water Management

Currently, the majority of the surface water collects on the quarry floor and permeates through the gravel floor and/or evaporates. However, during periods of high flow there is a west to east drainage of water across the surface of the quarry floor where it accumulates at the eastern extent of the quarry footprint before draining off site and into MacMaster Brook. During periods of high flow, surface water drainage has resulted in silt entering MacMaster Brook and additionally, gravel material sourced from the quarry area has also migrated down through MacMaster Brook. Members of the local community raised concerns about this occurrence during recent public engagement open house event (see Section 8.0).

As part of the proposed Project, the proponent is committed to managing surface water drainage and improving conditions within MacMaster Brook through installation of an on-site settling pond. The on-site settling pond will be constructed in the southeastern portions of the property beside the quarry entrance. A drainage ditch will be constructed alongside western portions of Rhodena Road to capture stormwater and drain it into the settling pond. An overflow channel will direct water into an existing ditch which drains alongside the Rhodena Road for approximately 300 meters, before it drains northeastward beneath the road and connects to MacMaster Brook (WC3).

Additional settling ponds will be added as needed as the quarry expands and surface water runoff increases.

As mentioned, a closed loop system for washing aggregate is present at the western extent of the quarry floor. Water is recycled through this closed loop system and re-used for aggregate washing.

2.4.4 Waste Management

Overburden is currently stored along the southern edge of the quarry area. This area will be expanded to store overburden during expansion. This overburden will be re-used during rehabilitation and reclamation of the quarry at the end of its operational phase. Sediment will be managed on site with active erosion and sediment control measures including the existing settling pond in the southeast corner of the quarry floor. If other surface water discharges are identified in other directions leaving the quarry area, additional erosion and sediment control measures will be implemented and monitored, as needed, to manage runoff outside the approved quarry area.

2.4.5 Hazardous Waste Management

There are no current or future plans to store hazardous materials, chemicals or petroleum products at the quarry site. Regular maintenance of the equipment (loaders, excavators and portable crushing equipment) is planned at the quarry site. Used oil and filters are currently removed from the quarry site and this practice will continue with the proposed expansion. Re-fueling of equipment will continue to be conducted on site on a regular basis at distances greater than 100m from any surface water and the operators will remain with the equipment at all time when re-fueling activities are taking place.

2.4.6 Transportation and Production

The transportation route for trucks leaving the quarry will follow Rhodena Road, a provincial gravel road, from the quarry to the intersection of Highway 105, the TransCanada Highway. The trucks will then either travel north or south on Highway 105 to reach the local market for aggregate production and sales. The majority of aggregate transported from the Rhodena Quarry to date has been to support concrete production at Ideal Concrete in Port Hawkesbury (south on Highway 105) or the Ideal Concrete Plant located in Whycocomagh (north on Highway 105), along with supporting aggregate needs for the local market (predominately road construction).

The historical and current production at the Rhodena Quarry has averaged 40,000 to 50,000 meter tonnes of aggregate from the quarry per year, when active. The planned production rate of the Rhodena Quarry during expansion is approximately 150 meter tonnes per year, which is consistent with current activities using existing infrastructure. The quarry is expected to operate 12 hours per day, 6 days a week, also consistent with current operational procedures. Based on current quarry operations, it is anticipated that approximately 25 trucks per day, with a load size of approximately 30 tons will be hauling during normal operations, and up to 50 trucks per day during peak season. Peak season typically extends from May through November. All truckloads will be covered to minimize dust and to contain aggregate material as necessary. Site activity is expected to remain consistent with current and historical use, and is dependent on projects. The quarry may be active for several months, and then sit idle for months or years, depending on local demand and consumer project needs.

2.4.7 Noise Management

Sound levels within the quarry will be monitored as requested by NSE at the property boundaries of the quarry, in accordance with the NSDEL *Pit and Quarry Guidelines* (NSDEL, 1999).

2.4.8 Dust Control

Dust emissions will be controlled with the application of water, which will be supplied from the source pond present in the western quarry floor (part of the closed loop wash system for aggregate). Dust emission and particulate matter will be monitored beyond the property boundary of the quarry, at the request of NSE, in accordance with the NSDEL *Pit and Quarry Guidelines* (NSDEL, 1999).

2.4.9 Viewscape Protection

The Rhodena Quarry is located in a remote location and is not visible from any adjacent public vantage points (Highway 105 or Highway 19). The quarry is also not visible from the nearest residence, located on Blueridge Road (southeast of the quarry location). Expansion of the quarry is not expected to change the viewscape for the resident on Blueridge Road (Bob and Louise Belyea), nor make the quarry visible from any adjacent public vantage point along nearby highways.

2.4.10 Risk Management

A contingency plan for the Rhodena Quarry and its proposed expansion is the responsibility of the Proponent: the quarry owner and operator. The contingency plan will cover notification procedures for emergencies, identification of owner team leaders and contacts, spill prevention, spill procedures, and

incident reporting procedures. This plan will be provided to NSE as part of the provincial industrial approval (IA) permitting process, which follows the EA registration and approval.

2.5 Decommissioning and Reclamation

Decommissioning and reclamation is planned towards the end of the operational window for the Rhodena Quarry. A detailed reclamation plan will be completed at the request of NSE prior to operations ceasing at the quarry. Decommissioning will involve removal of equipment and all structures from the quarry property. Reclamation will involve identification of short and long term goals and options for the site including, but not limited to: sloping, seeding, planting of native species, and fertilizing. Long term, the quarry site is expected to be used for timber production and harvesting and will be sloped and levelled, and allowed to regenerate.

2.6 Anticipated Schedule of Activities

The following milestone schedule (see Table 2) outlines the project schedule.

Table 2. Schedule of Project Activities

Task	Anticipated Completion Date
Environmental Studies	Spring 2016 through January 2017
Public Consultation	Open House March 21, 2017 and ongoing throughout the project to inform project design
Environmental Assessment Registration	June 2017
Expected EA Decision	August 2017
Provincial Permitting (Industrial Approval and Surface Water Permitting)	August to December 2017
Quarry Expansion Window	2018-2038
Reclamation	2038

3.0 ENVIRONMENTAL ASSESSMENT SCOPE

3.1 Boundaries of the Assessment- Spatial and Temporal

Assessment of effects was undertaken within the identified EA Study Area [portions of PIDs 50193390 and 50297316] (Figure 2 in Appendix A). The Municipality of the County Inverness was considered for the purpose of data collection relating to existing socioeconomic conditions and evaluation. Potable wells located within a 5.0 km buffer of the Study Area were assessed as potential receptors to evaluate groundwater. The downstream receiving aquatic environment including Lamey Brook, MacMaster Brook and the River Inhabitants were evaluated as part of the aquatic environment. All other evaluations were completed within the EA Study Area that was designed to buffer and surround the proposed expansion (working) area for the Rhodena Quarry.

The temporal boundaries of the EA include the construction (expansion), operation and maintenance, and decommissioning/ reclamation phases of the Project, and associated activities.

3.2 Assessment Scope

The EA planning process allows for the prediction of environmental effects of a proposed project. Furthermore, the EA identifies measures to minimize and then mitigate potential adverse environmental effects. Finally, the EA will attempt to predict significant residual adverse environmental effects once mitigation measures are implemented.

The EA focuses on specific environmental components called valued environmental components (VECs). VECs are specific components of the biophysical, social, and economic environments. A VEC is important (not only economically) to a local human population, or has a national or international profile. If altered, a VEC will be important for the evaluation of environmental impacts of industrial developments (NSE 2007, updated 2012). The scope of the assessment for this Project includes: the selection and assessment of potential VECs; evaluation of the potential VEC interactions with Project activities, identification of environmental effects, if any, for each VEC; and identification of thresholds to determine the significance of residual environmental effects.

4.0 ENVIRONMENTAL ASSESSMENT METHODOLOGIES

The EA registration document for the Rhodena Quarry Expansion Project will describe the biophysical, social, and economic environment. All VECs will then be identified, and the potential for interaction between individual VECs and Project activities will be determined. Methods to minimize and mitigate environmental effects resulting from the Project will be provided.

Through an evaluation of the VECs, the project team identified project environmental effects that, post-mitigation, have the potential for a residual effect on the environment. The significance of these residual effects was then determined and evaluated (Section 9.2).

This chapter details the following key aspects of the EA methodologies:

A. Biophysical: birds and bats, species at risk, wildlife, vegetation, watercourse evaluation, aquatic habitats, and wetland functional assessment and delineation.
B. Archaeological Resource Assessment.

4.1 Biophysical Assessments

The field components of the biophysical EA were initiated in Spring 2016 and carried through until January 2017 complying with the requirements for a *Class I* undertaking under Section 9(1) of the Nova Scotia Environmental Assessment Regulations (Undertaking B2). These studies were focused on highlighting the ecological linkages within the Study Area, as well as with the habitats surrounding the Study Area. This work included:

1. Avian: Spring migration surveys 2016; Breeding bird surveys (Summer 2016); Fall bird migration surveys 2016; Nocturnal owl surveys 2016;
2. Vegetation surveys for priority species across the Study Area (June and September 2016);

3. Opportunistic herpetofauna, mammal and other taxonomic group surveys for priority species across the Study Area (Spring 2016 to January 2017);
4. Wetland and watercourse identification and evaluation (Summer 2016) across the Study Area;
5. Winter wildlife and bird surveys (January 2017): and,
6. Archaeological assessments- Phase I (Desktop) and II (Field), 2016.

4.1.1 Priority Species

Assessment of wildlife, including vegetation and habitat was completed based on the requirements outlined in the Nova Scotia Environment (NSE) *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*, (NSE September 2009). A priority species list was created in accordance with this Guide as outlined below (NSE, 2009), with additional input from NSDNR Species at Risk Biologist, Mark Elderkin. As per conversations with Mark Elderkin during the early spring of 2015, it was requested that all priority species lists be built using sub-national (provincial) conversation rank (SRanks, S1, S2, S3) rather than general status ranks (GS Ranks Red and Yellow), as outlined in the NSE 2009 guidance document. The desktop priority list was based on general species habitat requirements and the broad geographic area that individual species are known to occur.

This priority list of species was first narrowed by broad geographic area. The priority list of species was then further narrowed by identifying specific habitat requirements for each species. For example, if a listed species on the Nova Scotia Endangered Species Act (NSESA) required open water lake habitat, and no open water lake habitat is present inside the Study Area footprint, this species was not carried forward to the final list of priority species for field assessments within the Rhodena Quarry Expansion Study Area.

Development of a priority list of species for each taxonomic group was completed based on a compilation of listed species from the following sources:

1) Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Federal Species-at Risk Act (SARA 2003). All species listed as Endangered, Threatened, or of Special Concern;
2) Nova Scotia Endangered Species Act (NSESA 1999). All species listed as Endangered, Threatened, or Vulnerable; and,
3) Conservation Rank: All species designated as S1, S2 or S3 as defined by the Atlantic Canadian Conservation Data Centre (ACCDC).

Collectively, this group of species is known as Priority Species. This umbrella grouping includes species of conservation interest (SOCI) that are not listed species under provincial or federal legislation (COSEWIC species and ACCDC S1, S2 and S3 species), and Species at Risk (SAR) which are listed on SARA or NSESA. Data was requested from the ACCDC to obtain records of rare species existing or historically found within the general location of the property. The results of the database search were also reviewed to identify priority species that could be potentially located within the Study Area (based on recorded sightings within or in close proximity to the Study Area, and general geographic and habitat requirements).

An in-text short list was created to outline those SAR with the highest potential of occurring within the Study Area, based on distribution and documentation by the ACCDC. The in-text priority species shortlist provided herein was developed by identifying SAR that have been documented within 20km of the Study Area by the ACCDC. The in-text list is provided in Section 5.6.

The final broad priority list of species used for field assessments is attached in Appendix C. The ACCDC report is included as Appendix C.

Field surveys were completed in Summer 2016 to assess for all identified priority species across the Study Area. For this survey, a list of all rare species records found within 100 km of the Study Area was also assembled prior to the survey being undertaken (from Atlantic Canada Conservation Data Centre-ACCDC data results) to provide additional information regarding the potential presence of priority species within the Study Area.

4.1.2 Habitat Surveys

In April 2016, a habitat assessment was completed within the Study Area. Using available forestry and wetlands databases, habitat survey routes were created with the goal of assessing all of the major habitat types and landscape features throughout the Study Area, and to inform necessary targeted surveys for the remaining baseline environmental field program. The habitat survey focused on assessing upland habitats, as detailed evaluation of all wetland habitat is completed as part of the surface water evaluation.

A MEL field team walked through the Study Area on April 17, 2016, following a meandering transect that reached all major habitat types expected within the Rhodena Quarry Expansion Study Area. The Forest Ecosystem Classification for Nova Scotia guides (Keys, Neily, Quigley and Stewart, 2011) were used to identify the ecosites and vegetation types present throughout the Study Area. Dominant vegetation and level of disturbance were noted, and photos of representative habitats were taken. Stand age classification (Over-mature, Mature, Immature and Regenerating) was determined through qualitative observations of multiple factors such as total basal area, level of canopy coverage, and species composition of the understory herb and shrub layers. The level of anthropogenic disturbance was described, particularly the presence of logging roads and harvested trees (clear-cut or selective harvest, and approximate time since harvest). Vegetation types were identified throughout the Study Area as described in the Forest Ecosystem Classification for Nova Scotia guides (Keys, Neily, Quigley and Stewart, 2011).

4.1.3 Avian

A review of the Canada Important Bird Areas database was completed and the breeding birds square (20PR26) was reviewed from the Maritime Breeding Bird Atlas (MBBA) to support bird survey design and methodology. The MBBA square results are included in Appendix D.

Avian field monitoring programs were completed by McCallum Environmental Ltd. (MEL), and included the following surveys:

- Spring nocturnal owl (April 16, 2016)

- Spring migration monitoring (May 12, 2016)
- Breeding bird (June 6 and 22, 2016)
- Fall migration monitoring (September 23 and October 8, 2016)

Detailed descriptions of each survey methodology are provided in the following sections.

4.1.3.1 Spring Nocturnal Owl

The objectives of the nocturnal owl survey are to gather information on the presence and distribution of owl species within the Study Area, determine the location of active nests, and record incidental observations of other species of conservation interest (SOCI) and SAR.

The methods for monitoring nocturnal owls followed the *Guideline for Nocturnal Owl Monitoring in North America* (Takats et al. 2001). The nocturnal owl survey took place on April 16, 2016, when vocal activity of the majority of owl species is greatest (Takats et al. 2001), at three-point count locations in proximity to the Study Area (all of the point count locations are within 850m of the Study Area). In Nova Scotia, data collected through the Nova Scotia Nocturnal Owl Survey program shows peaks in Barred (*Strix varia*) and Great Horned (*Bubo virginiatus*) Owls in early April, while Northern Saw-whet Owls (*Aegolius acadicus*) are late April to mid-May (Greg Campbell, personal communication, April 9, 2015). Other owl species have been observed at numbers that are too low to determine peak calling periods (G Campbell 2015, pers. comm., 9 April).

Wind can limit the ability of owls to hear a call broadcast and/or the ability of the observer to hear an owl calling. It is recommended that a survey be suspended if wind speed is Beaufort 4 or higher (i.e., > 20 km/hr; Takats et al. 2001). However, if there are other circumstances affecting detection, it may be necessary to reduce the wind threshold; this is at the discretion of the observer. If conditions were not suitable for surveying, then the survey was deferred or moved to a more suitable location.

Owls have been observed to be less vocal when temperatures are significantly lower than average for the season, thus surveys were also delayed in this circumstance (Takats et al. 2001). Surveys are to be stopped in the case of heavy precipitation; light drizzle and flurries are not likely to reduce calling rates or detectability (Takats et al. 2001).

Prior to starting the survey, the broadcaster being used (Pyle-Pro Pwma50db 50 watt portable waist band PA system) was tested to ensure that the owl calls being broadcasted from it were audible and recognizable at a distance of 400 meters (Takats et al. 2001). Ensuring that the broadcast could be heard beyond 400 meters minimizes bias at the next survey station due to owls hearing the recording from the previous station (Takats et al. 2001).

The broadcast used by the Bird Studies Canada (BSC) Nova Scotia Nocturnal Owl Survey program was used for the survey. It consists of a 9.5 minute broadcast which includes alternating owl calls with silent listening periods (BSC Atlantic Region 2015). Only the calls of two owl species, the Boreal (*Aegolius funereus*) and Barred Owls, are used in the Bird Studies Canada (BSC) Nova Scotia Nocturnal Owl Survey program call broadcast (BSC 2015) because they are particularly rare and sensitive, respectively. To date, the Boreal Owl has only been reported as breeding in Nova Scotia four times (Lauff, 2009). The

Barred Owl is targeted because it has been used as an indicator of ecosystem health due to its dependence on cavities in large trees for nesting (Allen 1987).

Point count survey stations were spaced at from 1.1 to 1.6 km apart. Some of the louder owls, such as the Barred Owl, can be heard at distances of two kilometers or more (Takats et al., 2001). However, most of the smaller owls cannot be heard as far or as clearly (Takats et al. 2001). Surveys were conducted between half an hour after sunset and midnight (Takats et al. 2001). There are three species of nocturnal owls that could potentially breed within or around the Study Area: Great Horned (*Bubo virginianus*), Barred (*Strix varia*), Long-eared (*Asio otus*) and Northern Saw-whet (*Aegolius acadicus*) Owls.

4.1.3.2 Spring Migration

Spring migration surveys were completed by MEL biologists and in accordance with the methods outlined by the Canadian Wildlife Service (CWS) in the Migratory Birds Environmental Assessment Guidelines (Milko, 1998).

Spring migration surveys were conducted at eight (8) point count stations within and surrounding the Study Area by MEL Biologists on May 12, 2016. Spacing requirements between point counts did not allow for all point counts to fit within the Study Area boundaries, and recent timber harvesting was also expected to potentially limit bird activity within the Study Area. Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. Weather conditions (i.e., precipitation and visibility) were monitored and confirmed to be within the parameters required by monitoring programs such as Environment Canada's (EC) Breeding Bird Survey. Bird observations were recorded at four distance regimes, within a 50 m radius, 50 to 100 m radius, outside the 100 m radius, and flyovers. For each point count, a record was made of the start time and a hand held GPS unit was used to geo-reference its location. General observations including the temperature, visibility, wind speed, date, start and end time and point count were also recorded. Species recorded outside of the 100 m radius and between point counts were recorded as incidentals. Bearings (in degrees) were taken for priority species observed both during dedicated survey periods and incidentally.

4.1.3.3 Breeding Birds

Surveys for breeding birds were conducted on two occasions in June 2016 at the same eight (8) point count stations as surveyed in the Spring, within and surrounding the Rhodena Quarry Expansion Study Area. Targeted surveys for Common Nighthawk were also conducted. The methods for these surveys are described in the following sections.

4.1.3.3.1 Point Counts

Two rounds of surveys for breeding birds were conducted by MEL Biologists on June 7 (early) and June 22 (late), 2016, at eight point count stations within and surrounding the Study Area The surveys were conducted using the same methods as the fall and spring migration surveys. Early morning point count surveys were conducted from 30-minutes before sunrise till 10:00 a.m. Species and number of birds observed at each point count location were recorded.

