NATURAL ENVIRONMENT
LEVEL 1 AND 2 TECHNICAL REPORTS

CUMBERLAND QUARRY
LOTS 12, 13 &14, CONCESSION 11
SEVERN TOWNSHIP, COUNTY OF SIMCOE

Prepared for: Severn Aggregates Limited Partnership
Submitted by: Niblett Environmental Associates Inc.
File: PN 10-015

Date: November 2017

Niblett Environmental Associates Inc.
Biological Consultants

November 29, 2017 PN 10-015

Severn Aggregates Limited Partnership
151 Whitehall Dr.
Markham, Ontario
L3R 9T1

Subject: NATURAL ENVIRONMENT
LEVEL 1 & 2 TECHNICAL REPORTS

CUMBERLAND QUARRY, LOTS 12, 13 &14, CONCESSION 11
SEVERN TOWNSHIP, COUNTY OF SIMCOE

Dear Mr. Kennedy:

We are pleased to submit our Level 1 and 2 Natural Environment Reports in support of your license application for a quarry under the Aggregate Resources Act.

The Level 1 and 2 reports have been bound together for submission.

If you require further details on my findings or inventories please contact us.

Sincerely,

Chris Ellingwood
President and Sr. Terrestrial and Wetland Biologist

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NATURAL ENVIRONMENT
LEVEL 1 TECHNICAL REPORT

CUMBERLAND QUARRY
LOTS 12, 13 &14, CONCESSION 11
SEVERN TOWNSHIP, COUNTY OF SIMCOE

ACKNOWLEDGEMENT

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LEVEL 1 TECHNICAL REPORT

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SEVERN TOWNSHIP, COUNTY OF SIMCOE

1.0 Introduction

1.1 Study Rationale

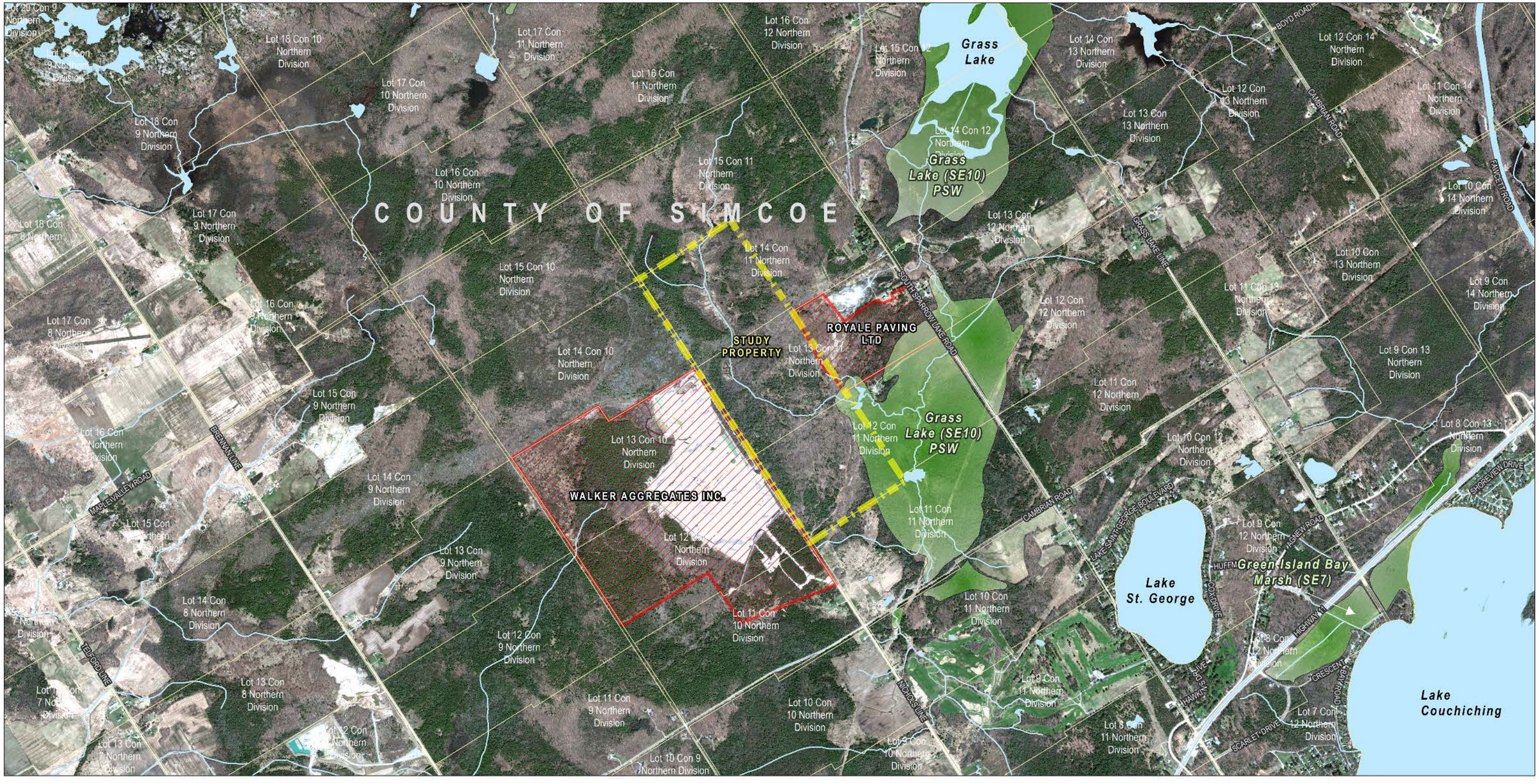
Niblett Environmental Associates Inc. (NEA) was retained by Severn Aggregates Limited Partnership to complete a Natural Environment Level 1 Technical Report in 2009. Under the Aggregate Resources Act Provincial Standards (Gov. Ont., 1997), a license application must be accompanied by a Natural Environment Level 1 Technical Report. The MNR Lands and Waters Branch issued a draft policy document dealing specifically with Aggregate Permit Applications: Natural Environment Report Standards (Policy AR2.01.07, March 2006). The policy provides a detailed outline of the content of a Level 1 report.

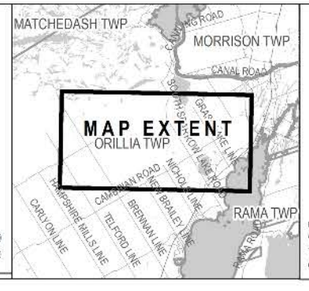
1.2 Site Location and History

The proposed quarry is for a limestone quarry on Lots 12, 13 and 14, west half of Concession 11, located north of Orillia fronting off of Nichols Line (Figure 1). The property is located in the Township of Severn, County of Simcoe. The proposed licensed area encompasses approximately 138 hectares.

The subject property is located north of Highway 11, west of Sparrow Lake Road in the geographic Township of Orillia North Division, now the Township of Severn. The property is owned by 1662947 Ontario Inc. and the present uses are the restoration of farmlands with forestry management taking place from time to time. Severn Aggregates Inc. (the applicant) has entered into an Exclusive Agreement with the Land Ownership to pursue licensing of the property to extract and market the limestone resource contained within the site.

Nichols Line is designated as an “Existing Major Haul Route” in the Township of Severn Official Plan, and provides direct access to Highway 11.





LEGEND

- OHN Waterbody
- Wetland, PSW
- Aggregate Authorized Area*
- Study Boundary
- Lot Fabric

World View-2 Satellite (Digital Globe, 60cm, April 2011)
* Boundaries are not surveyed. Taken from LIO (2012)

FIGURE 1: STUDY AREA & NATURAL FEATURES

Pt Lots 12, 13 & 14, Con 11 Northern Division
Township of Severn
County of Simcoe
Midhurst District

1 cm = 240 meters

UTM Zone 17
WKID: 26917 Authority: EPSG
Transverse Mercator
GCS North American 1983, ESRI ArcGIS 10.1

REVISIONS

NO	BY	DATE	DESCRIPTION
1	W.P.	26/04/2013	Initial map creation.

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PROJECT NO: 10-015
PROJECT TITLE: Severn Quarry
CLIENT: Severn Aggregates Ltd. Partnership

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Severn Aggregates Inc. has the objective to licence the subject property under the Aggregate Resources Act (ARA) as a Class 'A' Category 2 Quarry with a maximum annual tonnage of 500,000 tonnes. It is intended that existing agricultural and forestry uses will be maintained until extraction and rehabilitation will return the land to these uses.

1.3 Study Area

The study area for the identification of significant species and natural heritage features extended 120 m beyond the boundary of the proposed licensed area as per the requirements of the Aggregate Resources Act Provincial Standards (Government of Ontario, 1997). The search for significant natural features was also extended to 10 km to determine if other features or Species at Risk are present in the surrounding area that could find similar suitable habitat on the property.

The study area did not include lands owned by Severn Pines Quarry and the active licensed quarry extraction area to the west.

2.0 Methodology

2.1 General Approach

The study was completed in four distinct phases. A pre-consultation meeting with the Ministry of Natural Resources and Forestry (MNRF) took place on July 4, 2013. The meeting included a presentation on the site and proposed operation, as well as Species At Risk and fisheries. During Phase 2 of the Natural Environment Report, all available information on the study site and site vicinity was collected and reviewed. This included reviewing Official Plan Schedules, key natural feature mapping, air photographs, historical fisheries data and GIS mapping. An additional meeting with MNRF was conducted on March 14, 2013.