4.1.3.3.2 Common Nighthawk

The Common Nighthawk prefers to nest in gravelly substrates, and is best detected while foraging for insects shortly after sunset. Suitable habitat is available for this species within the Study Area (existing quarry area, cutblocks, and roadside clearings), therefore dedicated surveys for the Common Nighthawk were conducted from mid- to end of June at either dawn (1 hour before sunrise to 30 minutes after sunrise) or dusk (30 minutes before sunset to an hour after sunset), as described in the Common Nighthawk Survey Protocol (Saskatchewan Ministry of Environment, 2015). One survey point location (PC1) was surveyed once on June 7 and the survey was repeated on June 22, 2016. The point count location is surrounded by intact forested and cutblock habitat and is located next to Rhodena Road and within 200 m of the existing quarry. A call playback was used to detect the presence of Common Nighthawk, at the point count (up to 800 m radius which includes all potential nighthawk habitat within the Study Area and current quarry footprint). A three-minute passive point count is conducted at the point count location, followed by a call playback which includes 30-seconds of the conspecific Common Nighthawk call followed by 30-seconds of silence (or passive surveying), repeated for three-minutes (i.e. three times). The total time spent at the survey point was a minimum of six-minutes during each breeding season survey.

4.1.3.4 Fall Migration

Eight (8) count stations were surveyed through all representative habitat types within the Study Area and surrounding area. The same point count locations surveyed during the Spring and Breeding surveys were used for the Fall migration surveys. Point count stations are presented on Figure 7 in Appendix A.

Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. Weather conditions (i.e., precipitation and visibility) were monitored and confirmed to be within the parameters required by monitoring programs such as Environment Canada's (EC) Breeding Bird Survey. Ten-minute point counts were conducted on September 23 and October 8, 2016, during peak migration. Bird observations were recorded at four distance regimes, within a 50 m radius, 50 to 100 m radius, outside the 100 m radius, and flyovers. For each point count, a record was made of the start time and a hand held GPS unit was used to geo-reference its location. General observations including the temperature, visibility, wind speed, date, start and end time of each point count were also recorded. Species recorded outside of the 100 m radius and between point counts were recorded as incidentals. Bearings (in degrees) were taken for priority species observed both during dedicated survey periods and incidentally.

4.1.4 Vegetation Surveys

As described in the *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, Sept 2009), the vascular plant surveys focused on identifying general vegetative communities, with particular focus on identifying priority species. Early and late botany surveys were completed concurrently with wetlands and habitat surveys. The priority list created for the Rhodena Quarry Expansion was consulted before completing botany surveys.

A NS Communities, Culture & Heritage (NSCCH) report (Appendix C) for the presence of natural and heritage resources was requested and consulted prior to completion of field surveys. The NSCCH report contained records for the following plant SAR located within or surrounding the Study Area:

- *Anenome canadensis*
- *Bromus latiflumis*
- *Caulophyllum thalictroides*
- *Fallopia scandens*
- *Impatiens pallida*
- *Polystichum lonchitis*
- *Potamogeton obtusifolius*
- *Viola nephrophylla*
- *Zizia aurea*

4.1.5 Bats

A desktop review for known bat hibernacula nearby and within the Study Area was completed. The Nova Scotia Department of Natural Resources (NSDNR) records of abandoned mine openings (AMOs) were reviewed within the boundary of the Study Area and within 5km of the Study Area, as these AMOs potentially provide bat hibernacula. The ACCDC report, the Government of Canada Species at Risk Act Recovery Strategy for bats and the Nova Scotia Museum's records of bats were also consulted. During habitat surveys within the Study Area, MEL ecologists were also looking for any signs of habitat that could support winter bat hibernation.

4.1.6 Herptofauna Surveys

No targeted herptofauna surveys were undertaken as a result of habitat survey results within the Study Area that documented limited habitat potential within the Study Area for priority herptofaunal species (wood turtle and snapping turtle). However, all watercourses were evaluated for wood turtle habitat during surface water field surveys in 2016. Broadly, incidental observations of herptofauna across the Study Area were documented and photographed during all field surveys completed through 2016.

4.1.7 Wildlife Surveys

A winter wildlife survey was completed in January 2017. The survey involved the completion of two transects, one that encompassed non-standardized random transect within the Study Area and the other along Creignish Mountain Road, an unpaved narrow road to the south of the Study Area with minimal traffic. The two transects were walked, and all observations of any sign, including tracks, scat, browse, and hair snags that were present were recorded. Any birds that were present or could be heard were also recorded. Locations of observations were geo-referenced with a GPS unit.

Other than the winter surveys, no targeted wildlife surveys were undertaken. Incidental observations of mammals were documented and photographed during field surveys across the Study Area. Observations included such features as dens and nests, scat, tracks, and forage evidence. Mammal observations were collected throughout the field surveys in 2016.

4.1.8 Wetlands

A desktop review of available topographic maps, appropriate provincial databases and aerial photography was completed to aid in determination of wetland habitat in the Study Area. Mapped wetland areas were identified from the NSDNR Wetland Inventory Database (Figure 8, Appendix A).

Field surveys were conducted in August and September 2016 across the Study Area to identify wetland habitat and compare to the mapped wetland areas from the desktop review. Delineation was completed based on micro-topography, and observed surface hydrology and vegetation and soils in accordance with Nova Scotia Environment wetland delineation methodology. Qualified wetland delineators delineated wetlands. Wetland boundaries were documented using an SXBlue GPS unit and hand held field computer capable of sub 1m accuracy. Any inlet and outlet streams or other features associated with each wetland were marked during the delineation process and walked and mapped. Observations were made on wetland types, water flow path, dominant vegetation communities (and SAR/SOCI, if present), fish habitat potential and characterizations, and wetland functions. The analysis of wetland function was completed for each wetland using the NSE NovaWET 3.0 wetland evaluation technique. The evaluation of wetland function included gathering field and desktop information to support conclusions relating to wetland characteristics, condition and integrity of adjacent lands, identification of exceptional features, hydrologic conditions and integrity, water quality, groundwater interactions, shoreline stabilization, plant community, fish and wildlife habitat and habitat integrity, and community use and value. Summary Forms from the NovaWET functional assessments for each wetland are available upon request.

4.1.9 Aquatic Surveys

A desktop review of available topographic maps, appropriate provincial databases and aerial photography was completed to aid in determination of watercourses in the Study Area. Topography maps were reviewed (1:50,000, 1:30,000, and 1:10,000) to identify all mapped watercourses. Mapped watercourses were identified from the NS Topographic Database (Figure 8, Appendix A).

Field surveys were conducted in August and September 2016 across the Study Area to identify watercourses. Watercourses were documented using an SXBlue GPS unit and hand held field computer capable of sub 1m accuracy. Observations were made on fish habitat quality and fish habitat potential for each identified watercourse, as well as wood turtle potential.

4.1.10 Surface Water Sampling

MEL personnel collected surface water samples from the two mapped watercourses: Watercourse 1 and Watercourse 3/MacMaster Brook (Figure 7 in Appendix A). Four surface water samples were collected; two samples each from Watercourse 1 and Watercourse 3. For each watercourse, one sample was collected where the system flows into the Study Area (background up-stream of proposed development) and a second sample was collected where the watercourses flows outside of the Study Area (downstream sample). The surface water samples were kept cool and were transported to Maxxam Analytics, in Bedford, Nova Scotia for processing. The four surface water samples were analysed for Total Suspended Solids (TSS) and pH.

4.2 Archaeological Resource Assessment

Davis MacIntyre and Associates Limited completed an archaeological resource impact assessment for the Rhodena Quarry Expansion Project in 2016. This assessment consisted of two components:

i. Phase I archaeological resource impact assessment
ii. Field reconnaissance Phase II archaeological resource impact assessment

The methodologies of these two components are described below.

4.2.1 Phase I

The assessment included consultation of historic maps, manuscripts, and previous archaeological assessments as well as the Maritime Archaeological Resource Inventory in order to determine the potential for archaeological resources in the Study Area.

As part of this assessment, a historic background study was also conducted. Historical maps and manuscripts and published literature were consulted at Nova Scotia Archives and Records Management in Halifax. The Maritime Archaeological Resource Inventory, held at the Nova Scotia Museum's Heritage Division, was searched to understand prior archaeological research and known archaeological resources neighbouring the Study Area.

4.2.2 Phase II

Laura de Boer directed a field reconnaissance of the Study Area in August 2016.

GPS tracklogs of all reconnaissance areas were retained for records, and any sites determined to have potential for archaeological resources were recorded with photographs and GPS coordinates. The terrain and vegetation was noted in the interest of recording negative evidence for historic cultural activity.

5.0 BIOPHYSICAL ENVIRONMENT

5.1 General Spatial Setting for Project

The proposed Project is located in the Nova Scotia Uplands Ecoregion, as defined by the Nova Scotia Department of Natural Resources (Neily, Quigley, Benjamin and Stewart, 2003).

The Nova Scotia Uplands Ecoregion extends from Parrsboro in Cumberland County to Kellys Mountain in Cape Breton. The total area of the Nova Scotia Uplands Ecoregion is 9712 km^2 or approximately 17.6% of the province. This ecoregion is predominantly uplands with elevations ranging between 150-300m above sea level within the mainland and Cape Breton Island. However, lowlands exist throughout the ecoregion, which is comprised of valley habitat. (Neily et al., 2003)

The Nova Scotia Uplands Ecoregion is geologically diverse. The underlying geology is Cretaceous peneplain surface, with Precambrian to Paleozoic eras metamorphic, intrusive and volcanic rocks. There are several major faults present within the ecoregion, including the Cobequid-Chedabucto Fault zone and the Hollow Fault. Within the ecoregion, the parent material is generally sandy loams on the hills, whereas

clay loams and loams are found on the flat areas. Well to moderately well-drained soils are found where gently rolling topography is and rapid to well-drained soils are found where on steep sloped areas. Imperfectly to poorly drained soils are common in the flat topography areas throughout in the ecoregion (Neily et al., 2003).

Within the hills of the uplands, hardwood forests are dominated by Sugar Maple, Beech, Red Maple and Yellow birch. Along with the above hardwoods, White and Red Spruce and Balsam Fir form mixedwood forests on valleys and slopes throughout the ecoregion, with Eastern Hemlock common in ravines. In areas with imperfect and poorly drained soils, Black Spruce and Tamarack dominate. Where repeated burning has occurred, large areas of barrens dominated by Bracken Fern and Sheep Laurel dominate (Neily et al., 2003).

5.1.1 Natural Subregion

The Nova Scotia Uplands Ecoregion is further subdivided into eight ecodistricts. The Rhodena Quarry Expansion Project exists in the Cape Breton Hills Ecodistrict. The elevation within the ecodistrict range is between 150-300m above sea level. Due to the proximity to the Gulf of St. Lawrence, the temperatures within this ecodistrict in spring are slow to warm due to the strong, cold winds, resulting in a short growing season. The total area of this ecodistrict is 2,442 km^2 or 25% of the ecoregion (Neily et al., 2003).

The geology within the ecodistrict varies depending on the slope of area. On the steeper sloped areas, older resistant rocks are present, whereas on lower sloped areas, coarse carboniferous sediments are found. The soils found on the higher steeped slopes are well to moderately coarse textured tills and on the lower sloped areas, fine textured imperfectly drained soils are found. Karst topography is found throughout the lower elevations throughout the ecodistrict (Neily et al., 2003).

Tolerant hardwood forests, with scattered spruce and fir, dominate the ecodistrict. White Spruce is commonly found in the coastal areas and within ravines, Eastern Hemlock, White Pine and Red Spruce are found. Black Spruce and Balsam Fir dominate the imperfectly drained soils on the larger hill complexes. Where better-drained soils are found, Yellow Birch, Sugar Maple and Red Maple dominate (Neily et al., 2003).

5.1.2 Land Use and Habitat

The table below displays the land use components and area (in hectares) of each component within the Study Area:

Table 3. Calculations of Land Use

Land Use/Land Type	Area (hectares)	% of Study Area
Wetland Habitat	0.7	2.7
Quarry	4.0	15.6
Forest	20.6	80.5
Roads	0.3	1.2

Land Use/Land Type	Area (hectares)	% of Study Area
TOTAL STUDY AREA	25.6	100%

Land use within the Study Area is dominated by forested habitat. The total area of forested habitat accounts for 80.5% of the Study Area land base. The majority of the forested habitat within the Study Area has been recently harvested.

5.2 Atmospheric Environment

5.2.1 Weather and Climate

The Nova Scotia Uplands Ecoregion summers tend to be warm and the winters are long and cold. Snowfall is the greatest within Cobequid Hills and Cape Breton Hills in the ecoregion. Local weather, especially temperatures, can vary due to the hilly topography creating microclimatic environments, where sheltered and exposed conditions occur.

Due to the ecodistrict's proximity to the Gulf of St. Lawrence, the Cape Breton Hills Ecodistrict is influenced by gulf's strong, cold winds. A short growing season is a result of the slow to warm temperature in the spring. Annual precipitation within the ecodistrict ranges between 1400-1550 mm (Neily et al, 2003).

The average low temperature (based on statistics from the past 30 years) was recorded at -11.4 degrees Celcius in January and the average high temperature was recorded at 24.1 degrees Celcius in July (recorded in Collegeville Nova Scotia) located 57.9 km southeast of the Study Area (Government of Canada, 2010). Average annual rainfall at this location is recorded at 1124.4 mm with maximum rainfall levels in October of each year (average 139.8mm in October). Average annual snowfall has been measured at 190.7 cm with the maximum snowfall occurring each year in January (47.8 cm).

5.2.2 Air Quality

Measured air quality parameters across Nova Scotia include ground-level ozone (O_3), particulate matter (PM2.5), and nitrogen dioxide (NO_2), and these values are used to calculate a score in the Air Quality Health Index (AQHI) (ECCC, 2016). The AQHI is a scale from 1-10+, representing the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+). The monitoring station closest to the Study Area is located in Port Hawkesbury, Inverness County, NS. The AQHI at this site is usually low at all times of the year (ECCC, 2016).

5.3 Geophysical Environment

5.3.1 Physiography and Topography

The dominant forest within this ecodistrict is the tolerant hardwood forest with scattered spruce and fir. Mortality within the hardwood forests is predominantly due to natural causes such as blow down, insect defoliation or physical damage due to wind. Where early land grants were cleared for farming and subsequently abandoned the land, pure stands of White Spruce have established (Neily et al., 2003).

The topography within the Study Area is rolling with a hill present within the center of the Study Area. The topography of the Study Area slopes away to the east and southwest from the high point within the Study Area, which is approximately located where the quarry exists. The majority of the Study Area slopes towards the southwest. The Study Area elevation ranges from approximately 183m above sea level (ASL) on the hilltop to 133 m ASL near MacMaster Brook in the southeast corner of the Study Area.

5.3.2 Surficial Geology

The surficial geology of the Study Area consists of Stony Till Plain (Ground Moraine), and bedrock. Stony Till Plain is described as stony, sandy matrix, highly erodible with rapid drainage, which has been derived from local bedrock sources. The Stony Till Plain depth ranges from 2 to 20m, with a topography that is flat to rolling with many surface boulders present. Bedrock is of a variety of types and ages, glacially scoured basin and knobs are present. The bedrock is overlain by a thin, discontinuous veneer of till, shaped by glacial erosion with depths from 1 to 2 m. The topography of the bedrock is described as flat to strongly rolling, with ridges of hard rock exposed in thin till areas (NSDNR 2012).

5.3.3 Bedrock Geology

The Study Area overlies bedrock formations from the Neoproterozoic III period. It is Neoproterozoic granite from the Huntington Mountain Pluton. The granite consists of Uranium-lead (U-Pb) zircon in the age range of 619 ± 4 Ma[5] (mega-annum (million years). (NSDNR 2012)

This type of granite found within the Study Area is not net acid producing.

Surficial geology and bedrock geology within the Study Area are shown on Figure 9 and Figure 10 in Appendix A.

5.3.4 Hydrogeology and Groundwater

Water supplies for individual homes near the Study Area are provided by drilled on-site potable wells.

Details associated with individual wells within a 5 km radius of the Study Area were identified through a review of the NS well logs database (NSE 2016). This database provides information on more than 100,000 water wells in the province, including information on well locations, geology and well construction, well depth and yield. A search of this database was completed for the Study Area in Inverness County. A total of 27 well logs (all drilled) were available for review, see Table 4 (below) for well characteristics for each of these wells. General conclusions relating to the groundwater resource in the Study Area were derived from this information.

The geology of the Study Area is described as consisting of stony till with many surface boulders present overlying granite bedrock. The average depth to bedrock based on drilling data was generally 5.7m. Wells appeared to be drilled to an average depth of 36.96m below grade, and were constructed as 152mm wells with an average 13.21 m depth of casing (casting depth ranges from 4.87m to 36.54m). Information provided on depth of water bearing fractures during drilling activities indicated that

the average depth to the shallowest and the deepest water bearing fractures was approximately 13.09m and 90.44m below grade, respectively. Static water levels were not always recorded in the well logs, but information that was provided indicated an average static depth to water of 13.86m. A general review of water yields for these wells indicated an average yield of approximately 51.51 litres per minute (Lpm).