As the file has been ongoing for several years, the latest lists for the area and MNRF Make a Map Species at Risk were re-examined in November 2017.

The third phase included site visits by NEA biologists to confirm the data collected in the literature review and to collect information on species present including vegetation, herpetozoa, birds and mammals. Site visits were conducted on November 25, 2009; April 12, 13, 14, May 19, June 30, 2010; May 16, July 16, Sept 20, Oct 24, 2012; May 7, June 3, 4, Aug 29, 2013. The site visits resulted in a detailed inventory of the entire property.

Additional surveys were conducted for species that had been added to the Endangered Species Act list (COSSARO) in recent years. Details on the targeted SAR protocols are found in the detailed methodology section.

In the final phase, the literature and data collected in Phases 2 and 3 was compiled and analyzed to complete the Level 1 Natural Environment Report. The content of the Natural Environment Level I Report was based on the requirements of the Aggregate Resources Act. NEA worked with the study team including hydrogeologists, noise engineers and the licensee on the phasing, rehabilitation and mitigation measures.

2.2 Literature Review

Literature reviewed for the Level I Report included:

- Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNR, January 2015)
- Significant Wildlife Habitat Technical Guide (MNR, 2000)
- Provincial Policy Statement (Ont. Government., 2014)
- County of Simcoe Official Plan (2008)
- Township of Severn Official Plan (Office Consolidation, Sept. 2010)
- Aerial Photographs
- Key natural features GIS mapping (MNR 2010-2017)
- Ontario Breeding Bird Atlas (BSC, 2007)
- Make a Map: Natural Heritage Areas (MNRF), accessed 2017

2.3 Field Inventory Methodology

2.3.1 Surveys Identified

Field surveys to document the existing conditions of the natural environment included:

- Ecological Land Classification and vegetation survey
- Ontario Wetland Evaluation System applied to wetland boundary delineation
- Breeding Bird surveys
- Wildlife Observations
- Marsh Monitoring Protocol (amphibians)
- Herpetile Area Searches and basking surveys
- Whip-poor-will / Common Nighthawk Surveys
- Butternut Surveys
- Documentation of Other Target SAR species
- Linkages and Corridors Assessment
- Aquatic Habitat Assessment
- Fish Community Assessment
- Benthos Community Assessment
- Surface Water Quality Assessment
- Bat Bioacoustic Monitoring

Figure 2 shows the location of the various survey stations.

2.3.2 Vegetation

Ecological Land Classification and Vegetation Survey

All vegetation communities on and adjacent to the study lands were visited on November 25, 2009, April 13, 2010, April 14, 2010, May 19, 2010, June 30, 2010, July 16, 2012 and September 20, 2012. Additional notes were collected during Species At Risk surveys to document plant species pertinent to their habitat preferences. Species composition of dominant species in all vertical forest layers was determined. Vegetation criterion followed that of MNR's Ecological Land Classification for Southern Ontario (ELC) program (Lee et al., 1998) and was classified to the vegetation type level. Communities are delineated based on boundaries determined through a combination of air photo interpretation, ground truthing and GPS readings. All portions of the subject property and adjacent lands were visited including wetland, field, forest, aquatic and cultural communities.

Photographs and/or specimens were taken of plants requiring verification of identification.

National, provincial and regional significance was determined from accepted status lists and published reference lists such as SARA (2017), COSEWIC (2017), COSSARO (2017), Ontario Endangered Species Act (2007) and NHIC (2017). Regional and local lists were also reviewed and included Riley, (1989) and Varga et al. (2000). The uniqueness of habitat type and ELC communities was assessed using these references and Bakowsky (NHIC, 1998).

2.3.3 Wetlands

Wetland Evaluation Methods

The wetland boundary was determined through use of the protocols of the Ontario Wetland Evaluation System (OWES) southern Ontario manual, 3rd edition, version 3.2 (MNR, 2013 and updates). This manual is used by wetland evaluators to identify wetlands and score them using the criteria outlined in the manual. A certified wetland evaluator delineated the wetland boundaries using OWES methodologies. Wetland boundaries were determined through the 50% rule, the wetland boundary falls where 50% or greater of the plants depict wetland conditions. Other OWES practices were used to determine if a vegetation community was wetland using the OWES definitions based on soils, wetland indicator species, wetland species and vegetation cover (%). Boundaries shown on the figures are a combination of air photo interpretation, ground truthing and GPS readings. Boundaries of the Provincially Significant Wetland within the study area were flagged in

the field and surveyed by a Professional Ontario Land Surveyor (OLS). Wetland boundaries of unevaluated wetlands were also delineated using this method.

2.3.4 Breeding Birds

Breeding Bird Point Count Methodology

Breeding bird surveys (BBS) were conducted during the breeding season on May 19th and June 30, 2010; May 16th and July 6th, 2012; May 7th and July 4, 2013 for peak breeding season birds. Surveys were timed to coincide with the dawn chorus (5-9am) and within acceptable weather parameters. The surveys were modeled after the Ontario Breeding Bird Atlas (2nd) point count methodologies (2001) and used standardized data collection forms. The surveys were a combination of point counts and area searches and covered all portions of the property. The surveys were conducted within all vegetation communities in the study area. Weather conditions during the surveys can be found in the Level of Effort table (Table 1).

Table 1. Breeding Bird survey dates and conditions

Date	Weather	Time
May 19, 2010,	Temp=13, wind 1, cloud=3/10ths	0720-0900
June 30, 2010,	Temp=18. Wind 0; cloud=0/10ths	0620-0900
May 16th, 2012	Temp=16, wind -1; cloud=7/10ths	0700-0900
April 10, 2012	Temp=10, wind=1, cloud 0/10ths	0830-1130
July 6th, 2012	Temp=20, wind=1; cloud=0/10ths	0700-0900
May 7, 2013	Temp=24, wind=0; cloud=0/10ths	0820-1000
July 4th, 2013	Temp=20, cloud=8/10ths; wind=1	0800-0930

A breeding bird species list was generated from the Atlas of the Breeding Birds of Ontario for the 10 x 10 atlas square that contains the study area (17PK25) and adjacent squares. First and second atlas breeding evidence codes were reviewed and used to determine what currently listed (2015) species were found during our field inventories. The data was also reviewed to determine if any sensitive or Species At Risk breeding species have been recorded in the area of the development. Records of any special concern, threatened or endangered species were also solicited from MNR.

Significance on a national, provincial or regional level will be based on SARA (2017), COSEWIC (2017), SARO (2017), ESA (2007), MNR (2013) and Bird Studies Canada (2005).

2.3.5 Bats

Bat Acoustic Surveys

Acoustic surveys were conducted in two different locations during June 2017 according to current available information from the MNRF and to satisfy the MNRF's Significant Wildlife Habitat guidelines to document the potential presence of the Species at Risk (SAR) bats that may utilize this habitat, specifically: little brown (Myotis *Myotis lucifugus)*, northern myotis (*M. septentionalis)*, eastern small-footed myotis (*M. leibii*) and tricoloured bat (*Perimyotis subflavus*).

The goal in deployment of these bat detector units was to identify commuter zones that would give access to and from feeding areas as that is the best method to identify where bats were coming from and what species were using the area. Some bat species have an active feeding area of up to 25 km so it is important to know where they are coming from as well as when they are feeding. Sites were predominantly chosen based on their potential for bat use and their potential for high sequence quality. Sequence quality can be affected by the frequency and intensity of bat calls, temperature and humidity, and barometric pressure (Brigham et al., 1997; Lausen, 2017; Schnitzler and Kalko, 2001).

Surveys were conducted utilizing SM4BAT-FS bioacoustic detectors. These models record in zero-crossing format and then software converts it to full spectrum. Detectors were set to start triggering in the time between ½ hour before sunset and ½ hour after sunrise. Microphones used were the SMM-U1 models and a factory-tested directional horn was placed on certain survey locations that were in potential bat commuter zones. Due to the physics of sound, no microphone "range" can be estimated as there are too many factors that contribute to how sound can travel (Agranat, 2014). All microphones were tested with an ultrasonic calibrator to ensure that they were within the factory specifications of being higher -38 dB (Wildlife Acoustic, 2017). Deployed microphones were placed on 12 foot high metal poles approx. 4 meters above the ground and anchored into the rock. This would minimize reflection as well as act as a 'ground" for any potential electrical current that could pass through during a storm. Detectors were placed and left for a period of 10 nights minimum to satisfy MNRF Bat Maternity protocol, with fresh batteries and formatted SD memory cards.

The two bat detector units were deployed on August 1st, 2017 and retrieved on August 11, 2017. An omni-directional microphone was chosen for deployment due to the open location of the site and the lack of clearly defined commuter zone. The microphone was placed in area with that would pose minimal noise reflection, however close enough to the

forested edge where bats would be foraging over the open area. The direction in which the omni-directional microphone was facing was not relevant as the microphone collects sounds in a 360° area. The range of the microphone will fluctuate depending on the atmospheric attenuation. Cold clear nights are better for sound attenuation (Lausen, 2017. Pers. Comm). There are no set manufacturer specifications.

One unit was deployed in an open area at the north end of the site. The second was deployed at the south end near the entrance and the disturbed area. Both are in close proximity to open areas and wetlands and would act as commuter corridors.

2.3.6 Other Mammals

Observations of mammals were made during all site visits. Observations included direct sightings and indirect evidence such as calls, tracks, scat, burrows, dens and browse. Deer tracks/trails and presence of deer yards were investigated as part of the field inventories. As there was limited dense hemlock or conifer stands in the study area, winter browse surveys and presence of overwintering sites was not conducted. Moose overwintering sites and feeding area criteria were also assessed and potential habitat visited to determine the status. Black bear dens and other criteria that fall under the Significant Wildlife Habitat definitions were also investigated while on site.

Species significance on a national, provincial, regional, and local level was based on COSEWIC (2017), SARO (2017), SARA (2017) and ESA (2007).

2.3.7 Herpetozoa

Marsh Monitoring Protocol (MMP)

Targeted spring surveys for breeding amphibians were completed in the evenings to record any calling breeding frogs. Surveys were focused on the wetland to the north of the study property. As the wetland to the north was outside of the study area only one marsh monitoring survey was conducted. Due to the various other field visits conducted during spring time conditions a large number of incidental frog species were identified and therefore NEA did not believe targeted MMP surveys were needed in order to capture the identification of amphibians on the property. The one MMP survey was conducted on April 13, 2010 during the early spring breeding period. Temperatures during the survey were 14°C with a Beaufort wind scale of 0-1. No cloud cover was recorded.

The survey was completed at least 30 minutes after sunset and completed by midnight. Observations at the station were sustained for 3 minutes where Call level codes were recorded. Protocol from Environment Canada's Marsh Monitoring Program (BSC, 2008) was utilized using associated call level codes (Table 2).

Table 2. Amphibian Call Code Descriptions

Code 1: Calls not simultaneous, number of individuals can be accurately counted
Code 2: Some calls simultaneous, number of individuals can be reliably estimated
Code 3: Full chorus, calls continuous and overlapping, number of individuals cannot be reliably estimated.

The approximated distance from the survey point where the species were located (within or outside of 100 meters of the survey station) was recorded.

Herpetile Surveys

Area searches, basking surveys and targeted habitat searches for reptiles and amphibians were made during the site inventories. The only ponded area in the study area was a pond overlapping the County lands north of the property line and on County land. The remainder of the property had rock near the surface and areas of cedar swamp over rock. In addition, sand and gravel roadsides and areas of disturbed soils were checked for turtle nests during June site visits, coinciding with peak nesting time and over the summer and fall periods to search for predated nests, egg shells or young emerging from successful nest sites.

A specific effort was made to time visits to coincide with peak activity times (early morning, afternoon basking periods and peak season for nesting) to maximize the chances of detecting the snakes, skinks and turtles. Three 4 x 4 foot plywood snake cover boards were placed within Communities 9 and 11 in April 2010 and are still on-site. The boards were re-visited numerous times over the study period. Boards were checked for usage for species such as milk, red-bellied, ribbon, garter, smooth green and little brown snakes and salamanders. Surveys for other species such as hog-nosed snake and massasauga were conducted whenever on site and in areas where potential hibernacula or ovi-position sites were observed (e.g. cliffs, rock crevasses, log piles, rock piles, ledges, wood chip piles). The limestone ledge and rock barren was walked on numerous occasions searching for evidence of snake emergence in the spring and concentration of snakes in the fall, for live and dead snakes, and skin sheds.

Logs, woody debris and loose surface rocks were turned over in the open rock barrens to search for snakes and five-lined skinks.

Basking surveys were conducted on cool but sunny days at the one pond on site north of the proposed licensed area, over the course of the field study to search for basking Blanding's, spotted, map, painted and snapping turtles. There are no other ponded areas or marshes on the property.

The pond was also sampled by fisheries staff conducting aquatic sampling during a 24 hour fyke net set. The net was placed with part exposed at the surface in case of incidental catch of a turtle. The pond was also surveyed for turtles and was sampled as part of the benthic control site monitoring but no turtles were observed or captured during those in-water surveys. The level of effort table (Table 3) summarizes all of the field dates and inventory types.

Table 3. Turtle Surveys

Date	Weather	Time	Surveys Conducted
April 13, 2010	14, clear	1800-1920	Stations for MMP-amphibians
May 19, 2010,	Temp=13, p. cloudy	0800-1400	Part of wetland work, ELC and herp surveys
June 30, 2010,	Temp=18,clear	0620-1100	Part of bird surveys, herp surveys and plant inventories of the wetland
May 16th, 2012	Temp=16, p. cloudy	0700-0900	Bird station at pond site
July 6th, 2012	Temp=20, clear	0800	Bird station at pond site
May 7, 2013			
June 3-4, 2013	Air temp=15.7, water temp=13.2		Fish fyke net and benthics -net set with top above water in case of turtle being trapped.
July 4th, 2013	Temp=20, cloudy	0800-0930	-bird survey station at pond

2.3.8 Species at Risk

Species At Risk Identification

A species list was generated from the NHIC database early in 2010 to determine Species At Risk possible in the study area. NEA searches an area with 10 kilometres of the licensed boundary to ensure that all species possible in the larger area are assessed in our habitat

screening stage and to develop of field program. The MNR did provide NEA with an updated list on March 1st, 2013 (e-mail from Megan Eplett, SAR biologist, Midhurst District, MNRF) after a request was sent by NEA. Additional species had also been noted during the pre-consultation meeting with MNR in May 2012.

Finally, the recently released MNRF 'Make a Map: Natural Heritage Features' on –line GIS system was reviewed by NEA for all records with 10 km of the licensed boundary (Nov. 11, 2017). The listings in this report reflect the latest lists from COSEWIC (May 2017) and COSSARO (June 2017).

Whip-poor-will/ Common Nighthawk Surveys

Whip-poor-will and common nighthawk surveys were conducted on July 8th, 2013 and June 9th, 2014 using the draft Whip-poor-will survey protocol released by the MNR (2013). Surveys were conducted between the MNRF recommended dates (May 18th -June 30th) (MNRF, 2013) with the exception of the first date within early July in 2013. Point counts were established prior to going out in the field and all calling males were identified within a 300 meter radius. Information was recorded including the direction and distance of each individual using a digital compass bearing. Surveys were completed thirty minutes after sunset. Only two surveys instead of three were conducted in total as surveys in June of 2013 were successful in recording large numbers of Whip-poor-will. Surveys on June 9th, 2014 were conducted at an air temperature of 24 °C with Beaufort wind scale of 0-1 NE, Cloud cover was 10% and the moon was 88% full. Refer to appendix IX for detailed MNRF methodology (MNRF, 2013).

Table 4. Whip-poor-will Survey Dates and Conditions

Date	Weather	Time	Moon phase
July 4th, 2013	Temp=23, wind=1; noise=0; cloud cover= 1-3/10ths	2040-2150	19%, moon visible, moon rise at 1802
June 9, 2014	Wind 0-1, temp=24, background noise=0 Cloud cover=1/10ths	2049-2355	88.1%, moon visible, Moonrise at 1710

Butternut Surveys

Butternut surveys were conducted using the Butternut Health Assessment protocol (MNRF, 2013). Butternut surveys were conducted on April 13th and May 19th, 2010 and August 29th, 2013. Butternut trees were searched for along forest edges and within all woodland communities. Any butternuts identified on the subject property were assessed by an MNRF

certified Butternut Health Assessor. Characteristics of the tree were recorded including canopy cover, number of canker present, dbh, bark type etc. The data was entered into the MNR BHA excel spreadsheet which determines if the tree is Category 1 (non-retainable), Category 2 (retainable) or Category 3 (archivable).

Other Targeted SAR Surveys

The Ontario Endangered Species Act (ESA) was enacted in 2007. To ensure the project meets the strict policies of this act, we completed a background literature review from MNR-NHIC. A review of the list of federal and/or provincially significant species found within the study area from these sources was analyzed. The recently released MNRF 'Make a Map: Natural Heritage Features" GIS website was also reviewed. For those species that may find suitable habitat within the study area (fish, wildlife or plants), detailed targeted inventories were completed, using specific techniques and protocols for the following species identified as significant on a national/provincial level. Surveys were timed to maximize detection and where applicable, using standard and recognized survey methodologies at the time of the surveys.

Species At Risk that were targeted included: restricted plant species, common snapping turtle, eastern hognose snake, five-lined skink, olive-sided flycatcher, eastern ribbonsnake, Canada warbler, cerulean warbler, spotted turtle and eastern massasauga rattlesnake.

Surveys for the above bird species were conducted during our breeding bird surveys. Turtle surveys were conducted during the basking surveys, aquatic sampling and other times on site conducting ELC, bat surveys, bird surveys and other field work.

2.3.9 Linkages and Corridors

Linkages and Corridors Assessment

The occurrence of linkages and corridors was assessed based on field work and existing literature. Observations of bird, mammal and herpetozoa movements were made through the study period and information from previous reports and air photos and GIS natural features mapping reviewed to determine the presence of linkages across the landscape and between core natural areas. Tracks, trails, deer pellets, scat and wildlife sightings were noted and GPS readings made of any areas that may act as wildlife corridors and animal movement corridors.

2.3.10 Significant Wildlife Habitat

The presence of significant wildlife habitat can be determined during an environmental impact assessment process through use of the criteria and categories in the MNR Significant Wildlife Habitat Technical Guide (MNR, 2000) and the more recent Significant Wildlife Criteria Schedule for Ecoregion 6E (MNRF, Jan. 2015). Some of these categories have been identified by MNR through their GIS mapping. The criteria include four main categories: seasonal concentration areas, rare vegetation communities or specialized habitats for wildlife; habitats of species of concern and animal movement corridors.

A review of the criteria and the candidate criteria that may apply to this site was conducted during the early survey period. Survey effort was completed to confirm the presence or absence of the candidate criteria.