Table 4. Well Characteristics within 5km of the Study Area

Well Number	Address / Community	Depth (m)	Casing (m)	Depth to Bedrock (m)	Static Level (m)	Yield (Lpm)	Elevation	Easting	Northing	Accuracy ± (m)
013702	Highway #105, RR#1 Port Hood	44.15	19.49	9.14	7.61	11.35	76	627500	5064500	707
013725	Highway#105	44.15	30.45	27.4	3.04	27.24	76	627500	5064500	707
021245	Creignish	44.76	18.27	13.7	12.18	13.62	101	620500	5065500	707
030308	Troy	30.45	12.18	4.57	6.09	68.1	174	622500	5062500	707
031881	1114 General	30.15	6.09	3.96	3.65	27.24	170	624500	5062500	707
051837	Highway #105	60.6	12.18	3.65	42.63	113.5	122	628120	5063505	15
671059	Queensville	24.36	21.92	NA	NA	22.7	76	629347	5068379	150
690737	Queensville	18.27	6.39	4.57	5.18	22.7	76	627719	5066270	150
780778	Sugar Camp	29.54	21.01	5.18	11.27	36.32	122	627313	5062171	1130
790172	Sugar Camp	44.76	26.8	0.91	3.04	54.48	122	627313	5062171	1130
830032	Glendale	33.5	13.4	10.96	23.14	27.24	152	627155	5069887	1130
850817	Port Hawkesbury	13.09	6.39	4.26	3.35	54.48	85	627219	5066801	1130
860814	Creignish Mountain	20.1	4.87	3.65	4.87	18.16	212	622478	5065870	15
872139	MacIntyres Mountain	90.44	6.09	3.35	71.86	NA	128	627500	5069500	707
872145	Port Hastings	29.54	12.18	4.26	3.04	18.16	170	624500	5062500	707
872171	Creignish	29.54	13.4	5.48	2.44	45.4	101	620500	5065500	707
872172	Creignish	29.54	13.4	9.14	4.57	36.32	101	620500	5065500	707
882134	Queensville	44.76	14.92	5.48	35.02	68.1	96	628257	5063835	15
902201	MacIntyres	39.58	6.09	2.44	19.79	45.4	23	629500	5068500	707
912128	Rhodena	29.54	6.09	3.04	6.09	181.6	201	623500	5063500	707
921626	MacIntyres Road	52.37	6.09	2.44	21.32	90.8	46	629500	5064500	707
931785	Creignish Rear	33.5	6.09	4.26	3.04	9.08	191	623280	5064455	15

Well Number	Address / Community	Depth (m)	Casing (m)	Depth to Bedrock (m)	Static Level (m)	Yield (Lpm)	Elevation	Easting	Northing	Accuracy ± (m)
931813	Queensville	24.36	12.18	3.65	2.44	181.6	42	629369	5064016	15
942496	MacIntyres Road	67.9	11.88	2.44	35.63	90.8	104	628667	5063185	15
952390	MacIntyres Mountain	29.54	6.09	3.65	NA	0	152	625500	5070500	707
982248	MacIntyres Mountain	37.15	36.54	NA	12.18	6.81	73	627940	5068741	15
982265	Creignish Rear	22.23	6.09	0.91	3.04	68.1	202	623755	5063640	15
Average		**36.96**	**13.21**	**5.70**	**13.86**	**51.51**	**118.30**	**NA**	**NA**	**NA**

Groundwater resources within the Study Area are not used to supply residential potable water as there are no residential dwellings within the Study Area. According to the information available in the Well Logs Database, the closest mapped drilled groundwater well used for potable purposes is located 1.2 km southeast of the Study Area; however, the accuracy for this well within the database is ±1130m. Personal communication with the owner of the closest known residence on Blueridge Road (Bob Belyea) confirmed that there has been no residence present at that location since he has lived in his current residence (pre-1974). As a result, it is unlikely that a groundwater well is actually present at the mapped location (Figure 8, Appendix A).

The closest drilled well location, accuracy of ±150m, associated with a known residence, along Highway 105, is located 1.72km southeast of the Study Area (Bob and Louise Belyea).

The locations of wells in the well log database do not provide exact geographic coordinates. Older references indicate a map number only. Newest references are accurate within 50 m. Please refer to Figure 8 (Appendix A) for the location of domestic potable wells surrounding the Study Area.

5.3.4.1 Port Hawkesbury Water Supply Area

The Port Hawkesbury Water Supply Area Zone A is the closest NSE Protected Water Area. The zone is located approximately 7.6 km from the Study Area.

5.4 Terrestrial Environment

This section describes the Rhodena Quarry Expansion Study Area habitat, avian use, wildlife, and vegetation communities.

5.4.1 Habitat

Habitat assessments were completed on April 17, 2016 by Tiffany Gilchrist and John Gallop, within the Study Area. The Study Area contains a mosaic of natural and disturbed habitat, exhibiting evidence of both natural and anthropogenic disturbance regimes. Six wetlands are present throughout the Study Area, (described in detail within Section 4.1.8). Overall, the site falls within the Acadian Ecosites AC10 and AC13. These ecosites (described by Keys et al., 2011) represent moderate soil richness, and fresh moisture regime depending on topographic position, slope gradient, and soil drainage. Generally, these ecosites support early- to late-successional forests within the Study Area.

The eastern extent of the Study Area is considered disturbed habitat (quarry activities). The area in proximity to the existing quarry footprint and within the northern portion of the Study Area is forested yet disturbed. Quarry-related work areas and timber-harvesting activities, including clear-cuts are present. This area is in the early to mid-regenerating stage with abundant Balsam Fir, White Birch, and Balsam Fir saplings, emerging from a ground cover dominated by a variety of herbaceous species. The southern portion of the Study Area contains a mosaic of intact mature forests and lands disturbed by historic timber harvesting. The western extent of the Study Area is an uneven stand consisting of White Birch, and Balsam Fir with Starflower within the understory. Timber-harvesting activities are present across the western extent of the Study Area.

Undisturbed upland habitat present in the Study Area encompasses a range of vegetation types (as defined by Neily et al., 2011), such as Mixed Wood (MW4 and MW5) and Tolerant Hardwood (TH8). The vegetation types are consistent with expectations based on ecosite conditions. The mixed wood treed vegetation types follow stand-replacing disturbance events, such as fire, windthrow and harvesting. In areas with slightly richer nutrient regime, tolerant hardwood forests with Yellow Birch and Striped Maple are present (TH8). These hardwood-dominated vegetation types represent mid- to late-successional forest stands with rich nutrient regimes.

5.4.2 Vegetation

MEL botanist Melanie MacDonald completed vegetation surveys on June 07, and August 16, 2016 to support the identification of priority species. A total of 113 species were identified within the Rhodena Quarry Expansion Study Area. No priority species were observed. A list of all species identified within the Study Area is provided in Table 5 below.

Table 5: Vegetation List Rhodena Quarry Expansion Project

Latin Name	Common Name	Srank
Abies balsamea	Balsam Fir	S5
Acer pensylvanicum	Striped Maple	S5
Acer rubrum	Red Maple	S5
Acer saccharum	Sugar Maple	S5
Acer spicatum	Mountain Maple	S5
Alnus incana	Speckled Alder	S5
Anaphalis margaritacea	Pearly Everlasting	S5
Aralia nudicaulis	Wild Sarsaparilla	S5
Betula alleghaniensis	Yellow Birch	S5
Betula papyrifera	Paper Birch	S5
Betula populifolia	Gray Birch	S5
Brachyelytrum septentrionale	Northern Shorthusk	S5
Carex atlantica ssp. atlantica	Atlantic Sedge	S4
Carex canescens	Silvery Sedge	S5
Carex crinita	Fringed Sedge	S5
Carex flava	Yellow Sedge	S5
Carex folliculata	Northern Long Sedge	S5
Carex gynandra	Nodding Sedge	S5
Carex leptalea	Bristly Stalk Sedge	S5
Carex lurida	Sallow Sedge	S5
Carex novae-angliae	New-England Sedge	S5
Carex scabrata	Rough Sedge	S5
Carex trisperma	Three-seeded Sedge	S4?

Latin Name	Common Name	Srank
Carex vesicaria	Inflated Sedge	S4S5
Chelone glabra	Turtlehead	S5
Cinna latifolia	Drooping Wood Reed Grass	S5
Clintonia borealis	Yellow Bluebead Lily	S5
Coptis trifolia	Goldthread	S5
Cornus canadensis	Bunchberry	S5
Cypripedium acaule	Pink Lady's-Slippers	S5
Dennstaedtia punctilobula	Hay-scented Fern	S5
Doellingeria umbellata	Hairy Flat-top White Aster	S5
Dryopteris campyloptera	Mountain Wood Fern	S5
Dryopteris cristata	Crested Wood Fern	S5
Epigaea repens	Trailing Arbutus	S5
Epilobium leptophyllum	Bog Willowherb	S5
Equisetum sylvaticum	Woodland Horsetail	S5
Eriophorum virginicum	Tawny Cottongrass	S5
Eupatorium maculatum	Spotted Joe-pye Weed	S5
Eupatorium perfoliatum	Common Boneset	S5
Euthamia graminifolia	Grass-leaved Goldenrod	S5
Fagus grandifolia	American Beech	S5
Fragaria virginiana	Wild Strawberry	S5
Fraxinus americana	White Ash	S5
Galium asprellum	Rough Bedstraw	S5
Galium palustre	Common Marsh Bedstraw	S5
Galium trifidum ssp. trifidum	Three-petaled Bedstraw	S5
Gaultheria hispidula	Creeping Snowberry	S5
Gaultheria procumbens	Eastern Teaberry	S5
Glyceria canadensis	Canada Manna Grass	S5
Gymnocarpium dryopteris	Common Oak Fern	S5
Hamamelis virginiana	American Witch-hazel	S5
Hydrocotyle americana	American Marsh Pennywort	S5
Iris versicolor	Harlequin Blue Flag	S5
Juncus effusus	Soft Rush	S5
Juncus pelocarpus	Bog Rush	S5
Kalmia angustifolia	Sheep Laurel	S5
Larix laricina	Larch	S5
Ledum groenlandicum	Common Labrador Tea	S5
Linnaea borealis	Northern Twinflower	S5
Lonicera canadensis	Canada Fly Honeysuckle	S5

Latin Name	Common Name	Srank
Luzula multiflora	Common Woodrush	S5
Lycopus uniflorus	Northern Bugleweed	S5
Maianthemum canadense	False Lily-of-the-valley	S5
Maianthemum trifolium	Three-leaved False Solomon's Seal	S5
Mitchella repens	Partridgeberry	S5
Mitella nuda	Naked Bishop's-cap	S5
Monotropa uniflora	Indian Pipe	S4
Muhlenbergia uniflora	Bog Muhly	S5
Nemopanthus mucronatus	Mountain Holly	S5
Oclemena acuminata	Whorled Wood Aster	S5
Oclemena nemoralis	Bog Aster	S5
Oclemena x blakei	a hybrid White Panicled American-Aster	S4S5
Onoclea sensibilis	Sensitive Fern	S5
Osmunda cinnamomea	Cinnamon Fern	S5
Osmunda claytoniana	Interrupted Fern	S5
Oxalis montana	Common Wood Sorrel	S5
Phegopteris connectilis	Northern Beech Fern	S5
Picea glauca	White Spruce	S5
Picea mariana	Black Spruce	S5
Picea rubens	Red Spruce	S5
Pinus strobus	Eastern White Pine	S5
Platanthera clavellata	Small Green Woodland Orchid	S5
Platanthera lacera	Ragged Fringed Orchid	S4S5
Polypodium virginianum	Rock Polypody	S5
Polystichum acrostichoides	Christmas Fern	S5
Prenanthes altissima	Tall Rattlesnakeroot	S5
Prunella vulgaris	Common Self-heal	S5
Pteridium aquilinum	Bracken Fern	S5
Ranunculus acris	Common Buttercup	SNA
Ranunculus repens	Creeping Buttercup	S5
Rubus hispidus	Bristly Dewberry	S5
Rubus pubescens	Dwarf Red Raspberry	S5
Sambucus racemosa	Red Elderberry	S5
Solidago canadensis	Canada Goldenrod	S5
Solidago rugosa	Rough-Leaf Goldenrod	S5
Sorbus americana	American Mountain Ash	S5
Streptopus amplexifolius	Clasping Twisted Stalk	S4S5
Symphyotrichum novi-belgii	New Belgium American-Aster	S5

Latin Name	Common Name	Srank
Taxus canadensis	Canada Yew	S5
Thalictrum pubescens	Tall Meadow Rue	S5
Thelypteris simulata	Bog Fern	S4S5
Trientalis borealis	Northern Starflower	S5
Trillium undulatum	Painted Trillium	S5
Tussilago farfara	Coltsfoot	SNA
Typha latifolia	Broad-leaved Cat-tail	S5
Vaccinium myrtilloides	Velvet-leaved Blueberry	S5
Veronica officinalis	Common Speedwell	S5
Viburnum lantanoides	Hobblebush	S5
Viburnum nudum	Northern Wild Raisin	S5
Viola cucullata	Marsh Blue Violet	S5
Viola macloskeyi	Small White Violet	S5

Further details relating to potential SAR and SOCI flora species are provided in Section 5.6.1. No SAR and SOCI flora species were identified during field surveys.

5.4.3 Herpetofaunal Species

Herpetofaunal species were inventoried at the Study Area through incidental observations by MEL biologists during other surveys, especially wetland delineation and evaluation and watercourse evaluation (wood turtles). Specific focus was given to identifying priority species, especially those identified as having appropriate habitat within the Study Area through the desktop evaluation for priority species. The following four species (
Table 6) were identified during field surveys, none of which are a SOCI or a SAR.

Table 6. Herpetofaunal species inventoried during 2016 field surveys.

Scientific Name	Common Name	ACCDC Prov. Rank
Bufo americanus americanus	Eastern American Toad	S5
Lithobates sylvaticus	Wood frog	S5
Pseudacris crucifer	Spring peeper	S5
Thamnophis sirtalis pallidulus	Garter Snake	S5

The Study Area provides limited herpetofaunal habitat. The limitation for many turtle and amphibian species is the lack of open water habitats, particularly associated with wetlands. Although there are several wetlands across the Study Area, they do not exhibit vernal pool and open channel habitat. Species that may use stream channel habitats are more likely to find adequate habitat within the Study Area.

Further details relating to potential SAR and SOCI herpetofaunal species are provided in Section 5.6.2. No SAR and SOCI herpetofaunal species were identified during field surveys.

5.4.4 Mammals

Incidental observation of mammal species was documented during all field survey activities during 2016 across the Study Area. Specific focus was given to searching for signs of priority species identified as having appropriate habitat within the Study Area.

Table 7 lists those species that were confirmed within the Study Area either visually or by sign (scat, footprints, etc.). A discussion of bat usage within the Study Area is provided in Section 5.4.5.

Table 7. Confirmed mammalian species during 2016 field surveys.

Scientific Name	Common Name	ACCDC Prov. Rank
Odocoileus virginianus	White Tailed Deer	S5
Tamiasciursus hudsonicus	American Red Squirrel	S5
Lepus americanus	Snowshoe hare	S5
Alces alces	Eastern Moose	S1*

*S1 rank for Eastern Moose refers to the Nova Scotian mainland population, not the population of Moose in Cape Breton

Ungulate species expected to inhabit the vicinity of the Project Study Area were established by examination of distribution maps, comparison of preferred habitat with that in the vicinity of the proposed location and field assessments. Mammal species observed within the Study Area include the white-tailed deer **(***Odocoileus virginianus)* and Eastern Moose (*Alces alces*)**.** Optimal habitat for deer species occurs within young forest stands and riparian and shoreline areas within drainage systems within the Study Area. White-tailed deer forage on grasses, forbs and shrubby browse, and require large amounts of easily digested food (Buckmaster et al., 1999).

Common carnivore/omnivore species such as Raccoon (*Procyon lotor*), Coyote (*Canis latrans*), American Porcupine (*Erithizon dorsatum*), Red Fox *(Vulpes vulpes),* Bobcat (*Lynx rufus),* American Mink (*Mustela vision),* Striped Skunk (*Mephitis mephitis),* Short-tailed Weasel (*Mustela erminea)* may inhabit the Study Area or surrounding areas, at least periodically.

Further details relating to potential SAR and SOCI mammal species are provided in Section 5.6.3. No SAR and SOCI mammals were identified during field surveys.

5.4.5 Avian

5.4.5.1 Desktop Results

There are no Important Bird Areas (IBA) within 25km of the Study Area. (Bird Studies Canada, 2012). The closest IBA, Pomquet Beach Region (NS009), is approximately 32km west of the SA.

- Pomquet Beach Region (NS009) is located approximately 32km west of the Study Area within mainland NS. This IBA is located approximately 8km northeast of Antigonish. The communities of Antigonish Harbour and Monks Head are found within Pomquet Beach Region IBA. It is a series of barrier beaches, with one to two meter tides. Pomquet is one of the longer beaches, 5 to

10m wide at high tide, while having broader expanses of sand flats during low tide. Piping Plovers have used the Pomquet Beach Region for breeding for years. Piping Plovers are designated Endangered by Species at Risk Act (SARA) and The Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Pomquet Beach portion of the IBA is a provincial park, which does not fully afford protection of the kind needed at a Piping Plover site. The habitat is protected from development, however recreational activities, such as All-Terrain-Vehicles and beachgoers, are permitted (Bird Studies Canada, 2012).

The habitats provided within this IBA are not consistent with habitat available within the Study Area. The IBAs are mainly associated with coastal colonial nesting species and shorebirds dependant on exposed mudflats or sandy beaches.

The Project will not disrupt large contiguous wetland or forest habitat that may be of importance to birds. The closest significant migration staging area for waterfowl and shorebirds is also Pomquet Beach Region, approximately 32 km west of the Study Area. There is a Great Blue Heron colony on Pomquet Island, and Osprey and Bald Eagles breed in the general area around Pomquet Island. At this time, there is no knowledge of a large heron, gull or tern colony located near the site. Brileys Lake is the nearest water body, located approximately 1.2km northwest of the Study Area and the Atlantic Ocean is 5.5km to the west.

5.4.5.2 Avian Survey Results

Baseline assessments for birds were completed from April to October, 2016, by MEL Biologists. A total of 540 minutes (9 hours) of surveys were completed over three seasons. These surveys resulted in the observation of 474 individuals, representing 43 species within the Study Area. An additional three species were observed only incidentally during the three seasons: Olive-sided Flycatcher (*Contopus cooperi*), Pileated Woodpecker (*Hylatomus pileatus*) and Red-breasted Nuthatch (*Sitta canadensis*). Across all survey seasons a total of six (6) priority species were observed either during dedicated survey periods or incidentally. These species include the Boreal Chickadee *(Poecile hudsonica)*, Olive-sided Flycatcher *(Contopus cooperi*), Red-breasted Nuthatch, Ruby-crowned Kinglet (*Regulus calendula*), Swainson's Thrush (*Catharus ustulatus*) and Yellow-bellied Flycatcher (*Empidonax flaviventris*). The later three species were observed during a breeding bird survey and are listed as priority species (S3S4B) by ACCDC during the breeding season. The Olive-sided Flycatcher was the only SAR (Threatened) observed during the surveys.

Bird species were identified based on functional bird groups to understand how each group of birds is using the Study Area. These functional groups include passerines, non-passerine landbirds, raptors, shorebirds and waterfowl. The most abundant group observed on site was passerines. Targeted surveys for Common Nighthawks and nocturnal owls were conducted, but no nocturnal owl species or Common Nighthawks were observed, therefore these species are not discussed in this section of the report.

5.4.5.3 Spring Migration

Eight (8) point count stations were surveyed during the spring bird migration period. The spring bird migration survey was conducted during one visit on May 12, 2016. During spring migration, 68 individuals, representing 20 species, were observed during the dedicated survey period. One additional species was observed incidentally during the spring migration survey, Winter Wren (*Troglodytes hiemalis*). One SOCI, Boreal Chickadee (S3) was observed during the spring migration survey. No SAR were observed.

Table 8. Species and abundance of birds observed during Spring Migration

Species code	Common name	Scientific name	#	Points obs.	Bird group
AMCR	American Crow	*Corvus brachyrhynchos*	1	2	6
AMGO	American Goldfinch	*Spinus tristis*	2	5	6
AMRO	American Robin	*Turdus migratorius*	7	1,2,5,6,8	6
BEKI	Belted Kingfisher	*Megaceryle alcyon*	2	8	3
BAWW	Black-and-white Warbler	*Mniotilta varia*	3	1,5,8	6
BCCH	Black-capped Chickadee	*Poecile atricapillus*	1	1	6
BLJA	Blue Jay	*Cyanocitta cristata*	7	2,3	6
BHVI	Blue-headed Vireo	*Vireo solitarius*	1	7	6
BOCH	Boreal Chickadee	*Poecile hudsonicus*	3	7	6
DEJU	Dark-eyed Junco	*Junco hyemalis*	5	1,2,6,8	6
DOWO	Downy Woodpecker	*Picoides pubescens*	4	5,7	7
HETH	Hermit Thrush	*Catharus guttatus*	4	7,8	6
NOFL	Northern Flicker	*Colaptes auratus*	7	2,3,5,7	7
OVEN	Ovenbird	*Seiurus aurocapilla*	1	8	6
PAWA	Palm Warbler	*Setophaga palmarum*	1	4	6
REVI	Red-eyed Vireo	*Vireo olivaceus*	7	2,3,4,5,8	6
RCKI	Ruby-crowned Kinglet	*Regulus calendula*	2	7	6
SWTH	Swainson's Thrush	*Catharus ustulatus*	2	1	6
UNWO	Unidentified Woodpecker	*n/a*	1	4	7
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	7	2,3,5	6
		Total Number:	68		

Notes: Incidental observations not included (those observed outside of point count locations, or at distances greater than 100m. Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e. that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds.

The species most commonly observed were Northern Flicker (*Colaptes auratus*; n=7), Red-eyed Vireo (*Vireo olivaceus*; n=7), Blue Jay (*Cyanocitta cristata*; n=7), American Robin (*Turdus migratorius*; n=7), and White-throated Sparrow (*Zonotrichia albicollis*; n=7). No obvious concentration of ducks or shorebirds was observed. The majority of observations were of one or two individuals, and the largest group of birds observed was five Blue Jays. The most abundant species group observed on site during the

spring migration period was passerines, non-passerine landbirds was the next most abundant group on-site, followed by other waterbirds.

5.4.5.4 Breeding Season

The breeding bird survey consisted of eight point count stations, which were surveyed twice in the month of June 2016. A total of 256 individuals representing 35 species were observed. With incidental observations removed (those outside of point count locations, and those observed at a distance exceeding 100m), 231 individuals representing 33 species were observed and included in the summary below. Two species were observed only incidentally; the Winter Wren and Olive-sided Flycatcher were observed over 100m south of the Project Area. In total, three SOCI were observed during breeding bird surveys: Ruby-crowned Kinglet (S3S4B; *Regulus calendula*), Swainson's Thrush (S3S4B; *Catharus ustulatus*) and Yellow-bellied Flycatcher (S3S4B; *Empidonax flaviventris*). One SAR was observed incidentally, the Olive-sided Flycatcher (*Contopus cooperi*). The Olive-sided Flycatcher is listed as Threatened by SARA, COSEWIC and NSESA.

Table 9. Species and abundance of birds observed during Breeding Season Surveys

Species code	Common name	Scientific name	#	Points obs.	Bird Group	Breeding Status
ALFL	Alder Flycatcher	*Empidonax alnorum*	10	2, 3, 5	6	Probable
AMCR	American Crow	*Corvus brachyrhynchos*	2	1	6	Possible
AMGO	American Goldfinch	*Spinus tristis*	12	2, 5, 6	6	Probable
AMRO	American Robin	*Turdus migratorius*	11	1, 2, 4, 6, 7, 8	6	Probable
BAWW	Black-and-white Warbler	*Mniotilta varia*	9	1, 2, 3, 4, 5, 8	6	Possible
BCCH	Black-capped Chickadee	*Poecile atricapillus*	7	1, 6, 8	6	Possible
BHVI	Blue-headed vireo	*Vireo solitarius*	3	6, 8	6	Possible
BLBW	Blackburnian warbler	*Setophaga fusca*	3	1, 4	6	Possible
BLJA	Blue Jay	*Cyanocitta cristata*	5	1, 5, 6, 7	6	Possible
BTNW	Black-throated Green Warbler	*Setophaga virens*	18	1, 2, 4, 5, 7, 8	6	Probable
CEDW	Cedar Waxwing	*Bombycilla cedrorum*	4	5	6	Possible
CHSP	Chipping Sparrow	*Spizella passerina*	3	1, 3, 4	6	Possible
COYE	Common Yellowthroat	*Geothlypis trichas*	9	3, 5	6	Probable
CSWA	Chestnut-sided Warbler	*Setophaga pensylvanica*	4	2, 3, 7	6	Possible
DEJU	Dark-eyed Junco	*Junco hyemalis*	14	1, 2, 3, 4, 5, 6	6	Probable
HAWO	Hairy Woodpecker	*Leuconotopicus villosus*	2	6, 7	7	Possible
HETH	Hermit Thrush	*Catharus guttatus*	5	1, 6, 8	6	Possible
LISP	Lincoln's Sparrow	*Melospiza lincolnii*	1	3	6	Possible
MAWA	Magnolia Warbler	*Setophaga magnolia*	8	2, 3, 4, 6, 7	6	Probable

Species code	Common name	Scientific name	#	Points obs.	Bird Group	Breeding Status
MODO	Mourning Dove	*Zenaida macroura*	1	5	6	Possible
NOFL	Northern Flicker	*Colaptes auratus*	4	1, 5, 7	7	Possible
NOPA	Northern Parula	*Setophaga americana*	5	3, 5, 7	6	Possible
OVEN	Ovenbird	*Seiurus aurocapilla*	19	1, 4, 6, 7, 8	6	Probable
PAWA	Palm Warbler	*Setophaga palmarum*	8	2, 3, 5, 7, 8	6	Possible
PUFI	Purple Finch		1	2	6	Possible
RCKI*	Ruby-crowned Kinglet	*Regulus calendula*	2	3	6	Possible
REVI	Red-eyed Vireo	*Vireo olivaceus*	18	1, 2, 3, 4, 5, 6, 7, 8	6	Probable
SWTH*	Swainson's Thrush	*Catharus ustulatus*	5	1, 6	6	Possible
UNWO	Unidentified Woodpecker	n/a	2	1, 3	7	Possible
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	18	1, 2, 3, 4, 5, 8	6	Probable
YBFL	Yellow-bellied Flycatcher	*Empidonax flaviventris*	7	1, 4, 6, 8	6	Possible
YEWA	Yellow Warbler	*Setophaga petechia*	8	1, 2, 3, 4, 5	6	Possible
YRWA	Yellow-rumped Warbler	*Setophaga coronata*	3	4, 5	6	Possible
	Total: 33 Species	Total Number:	231			

Notes: Incidental observations not included (those observed outside of point count locations, or at distances greater than 100m. Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e. that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds.

The most commonly observed species was the Ovenbird (n=19), followed by the Red-eyed Vireo, White-throated Sparrow and Black-throated Green Warbler (n=18 each). Since the site surveyed is a relatively small part of the surrounding area, it is not possible to confirm that all species identified were actually nesting within the boundaries of the site. For instance, for a bird that was observed carrying food (confirmed breeding evidence), it is possible that the bird was nesting on an adjacent parcel of land. All birds observed on site are presumed to be possible breeders, ten of which are considered probable breeders. Those identified as probable breeders in Table 9 above were observed at the same location on two subsequent breeding season surveys. As such, they are recorded as probable breeders. No evidence of confirmed breeding was observed during field surveys.

All of the species identified are native species in this area of Nova Scotia and the province in general, and within the typical and common habitat associated with the Study Area and surrounding landscape. The majority of observations were of one or two individuals. The most abundant species group observed on site during the breeding bird period was passerines, followed by other landbirds.

5.4.5.5 Fall Migration

The fall bird migration survey consisted of eight point count stations and dedicated surveys were conducted twice during the fall migration period, September 23 and October 8, 2016. During fall migration, a total of 141 individuals representing 22 species were observed. When incidental observations were removed (those observed outside of Point Count locations or heard at a distance exceeding 100m), 128 individuals representing 19 species remain, and are included in Table 10 below. The three incidental species observed include the American Crow (*Corvus brachyrhynchos*), Pileated Woodpecker (*Hylatomus pileatus*), and Red-breasted Nuthatch (*Sitta canadensis*). Only one SOCI was observed incidentally during fall migration surveys, the Red-breasted Nuthatch (S3). No SAR were observed during fall migration surveys.

Table 10. Species and abundance of birds observed during Fall Migration

Species code	Common name	Scientific name	#	Point obs.	Group
AMGO	American Goldfinch	*Spinus tristis*	12	4, 5, 8	6
AMRO	American Robin	*Turdus migratorius*	15	1, 2, 4, 5, 7	6
BAWW	Black-and-white Warbler	*Mniotilta varia*	3	1, 3	6
BCCH	Black-capped Chickadee	*Poecile atricapillus*	26	1, 3, 6, 7	6
BEKI	Belted Kingfisher	*Megaceryle alcyon*	2	4, 7	3
BLJA	Blue Jay	*Cyanocitta cristata*	21	2, 3, 4, 5, 6, 8	6
CEDW	Cedar Waxwing	*Bombycilla cedrorum*	3	1	6
CORA	Common Raven	Corvus corax	2	4	6
COYE	Common Yellowthroat	*Geothlypis trichas*	2	5, 7	6
DEJU	Dark-eyed Junco	*Junco hyemalis*	19	1, 2, 4, 5, 6, 7, 8	6
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	2	1	6
HAWO	Hairy Woodpecker	*Leuconotopicus villosus*	4	1, 4, 6, 8	7
NOFL	Northern Flicker	*Colaptes auratus*	4	3, 6, 7	7
RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1	6	4
SOSP	Song Sparrow	*Melospiza melodia*	1	2	6
UNWA	Unknown Warbler	*n/a*	4	2, 7	6
WIWR	Winter Wren	*Troglodytes hiemalis*	1	3	6
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	5	2, 4, 6, 7	6
YEWA	Yellow Warbler	*Setophaga petechia*	1	3	6
	19 Species	Total Number:	128		

Notes: Incidental observations not included (those observed outside of point count locations, or at distances greater than 100m. Bird group is coded as: 1 = waterfowl; 2 = shorebirds; 3 = other waterbirds (i.e. that are not waterfowl or shorebirds); 4 = diurnal raptors; 5 = nocturnal raptors; 6 = passerines (excluding dippers) and 7 = other landbirds.

The most commonly observed species were Black-capped Chickadee (n=26), followed by Blue Jay (n=21) and the Dark-eyed Junco (n=19). Most observations documented groups of up to two individuals, no large flocks of birds were observed. The most abundant group observed on site during the fall

migration period was passerines. Other landbirds were the next most abundant group on-site, followed by other waterbirds and diurnal raptors.

5.4.5.6 Summary of Bird Surveys

A relatively low number of birds were observed during both the spring and fall migration periods, compared to during the breeding period. However, only one visit was conducted in the spring and two visits in the fall, so it is possible that larger flocks of birds were missed. That said, a significant portion of the site has already been clear-cut prior to the surveys, so suitable habitat for many bird species was limited within the Rhodena Quarry Expansion Study Area. Within the Study Area, disturbance has been ongoing due to current quarry activities and recent forestry activities, which could contribute to the relatively low numbers and diversity of bird species observed during field evaluations. The forestry activities have created edge habitat for foraging and created habitat niches for certain bird species. However, this edge habitat is also available along the network of forestry roads within the area.

Across all survey seasons a total of six (6) priority species, one SAR and five SOCI were observed either during dedicated survey periods or incidentally: Boreal Chickadee, Olive-sided Flycatcher, Red-breasted Nuthatch, Ruby-crowned Kinglet, Swainson's Thrush and Yellow-bellied Flycatcher.

5.4.6 Bat Use

According to the ACCDC report, no known bat hibernacula are present within 5km of the Study Area. No provincial government records of abandoned mine openings (AMOs) were located within the Study Area or within 5km of the Study Area. There is one government record of an AMO within 10km of the Study Area. This record indicates that the closest AMO is approximately 7 km to the northeast of the Study Area, in proximity to the community of Glendale.

The closest critical habitat for the Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Nova Scotia is approximately 69km northeast of the Study Area, near the community of Baddeck, NS (Environment Canada, 2015).

No observations of potential bat hibernacula were identified in the Rhodena Quarry Expansion Study Area during field evaluations and surveys.

5.4.7 Wildlife Habitat

Habitat across the Study Area is described in detail in Sections 5.4.1. The majority of the Study Area is forested with areas that have been recently harvested, and is in early stages of regeneration. These recently harvested areas generally lack tree cover, and are dominated by early colonizing species. Intact forest within the site generally falls within the Acadian Ecosites AC10 and AC13. These ecosites (described by Keys et al., 2007) represent moderate soil richness, and fresh moisture regime depending on topographic position, slope gradient, and soil drainage. Generally, these ecosites support early- to late-successional forests within the Study Area.

Habitat within the Study Area is currently fragmented by the existing quarry, roads and historical forestry operations. The extent of habitat fragmentation within the Study Area limits the habitat quality for species

that prefer interior, mature, undisturbed habitats, such as Lynx and Fisher. Habitat within the Study Area is suitable for those wild species that thrive in fragmented, diverse landscapes, such as White-tailed Deer, Coyote, and Snowshoe Hare. This fragmented, diverse landscape provides edge habitat for foraging, and patches of full canopy coverage for refuge and cover through all seasons. Wildlife habitat observed was neither unique nor rare in the local or regional landscape context.

5.5 Aquatic Environment

Three watercourses and six wetlands were identified within the Rhodena Quarry Expansion Study Area. The following sections provide details about the aquatic habitat identified, including the results from the surface water sampling program.

Surface water located on the western extent of the Study Area (west of the existing quarry) drains south towards an unnamed watercourse beyond the Study Area, which then drains into Lamey Brook. The surface water present within the center and on the east side of the exiting quarry drains east towards MacMaster Brook. MacMaster Brook eventually meets with Lamey Brook east of the Study Area, and then drains northeast into the River Inhabitants. The River Inhabitants then drains south into the Inhabitants Bay (Atlantic Ocean).

The Rhodena Quarry Expansion Study Area lays within the Brileys Lake Tertiary Watershed (1FA-1-T). The tertiary watershed discharges into the River Inhabitants, which is located within the River Inhabitants Secondary Watershed (1FA-1) (Figure 11, Appendix A). The River Inhabitants drains south into the Inhabitants Bay within the Atlantic Ocean. The sizes of the secondary watershed and the tertiary watershed are 34,284 ha and 8,168 ha, respectively.

5.5.1 Wetlands

The NS Environment Act defines wetlands as:

> *Land referred to as a marsh, swamp, fen, or bog that either periodically or permanently has water table at, near, or above the land surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation, and biological activities adapted to wet conditions.* (Environment Act, 2006)

Wetland functions are the natural processes associated with wetlands and include water storage, pollutant removal, sediment retention and provision of nesting/breeding habitat. Functions may also include values and benefits associated with these natural processes and include aesthetics/recreation, cultural values, and subsistence production. The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec 1997) or in line with the methodologies adapted by Nova Scotia for wetland delineation.

A review of the NSDNR Wetlands Inventory Database (SSHD, 2010) did not identify any wetlands within the Rhodena Quarry Expansion Study Area. During field surveys across the Study Area, six wetlands were identified (Figure 12, Appendix A). An additional wetland was observed outside and to the west of the Study Area (hardwood treed swamp contiguous with Watercourse 1).

Table 11. Wetland Characteristics

Wetland ID	Type	Area (m^2)	Water Flow Path
WL1	Mixed-wood Treed Swamp	2,556	Isolated
WL2	Mixed-wood Treed Swamp	1,238	Isolated
WL3	Coniferous Treed Swamp	1,209	Outflow
WL4	Mixed-wood Treed Swamp	723	Throughflow
WL5	Coniferous Treed Swamp	442	Isolated
WL6	Clear-cut Swamp	408	Isolated

A more detailed table outlining the characteristics of each wetland, including the soil type and depth, surface hydrology indicators, wetland buffer and dominant vegetation, are provided in Appendix E.

NSE NovaWET functional assessments were completed for all identified wetlands within the Study Area. A general summary of wetland function is found below.

Four wetlands identified within the Study Area are in isolated positions; one is located in a throughflow position (WL4); and the sixth wetland is located in a headwater (outflow) position (WL3). Treed swamps are the dominant wetland type on the landscape within the Study Area. The dominant tree species in the overstory layer within the wetlands are Red Maple and Balsam Fir, which are also found in the understory shrub layer. In addition to Red Maple (*Acer rubrum*) and Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*) and Speckled Alder (*Alnus incana*) are also found within the shrub layer. A variety of herbaceous species are found within the ground cover, depending on local hydrology, disturbance regime, and nutrient regime. Three-seeded Sedge (*Carex trisperma*), Cinnamon Fern (*Osmunda cinnamomea*), Atlantic Sedge (*Carex atlantica spp.atlantica*) and Nodding Sedge (*Carex gynandra*) are common in the herbaceous layer.

A high water table and saturation at surface were present in all the wetlands within the Study Area. Surface water was present within Wetlands 2, 4, 5 and 6. The average depth of surface water and cover for Wetland 2, 4, 5 and 6 are 10 cm covering 2%; 3 cm covering 10%; 25 cm covering 5% and 15 cm covering 10% of the wetland area, respectively. None of these wetlands provide fish habitat based on limited surface water availability. Hydric soil within on-site wetlands is typically indicated by decomposed organic soil either over clay mineral soil, rock or a hard pan. Depleted mineral soil indicators, such as histic epipedon, and depleted matrix (hydric soil indicators A2 and F3) are present within these wetlands. Deeper organic soil is present in Wetlands 5 and 6 with a hydric soil indicator histosol (A1).

The characteristics and wetland functions of the wetlands encountered within the Study Area were similar in the following respects:

- The wetlands within Brileys Tertiary Watershed all contribute highly to floodwater detention;
- Soils display evidence of either periodic or sustained saturation;

- Surface hydrology is present in all wetlands, including the presence of a high water table and saturated surface;
- None of the wetlands are considered to be:
    - A WSS;
    - A calcareous fen, black ash or cedar swamp;
    - Within a federal/provincial or Municipal area of interest;
    - Within a Drinking Water Protected Area;
    - Within a floodplain and upstream of or within a populated area; or,
    - Under a compensation agreement/activity or conservation agreement.
- Wetlands within the Study Area do not have the ability to stabilize shorelines as they do not fridge watercourses or waterbodies;
- No water supplies are withdrawn from the wetlands;
- Forest harvesting activities within the buffers of wetlands limit the ability of these buffers to minimize erosion;
- There is no stormwater/wastewater/agricultural runoff or any nutrients and/or sediments being deposited into the wetlands;
- The wetlands exhibit natural hydrologic conditions;
- None of the wetlands provide high functional significance for wildlife or fish habitat;
- During periods of low precipitation, the wetlands provide nutrient supplies to dependant wildlife. Wildlife indicators adjacent to the assessed wetlands (*i.e.*, tracks, browse, visible sightings) suggest that the habitat is valuable for species in the area;
- Vegetation is consistent with neighbouring wetland areas, and as such, the wetlands do not appear to provide regionally or locally unique habitat; and,
- Based upon the results of the public consultation, location of the Project, and field assessments, there is no evidence to suggest that any social/commercial/or cultural values are influenced by the wetlands encountered.