The MNRF LIO database was reviewed in terms of deer wintering areas (Stratum 1 and 2) within 5 km of the property. The presence of deer yarding on the property was reviewed during our surveys and by examining the ELC data and coniferous forest cover percentages in our vegetation community polygons.

2.3.11 Fish and Aquatic Habitat

Biophysical habitat characteristics of the wetlands and watercourses within the study area were assessed using aerial photography, literature and confirmed through ground-truthing by NEA fisheries biologists. The fisheries habitat assessment was made using qualitative and quantitative studies.

Aquatic Habitat Assessment

NEA biologists assessed the aquatic habitat, direct and indirect fish habitat by determining all existing aquatic habitat types based on substrate, riparian habitat, percent in-stream cover and unique features on October 24th 2012; and June 3rd and June 4th 2013. Preliminary field work was conducted in 2010 which aided NEA biologists in their site selections for the 2012 and 2013 sampling years. Habitat types were identified using aerial imagery providing a site map characterize the existing aquatic habitat. Assessments were conducted using standardized provincial aquatic protocols (OSAP, MTO) in addition to NEA's standardized habitat analysis techniques.

Fish habitat is defined by NEA as the "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their

life processes". Direct fish habitat is defined as features that directly support fish (i.e. fish bearing reaches or reaches connected to fish bearing reaches that exhibit connectivity with suitable habitat).

The fish and fish habitat impact assessment in the Level 2 Technical report will be based on historical fisheries data (MNR and DFO), NEA's fish and fish habitat survey results and biophysical habitat conditions observed on site.

Fish Community Assessment

Qualitative fish community and presence sampling was conducted on June 3rd and 4th 2013 by NEA biologists to assesses potential impacts from the proposed quarry expansion on the existing fish community data and fish species within the study area. Fish community was samples using a fyke net, mini-hoop net, and seine nets, fyke and mini hoop nets were set for approximately 24 hours. Fish presence/absence was sampled using minnow traps set for approximately 24 hours.

Benthos Community Assessment

A control study design was chosen for monitoring of potential effects to aquatic habitats downstream of the proposed quarry development using set reference sites to sample before and after the stressor discharge (construction and completion of quarry). Baseline benthos samples were collected at three sites on October 24th 2012. Due to the construction of an ATV/snowmobile trail through the benthos control site on August 29th 2013, biologist re-established and re-sampled the control site on October 15th 2014. Samples were collected using a 500 µm (mesh size) travelling kick and sweep method as outlined in the Ontario Benthos Biomonitoring Network Protocol Manual (OBBN, 2004).

A minimum of 100 animals were collected per replicate or sub-sample. Specimens were preserved in 70% methyl alcohol and identified in lab to the taxonomic level of family. Subsequent data was analyzed using the Hilsenhoff Biotic Index, Simpsons Diversity Index and quantitative descriptions.

Hilsenhoff Biotic Index uses a listing of tolerance values for each taxonomic family to derive a water quality score based on individual benthic macro-invertebrate presence. The Hilsenhoff Biotic Index method assigns a tolerance score to each individual in the sample. The higher the biotic index value, the greater the tolerance to organic pollution. Tolerance values range from 0 for organisms very intolerant of organic pollution to 10 for organisms very tolerant of organic pollution.

The Biotic Index uses a listing of tolerance values for each taxonomic family to derive a water quality score based on individual benthic macro-invertebrate presence. The higher the biotic index value, the greater the tolerance to organic pollution. Tolerance values range from 0 for organisms very intolerant of organic pollution to 10 for organisms very tolerant of organic pollution.

Simpsons Diversity Index measures the diversity within the sample where values ranged from 0 for low diversity samples to 1 for high diversity samples.

Quantitative descriptions are also quantified and include: total number of organisms; Richness (number of taxa); percent of dominant taxa; percent of Oligochaeta; percent of Chironomidae; percent of EPT; ratio of EPT to Chironomidae; and percent of ETO.

Surface Water Quality Assessment

Local water quality data was collected in October 24th 2012 and June 4th 2013 at all sample locations to support interpretation of aquatic assessment findings. Measured parameters included, turbidity (NTU), dissolved oxygen (mg/L), pH, conductivity (mS), total dissolved solids (mg/L) and water temperature (°C) using a handled YSI Pro2030 System. The Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment, 2002) as well as Provincial Water Quality Objectives (PWQO)(Energy, 1994) were used to interpret water quality data.

2.4 Search Effort

Approximately 275 hours of field time were completed by the eleven biologists that worked on this project. A record of the field work conducted was documented including details such as the date and time of day the field work took place, the type of survey administered and for what the survey was intended to target (Table 5).

Table 5. Search Effort for Aquatic and Terrestrial Field Work in the Study Area (2009-2014).

Date	Time of Day	Weather Conditions (when applicable)	Survey Type	Target Species
November 25, 2009	Daytime, evening		ELC, wetland delineation,	Plants
April 12 2010	Daytime		Aquatic Scoping	Aquatic habitat
April 13, 2010	Daytime, Evening	14°C with a Beaufort wind scale of 0-1. No cloud cover	Marsh Monitoring, amphibian surveys, butternut assessments, aquatic scoping, plants, ELC	Amphibians, butternuts, plants, turtles, snakes
April 14, 2010	Daytime/Evening		Plants, ELC, snakes, birds, basking, snakes, wetland delineation	Plants, snakes, birds, herps
May 19, 2010	Morning and daytime	13°C, partly cloudy, wind 1	ELC, SARs, herps, wetland delineation, Breeding Bird surveys (BBS), butternut assessment, basking survey	Butternut, plants, turtle basking, snakes, SARs, birds
June 30, 2010	Daytime	18°C, wind 0, clear	ELC, wetland boundary, Breeding Bird surveys (BBS)	Vegetation, birds, incidental wildlife
May 16, 2012	Morning	16°C, cloudy, wind 1	Bird surveys (BBS)	Birds, incidental wildlife
July 6, 2012	Morning	20°C, clear, wind 1	Bird surveys (BBS)	birds
July 16, 2012	Daytime		ELC, wetland boundary,	Vegetation
September 20, 2012	Daytime		Plants, ELC, amphibians, mammals	Plants, amphibians, vegetation, turtles, mammals
October 24, 2012	Daytime		OBBN benthos community sampling, fish habitat and water quality assessments	Benthos Community
May 7, 2013	Morning	24°C, clear, wind 0	Breeding Bird Surveys(BBS), Butternuts, SARs	Birds, butternuts, snakes

June 3, 2013	Daytime		Fish community and habitat assessments, basking survey	Fish Community
June 4, 2013	Daytime		Fish community and habitat assessments; water quality assessment, basking survey	Fish Community
July 4, 2013	Morning	20°C, clear, no wind	Bird surveys (BBS), basking survey	Birds, SAR
July 8, 2013	Evening		Whip-poor-will/common nighthawk surveys	Whip-poor-will/common nighthawk
August 29, 2013	Daytime		Butternut assessments	Butternut
June 9, 2014	Evening	24 °C with Beaufort wind scale of 0-1 NE, Cloud cover was 10% and the moon was 80% full	Whip-poor-will/ common nighthawk surveys	Whip-poor-will, common nighthawk
October 15, 2014	Daytime		OBBN benthos community at Control Site	Re-establishing control site for benthos community
August 1-11, 2017	10 day period		Bat acoustic monitoring-2 boxes at commuter zones	4 SAR bat species

3.0 Resource Inventory

3.1 Physical Description

The property is located just south of the contact line between the St. Lawrence Platform made of sedimentary rock and Grenville made of metamorphic rock. The majority of the property was relatively flat excluding the limestone ledge on the western portion. The study area is located just north-west of Highway 11 fronting on Nichols line. The vegetation contained a mix of forested, cleared and wetland area. The majority of the property and adjacent lands was forested with treed swamps associated with the watercourse and depressions in the rock establishing as treed swamps. A portion of the property was cleared to allow an access road to the northern limits of the property. Agricultural lands were found on a northern portion of the property. The vegetation communities included a variety of deciduous, coniferous and mixed forest types, cultural meadows, rock barren, marshes, swamps and thickets. The Grass Lake PSW is located in the southeast corner of the property and extends to the south and east.