Summary NovaWET 3.0 functional assessment forms are available upon request for each evaluated wetland within the Rhodena Quarry Expansion Study Area.

5.5.2 Aquatic and Fish Habitats

There are no lakes or areas of open water in the Rhodena Quarry Expansion Study Area. Brileys Lake is located approximately 1.5 km northwest of the Study Area, and this lake has been documented as a Nova Scotia Significant Habitat for Wood Turtles (F.M. MacKinnon, Personal Communication, 2015).

Two mapped watercourses and one unmapped intermittent watercourse were confirmed as present within the Study Area (Figure 12, Appendix A). The first, Watercourse 1, a mapped watercourse, exists in the western extent of the Study Area. The watercourse initiates to the north of the Study Area and flows in a southerly direction through the Study Area. Watercourse 1 flows through a culvert under Creignish Mountain Road and continues south and drains into Lamey Brook. Watercourse 1 is fish bearing and a trout species was observed in Watercourse 1 within the Study Area. No barriers to fish passage were observed within Watercourse 1 within the Study Area.

Through field surveys, an unmapped watercourse (Watercourse 2) was identified within the western portion of the Study Area. The watercourse is a first order watercourse that initiates within Wetland 3 and flows into Wetland 4. No defined watercourse channel exists within Wetland 4. The section of watercourse between Wetland 3 and 4, approximately 45m in length, was determined to be ephemeral and has limited connectivity for fish resources. The section of Watercourse 2 from Wetland 4 to the southern boundary of the Study Area is also ephemeral (intermittent). Watercourse 2 has low potential and low quality fish habitat. No fish were observed within the watercourse and the two associated wetlands do not support habitat for fish.

A second mapped watercourse, known as MacMaster Brook (Watercourse 3), exists in the eastern extent of the Study Area. The watercourse initiates to the north of the Study Area and flows in a southeasterly direction through the Study Area (Figure 11, Appendix A). No barriers to fish passage were observed within the Study Area and it is assumed that the Watercourse 3 is fish bearing based on observed habitat and conversations with local residents at the public open house completed for the quarry expansion. Both aquatic systems (Lamey Brook and MacMaster Brook) eventually flow into River Inhabitants east of the Study Area. Physical characteristics of the watercourses within the Study Area are described in Table 12.

Each watercourse was evaluated for habitat characterizations based on parameters identified in the *Standard Methods Guide for Freshwater Fish and Fish Habitat Survey sin Newfoundland and Labrador* (NL Guide; Sooley et al., 1998). As described in the guide water quality and quantity tolerances of the Atlantic Salmon (*Salmo* salar) were used as an index of the relative health of the river for fish populations. The Atlantic Salmon were used as the indicator species for several reasons (Sooley et al., 1998);

- Salmon inhabit areas targeted for the assessments (riffles and pool habitat);
- Salmon are sensitive to acidification;
- Salmon are a predatory species at the top of the food chain; and
- Data exists that defines preferred habitat conditions for this species.

Watercourse 1 and 3 contain Type I fish habitat and Watercourse 2 contains Type IV fish habitat. A description of each fish habitat types found within the Study Area as described in the NL Guide (Sooley et al., 1998) is documented below:

A Type I watercourse consists of:

- good salmonid spawning and rearing habitat,
- provides feeding pools for larger age classes of fish.
- contains moderate riffles and is relatively shallow.
- Substrate is gravel to small cobble size rock, some larger rocks or boulders and;
- general habitat types consist of primarily riffles and pools.

A Type IV watercourse consists of:

- poor juvenile salmonid rearing habitat with no spawning capability,
- provides shelter and feeding habitat for larger, older salmonid (especially Brook Trout),
- water flows usually are sluggish and varies in depth

- substrate is soft sediment or sand, occasionally large boulders or bedrock and;
- general habitat types consist of flats, pools and glides.

Watercourse 1 (WC1) and Watercourse 3 (WC3) both exhibit characteristics that describe Type I fish habitat due to the substrate of cobble and small boulder with some gravel present, and rate of flow within the watercourses. Pools for feeding and refuge are present within the relatively shallow watercourses. WC1 and WC3 are fish bearing watercourses, and a trout species was observed during field evaluations within WC1. No barriers to fish passage were observed within the Study Area. WC1 and WC3 provide potential feeding, refuge, passage, rearing and overwintering habitat. WC1 and WC3 are located outside of the proposed maximum working area for the Rhodena Quarry expansion, and therefore will not be directly impacted by proposed expansion of the quarry.

Watercourse 2 (WC2) exhibits Type IV characteristics and is an ephemeral and intermittent watercourse, which reduces the potential for fish presence and reduces overall fish habitat quality. The waterflow within WC2 is sluggish and the substrate is dominated by silt (soft sediment) with some rubble present throughout. WC2 provides minimal potential feeding and refuge habitat only when water depth allows and provides no spawning or overwintering habitat. Watercourse 2 is not present in a confined channel through Wetland 4.

Table 12 below describes the physical characteristic of the three watercourses identified within the Study Area.

Table 12. Physical Characteristics of Watercourses within the Study Area

Water course	Reference UTMs		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	Habitat Type (Sooley et al., 1998)
	Easting	Northing										
1	625107	5066845	555	Moderate	4%	100-320	100-500	20	50	B=1, Gr=9, Co=50, SB=40	Glide= 1, Run= 80, Pool=10, Riffle=9	I
2	625245	5066944	110	Low	2%	15-20	20-100	5-10	15	Ru=5-10, Sa=10-15, Si=80	Riffle= 50, Pool= 50	IV
3 (MacMaster Brook)	625836	5067142	250	High	5%	150-350	300-500	50	100	B=40 SB=5 Ru=10 Gr=20 Pe=15 Sa=10	Cascade=35, Run= 35, Pocket water= 10, Pool= 10, Riffle =10	I

B=Bedrock, GR=Gravel, Co=Cobble, SB=Small Boulder, Ru=Rubble, Sa=Sand, Si=Silt, Pe=Pebble

5.5.3 Surface Water Samples

Four surface water samples were collected from the two mapped watercourses (WC1 and WC3) both upstream and downstream of the Study Area to document baseline conditions. These samples were analysed at Maxxam Analytics in Bedford, Nova Scotia for Total Suspended Solids (TSS) and pH. Table 13 below provides the results for the four surface water samples.

Table 13. TSS and pH Analysis Results Surface Water Samples

Sample ID	Sample from Watercourse	Sample Location (UTM; 20T)	Total Suspended Solids (mg/L)	pH
Rhodena Site 1 (WQ1)	WC1 downstream	625173m E 5066676m N	1.4	7.60
Rhodena Site 2 (WQ2)	WC1 upstream	625034m E 5066991m N	Not detected	6.91
Rhodena Site 3(WQ3)	WC3 (MacMaster Brook) upstream	625634m E 5067274m N	3.3	7.23
Rhodena Site 4 (WQ4)	WC3 (MacMaster Brook) downstream	625948m E 5067005m N	1.0	8.35

The surface water sample results were compared to the Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life for Freshwater (FWAL) guidelines for pH. All four surface water samples meet the applicable guidelines for pH. The samples reported pH ranging from 6.91 to 8.35, which meet the CCME FWAL guideline for pH set at a range of 6.5 to 9.0. WC1 and WC3 have pH levels reported within the pH range suitable for fish within freshwater habitat.

The purpose of the analysis for TSS was to establish a baseline for comparison of surface water quality.

5.6 SAR and SOCI

A review of Atlantic Canada Conservation Data Centre (ACCDC) findings confirms the presence of several priority species in proximity to the Study Area (Figure 8, Appendix A). The ACCDC identified the following records of SAR, SOCI and Special Areas within 5 km of the Study Area including:

- 22 records of 5 vascular flora,
- 26 records of 10 vertebrate and,
- 5 records of 3 invertebrates.

Of these identified records, two SAR were identified within 5 km of Study Area:

- Olive-sided Flycatcher- listed as Threatened by SARA. This species, along with its potential habitat was identified during field surveys within the Study Area.
- Wood Turtle- listed as Threatened by SARA. No Wood Turtles were observed during field surveys within the Study Area. No suitable nesting habitat was identified during field surveys within the Study Area.

The Significant Habitats that were identified within 5km of the Study Area through the NSDNR Provincial Landscape Viewer (NSDNR, 2015) were Wood Turtles, 15 sightings from 1956 to 2016 (F. MacKinnon, NSE, personal communication, November 28, 2016) and three deer wintering habitats.

A summary of federally and provincially protected species identified within 20km of the Study Area is provided below (Table 14). For avifaunal priority species, breeding status as documented in the Maritime Breeding Bird Atlas square summary (square 20PR26) is also included. If the species was observed during atlas surveys, with no breeding evidence noted, this is indicated below as well.

Table 14. Summary of ACCDC observations of federally and provincially protected species within 20km of the Study Area.

Scientific Name	Common Name	COSEWIC	SARA	NSESA	S Rank	Distance	MBBA
Charadrius melodus melodus	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	18.7±0.0	Obs
Chordeiles minor	Common Nighthawk	Threatened	Threatened	Threatened	S3B	9.7 ± 7.0	Obs
Contopus cooperi	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B	2.0 ± 7.0	Possible
Contopus virens	Eastern Wood-Pewee	Special Concern	N/A	Vulnerable	S3S4B	2.0 ± 7.0	Possible
Degelia plumbea	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S2	18.6 ± 0.0	n/a
Dolichonyx oryzivorus	Bobolink	Threatened	N/A	Vulnerable	S3S4B	9.7 ± 7.0	Possible
Euphagus carolinus	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2S3B	8.0 ± 7.0	Possible
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B	11.3 ± 0.0	Not Obs
Fraxinus nigra	Black Ash	N/A	N/A	Threatened	S1S2	8.4 ± 0.0	n/a
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	Threatened	S2	3.3 ± 0.0	n/a
Hirundo rustica	Barn Swallow	Threatened	N/A	Endangered	S3B	9.7 ± 7.0	Possible
Lynx canadensis	Canadian Lynx	Not at Risk	N/A	Endangered	S1	11.1 ± 1.0	n/a
Riparia riparia	Bank Swallow	Threatened	N/A		S3B	2.0 ± 7.0	Possible
Salmo salar	Atlantic Salmon- Gaspe- Southern Gulf of St. Lawrence pop.				S2	12.0± 7.0	n/a
Wilsonia canadensis	Canada Warbler	Threatened	Threatened	Endangered	S3B	12.0 ± 7.0	Possible

5.6.1 Flora

The Study Area was assessed for rare, sensitive and at-risk vegetation during the field surveys in 2016. Early spring ephemeral surveys and late season surveys were completed throughout the Study Area. Care was taken to assess for potential rare vegetation species and habitats that were identified from the ACCDC data search and present on the priority species list.

Based on data provided by the ACCDC, 4172 records of 252 vascular, 318 records of 32 nonvascular flora (S1 to S3 species) were identified within the 100km buffer around the Study Area. According to the ACCDC report, Black Ash (*Fraxinus nigra*) and Blue Felt Lichen (*Degelia plumbea*) are located within 20km of the Study Area.

Black Ash

Typical habitat for the Black Ash (Threatened listed on NSESA); S1S2) includes poorly drained soils and swampy woods. Potential Habitat for the Black Ash is present within the Study Area, however no Black Ash was identified within the Study Area.

Blue Felt Lichen

Blue Felt Lichen (BFL) typically grows in mature hardwood forests in varying moisture regimes. BFL is listed as Special Concern by SARA and COSEWIC, it's SRank is S2. There is no mature hardwood stands located within the Study Area. No BFL was identified within the Study Area.

During field studies at the Study Area, no additional flora species of conversation interest (SOCI) or species at risk (SAR) were identified.

5.6.2 Herpetofauna

The Study Area was assessed for rare, sensitive and at-risk herpetofauna species during the field surveys in 2016. Care was taken to assess for potential rare species and habitats that were identified from the ACCDC data search and the priority species list. Based on data provided by the ACCDC, one location sensitive species, Wood Turtle (*Glyptemys insculpta*), has been observed within 5 km of the Study Area. SARA, COSEWIC and NSESA list Wood Turtles as Threatened. This species prefers clear rivers, streams or creeks with moderate current and sandy or gravelly substrate (Environment Canada, 2016).

Wood Turtle

A review of the NSDNR Provincial Landscape viewer has identified WC1 and WC3 as a significant habitat (NSDNR 2015) for Wood Turtles (F.M. MacKinnon, Personal Communication, 2015). Wood Turtles are listed Threatened under SARA, COSEWIC and Nova Scotia Environment Species at Risk Act (NSESA). The species live along permanent streams but may roam, during summer, overland and can be found in a variety of terrestrial habitat. Wood Turtle nest on sand or gravel-sand beaches and banks.

No sand or gravel-sand beaches are located within the Study Area. WC1 has low potential for Wood Turtle nesting habitat and hibernacula within the Study Area. This is due to the dominant substrate consisting of small boulders and cobble only. However, the species could use the watercourse for passage. WC2 is an ephemeral stream with a silt-dominated substrate. As a result, it also provides no potential for nesting habitat or hibernacula for the Wood Turtle.

WC3 substrate is dominated by bedrock, with minor presence of gravel and pebbles. The potential for the Wood Turtle to nest and hibernate within WC3 within the Study Area is also low. No suitable nesting habitat or hibernacula for the Wood Turtle was identified within any of the three watercourses within the

Study Area. No opportunistic observations of Wood Turtles were documented during any wetland or watercourse surveys throughout the entirety of the Study Area.

No herpetofaunal species at risk or species of conservation interest were observed within the Study Area during 2016 field surveys.

5.6.3 Mammals

Table 15 provides a summary of mammalian SOCI and SAR with potential to be found within the Study Area, based on habitat preference. Bat species are discussed in further detail in Section 4.1.5.

Table 15. Potential Mammalian Priority Species within Study Area

Scientific Name	Common Name	ACCDC Provincial Rank	NS Protection
Lynx canadensis	Canada lynx	S1	Endangered
Martes pennanti	Fisher	S2	-
Sorex dispar	Long-tailed Shrew	S1	-
Microtus chrotorrhinus	Rock Vole	S2	-

Canada Lynx

Canada Lynx (*Lynx canadensis)* is the only mammalian SAR that may potentially be located within the Study Area. Lynx on the mainland of Nova Scotia were extirpated by the beginning of the twentieth century. Lynx numbers fluctuate depending on cyclical highs and lows of its primary prey, the Snowshoe Hare (*Lepus americanus*), which comprises most of its diet (NSDNR 2007). The habitat requirements for Lynx in Nova Scotia are not well defined and therefore habitat deficiencies, if they exist, are as yet unknown. Prolonged deep snow cover and coniferous forest cover are important factors in the distribution of Lynx in eastern North America.

The historic breeding range of Lynx in Nova Scotia included areas with relatively high elevations such as the Pictou Uplands, Cobequid Mountains, and Musquodoboit Hills as well as Cape Breton. The current breeding population of Lynx is considered to be restricted to Cape Breton; it has been roughly estimated at 50 to 500 animals. The closest Cape Breton Island Lynx Range is approximately 6 km to the northeast of the Study Area, in proximity to the community of Kingsville (NSDNR 2015). The likelihood of the presence of Lynx within the Study Area is low, based on traditional knowledge of where concentrations of Lynx are present on Cape Breton Island.

No observations of Lynx were recorded during field assessments throughout Spring, Summer and Fall 2016 within the Rhodena Quarry Expansion Study Area.

Fisher

The Fisher is ranked as S2 by the ACCDC in Nova Scotia. These rankings suggest the species is both rare and sensitive to human or natural disturbance.

Fishers inhabit upland and lowland forests, including coniferous, mixed, and deciduous forests. They occur primarily in dense coniferous or mixed forests, including early successional forest with dense overhead cover. Fishers commonly use hardwood stands in summer but prefer coniferous or mixed forests in winter. They generally avoid areas with little forest cover or significant human disturbance and conversely prefer large areas of contiguous interior forest. The habitat preferences for the fisher are not present within the Study Area as the Project is located within a disturbed forest type. Portions of the Study Area have been recently harvested and the Study Area does not contain blocks of contiguous interior forest. No observation of this species was documented during field surveys.

Long Tailed Shrew

The Long-tailed Shrew is ranked as S1 in the province of Nova Scotia by the ACCDC. Long-tailed Shrew is found in mountainous, forested areas with loose talus. They will use artificial talus created by road construction and pit mines. They also use rocky damp areas with deep crevices. The habitat preferences for Long-tailed Shrews are present within the Study Area, however there were no observations of this species within the Study Area during field surveys in 2016.

Rock Vole

The ACCDC ranks the Rock Vole as S2 for the Province. Habitat for Rock Voles include fern/mossy debris near flowing water in coniferous forest, spruce clear-cuts (mainly recent cuts), grassy balds near forest and sterile-looking rocky road fills. The habitat preferences for the Rock Vole are present within the Study Area, however there were no observations of this species within the Study Area during field surveys in 2016.

5.6.4 Avian

Six (6) avian priority species, one SAR and five SOCI (see
Table 16) were identified within or surrounding the Study Area during the field evaluations. The Olive-sided Flycatcher (*Contopus cooperi*) was the SAR observed incidentally within the surrounding area of the Study Area. The Olive-sided Flycatcher is listed as Threatened under SARA, COSEWIC and NSESA. Five SOCI species were observed within, or surrounding the Study Area: Boreal Chickadee, Red-breasted Nuthatch, Ruby-crowned Kinglet, Swainson's Thrush and Yellow-bellied Flycatcher.

Table 16. SAR and SOCI observed during dedicated survey periods

Common Name	Scientific Name	SARA	COSEWIC	NSESA	NS S-Rank
Olive-sided Flycatcher	*Contopus cooperi*	T	T	T	S3B
Boreal Chickadee	*Poecile hudsonica*	-	-	-	S3
Red-breasted Nuthatch	*Sitta canadensis*				S3
Ruby-crowned Kinglet	*Regulus calendula*	-	-	-	S3S4B
Swainson's Thrush	*Catharus ustulatus*	-	-	-	S3S4B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	-	-	-	S3S4B

A SAR is a species which is legally protected under the federal Species at Risk Act (SARA) or the provincial Nova Scotia Endangered Species Act (NSESA), while a SOCI is one which is listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or one which is classified as S1 to S3 by the ACCDC.

One SAR, the Olive-sided Flycatcher, was observed and is listed as Threatened by SARA, COSEWIC and NSESA. The five other SOCI observed were listed as either S3 or S3S4B (Vulnerable) by the ACCDC. The potential for these species to be impacted by this project is evaluated below.

Olive-sided Flycatcher

One Olive-sided Flycatcher was observed incidentally during the breeding bird survey at PC3 (Figure 12) south of the Study Area along Creignish Mountain Road. Olive-sided Flycatchers build their nest in conifer trees with twigs and rootlets. They nest within the forest edge near forest clearings (natural or man-made). There are forest clearings within the Study Area that provide suitable breeding habitat for the Olive-sided Flycatcher. Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 9.2.4 and 9.3 respectively.