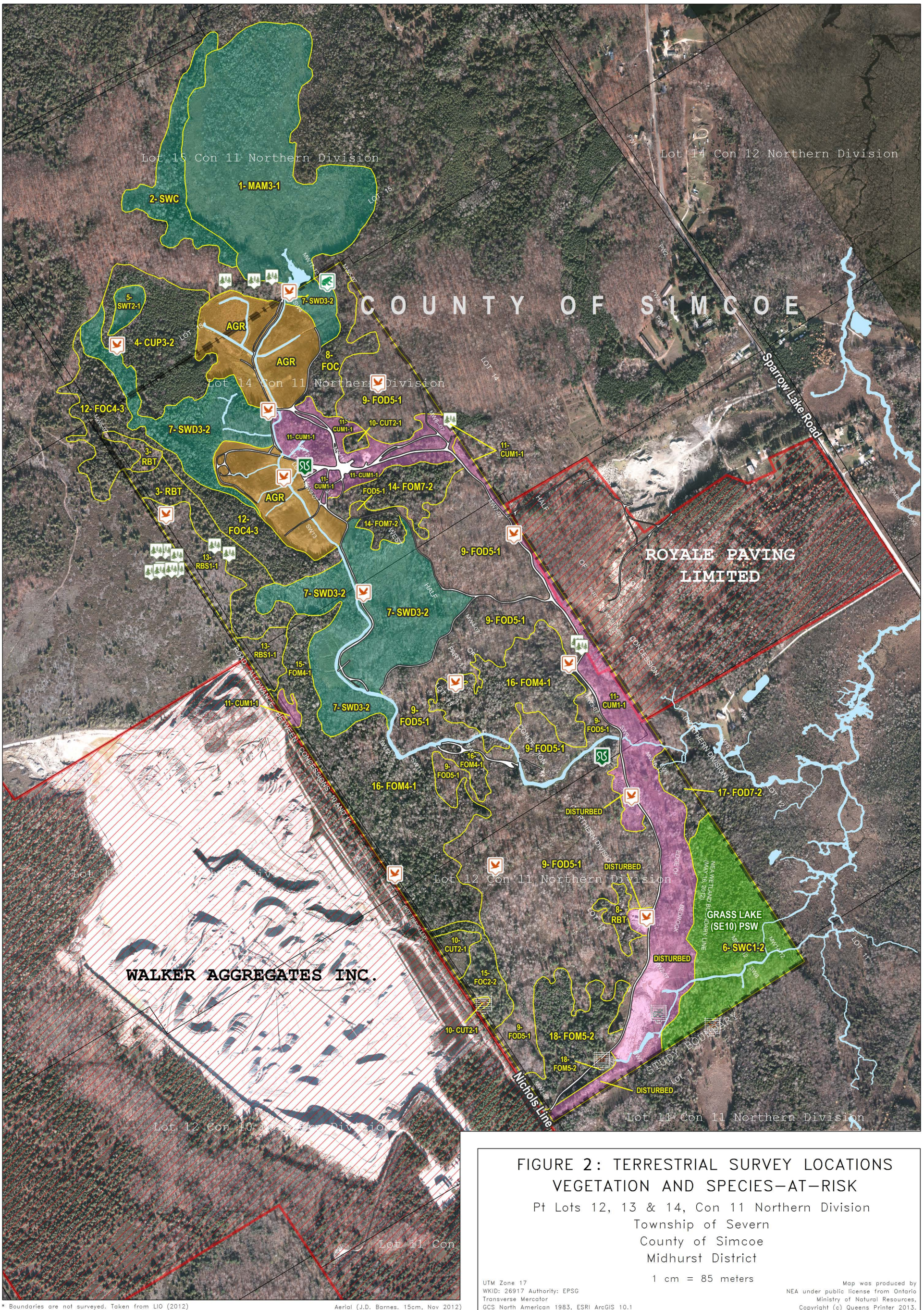
The property has been historical used as a farmstead, with portions of the property having abandoned and active agricultural fields, selective and clear cut logging operations for firewood and lumber and other disturbances. The variety in ages of the forested communities and meadows reflects these long term uses on the property. The Grass Lake PSW is located in the southeast corner of the property and extends to the south and east.

Adjacent land uses include an active licensed limestone quarry to the west, County forest to the north, private land (licensed quarry) to the west partially forested and abandoned farmland and pasture and forest to the south within the 120 m study area.

3.2 Vegetation

The subject property was comprised of a diversity of vegetation community types (Figure 2). The forested areas dominated in white cedar/balsam fir, white cedar hardwood mix, white cedar/white birch, ash lowland, poplar mixed, white cedar conifer, white pine/red pine, sugar maple/oak and sugar maple forests. The wetland areas included communities such as a bluejoint marsh, alder thickets, black ash swamp, cedar swamp and a silver maple swamp.

A total of 18 vegetation communities were delineated within the study area (Figure 2) with a total of 309 plants identified (Appendix I-A).



* Boundaries are not surveyed. Taken from LIO (2012)

Aerial (J.D. Barnes. 15cm, Nov 2012)

FIGURE 2: TERRESTRIAL SURVEY LOCATIONS VEGETATION AND SPECIES-AT-RISK

Pt Lots 12, 13 & 14, Con 11 Northern Division
Township of Severn
County of Simcoe
Midhurst District

1 cm = 85 meters

UTM Zone 17
WKID: 26917 Authority: EPSG
Transverse Mercator
GCS North American 1983, ESRI ArcGIS 10.1

Map was produced by NEA under public license from Ontario Ministry of Natural Resources.

LEGEND

- Access Road/Trails
- Creek/River
- Study Boundary
- Aggregate Authorized Area*
- Wetland, PSW
- Amphibian Survey
- Bird Survey
- Snake Board
- Butternut Occurrence
- Agriculture Community
- Meadow Community
- Wetland Community

ELC TYPES

CODE	NAME
CUM1-1	Old field meadow
CUP3-2	White pine conifer plantation
CUT2-1	Common juniper cultural alvar thicket
FOC	Coniferous forest
FOC2-2	Dry-fresh white cedar conifer forest
FOC4-3	Fresh-moist white cedar-balsam fir conifer forest

ELC TYPES CONT'D

CODE	NAME
FOD5-1	Dry-fresh sugar maple deciduous forest
FOD7-2	Fresh-moist ash lowland deciduous forest
FOM4-1	Dry-fresh white cedar-white birch mixed forest
FOM5-2	Dry-fresh poplar mixed forest
FOM7-2	Fresh-moist white cedar-hardwood mixed forest
MAM3-1	Bluejoint organic meadow marsh
RBS1-1	Common juniper carbonate shrub rock
RBT	Treed rock barren
SWC	Conifer swamp
SWC1-2	White cedar-conifer mineral conifer swamp
SWD3-2	Silver maple mineral deciduous swamp
SWT2-1	Alder mineral thicket swamp

REVISIONS

NO	BY	DATE	DESCRIPTION
1	W.P.	03/07/2013	Initial map creation.

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PROJECT NO: 10-015
PROJECT TITLE: Severn Quarry
CLIENT: Severn Aggregates Ltd. Partnership

10015_006

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Community 1 Bluejoint Organic Meadow Marsh Type (ELC Code: MAM3-1)

This community was located on the far northern limits of the property. This wetland generated by beaver activity was primarily dominated by Canada bluejoint (*Calamagrostis canadensis*), however contained other species interspersed throughout the wetland. American basswood (*Tilia americana*), balsam fir (*Abies balsamea*), black ash (*Fraxinus nigra*), eastern white cedar (*Thuja occidentalis*), green ash (*Fraxinus pennsylvanica var subintege*) and silver maple (*Acer saccharinum*) were found throughout the wetland. Other species found on the ground included sensitive fern (*Onoclea sensibilis*), awl-fruited sedge (*Carex stipata*), bitter nightshade (*Solanum dolcamara*), boneset (*Epatorium perfoliatum*), broad-leaved arrowhead (*Sagittaria latifolia*), broad-leaved plantain (*Plantago major*) and common cattail (*Typha latifolia*).

Photo 1: Bluejoint organic meadow marsh (June 30, 2010)

Community 2 Coniferous Swamp (ELC Code: SWC)

This community was also located on the northern limits of the study property. This small linear pocket of wetland was dominated by coniferous species including balsam fir (*Abies balsamea*), eastern hemlock (*Tsuga canadensis*) and eastern white pine (*Pinus strobus*). The ground contained species such as western poison-ivy (*Rhus rydbergii*), common strawberry (*Fragaria virginiana*), dwarf raspberry (*Rubus pubescens*), false Solomon's seal (*Smilacina racemosa*), jack-in-the-pulpit (*Arisaema triphyllum*), helleborine (*Epipactis helleborine*), marsh marigold (*Caltha palustris*) and mayapple (*Podophyllum peltatum*).

Community 3 Treed Rock Barren (ELC Code: RBT)

This community was located within the northwest sector of the property. Similar to Community 9 which will be discussed in further sections of the report, this community was dominated by deciduous species of similar type. In the areas bordering the access road, rock fissures were observed beneath the canopy. The rock base distinguished the two communities apart. The dominant tree species were young American elm (*Ulmus americana*) and sugar maple (*Acer saccharum ssp. saccharum*) with trembling aspen (*Populus tremuloides*) and white birch (*Betula papyrifera*) as minor associates. The community was generally flat with rock fixtures containing many deep crevices. The ground species contained only a few species including black snakeroot (*Sanicula marilandica*), Canada mayflower (*Maianthemum canadense*), common juniper (*Juniperus communis var. depressa*), western poison-ivy, maidenhair spleenwort (*Asplenium trichomanes ssp. quadrivalens*) and early meadow rue (*Thalictrum dioicum*).

Photo 2: Treed Talus (July 16, 2012)

C**ommunity 4 White Pine Coniferous Plantation (ELC Code: CUP3-2)**

This community was located on the northern limits of the property with the majority of the community located beyond the northern licensed boundary. This community almost entirely dominated by eastern white pine contained other tree species interspersed including American basswood, American elm, balsam fir, balsam poplar (*Populus balsamifera*) and black ash. The ground species included black snakeroot, Canada mayflower, eastern bracken fern (*Pteridium aquilinum*), black nightshade (*Solanum nigrum*), ground-pine (*Lycopodium obscurum*), helleborine and long spurred violet (*Viola rostrata*). Shrub species includes fly honeysuckle (*Lonicera canadensis*), European buckthorn (*Rhamus cathartica*), prickly gooseberry (*Ribes cynosbati*) and wild red raspberry (*Rubus idaeus*).