Boreal Chickadee

Four Boreal Chickadees were observed, three during spring migration surveys (PC7) and the other incidentally during winter wildlife surveys. The Boreal Chickadee nests in tree cavities. Suitable breeding habitat is available within the Study Area for this species. Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 9.2.4 and 9.3 respectively.

Red-breasted Nuthatch

Two Red-breasted Nuthatches were observed incidentally during the fall migration survey (>100m from PC2). Red-breasted Nuthatches live mainly in coniferous forests of spruce, fir, pine, hemlock, larch, and western red cedar. Suitable breeding habitat for this species is provided throughout the Study Area. Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 9.2.4 and 9.3 respectively.

Ruby-crowned Kinglet

Two pairs of Ruby-crowned Kinglets were observed; one pair during spring migrations (PC7) and one pair during breeding bird surveys (PC3). Ruby-crowned Kinglets build their nests high within a conifer tree. Suitable breeding habitat for this species is provided throughout the Study Area. Possible breeding evidence was observed during the breeding bird survey. Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 9.2.4 and 9.3 respectively.

Swainson's Thrush

Seven Swainson's Thrushes were observed during spring migration (n=2 at PC 1) and breeding bird surveys (n=5 and PC1 and PC6). Swainson's Thrush nest within the understory of the forest, commonly in thickets of deciduous shrubs or conifer saplings. Suitable breeding habitat for this species is provided throughout the Study Area, Possible breeding evidence was observed during the breeding bird survey.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 9.2.4 and 9.3 respectively.

Yellow-bellied Flycatcher

Seven Yellow-bellied Flycatchers were observed during the breeding bird surveys throughout the Project Area (PC1, 4, 6, and 8). Yellow-bellied Flycatchers build their nest on or near the ground. Suitable breeding habitat for this species is provided throughout the Study Area. Possible breeding evidence was observed during the breeding bird survey. Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 9.2.4 and 9.3 respectively.

5.6.5 Invertebrates

Based on data provided by the ACCDC, the 100km buffer around the Study Area contains 437 records of 48 invertebrate species. According to the ACCDC report, three SOCI invertebrates were identified within 5km from the Study Area: Black Meadowhawk (*Sympetrum danae*; S3), Elfin Skimmer (*Nannothemis bella;* S3) and the Vernal Bluet (*Enallagma vernale*; S3). No SAR invertebrates were identified by ACCDC within 20km of the Study Area.

Black Meadowhawk

Black Meadowhawk's typical habitat includes shallow lake borders, marshes and fens with abundant emergent vegetation. No habitat for the Black Meadowhawk was identified within the Study Area.

Elfin Skimmer

Elfin Skimmer's typical habitat is sphagnum bogs and sedge seepage areas at lake edges. No typical habitat for the Elfin Skimmer was identified within the Study Area.

Vernal Bluet

Vernal Bluet's typical habitat is lakes and slow streams, including boggy ones, often with fish. Slow streams are present within the Study Area, however the WCs are not considered boggy.

During field studies within the Study Area, no invertebrate species of conversation interest (SOCI) or species at risk (SAR) were identified.

5.6.6 Fish

Based on data provided by the ACCDC, the 100km buffer around the Study Area contains 85 records of 4 fish species. According the ACCDC report, the Atlantic Salmon (Gaspe-Southern Gulf of St. Lawrence population) was identified approximately 12 km from the Study Area. This reference is for the population of Atlantic Salmon in rivers that drain to the Northumberland Straight from Cape Breton (this population would not be present within the Rhodena Quarry Expansion Study Area).

The Study Area is present within the River Inhabitants Secondary Watershed. The River Inhabitants is an Atlantic Salmon (*Salmo salar*) river (Eastern Cape Breton population- COSEWIC endangered) (Atlantic Salmon Federation, accessed 2017). The Eastern Cape Breton Atlantic Salmon is found in rivers

extending from the northern tip of Cape Breton Island around the Atlantic coast to the Canso Causeway. Those rivers in the area that drain into the Bras d'Or Lakes are also included in this population group.

Atlantic Salmon spawn in fresh water, generally in the same river where they were born. Juveniles spend one to eight years in fresh water before migrating to salt water in the North Atlantic. After staying within the salt water for one to four years, adult salmon will return to fresh water to spawn. Salmon rivers or streams are generally clear and cool, with gravel, cobble and boulder river beds. (DFO, 2014)

WC1, WC2, and WC3 are first order streams located in the upper reaches of the Secondary River Inhabitants Watershed. These streams travel south and eventually drain into the River Inhabitants. WC2 provides minimal feeding and refuge habitat during times of high flow only (ephemeral in nature). WC1 and WC3 provide feeding, refuge, passage, rearing and overwintering habitat. WC1 and WC3 are both considered Type I fish habitat. Direct impacts to these Type I watercourses are not anticipated from the proposed quarry expansion. No Atlantic Salmon were observed during field surveys in 2016. No additional fish species of conversation interest (SOCI) or species at risk (SAR) were identified.

6.0 SOCIO-ECONOMIC CONDITIONS

The Project is located 10.5 km north of Port Hastings, Cape Breton, Nova Scotia, in Inverness County. Background on the area and populations of the county and nearby centres are summarized below.

6.1 Population and Demographics

Rhodena is located in Inverness County, on Cape Breton Island, Nova Scotia.

Inverness County, the 13th most populous county in Nova Scotia, had a total census population of 17,235 in 2011, approximately 1.9 per cent of the provincial population. Over the past six years, the county population has declined 4.0 per cent while the population for the province as a whole increased by 0.9 per cent. Statistics on the population and demographics of Inverness County and Nova Scotia are presented in Table 21.

Inverness County has several population centres, the largest being Port Hawkesbury near the Canso Causeway. Other population centres near the project area are Port Hood, Inverness, and Whycocomagh.

Table 21. Population and Demographics for Inverness County and Nova Scotia.

	Inverness County	Nova Scotia
Population in 2011	17,235	921,727
Population in 2006	17,947	913,462
2006-2011 Population Change (%)	-4.0	0.9
Total private dwellings (2011)	9,876	442,155
Total number of households (2011)	7,351	390,280
Population density per square km (2011)	4.5	17.4

	Inverness County	Nova Scotia
Land area (square km) (2011)	3,831.2	52,939.4
Median Age of the Population (2011)	47.3	43.7

The population of Inverness County has a median age of 47.3 years, slightly older than that of the province as a whole, which has a median age of 43.7. The population by age cohort in Inverness County is presented in Figure 1.

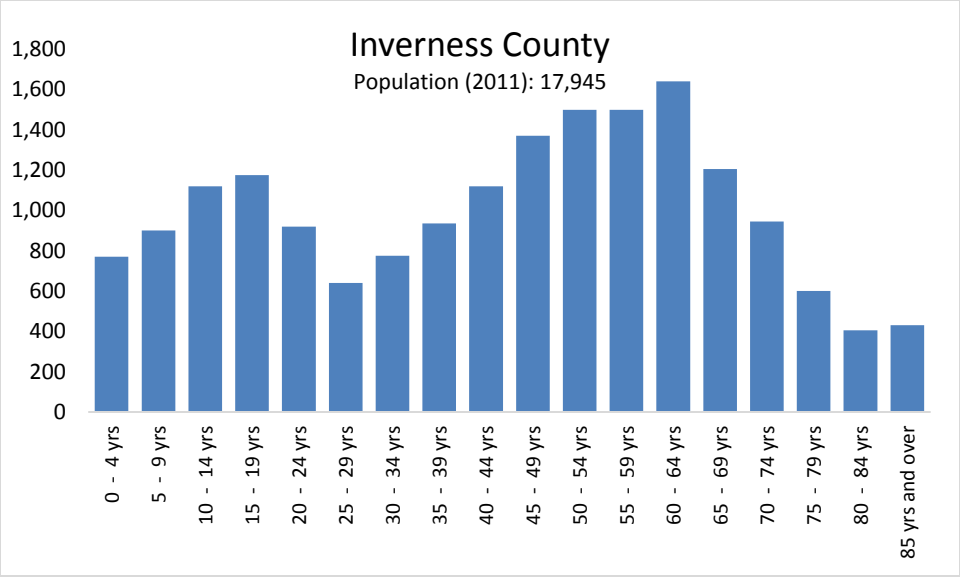

Figure 1. Population by Age Cohort, Inverness County

Source: Statistics Canada 2011 Census of Population Community Profiles

Median income in Inverness County (2011) for persons 15 years and older with income was $26,184. Employment income accounted for 63.0% of income, while 22.0% came from Government Transfers.

6.2 Health, Industry and Employment

As of April 1, 2015, Nova Scotia consolidated their health services into one Health Authority, the Nova Scotia Health Authority. The Project Area is in the Inverness, Guysborough and Antigonish Area, and not far from the Cape Breton County area. Labour Force by Industry statistics are provided for Inverness in Table 22. The Project Area is served by the Strait Richmond hospital in Port Hawkesbury, the Inverness Consolidated Memorial Hospital, and the Victoria County Memorial Hospital in Baddeck. Other facilities can be found in Sydney, Glace Bay, North Sydney, Sydney Mines, as well as facilities farther away (Neil's Harbour, Cheticamp, and in Antigonish and Guysborough Counties across the Strait of Canso). Some 3,500 staff members and 270 medical staff are employed by the health authority in regional facilities.

Table 22. Labour Force by Industry, Inverness County

Industry	Total	Male	Female
Agriculture; forestry; fishing and hunting	8,625	4,475	4,145
Mining; quarrying; and oil and gas extraction	980	825	155
Utilities	165	155	-
Construction	70	35	-
Manufacturing	610	540	70
Wholesale trade	835	705	125
Retail trade	110	80	30
Transportation and warehousing	1,135	430	710
Information and cultural industries	360	290	75
Finance and insurance	90	70	15
Real estate and rental and leasing	180	30	150
Professional; scientific and technical services	35	20	-
Management of companies and enterprises	230	145	85
Administrative and support; waste management and remediation services	-	-	-
Educational services	185	70	115
Health care and social assistance	825	175	650
Arts; entertainment and recreation	990	130	865
Accommodation and food services	170	105	65
Other services (except public administration)	705	170	535
Public administration	370	215	155

Source: Statistics Canada 2011 National Household Survey

About 52% of the experienced labour force in Cape Breton County is male. In 2011, the majority of the labour force worked in the service producing industries. Retail Trade, health care and social assistance, and manufacturing are the largest employer occupations. Accommodation and food services and other services would be included in the tourism sector, which would also be supported by the Wholesale and Retail trade industries. Nearly seventeen per cent of the labour force in the county worked in the construction and manufacturing industry combined.

The participation rate (*i.e.*, the percentage of working age population in the labour force) in 2011 for the county was 59.7%, slightly lower than the provincial average of 63.1%. The unemployment rate for Inverness County in 2011 was 15.6%, substantially higher than the provincial average of 10.0%.

6.3 Tourism and Cape Breton

Nova Scotia markets itself as a tourism destination, with a tourism industry that contributes more than $722 million to provincial GDP (2010), and with 34,400 direct and spinoff jobs. In 2013, tourism revenues were an estimated $2.34 billion for the province as a whole.

Drawing visitor revenues of $251 million in 2010, the tourism industry is important to Cape Breton, with vast wild areas, the scenic Bras d'Or lakes, and Cabot Trail that skirts the top of Cape Breton Island, where the Cape Breton Highlands National Park lies. Provincial parks in the area include Dundee, Burnt Island, Port Michaud beach, Battery, and the Isle Madame parks (*i.e.*, Lennox Passage and Pondville Beach).

The greater Cape Breton region boasts heritage sites, and provides many types of all-season tourism. The eastern part of the Island is home to Isle Madame, home to the largest number of lighthouses in Canada. Golf destinations and premiere accommodations are popular destinations for tourists. Historic and cultural destinations such as the Alexander Graham Bell museum in Baddeck, the Fortress of Louisbourg and the Gaelic College of Celtic arts and crafts are important to the rich cultural history of the area. The region is popular for paddling, fishing and hiking.

6.4 Recreation

Land use within the Study Area is dominated by historical and recent timber harvesting and commercial activity (active quarry) in the eastern extent of the Study Area. There are no public trails or recreational lands within the Study Area.

The closest Provincial Park to the Study Area is Dundee Provincial Park located near Dundee, approximately 23km southeast of the Study Area. This Provincial Park provides a boat launch for the Bras d'Or Lake and provides some beach access.

St. Peter's Canal National Historic site is located 40km east of the Study Area, in St. Peter's, NS. This site is a historic waterway, which connects Bras d'Or Lake to the Atlantic Ocean.

7.0 ARCHAEOLOGICAL RESOURCES

Two phases of the archaeological resource impact assessment were completed for the Rhodena Quarry Expansion Project. The first, Phase I, was a historical assessment of the potential for archaeological resources to be present inside the Study Area. The second, Phase II, was the field reconnaissance program within the Study Area. The results described below are taken directly from the assessment completed by Davis McIntyre & Associates (Appendix F).

7.1 Phase I

The Maritime Archaeological Resource Inventory, managed by the Nova Scotia Culture and Heritage Development Division, was consulted in August 2016 to determine if known archaeological resources exist near the Study Area. No archaeological sites were identified within 10km of the Study Area through this process.

Geological Survey of Canada map from 1884 and historic aerial photography were also consulted. The Geological Survey of Canada map shows two structures within the southwest of the Study Area and aerial imagery from 1953 shows a small cluster of buildings in the same area as the two structures.

7.2 Phase II

An archaeological field reconnaissance was conducted in August 2016 within the Study Area. The assessment was directed by Laura de Boer of Davis MacIntyre & Associates Limited.

During the field reconnaissance, a probable nineteenth and twentieth century farmstead was identified within the southwest extent of the Study Area (Figure 13, Appendix A,). Stone piles and two stone foundations without cellars and a narrow stone-lined well were identified at this location. It is recommended that a 20m buffer be established around the archaeological site. To ensure that the buffer is maintained, it is recommended that the 20m buffer is flagged.

The 2016 report can be found in Appendix F.

8.0 PUBLIC ENGAGMENT SUMMARY

8.1 Public Consultation

Zutphen believes that open, honest and transparent relationships are essential to their success. Zutphen also believes that communities have a right to know about its activities in those communities.

Community involvement specific to the Rhodena Quarry Expansion Project was initiated in March 2017.

In advance of the Open House completed for the Rhodena Quarry Expansion Project, 250 flyers were distributed via Canada Post to residents within the postal code area B9A, which includes the Rhodena, Port Hastings, Queensville and Creignish Rear communities (Appendix G). These flyers announced the Open House date and location, as well as opened the line of communication directly with the Zutphen Resources Inc. project team. If people had questions, comments or concerns about the Project, the flyer provided contact information for the local Zutphen representative. Flyers were also placed in local stores in the surrounding communities, including:

- Aulds Cove: Petro Canada/Tim Hortons and Irving Big Stop;
- Port Hastings: Skye Lodge, Post Office, Workmans and Canadian Tire Gas Bar; and
- Port Hawkesbury: Sobeys and Civic Center

A Notice providing the same information was advertised in the Cape Breton Post on March 17, 2017 (Appendix G).

A Project Description letters, along with an invitation to the open house were sent to local representatives, including:

- Allan MacMaster, MLA;
- Chief Rod Googoo, Waycobah First Nation;
- David Mitchell, NS Office of Aboriginal Affairs:
- Melissa Nevin, Kwilmu’kw Maw-klusuaqn (KMKNO)
- John Dowling, Councillor - District 6,
- Rodger Cuzner, MP; and
- Twila Gaudet, KMKNO.

On March 21, 2017, Zutphen hosted an open house at the Skye Lodge in Port Hastings (5-8 pm). This provided residents and other interested parties an opportunity to view and discuss with Zutphen representatives (2 in attendance) information on the Project. The Project was introduced to the community through a series of poster boards and one consultant from McCallum Environmental Ltd. (Meghan Milloy, Project Manager) was present to describe the Project, the EA process, and proposed and expected timelines for construction of the Project.

- Six people attended the Open House (according to signatures on the sign in sheet provided at the front door);
- Attendees were encouraged to fill out comment cards. Three comment cards were received.

The Sign in Sheet and Comment Cards are provided in Appendix G.

During the Open House event, Zutphen Resources Inc. and consultants discussed the Project with local residents and members of the public. The following concerns were relayed to the Project team regarding the Project:

- Concern was noted about the current condition of the bridge on Rhodena Road, north of the existing quarry. Leonard van Zutphen indicated this bridge was owned and operated by Nova Scotia Transportation and Infrastructure Renewal (NSTIR).
- Concern was noted about the condition of MacMaster Brook and siltation observed coming from the existing quarry across Rhodena Road and into the brook. Residents noted that silt was present along the eastern side of Rhodena Road, along the western banks of MacMaster Brook. As discussed in Section 2.4.3, the Proponent is committed to resolving this issue by constructing a settling pond in southeastern portions of the property, and diverting surface water run-off sourced from the quarry area into it via the construction of a drainage ditch. Water from the settling pond will be diverted into the roadside ditch alongside Rhodena Road, and will drain beneath the road connecting with MacMaster Brook. Material that has accumulated along the banks of MacMaster Brook as a result of previous stormwater run-off consists primarily of gravel and small stone. It was determined during a recent evaluation of the watercourse that removing this material would lead to further siltation, and negatively impact the integrity of the existing watercourse. For these reasons, this material will remain in place. Additional settling ponds will be constructed within the quarry area to ensure water quality discharging from the site is does not contain silt or promote the transportation of other materials from the quarry area, to downstream aquatic receptors.

8.2 Mi'kmaq Consultation & Traditional Use

Project details and an invite to the March 21, 2017 Open House were submitted to the Kwilmu'kw Maw-klusuaqn (KMKNO) Negotiation Office, Waycobah First Nation, and the NS Office of Aboriginal Affairs on March 15, 2017. To date, no response has been received and no representatives from Waycobah First Nation or the KNKMO were present at the open house.

9.0 DISCUSSION OF IMPACTS

9.1 Valued Ecosystem Component Selection

The scope, methodology and baseline environmental conditions for the Rhodena Quarry Expansion Project have been described in detail in Sections 3 through 8 in this registration document. Each potential Valued Ecosystem Component (VEC), as identified and defined in the NSE *Guide to Preparing an Environmental Assessment Registration Document for Pit and Quarry Developments in Nova Scotia*, revised September 2009, has been described and baseline environmental work has been completed to evaluate each VEC based on the site specific conditions relating to the Rhodena Quarry.

Based on the environmental baseline work completed for each VEC over the course of a twelve-month period, and the expertise of the various members of the EA Project Team, evaluation of each VEC has been completed to determine which VEC could have potential residual effects once planned mitigation has been completed. This evaluation is described in Table 17**Error! Reference source not found.** VECs w ith potential project interactions and possible identified potential residual effects are carried forward (in Section 9.2) for further discussion.