Photo 3. White Pine Plantation (July 16, 2012)

Community 5 Alder Mineral Thicket Swamp (ELC Code: SWT2-1)

This community was found just beyond the northern boundary of the study property and surrounded by pine plantation. It was primarily dominated by speckled alder (*Alnus rugosa*). Other species also found within this thicket included Alleghany blackberry (*Rubus allegheniensis*), boneset (*Eupatorium perfoliatum*), burning bush (*Euonymus atropurpurea)*, common gromwell (*Lithospermum officinale*), greenish sedge (*Carex viridula*), marsh bedstraw (*Galium palustre*) and marsh bellflower (*Campanula aparinoides*).

Community 6 White Cedar Conifer Mineral Coniferous Swamp (ELC Code: SWC1-2)

This community was located adjacent and included part of the provincially significant wetland on the eastern borders of the property. Eastern white cedar was the dominant species in the cedar swamp. The swamp was hummocky in nature and contained other species characteristic of wet communities and moist areas. These species included American water-horehound (*Lycopus americanus*), black ash, dwarf raspberry (*Rubus pubescens*), early meadow rue, field horsetail (*Equisetum arvense*) and foam flower (*Tiarella cordifolia*).

Photo 4. White Cedar Swamp (May 19, 2010)

Community 7 Silver Maple Mineral Deciduous Swamp (SWD3-2)

Community 7 was identified in the central and north-western portions of the property. Silver maple (*Acer saccharinum*) was the dominant species of this community with minor associates of American basswood, American elm, balsam fir and balsam poplar. Other species found on the ground include bitter nightshade, broad-leaved plantain, bull thistle (*Cirsium vulgare*), Canada enchanter's nightshade (*Circaea lutetiana L. ssp. canadensis*), Canada mayflower, Christmas fern (*Polystichum acrostichoides*), cinnamon fern (*Osmunda cinnamonea*), common evening primrose (*Oenothera biennis*), dwarf raspberry and marsh beggar-ticks (*Bidens frondosa*).

Photo 5. Silver maple swamp (July 16, 2012)

Community 8 Coniferous Forest (ELC Code: FOC)

This community was located on the north-eastern corner of the property bordering the agricultural area and Community 9. Dominated by coniferous species, trees within this community included eastern white pine and eastern white cedar.

Community 9 Dry-Fresh Sugar Maple Deciduous Forest (ELC Code: FOD5-1)

This community is located in several areas around the property, a portion of land in the north-east corner and central area of the property, as well as a portion of land in the southern half of the property. A large portion of the property is comprised of this deciduous forest. Sugar maple makes up the dominant species for this community, however several other tree species are found in community. American basswood, American beech (*Fagus grandifolia*), American elm, balsam fir, balsam poplar, black ash and black cherry (*Prunus serotina*) were also found throughout this community among the sugar maples. Ground species included black medick (*Medicago lupulina*), black snakeroot (*Sanicula marilandica*), bloodroot (*Sanguinaria canadensis*), bottle gentian (*Gentiana andrewsii*) and bottle-brush grass (*Elymus hystrix*).

Photo 6. Sugar Maple forest (August 29, 2013)

Community 10 Common Juniper Cultural Alvar Thicket Type (ELC Code: CUT2-1)

Several small pockets of juniper thickets were observed throughout the property. Two areas along the western property edge of the property, as well as a small pocket in the northern portion of the property. This community was dominated by common juniper with few scattered trees throughout, including American basswood, American elm, bur oak (*Quercus macrocarpa*), eastern red cedar and eastern white pine. The ground cover consisted of eastern bracken fern (*Pteridium aquilinum*), arrow-leaved aster (*Symphyotrichum urophyllum*), black-eyed Susan (*Rudbeckia hirta*), bladder campion (*Silene vulgaris*), broad-leaved plantain, bull thistle, calico aster (*Aster lateriflorus*), chicory (*Cichorium intybus*) and Canada goldenrod (*Solidago canadensis*).

Photo 7: Juniper thicket (August 29, 2013)

Community 11 Dry-Moist Old Field Meadow (ELC Code: CUM1-1)

This community followed the access road to the northern portions of the property. Several areas of exposed rock were found within this community, especially on the southern portions of the property. This community contained mostly species typical of disturbed areas. Some of these species included agrimony (*Agrimonia gryposepela*), awnless brome grass (*Bromus inermus ssp inermus*), bird's-foot trefoil (*Lotus corniculatus*), bitter dock (*Rumex obtusifolius*), black-eyed Susan, burning bush (*Euonymus atropurpurea*) and Canada anemone (*Anemone canadensis*).

Photo 8 & 9: Field meadow with some exposed rock (August 29, 2013)

Community 12 Fresh-Moist White Cedar-Balsam Fir Coniferous Forest (ELC Code: FOC4-3)

This community was located along the western edge of the field set aside for agricultural purposes. This coniferous forest was primarily dominated by eastern white cedar and balsam fir. This forest was situated on a steep slope abutting the rock barren Community 13 to the west of it. Other tree species found in this community as minor associates included balsam poplar, red oak (*Quercus rubra*), trembling aspen, white birch and white spruce (*Picea glauca*). The ground cover was not dense as little sunlight reached the forest floor. Those ground species found to tolerate these conditions included American gromwell (*Lithospermum latifolium*), American yew (*Taxus canadensis*), black snakeroot, bluebead lily (*Clintonia borealis*), bristly black currant (*Ribes lacustre*), bulbet bladder fern (*Cystopteris bulbifera*), Canada mayflower, coltsfoot (*Tussilago farfara*) and common bearberry (*Arctosaphylos uva-ursi*).

Photo 10. Conifer forest (August 29, 2013)

Community 13 Common Juniper Carbonate Shrub Rock Barren (ELC Code: RBS1-1)

This community was found directly adjacent to the existing quarry off of property. The tree cover varied from patch and barren to more closed in nature with a tree cover of <25% and shrub cover of >25%. Common juniper was the dominant shrub that persisted through the entire community. Some of the few tree species observed on site included American

basswood, American elm, black cherry, bur oak, eastern white cedar and eastern white pine. Several ground species were found patchy in nature including balsam ragwort (*Senecio pauperculus*), barren strawberry (*Waldsteinia fragarioides*), Bicknell's crane's-bill (*Geranium bicknellii*), buffalo berry (*Shepherdia canadensis*), Canada goldenrod, climbing bittersweet (*Celastrus scandens*), maidenhair spleenwort and early saxifrage (*Saxifraga virginiensis*).


Photo 11 and 12. Juniper shrub rock barren (August 29, 2013)

Community 14 Fresh-Moist White Cedar-Hardwood Mixed Forest (ELC Code: FOM7-2)

This community was found in small pockets, patchy in nature, along the northern limits of the access road. This mixed forest contained eastern white cedar with other species including American basswood, American elm, balsam fir, black ash, bur oak and eastern red cedar. Other species found within these forest pockets include asparagus (*Asparagus officinalis*), barren strawberry, bitter nightshade, buffalo berry, common yarrow (*Achillea millefolium*), dwarf raspberry, fringed loosestrife (*Lysimachia ciliata*), grass-leaved goldenrod (*Euthamia graminifolia*), rugosa rose (*Rosa rugosa*) and snowberry (*Symphoricarpos albus*).

Community 15 Dry-Fresh White Cedar Coniferous Forest (ELC Code: FOC2-2)

This community was found surrounding Community 10 on the western boundary of the property. Dominated by eastern white cedar, other tree species also existed including balsam fir, balsam poplar, eastern white pine, ironwood (*Ostrya virginiana*) and red oak in lower densities. The ground was covered in herbaceous species including Canada mayflower, helleborine, northern lady fern (*Athyrium filix-femina*), maidenhair spleenwort and western poison-ivy (*Rhus rydbergii*).

Community 16 Dry-Fresh White Cedar-White Birch Mixed Forest (ELC Code: FOM4-1)

This large community in the central portion of the property contained a good mixture of species. Several steep inclines existed within this community and lots of blowdown was found throughout. The dominant species were eastern white cedar, sugar maple and eastern hemlock and white birch present. Several other tree species were found including balsam fir, balsam poplar and American basswood. Other species within this community included bitter nightshade, black snakeroot, blue cohosh (*Caulophyllum giganteum*), bull thistle, Canada enchanter's nightshade, Christmas fern, coltsfoot (*Tussilago farfara*) and common gromwell (*Lithospermum officinale*).

Photo 13. Steep slope of white cedar-white birch mixed forest (August 29, 2013)

Community 17 Moist Ash Lowland Deciduous Forest (ELC Code: FOD7-2)

This community was located on the eastern side of the property adjacent to the access road. Green ash was the dominant species within this community; other tree species present included sugar maple, white birch, red maple and balsam fir. Blue cohosh, Canada mayflower, early meadow rue, evergreen wood-fern, hairy Solomon's seal, large-flowered bellwort (*Uvularia grandifolia*) and northern white violet (*Viola macloskeyi*) were some of the many ground species present within this forest community.

Community 18 Dry-Fresh Poplar Mixed Forest (ELC Code: FOM5-2)

This community was found adjacent the entrance to the quarry site and followed the access road. This community was primarily dominated by poplar species including trembling aspen and large-toothed aspen (*Populus grandidentata*). Other tree species found included eastern white cedar, eastern white pine, sugar maple, white ash and white birch. Shrub species present within the community included beaked hazel (*Corylus cornuta*), hawthorn species (*Crataegus* ssp), leatherwood (*Dirca palustris*) and prickly gooseberry.