Table 17. Valued Ecosystem Component (VEC) Evaluation

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 9.2)	Applicable Section of Report
Atmospheric Environment	**Weather and Climate** **Air Quality**	Potential impacts to localized air quality conditions: • Continued current usage of quarry equipment which will result in continued air emissions from equipment and vehicles during construction, operation and decommissioning; and, • Continued generation of dust during construction and operation activities.	Project-related air emissions and dust are expected to be minimal and localized in nature, and will mimic current levels produced at the Rhodena Quarry. Dust emission and particulate matter will be monitored at the property boundary of the quarry at the request of NSE.	No	Description of VEC Section 5.2
Geophysical Environment	**Physiography and Topography** **Surficial Geology** **Bedrock Geology** **Hydrogeology and Groundwater**	Potential impacts include disturbance of surficial soils and bedrock; • Potential for Acid Rock Drainage (ARD); and, • Damage from blasting activities to potable groundwater supplies. The closest residence (and the only within 2 km of the quarry footprint) is 1.72 km from the closest corner of the Rhodena Quarry Expansion Study Area.	Blasting will take place 1-2 times per year, consistent with current blasting requirements at the Rhodena Quarry. Blasting will be completed in accordance with the Pit and Quarry Guidelines. The likelihood of ARD occurring on site is considered low as bedrock on site is not acid slates and the material is net acid consuming. Project-related effects to the geophysical environment are possible through construction and operational phases of the project. Due to the potential residual effects of quarry activities on groundwater once mitigation	Yes	Description of VEC Section 5.3 Effects Assessment 9.2.1 and 9.2.2 Mitigation Section 9.3

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 9.2)	Applicable Section of Report
Geophysical Environment			efforts are employed, this VEC has been considered for further assessment.		
Terrestrial Environment	**Vegetation**	Potential terrestrial impacts to flora and fauna. Please note, species of conservation interest and species at risk and birds have been considered as separate VECs for the purpose of this assessment. Impacts to flora and fauna include: • loss of vegetation due to clearing activities to support quarry expansion; • Habitat fragmentation; • Introduction of invasive species; • Sensory disturbance to fauna; and • Mortality of fauna species due to clearing and construction activities.	Cleared areas will be limited to areas needed for quarry expansion and will occur when needed, in accordance with the proposed quarry development plan (20 years). The expansion size (17 hectares) is small and located in a sparsely populated and very rural/undisturbed part of Cape Breton. Therefore, the effects associated with potential habitat fragmentation are considered to be minimal. Mortality of fauna is expected to be minimal due to the small overall size of the project and the fact that a current quarry is operating at this location. Sensory disturbance related to the expansion and operational phases of the Project are possible. However, quarry activities have been on-going at this location since the early 1990s. Fauna with sensitivities would likely re-locate and/or avoid the area to reduce sensory disturbance.	Yes	Description of VEC Section 5.4.2, 5.4.2, and 5.4.3 Effects Assessment 9.2.3 Mitigation Section 9.3
	Herpetofaunal species				
	Mammals				

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 9.2)	Applicable Section of Report
Terrestrial Environment	**Birds (Avifauna)**	Potential concerns associated with birds include: • Habitat alteration; and, • Sensory disturbance. Potential effects are dependant on many variables such as: • Habitat present; • Migration pathways and bird community present; and • Topography	Due to the potential residual effects on birds once mitigation efforts are employed, this VEC has been considered for further assessment. Detailed effects and mitigation measures are discussed in Section 9.2.	Yes	Description of VEC Section 5.4.4 Effects Assessment 9.2.4 Mitigation Section 9.3
	Wetlands	Potential concerns associated with wetlands include: • Direct impact of quarry expansion and wetland habitat; and, • Potential indirect impact of wetland habitat from quarry expansion, or impacts to surface water systems that indirectly could affect wetland habitat.	Wetland habitat has been delineated and a 30-meter upland buffer has been identified across the Study Area. However, in order to expand the Rhodena Quarry, wetland habitat will be lost. Due to the potential residual effects on wetlands once mitigation efforts are employed, this VEC has been considered for further assessment. A provincial approval to alter wetland habitat will be obtained by NSE prior to alteration of wetland habitat.	Yes	Description of VEC Section 5.5.1 Effects Assessment 9.2.6 Mitigation Section 9.3

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 9.2)	Applicable Section of Report
Terrestrial Environment	**Species of Conservation Interest (SOCI) and Species at Risk (SAR)**	One fauna species SAR (Canada Lynx) and two fauna SOCI (Long-tailed Shrew and Rock Vole) has the potential to be found within or immediately surrounding the Study Area. No SAR/SOCI vegetation was identified during baseline evaluation. No bat hibernacula were identified within the Study Area. The Olive-sided Flycatcher (SAR) was observed incidentally during a breeding bird point count survey. Five SOCI birds were also identified during baseline evaluations. Potential concerns these species include: • Sensory disturbance resulting in area avoidance or behaviour changes; • Potential direct mortality during quarry expansion; and, • Alteration or loss of habitat/habitat fragmentation.	Due to the potential residual effects of quarry expansion on SAR/SOCI once mitigation efforts are employed, this VEC has been considered for further assessment. Detailed effects and mitigation measures are discussed in Section 9.2.	Yes	Description of VEC Section 5.6 Effects Assessment 9.2.5 Mitigation Section 9.3

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 9.2)	Applicable Section of Report
Freshwater Environment	**Watercourses** **Fish Habitat**	No areas of open water were identified within the Study Area during field surveys. Three watercourses were identified in the Study Area, two of which are considered fish bearing. Six wetlands were identified within the Study Area, none of which support fish habitat. Watercourse 2 (ephemeral first order watercourse) will be subject to alteration as a result of the Project expansion. Alteration of this watercourse habitat is not expected to trigger a serious harm to fish threshold through Fisheries and Oceans Canada (DFO) due to its ephemeral nature and limited fish habitat quality (no spawning, overwinter or rearing habitat present within the reaches of this watercourse within the Study Area).	Due to the potential residual effects of quarry expansion on Watercourse 2 this VEC has been considered for further assessment. Detailed effects and mitigation measures are discussed in Section 9.2.	Yes	Description of VEC Section 5.5.2 Effects Assessment 9.2.7 Mitigation Section 9.3
Socio-Economic Environment	**Land Use/Property Values** **Recreation**	The Rhodena Quarry Expansion Project is a small project proposed on a privately owned single parcel of land in a sparsely developed area. Therefore, impacts to the tourism in the surrounding community are expected to be low.	Zutphen Equipment Inc. has met provincial separation distances between the quarry (and its proposed expansion) and surrounding land uses (watercourses, wetlands, property boundary and off-site structures).	No	Description of VEC Section 6.1-6.4

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 9.2)	Applicable Section of Report
	Tourism	The Study Area lands are privately owned and do not support public recreation areas. The Project will continue to support the local economy and local jobs within Cape Breton County.	Zutphen will employ, whenever possible, local contractors to complete Project tasks.		
	Local Economy				

As indicated in Table 17, the following seven VECs have been carried forward to the detailed effects assessment:

- Surficial and bedrock geology;
- Groundwater;
- Terrestrial Environment (Fauna/Flora);
- Terrestrial Environment (Birds);
- SOCI/SAR;
- Wetlands; and,
- Watercourses.

9.2 Effects Assessment

Effects assessment involves the following steps:

1. Identification of potential project interactions on selected VEC;
2. Identification of potential effects;
3. Description of recommended mitigation;
4. Identification of expected residual effects (post mitigation);
5. Evaluation of significance of residual effects; and,
6. Description of recommended follow up and monitoring.

Project interactions and potential effects for each identified VEC are discussed and evaluated in the following sections to determine specific mitigation requirements, expected significance of residual effects, and any monitoring and follow up requirements.

9.2.1 Surficial and Bedrock Geology

Table 18 provides a summary of the potential project interactions and environmental effects resulting from the Project-VEC interactions with soils, sediment and bedrock. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

Most potential interactions with soil and sediment associated with the construction phase will be limited, based on the current level of disturbance (e.g. existing quarry and previous timber harvesting) and the small size of the overall project (17 hectare proposed expansion area). However, some interactions with surficial geology (soils and sediment) will be present during construction, and interactions with soils, sediment and bedrock are expected through the operational phase of the project during quarrying activities.

Table 18: Project- VEC Interactions by Project Phase on Surficial and Bedrock Geology

	Acid Rock Drainage	Siltation to surface waters/wetlands
Construction		
Site preparation/clearing		X
Grubbing		X
Watercourse and Wetland Alteration		X
Removal of overburden	X	X
Waste management		
Expansion of storage areas for grubbings and overburden soils	X	X
Operation and Maintenance		
Rock Blasting	X	
Rock Transfer		
Sorting and Crushing	X	X
Rock Washing	X	X
Management of surface water	X	X
Environmental Monitoring of Surface Water Discharges		X
Trucking/Transport of product		
Decommissioning		
Re-grading of rock face	X	X
Reclamation/re-vegetation		X
Accidents, Malfunctions and Unplanned Events		
Erosion and sediment control failure	X	X
Fuel spill from machinery/trucks		X
Fire	X	X

Clearing and grubbing for site preparation will remove vegetation and overburden soils to access rock for quarry activities. Wetlands and Watercourse 2 (ephemeral stream) will be altered when required (as per the proposed development plan) to support quarry development. Alteration will involve organic material removal from these habitats and surface water will be diverted around the active quarry area. Surface water draining from Watercourse 2 will be engineered to continue to drain south to join into downstream receiving environments (Lamey Brook). Monitoring of surface water discharge leaving the property boundaries and prior to discharge into a watercourse will be completed to ensure unacceptable levels of silt are not deposited into the surrounding aquatic environment.

During construction and operations (active quarrying), regular testing of rock will be conducted for acid generating potential at a rate to be determined by NSE.

There are no expected significant residual environmental effects on soil, sediment and bedrock resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation and monitoring has been implemented and completed.

9.2.2 Groundwater

Table 19 provides a summary of the potential project interactions and environmental effects resulting from the Project-VEC interactions with groundwater. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

There is no expected project interaction with groundwater during the construction phase. However, interactions with groundwater are possible through the operational phase of the project during quarrying activities.

Table 19. Project- VEC Interactions by Project Phase on Groundwater

Project Activities and Physical Works	Potential Project Interactions and Environmental Effect	
	Interaction with groundwater	**Adjacent Potable water resources**
Construction		
Site preparation/clearing		
Grubbing		
Watercourse and Wetland Alteration	X	
Removal of overburden		
Waste management		
Expansion of storage areas for grubbings and overburden soils		
Operation and Maintenance		
Rock Blasting	X	X
Rock Transfer		
Sorting and Crushing		
Rock Washing		
Management of surface water		
Environmental Monitoring of Surface Water Discharges		
Trucking/Transport of product		
Decommissioning		
Re-grading of rock face		
Reclamation/re-vegetation		
Accidents, Malfunctions and Unplanned Events		
Erosion and sediment control failure		
Fuel spill from machinery/trucks	X	
Fire		

The key sensitive receptor is the closest residential receptor located 1.72km southeast of the Rhodena Quarry Expansion Study Area closest boundary. Impacts to groundwater quantity and quality are not expected to affect this residence. Quarry activities have been on-going at the Rhodena location for 20 years, without any concerns raised from this resident. Expansion of the quarry is proposed in a westerly

direction, away from this nearest resident. There are no other residential receptors within 2 kms of this quarry.

There is no evidence that current quarrying activities have interacted with the groundwater table (no observed seepages through the exposed rock face of build up of water on the quarry floor), and the proposed expansion is expected to maintain this trend.

There are no expected significant residual environmental effects on groundwater resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation and monitoring has been implemented and completed.

9.2.3 Terrestrial Environment (Fauna/Flora)

Table 20 provides a summary of the potential project interactions and environmental effects resulting from the Project-VEC interactions with flora and fauna. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

The highest likelihood of project interactions with flora and fauna will occur during the construction/expansion phase during clearing, grubbing, and removal of overburden. On-going interactions with fauna during operations of the quarry are possible, although unlikely, given the general expectation of avoidance of the area by fauna species who reside in close proximity to the quarry. Accidents like fuel oil spills or fire could also affect fauna and flora adjacent to the quarry.

Table 20. Project- VEC Interactions by Project Phase on Flora and Fauna

Project Activities and Physical Works	Potential Project Interactions and Environmental Effect		
	Direct Mortality	**Habitat Alteration**	**Sensory Disturbance**
Construction			
Site preparation/clearing	X	X	X
Grubbing	X	X	X
Watercourse and Wetland Alteration	X	X	X
Removal of overburden		X	X
Waste management			X
Expansion of storage areas for grubbings and overburden soils	X	X	X
Operation and Maintenance			
Rock Blasting			X
Rock Transfer			X
Sorting and Crushing			X
Rock Washing			X

Project Activities and Physical Works	Potential Project Interactions and Environmental Effect		
	Direct Mortality	**Habitat Alteration**	**Sensory Disturbance**
Management of surface water	X	X	
Environmental Monitoring of Surface Water Discharges	X	X	
Trucking/Transport of product			X
Decommissioning			
Re-grading of rock face			X
Reclamation/re-vegetation		X	X
Accidents, Malfunctions and Unplanned Events			
Erosion and sediment control failure	X	X	
Fuel spill from machinery/trucks	X	X	
Fire	X	X	X

Wildlife habitat directly within the footprint of the expansion area will be eliminated. Clearing and grubbing for site preparation will remove vegetation, reducing the quantity of terrestrial habitat, and will affect the quality of already marginal habitat. The Project will result in an increase in edge area, which may act as a barrier for some animal movements, and could increase predation on birds and small mammals, but also has potential benefits related to habitat creation (edge nesting birds), suitable bat habitat, and food availability (near edge and ditches).

Very little additional clearing is necessary for this Project, as the majority of the expansion area has recently been harvested.

Wildlife species that currently use the habitat within the direct area of the quarry expansion will be permanently displaced during the initial stages of construction. This could potentially cause direct mortality of species that are unable to relocate to alternate suitable habitat. During construction, fauna may be affected by disturbance and noise related to construction activities (*i.e.*, blasting, and forest removal). Fauna affected may temporarily move out of the range of disturbance throughout the construction period. Similar, and more intact habitat (due to recent harvesting within the Study Area) to that identified within the Project footprint is present in surrounding lands. This provides an alternate habitat resource for all wildlife during the construction phase. The additional area required for clearing is expected to be minimal. As there is no unique habitat within the Study Area and the area has been historically harvested, displaced fauna should be able, and are expected, to move to similar habitat patches adjacent to the Study Area.

Change in wildlife habitat quality includes the potential fragmentation of habitat during construction. Habitat fragmentation can adversely affect local populations of wildlife living adjacent to the Study Area. This would be a result of specific species not willing to leave their habitat which is currently provided by contiguous forest cover. As such, the species won't enter cleared areas, which results in a reduction in available habitat to a specific species. Habitat fragmentation may adversely affect local populations of

fauna living adjacent to the current quarry. However, the size of this project (expansion area 17 hectares) and the relatively undeveloped surrounding landscape suggests that the significance of this impact would be low.

Wildlife, including birds may be displaced from areas adjacent to the Project as a result of Construction-Operations-related noise. This potential environmental effect would be prolonged (over 20 years).

The most likely potential effect of the Project on flora is direct mortality resulting from construction activities. No species of conservation interest or species at risk (flora) were identified within the proposed expansion area. Furthermore, the vegetation identified within the Study Area was determined to be locally and regionally common. Fauna species, including birds, are expected to avoid the area during construction and operations. The most likely effect of the Project during the operational phase on fauna species is sensory disturbance from blasting, crushing activities and truck traffic.

Decommissioning of the quarry will result in a positive effect on the Project, involving the reclamation of land, regarding of the quarry face, and re-establishment of vegetation across the Study Area.

There are residual environmental effects on flora (loss of 17 hectares of habitat) resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation and monitoring has been implemented and completed. However, these residual environmental effects have not been determined to be significant. There are no residual environmental effects on fauna expected from the proposed expansion of the Rhodena Quarry once all appropriate mitigation and monitoring has been implemented and completed.

9.2.4 Terrestrial Environment (Birds)

Table 21 provides a summary of the potential environmental effects resulting from the Project-VEC interactions with birds. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

The highest likelihood of project interactions with birds will occur during the construction/expansion phase during additional clearing, grubbing, and removal of overburden. On-going interactions with birds during operations of the quarry are possible (especially sensory disturbance), although unlikely, given the general expectation of avoidance of the area by fauna species who reside in close proximity to the quarry. Accidents like fuel oil spills or fire could also affect birds and bird habitat adjacent to the quarry.

Table 21. Project- VEC Interactions by Project Phase on Birds

Project Activities and Physical Works	Potential Project Interactions and Environmental Effect		
	Direct Mortality	**Habitat Alteration**	**Sensory Disturbance**
Construction			
Site preparation/clearing	X	X	X
Grubbing	X	X	X
Watercourse and Wetland Alteration	X	X	X
Removal of overburden		X	X
Waste management			X
Expansion of storage areas for grubbings and overburden soils	X	X	X
Operation and Maintenance			
Rock Blasting			X
Rock Transfer			X
Sorting and Crushing			X
Rock Washing			X
Management of surface water		X	
Environmental Monitoring of Surface Water Discharges		X	
Trucking/Transport of product			X
Decommissioning			
Re-grading of rock face		X	X
Reclamation/re-vegetation		X	
Accidents, Malfunctions and Unplanned Events			
Erosion and sediment control failure	X	X	
Fuel spill from machinery/trucks	X	X	
Fire	X	X	X

Bird habitat directly within the footprint of the expansion area will be eliminated. Clearing and grubbing for site preparation will remove vegetation, reducing the quantity and quality of terrestrial habitat for birds, and will affect the quality of already marginal habitat. The Project will result in an increase in edge area, which may increase predation on birds, but also has potential benefits related to habitat creation (edge nesting birds) and food availability (near edge and ditches).

Very little additional clearing is necessary for this Project, as the majority of the expansion area has recently been harvested.

Bird species that currently use the habitat within the direct area of the quarry expansion will be displaced during the initial stages of construction. This could potentially cause direct mortality of species if individuals are unable to relocate to alternate suitable habitat. During construction, birds may be affected by disturbance and noise related to construction activities (*i.e.*, blasting, and vegetation removal). Birds are expected to temporarily move out of the range of disturbance throughout the construction period. Similar, and more intact habitat (due to recent harvesting within the Study Area) to that identified within

the Project footprint is present in surrounding lands. This provides an alternate habitat resource for all wildlife including birds during the construction phase. The additional area required for clearing is expected to be minimal. As there is no unique habitat within the Study Area and the area has been historically harvested, displaced birds should be able, and are expected, to move to similar habitat patches adjacent to the Study Area.

Construction, in particular site preparation, during the breeding season for birds has the potential to cause direct mortality, abandonment of nests, the destruction of nest contents, which could include species designated as SAR or SOCI. If adjacent suitable habitat is not available, birds that have been displaced will not likely nest until nearby habitat becomes available, as most birds return to the same general area from year to year. This may result in a higher non-breeding population. The construction phase of the Project is planned to take place outside of the nesting season for most birds (May-August).

The environmental effects of clearing and grubbing are most severe when these activities are conducted during the period when most bird species are breeding (May to end of August). Clearing and grubbing at this time could result in the direct mortality of eggs and unfledged nestlings. The killing of birds or the destruction of their nests, eggs, or young is an offence under the Migratory Birds Convention Act.