3.3 Breeding Birds

A total of 72 bird species were recorded, representing forest, field and wetland species (Appendix II). Most species were breeding either on the property or within the greater study area. Bird species included Canada goose (*Branta canadensis*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), ruffed grouse (*Bonasa umbellus*), American bittern (*Botaurus lentiginosus*), killdeer (*Charadrius vociferous*), red-shouldered hawk (*Buteo lineatus*), barred owl (*Strix varia*), belted kingfisher (*Megaceryle alcyon*) and blue-headed vireo (*Vireo solitarius*).

3.4 Herpetozoa

Amphibian species recorded in the spring and summer surveys included northern leopard frog *(Lithobates pipiens)*, gray treefrog *(Hyla versicolor)*, green frog *(Lithobates clamitans melanot),* American toad *(Bufo americanus americanus)*, wood frog (*Rana sylvatica*), American bullfrog (*Lithobates catesbeiana*), spring peeper (*Pseudacris crucifer*), red-spotted newt (*Notophthalmus viridescens viride*) and eastern red-backed salamander (*Plethodon cinereus*) (Appendix III). Large numbers of adult red-spotted newt (dozens) were found in the watercourse throughout the site.

Photo 14. Painted turtle caught June 3rd. 2013

Photo 15. Adult eastern red-spotted newt

Three snakes were observed on the property including smooth green snake (*Opheodrys vernalis*), northern red-bellied snake (*Storeria occipitomaculata occipitomacu*) and common gartersnake (*Thamnophis sirtalis*) (Appendix III). No massasauga or eastern hog-nosed snake were observed. No hibernacula or oviposition sites were found during our surveys. An adult eastern painted turtle was caught in a fyke net in the pond north of the property limits on June 3rd, 2013. No Blanding's turtle, map, spotted or snapping turtles were observed.

3.5 Mammals

Wildlife recorded on site included white-tailed deer (*Odocoileus virginianus),* red squirrel (*Tamiasciurus hudsonicus*) and eastern chipmunk (*Tamias striatus*) (Appendix IV). Other species recorded indirectly by sign included: black bear (*Ursus americanus*), American beaver (*Castor canadensis*), common porcupine (*Erethizon dorsatum*), common raccoon (*Procyon lotor*), coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*), red fox (*Vulpes vulpes*) and moose (*Alces alces*).

Bat acoustic data is being reviewed for this site. Bat information will be provided in an addendum to MNRF.

3.6 Fish and Aquatic Habitat

3.6.1 Aquatic Habitat Assessment

Surface water and associated aquatic habitat belongs to the Regional Black-Severn River watershed. The aquatic habitat present within the study area was present in two first order tributaries and connected wetlands of the Grass Lake watershed.

The first order watercourses were not officially named. For the Cumberland Quarry project, they will be referred to as Watercourse 1 and 2 (MTE, January 31, 2014). Both watercourses are intermittent, flowing all year except for the month of July (MTE, January 31, 2014).

Surface water flows are provided from the upstream wetland headwater features located off-site, four on-site catchment areas and Watercourse 1 and 2 local catchment, local springs and the neighbouring Severn Pines Quarry groundwater discharge and precipitation, diverted directly into Watercourse 1 (MTE, January 31, 2014). The Severn Pines Quarry contributes 76% of the Watercourse 1 baseflow and is a predominate feature influencing the watercourse aquatic habitat.

Biologists were onsite October 24th 2012, June 3rd and June 4th 2013 to assess the Watercourse 1 and 2 aquatic habitat form and function. The number and distribution of survey sites were selected and stratified based on the study objective (before and after comparison), stream order, current land use and unique features (Table 66 & Figure 3). A total of seven aquatic habitat sites were established and assessed in 2012 and 2013. Detailed site descriptions have been provided below.

Watercourse 1

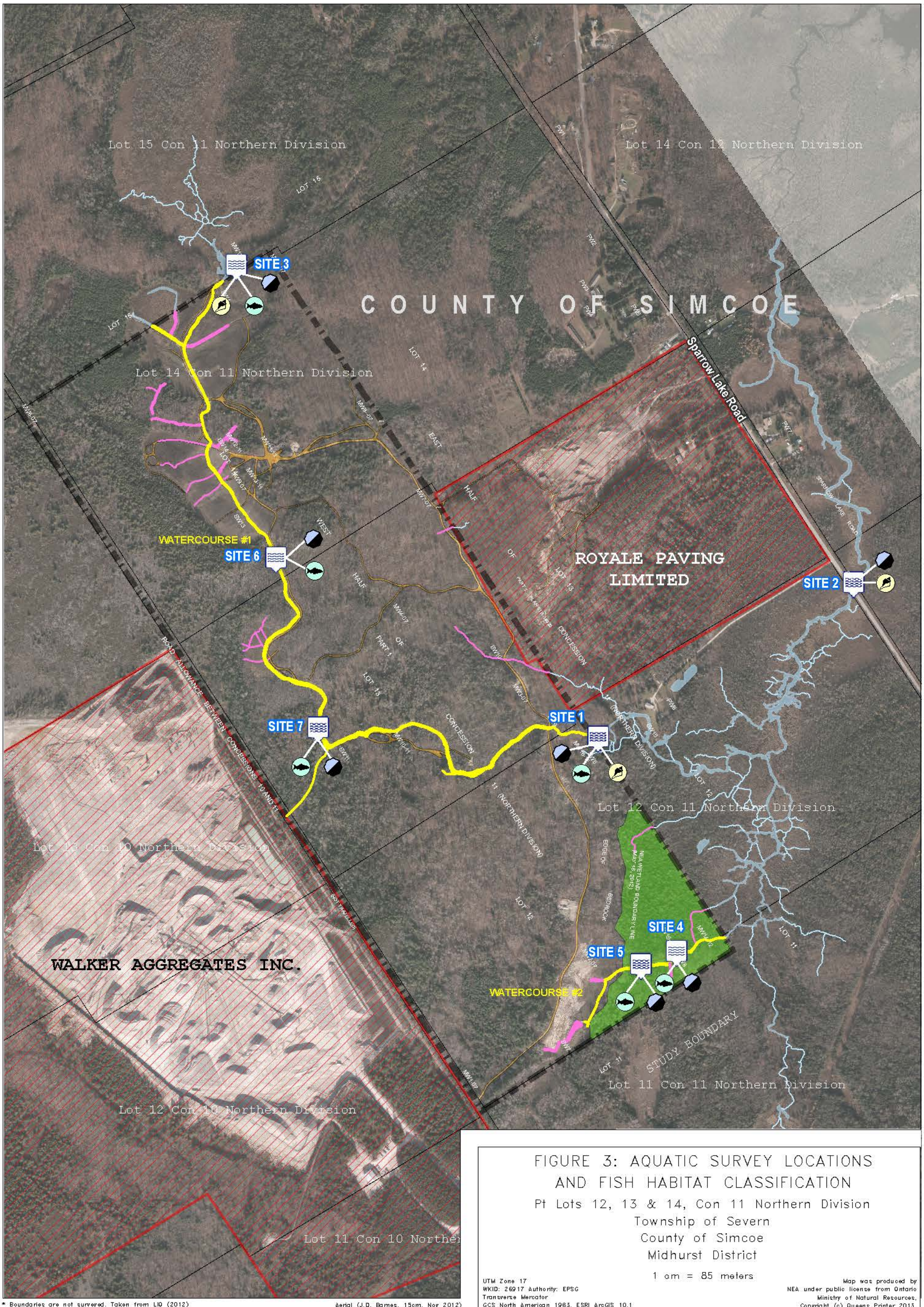
The Watercourse 1 channel form has been heavily modified form historic ditching and grading. The ditching has straightened and hardened the watercourse banks, exposing the shallow limestone and homogenizing the aquatic substrate. The surrounding land use north of the Severn Pines Quarry outlet has been cleared for agricultural purposes, minimizing the riparian buffer, destabilizing banks and enhancing sedimentation of upland soils into the watercourse. Downstream of the Severn Pines Quarry, the surrounding land use is primary forested lands that have been maintained and channel manipulation is less prevalent. The watercourse leaves the site along the west property line through a CSP culvert, draining into a wetland where natural channel form returns.

Three aquatic survey sites (Site 1, 6 and 7) were established to provide a baseline of the watercourse substrate composition, riparian habitat, percent in-stream cover and unique features. Biologist walked the entire length of the watercourse of 2269 m, selecting sites representative of the watercourse and reflective of unique habitat types (Figure 3 for watercourse and site locations).

Table 6. Aquatic Habitat Observations (October 24th 2012, June 3rd & 4th 2013).