Change in wildlife habitat quality includes the potential fragmentation of habitat during construction. Habitat fragmentation can adversely affect local populations of birds living adjacent to the Study Area. This would be a result of specific species not willing to leave their habitat, which is currently provided by remaining contiguous forest cover. As such, the species won't enter cleared areas, which results in a reduction in available habitat to a specific species. Habitat fragmentation may adversely affect local populations of birds living adjacent to the current quarry. However, the size of this project (expansion area 17 hectares) and the relatively undeveloped surrounding landscape suggests that the significance of this impact would be low.

Wildlife, including birds may be displaced from areas adjacent to the Project as a result of Construction-Operations-related noise. This potential environmental effect would be prolonged (over 20 years).

The most likely potential effect of the Project on birds is habitat alteration and sensory disturbance resulting from construction and operational activities. Six bird species of conservation concern were identified during baseline surveys within the Rhodena Quarry Expansion Study Area, including one observation of the Olive-sided Flycatcher, a species at risk (Endangered – SARA, NSESA). Birds are expected to avoid the area during construction and operations. The most likely effect of the Project during operations on bird species is sensory disturbance from blasting, crushing activities and truck traffic.

Decommissioning of the quarry will result in a positive effect on the Project, involving the reclamation of land, regarding of the quarry face, and re-establishment of vegetation and habitat for birds across the Study Area.

Erosion and sediment control measures could fail during precipitation events and release sediment, potentially affecting wetland or stream habitat specifically used by birds. This type of effect is temporary and short-term, and is highly localized to the affected area. There were no areas of wetland identified within the Study Area that provide suitable bird habitat (e.g. mudflats, shallow open water) so this effect is rated low and not significant.

Fire events during any phase of the Project could remove significant amounts of vegetation, thereby having an environmental effect on habitat for birds, and potentially result in their displacement or mortality, particularly during breeding season when the young are less mobile.

There are no expected significant residual environmental effects on birds resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation and monitoring has been implemented and completed.

9.2.5 Species of Conservation Interest and Species at Risk

With the exception of bird species discussed separately in this report, as discussed in Section 9.1, three fauna SOCI or SAR may be present within or near the Study Area (none were documented within the Study Area but are presumed to potentially be present within the Study Area). None of these species were observed within the Study Area. No flora SAR or SOCI were documented within the Study Area;

- Canada Lynx (SAR)
- Long-tailed Shrew (SOCI) and
- Rock Vole (SOCI)

Potential effects on the above-mentioned species from the Rhodena Quarry Expansion Project include:

- Sensory disturbance resulting in area avoidance or behaviour changes; and,
- Alteration or loss of habitat/habitat fragmentation.

Table 22 provides a summary of the potential environmental effects resulting from the Project-VEC interactions on all three species. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

The majority of potential interactions associated with the construction phase are limited due to the historical disturbances that have already occurred (i.e. quarry, existing access road and tree harvesting), and the small size of the overall Project.

Table 22. Project- VEC Interactions by Project Phase on potential SAR/SOCI

Project Activities and Physical Works	Habitat Alteration	Sensory Disturbance
Construction		
Site preparation/clearing	X	X
Grubbing	X	X
Watercourse and Wetland Alteration	X	X
Removal of overburden	X	X
Waste management		
Expansion of storage areas for grubbings and overburden soils	X	X
Operation and Maintenance		
Rock Blasting		X
Rock Transfer		X
Sorting and Crushing		X
Rock Washing		X
Management of surface water	X	
Environmental Monitoring of Surface Water Discharges	X	
Trucking/Transport of product		X
Decommissioning		
Re-grading of rock face	X	X
Reclamation/re-vegetation	X	
Accidents, Malfunctions and Unplanned Events		
Erosion and sediment control failure		X
Fuel spill from machinery/trucks		X
Fire		X

Project construction and operation is not expected to significantly impact the SOCI and SAR that may be present in the area. The expansion area is limited to 17 hectares. If present, the species may be displaced due to noise and activity. SAR/SOCI, if present, are expected to move out of the range of disturbance throughout the construction period. Similar, and more intact habitat (due to recent harvesting within the Study Area) to that identified within the Project footprint is present in surrounding lands. This provides an alternate habitat resource for all wildlife including potential SAR/SOCI during the construction and operational phase of this Project.

Decommissioning of will result in a positive effect on the Project, involving the re-grading of the rock face, reclamation of land and vegetation across the Study Area, and reduction in overall habitat fragmentation associated with the Project.

Fire events, fuel losses, or erosion/sediment control failure during any phase of the Project could remove/destroy/flood significant amounts of vegetation, thereby having an environmental effect on habitat for wildlife including SAR and SOCI and potentially result in their displacement or mortality.

There are no expected significant residual environmental effects on SAR and SOCI resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation and monitoring has been implemented and completed.

9.2.6 Wetlands

Table 23 provides a summary of the potential project interactions and environmental effects resulting from the Project-VEC interactions with wetlands. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

The highest likelihood of project interactions with wetlands will occur during the construction/expansion phase during clearing, grubbing, and removal of overburden. On-going interactions with adjacent wetland habitat surrounding the quarry during operations of the quarry are possible if surface water discharge is not well managed and erosion and sediment control measures are not well implemented, or during an accident, malfunction or unplanned event.

Table 23. Project- VEC Interactions by Project Phase on Wetlands

Project Activities and Physical Works	Potential Project Interactions and Environmental Effect		
	Loss of groundwater recharge	**Change in water quantity**	**Change in water quality**
Construction			
Site preparation/clearing			
Grubbing	X	X	X
Watercourse and Wetland Alteration	X	X	X
Removal of overburden			
Waste management			
Expansion of storage areas for grubbings and overburden soils			
Operation and Maintenance			
Rock Blasting		X	
Rock Transfer			
Sorting and Crushing			
Rock Washing			X
Management of surface water		X	X
Environmental Monitoring of Surface Water Discharges		X	X
Trucking/Transport of product			
Decommissioning			
Re-grading of rock face			
Reclamation/re-vegetation			
Accidents, Malfunctions and Unplanned Events			
Erosion and sediment control failure		X	X
Fuel spill from machinery/trucks		X	X
Fire		X	X

Quarry expansion is expected to directly impact Wetland 2 through Wetland 6, as identified during baseline surveys within the Study Area. Wetlands 5 and 6 are expected to require alteration permitting within the first six months of expansion to allow for construction and expansion to commence. Wetland 2 will require alteration permitting within five years to allow for continued quarry expansion. Wetlands 3 and 4, along with the ephemeral Watercourse 2, will require alteration permitting after ten years of quarry expansion. Zutphen intends to avoid Wetland 1. Monitoring within this wetland to ensure that indirect impacts from quarrying activities do not occur may be necessary depending on the extent of quarry expansion west of Wetlands 3 and 4.

Wetlands alteration requires a provincial permit through NSE regional offices. Wetland alteration permit application(s) will be submitted to NSE and approval granted prior to commencement of any wetland alteration to support quarry expansion. Compensation to offset lost wetland habitat will be provided as part of the permit process.

In-direct impacts to wetlands are possible during quarry expansion, especially from accidents, erosion and sediment control failure or unplanned events. Management of surface water and monitoring for siltation at discharge points from the active quarry areas will be required to ensure wetlands are not indirectly impacted prior to alteration approval being in place. Erosion and sediment control systems will be monitored regularly to ensure they are in working order and effectively managing site run off.

There are expected residual environmental effects on wetlands (loss of five wetlands from the local area) resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation (and compensation) and monitoring has been implemented and completed. However, these residual environmental effects have been determined to be not significant.

9.2.7 Watercourses

Table 24 provides a summary of the potential project interactions and environmental effects resulting from the Project-VEC interactions with watercourses. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions.

The highest likelihood of project interactions with watercourses will occur during the construction/expansion phase during clearing, grubbing, and removal of overburden. On-going interactions with adjacent watercourse habitat surrounding the quarry during operations of the quarry are possible if surface water discharge is not well managed and erosion and sediment control measures are not well implemented, or during an accident, malfunction or unplanned event.

Table 24. Project- VEC Interactions by Project Phase on Watercourses

Project Activities and Physical Works	Potential Project Interactions and Environmental Effect	
	Change in water quantity	Change in water quality
Construction		
Site preparation/clearing		
Grubbing	X	X
Watercourse and Wetland Alteration	X	X
Removal of overburden		
Waste management		
Expansion of storage areas for grubbings and overburden soils		
Operation and Maintenance		
Rock Blasting	X	
Rock Transfer		
Sorting and Crushing		
Rock Washing		X
Management of surface water	X	X
Environmental Monitoring of Surface Water Discharges	X	X
Trucking/Transport of product		
Decommissioning		
Re-grading of rock face		
Reclamation/re-vegetation		
Accidents, Malfunctions and Unplanned Events		
Erosion and sediment control failure	X	X
Fuel spill from machinery/trucks	X	X
Fire	X	X

Quarry expansion is expected to directly impact the upper reaches of Watercourse 2 (~140m in length) as identified during baseline surveys within the Study Area. Water flow direction will be maintained post alteration to ensure the viability of lower reaches of WC2 remain. Zutphen expects to be within close proximity of Watercourse 2 after ten years of quarry expansion.

Through field surveys, an unmapped watercourse (Watercourse 2) was identified within the western portion of the Study Area. The watercourse is a first order watercourse that initiates as an outlet from Wetland 3 and flows into Wetland 4. No defined watercourse channel exists within Wetland 4. The section of watercourse between Wetland 3 and 4, approximately 25m in length, was determined to be ephemeral and has limited connectivity for fish resources. The section of Watercourse 2 from Wetland 4 to the southern boundary of the Study Area (~115m) is also ephemeral (intermittent). The watercourse joins with Watercourse 1 south of the Study Area and drains into Lamey Brook.

Watercourse 2 has low potential and low quality confirmed fish habitat (Type IV). No spawning, overwintering or rearing habitat is present within the reaches of this watercourse in the Study Area. No fish were observed within the watercourse and the two associated wetlands do not support habitat for fish.

Zutphen intends to avoid Watercourse 1 and Watercourse 3 (MacMaster Brook). These watercourses were included within the Study Area in order to allow baseline collection of watercourse characteristics and surface water samples. Monitoring within Watercourse 1 to ensure that indirect impacts from quarrying activities do not occur may be necessary depending on the extent of quarry expansion west of Wetlands 3 and 4. Watercourse 3 (MacMaster Brook) could potentially be affected by quarry activities especially during an accidental release of substance or an erosion and sediment control failure.

Watercourse alteration requires a provincial permit through NSE regional offices. A watercourse alteration permit application will be submitted to NSE and approval granted prior to commencement of alteration to Watercourse 2 to support quarry expansion.

In-direct impacts to watercourses are possible during quarry expansion, especially from accidents, erosion and sediment control failure or unplanned events. Management of surface water and monitoring for siltation at discharge points from the active quarry areas will be required to ensure watercourses are not indirectly impacted prior to alteration approval being in place. Erosion and sediment control systems will be monitored regularly to ensure they are in working order and effectively managing site run off.

There are expected residual environmental effects on watercourses (loss of one ephemeral first order stream length approximately 140m) resulting from the proposed expansion of the Rhodena Quarry once all appropriate mitigation (and compensation) and monitoring has been implemented and completed. However, these residual environmental effects have been determined to be not significant.

9.3 Mitigation and Monitoring

Zutphen will limit sediment and erosion from occurring through management practices and planning. Topsoil and overburden piles that have been stripped prior to blasting will be stored onsite for subsequent use during reclamation. These topsoil and overburden piles will be hydro-seeded wherever possible to reduce the potential for erosion and sedimentation. Clearing and grubbing to support quarry expansion will be completed as necessary and will be limited to maximum area of 2 years development at a time to minimize exposed soil and potential for erosion.

Monitoring of surface water discharge leaving the property boundaries and prior to discharge into a watercourse or wetland will be completed to ensure unacceptable levels of silt are not deposited into the surrounding aquatic environment. During construction and operations (active quarrying), regular testing of rock will be conducted for acid generating potential at a rate to be determined by NSE. Prior to any excavation below the watertable, a hydrological study will be completed and submitted to NSE.

To avoid destroying nesting or breeding species during breeding timeframes, clearing of remaining vegetation and any necessary routine vegetation management will occur outside of the breeding and nesting season for most bird species (May-August).

The Project is committed to use of limited lighting during construction and operations. Furthermore, there will be no general lighting at the quarry (restricted to during times when activity is occurring only).

Zutphen is committed to limiting the area of disturbance associated with the Project in order to minimize potential impacts of potential birds and SAR/SOCI habitat within the Study Area.

Wetland alteration requires a provincial permit through NSE regional offices. Wetland alteration permit application(s) will be submitted to NSE and approval granted prior to commencement of any wetland alteration to support quarry expansion. Compensation to offset lost wetland habitat will be provided as part of the permit process.

Watercourse alteration requires a provincial permit through NSE regional offices. A watercourse alteration permit application will be submitted to NSE and approval granted prior to commencement of alteration to Watercourse 2 to support quarry expansion.

10.0 CONCLUSIONS

Zutphen Resources Inc. (Zutphen) currently owns and operates the Rhodena Quarry, operating under a Nova Scotia Environment (NSE) Industrial Approval (NSE Approval #92-049). This quarry has been active since 1992 (25 years). Zutphen plans to expand the existing Rhodena Quarry, which requires a Provincial Environmental Assessment registration (Class I undertaking). The purposed of the proposed quarry expansion is to continue to have quarry reserves available to serve the local market, Nova Scotia Transportation and Infrastructure, Ideal Concrete and local contractors.

The proposed expansion is located on private land [PID 50193390 and 50297316] within the community of Rhodena, Cape Breton, Nova Scotia. This Project encompasses a total proposed expansion area of 17 hectares (including the 4 hectare area for the current operating quarry). A broader 25-hectare Study Area was identified for the purposes of the provincial EA process.

The field data, regulatory consultation, and subsequent conclusions of this assessment indicate there are no expected significant residual environmental effects resulting from the Rhodena Quarry Expansion Project once all appropriate mitigation and monitoring has been implemented and completed. Standard construction mitigation methods will be implemented to ensure there are no significant impacts of the Project on VECs.

Six wetlands were observed within the Study Area and three watercourses are present (two previously mapped, and one additional field identified ephemeral stream). Watercourses 1 and 3 (the mapped watercourses) will be avoided and were both identified as Type I fish habitat (potential spawning). Watercourse 2 will require alteration to support the quarry expansion. This watercourse is a first order stream, and was determined to be Type IV fish habitat and ephemeral in nature. Wetland and watercourse alteration permitting will be necessary to support project expansion.

Species at risk inventories within the Project revealed that no flora or fauna species at risk were identified across the Study Area.

Due to the Project location (Cape Breton) and on-site habitat suitability, it is possible that Canada Lynx (a SAR) could use the Study Area. However, the Study Area is not located near the primary areas in Cape Breton where the lynx has been known to reside. The small size of the Project results in low residual impact to the Canada Lynx should it exist at this location.

Bird usage within the Study Area was determined to be low to moderate, with more bird activity during the breeding season then observed during the spring and fall migration periods. A significant portion of the Study Area was already harvested prior to the field surveys; so suitable habitat for many birds was limited. Across all survey seasons a total of six (6) priority species were observed either during dedicated survey periods or incidentally: Boreal Chickadee, Olive-sided Flycatcher, Red-breasted Nuthatch, Ruby-crowned Kinglet, Swainson's Thrush and Yellow-bellied Flycatcher. Of these priority birds, one species at risk (SAR) was observed, the Olive Sided Flycatcher (incidentally during the breeding season). The EA process has determined that residual environmental effects on birds are low, post-mitigation.

There is no evidence that current quarrying activities have interacted with the groundwater table (no observed seepages through the exposed rock face of build up of water on the quarry floor). Zutphen does not intend to work below the watertable during quarry expansion. However, should this be necessary, prior to any excavation below the watertable, a hydrological study will be completed and submitted to NSE.

During the field reconnaissance, a probable nineteenth and twentieth century farmstead was identified within the southwest of the Study Area. Stone piles and two stone foundations without cellars and a narrow stone-lined well were identified at this location. It is recommended that a 20m buffer be established around the archaeological site. To ensure that the buffer is maintained, it is recommended to flag the 20m buffer.

There are no adverse effects anticipated on health and socio-economic conditions, physical and cultural heritage areas, traditional land use, and traditional structures or sites as a result of environmental changes from the Project.

Zutphen has exceeded residential setbacks associated with the Pit and Quarry Guidelines with the closest residential receptor being located approximately 1.72 km from the closest boundary of the Rhodena Quarry Expansion Study Area.

The magnitude of disturbance and risk associated with the Project are all considered minimal given the size of the Project and the mitigation techniques and technologies currently available. Furthermore, this assessment concludes there are no significant environmental concerns and no significant impacts expected that cannot be effectively mitigated through well established and acceptable practices, or ongoing monitoring and response. Residual environmental effects have been determined to be minimal or low for identified VECs.

11.0 LIMITATIONS

Constraints Analysis

- On some maps, land use or land cover is defined everywhere to form a complete mosaic of polygons. On topographic maps landuse/landcover is depicted only in certain areas. The source data in some cases may need to be conditioned to allow the second type of depiction if it is a mosaic, and certain constraints will operate differently in each case (Agent Consortium, 2001); and,
- Conflicts that might exist between objects in a database are typically of a logical nature, such as topological inconsistencies or duplicate identifiers. We attempted to ensure that our database has addressed any potential inconsistencies, however inconsistencies may still occur. In map generalization, the vast majority of conflicts are physical, spatial consequences of reducing map scale. The greater the degree of scale change, the more cluttered an un-generalized map will be, and this signals the extents of potential conflicts in presentation of the data.

Limitations incurred at the time of the assessment include:

- McCallum Environmental Ltd. has relied in good faith upon the evaluation and conclusions in all third party assessments. McCallum Environmental Ltd. relies upon these representations and information provided but can make no warranty as to accuracy of information provided;
- There are a potentially infinite number of methods in which human activity can influence wildlife behaviors and populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors;
- The EA provides an inventory based on acceptable industry methodologies. A single assessment may not define the absolute status of site conditions;
- Effects of impacts separated in time and space that may affect the areas in question, have not been not been included in this assessment.

General Limitations incurred include:

- Classification and identification of soils, vegetation, wildlife, and general environmental characteristics (*i.e.*, vegetation concentrations, and wildlife usage) have been based upon commonly accepted practices in environmental consulting. Classification and identification of these factors are judgmental and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may not identify all factors;
- All reasonable assessment programs will involve an inherent risk that some conditions will not be detected and all reports summarizing such investigations will be based on assumptions of what characteristics may exist between the sample points.

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13.0 CERTIFICATION

This Report has considered relevant factors and influences pertinent within the scope of the assessment and has completed and provided relevant information in accordance with the methodologies described.

The undersigned has considered relevant factors and influences pertinent within the scope of the assessment and written, and combined and referenced the report accordingly.

Meghan Milloy
Vice President
McCallum Environmental Ltd.