Site #	Survey Type	Collection Date	Substrate Composition	Percent In-stream Cover	Riparian Habitat Cover	Average Wetted Width (m)	Average Depth (m)	Direct or Indirect Habitat
1	FC	June 3rd & 4th 2013	50% sand 20% clay 30% fine organics	5% large woody debris 5% overhanging vegetation	30% shrubs	1.5	0.43	Direct
	BC	October 24th 2012						
	WQ	October 24th 2012 & June 4th 2013						
2	BC	October 24th 2012	50% gravel 20% sand 20% detritus	5% submergent vegetation 5% emergent vegetation 15% undercut banks	5% shrubs 5% woody debris 10% undercut banks	7.5	0.50	Direct
	WQ	October 24th 2012						
3	FC	June 3rd & 4th 2013	10% sand 80% fine organics 10% vegetation	60% emergent vegetation	5% dead trees 2% shrubs 2% woody debris	30	0.35	Direct
	BS	October 24th 2012						
	WQ	October 24th 2012 & June 4th 2013						
4	FC	June 3rd & 4th 2013	50% fine organics 50% detritus	80% algae	20% tree stumps	3.5	0.69	Direct
	WQ	June 4th 2013						
5	FC	June 4th 2013	70% clay 30% detritus	10% vegetation 30% algae	2% shrubs	3.5	0.46	Direct
	WQ	June 4th 2013						
6	FC	June 3rd & 4th 2013	100% sand	15% emergent vegetation	10% trees 5% terrestrial vegetation	2.2	0.13	Direct
	WQ	June 4th 2013						
7	FC	June 3rd & 4th 2013	20% sand 40% clay 20% silt 20% fine organics	2% submergent vegetation 1% emergent vegetation 1% boulders 1% undercut banks	2% trees 10% shrubs 3% non woody vegetation 1% undercut banks	4.0	0.3	Direct
	WQ	June 4th 2013						

Note: FC=Fish Community, BC=Benthos Community, WQ=Water Quality



* Boundaries are not surveyed. Taken from LIO (2012)

Aerial (J.D. Barnes, 15cm, Nov 2012)

FIGURE 3: AQUATIC SURVEY LOCATIONS AND FISH HABITAT CLASSIFICATION

Pt Lots 12, 13 & 14, Con 11 Northern Division
Township of Severn
County of Simcoe
Midhurst District

1 cm = 85 meters

UTM Zone 17
WKID: 26917 Authority: EPSG
Transverse Mercator
GCS North American 1983, ESRI ArcGIS 10.1

LEGEND

- Watercourse
- Surface Water
- Study Boundary
- Aggregate Authorized Area*
- Wetland, PSW
- Access Road/Built-up Area

Fish Habitat

- Direct Fish Habitat
- Indirect Fish Habitat

Survey Sites

- Aquatic Survey Site
- Benthic Collection
- Fish Collection
- Water Quality

REVISIONS

NO	BY	DATE	DESCRIPTION
1	W.P.	03/07/2013	Initial map creation.
1	W.P.	30/07/2013	Added water quality to Site 2.

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PROJECT NO: 10-015
PROJECT TITLE: Severn Quarry
CLIENT: Severn Aggregates Ltd. Partnership

10015_009

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Watercourse 1 Site Descriptions

Site 6 was the most northern site, located approximately 600m northeast of the Severn Pines Quarry (Figure 3). The substrate at this site was dominated by sand (0.06-2mm) with low overhead cover (0-24%) consisting of trees and overhanging terrestrial grasses. The instream cover was considered to be moderate with aquatic emergent vegetation. The average wetted width was 2.2m with an average water depth of 0.13m. The surrounding vegetation was dominated by terrestrial grasses and woody debris (Table 6). Site 6 was located within Vegetation Community 7 (Vegetation Section 3.2 and Figure 2 for full details). The watercourse was classified as direct fish habitat based on its permanency; habitat structure and the presence of fish (Fish Community, Section 3.6.2).

Photo 16: Site 6, fish community and water quality location, facing north (June 3rd 2013).

Site 7 was located approximately 512m south of Site 6 and 615m northwest of Site 1 (Figure 3). The substrate was dominated by clay (hard pan) and with low overhead cover (0-24%) consisting of trees and non woody vegetation. There was little to no instream cover, the average wetted width was approximately 4.0m with an average water depth of 0.3m. The surrounding vegetation was dominated by a wooded lot (Table 6). Site 7 was located between Vegetation Communities 9 and 16 (Vegetation Section 3.2 and Figure 2 for full details). The watercourse was classified as direct fish habitat based on its permanency; habitat structure and the presence of fish (Fish Community, Section 3.6.2).

Photo 17: Site 7, fish community and water quality location, facing north (June 4th 2013).

Site 1 was the most south-eastern site in Watercourse 1, located north on Nichols Line and north east of the quarry entrance. The site was downstream of the confluence and east of the ATV trail (Figure 3). The substrate was dominated by sand (0.06-2mm) with low overhead cover (0-24%) consisting of overhanging terrestrial grasses, trees and shrubs. The instream cover was also low consisting of small woody debris, the average wetted width was approximately 1.5m and the average water depth was 0.43m. The surrounding riparian vegetation was dominated by terrestrial shrubs (Table 6). This site was located in Vegetation Community 11 (Vegetation Section 3.2 and Figure 2 for full details). The watercourse was classified as direct fish habitat based on its permanency; habitat structure and the presence of fish (Fish Community, Section 3.6.2).

Photo 18: Site 1, fish community & water quality location, facing east (downstream of benthos collection) (June 3rd 2013).

Photo 19: Site 1, benthos and water quality location, facing east (upstream of fish community sampling location) (October 24th 2012).

Watercourse 2

The Watercourse 2 channel form has been modified from ditching and grading at its headwaters. The ditching has straightened and hardened the watercourse banks, exposing the shallow limestone and homogenizing the aquatic substrate. Watercourse manipulation has degraded the riparian buffer, destabilized banks and enhanced sedimentation of upland soils into the watercourse. The lower half of the watercourse has been maintained and channel form is naturalized, dissipating into a PSW wetland.

Two aquatic survey sites (Site 4 and 5) were established to provide a baseline of the watercourse substrate composition, riparian habitat, percent in-stream cover and unique features. Biologist walked the entire length of the watercourse (427m), selecting sites representative of the watercourse and reflective of unique habitat types (Figure 3 for watercourse and site locations).

Watercourse 2 Site Descriptions

Site 4 was located in Watercourse 2 at the most south-east corner of the property boundary, approximately 500m southeast of Site 1 (Figure 3). The substrate was comprised equally of fine organics and detritus with moderate overhead cover (25-49%) consisting of trees, and large woody debris. The instream cover was dense and comprised of large amounts of algae mats. The average wetted width was approximately 3.5m with an average water depth of 0.69m. The surrounding riparian vegetation consisted of a wooded lot and terrestrial vegetation common to those found in swamps (Table 6). This site was located in Vegetation Community 6 (Vegetation Section 3.2 and Figure 2 for full details). The watercourse was classified as direct fish habitat based on its permanency; habitat structure and the presence of fish (Fish Community, Section 3.6.2).

Photo 20: Site 4, fish community and water quality location, facing west (June 3rd 2013).

Site 5 was located at the southeast corner of the property boundary, approximately 120m west of Site 4 (Figure 3). The substrate at this site was dominated by clay (hard pan) with low overhead cover (0-24%) consisting of shrubs and overhanging terrestrial grasses, similar to Site 4 the instream cover was dense with algae. The average wetted width was approximately 3.5m and average water depth was 0.46m. The surrounding vegetation consisted of terrestrial and aquatic shrubs and grasses (Table 6). The site was located in Vegetation Community 6. Refer to the Vegetation section 3.2 for full details (Figure 2). The watercourse was classified as direct fish habitat based on its permanency; habitat structure and the presence of fish (Fish Community, Section 3.6.2).

Photo 21: Site 5, fish community and water quality location, facing east (June 4th 2013).

Off-Site Locations

A total of two offsite locations were established outside the study area boundaries for long-term monitoring. Aquatic survey sites documented substrate composition, riparian habitat, percent in-stream cover and unique features. Off-site aquatic survey site location descriptions have been provided below and illustrated in Figure 3.

Site 2 was located on the east side of South Sparrow Road, approximately 1000m northwest of the Cambrian, South Sparrow Road intersection and 720m northeast of Site 01 (Figure 3). The substrate was dominated by gravel (2-65mm) with little to no overhead cover (0-24%) consisting of overhanging terrestrial and wetland grasses. The instream cover was comprised of emergent and submergent aquatic vegetation. The average wetted width was approximately 7.8m with an average water depth was 0.50m. The surrounding vegetation consisted of wetland plant species (Table 6). The watercourse was classified as direct fish habitat based on its permanency, habitat structure and the presence of fish (Fish Community, Section 3.6.2).

Photo 22: Site 2, benthos and water quality location, facing east (October 24th 2012).

A control site (Site 3) was established to compare temporal aquatic form and function data during operation and decommissioning. The site was located north on South Sparrow Road (approximately 1000m north of Site 2) in a wetland located just north of northern boundary of the study area, west of the ATV trail (Figure 3). The site was selected as a control site and will be used to assess long-term aquatic habitat health within the study area. The control site is upstream of the quarry development and will not be directly

impacted by the proposed works. The site substrate was comprised equally of clay (hard pan), silt (<0.06mm) and detritus. Overhead cover was low (0-24%) consisting of dead trees and aquatic vegetation. The instream cover was dense with emergent aquatic vegetation; the average wetted width was approximately 30m with an average water depth of 0.35m (Table 6). The surrounding vegetation was dominated by common wetlands species. This site was located in Vegetation Community 1 (Vegetation Section 3.2 and Figure 2 for full details). The watercourse/wetland was classified as direct fish habitat based on its permanency; habitat structure and the presence of fish (Fish Community, Section 3.6.2).

During a site visit on August 29th 2013, NEA staff observed a new ATV/snowmobile trail was constructed through the off-site wetland. The road was constructed directly over top of the control site. NEA staff re-established the site in 2014 to facilitate temporal data comparison.

Photo 23: Site 3, fish community, benthos and water quality location, facing northeast (June 4th 2013).

Photo 24: ATV road constructed in 2013 through the off-site wetland, facing northeast. (August 29th 2013).

Photo 25 (left): Site 3, newly established benthos community control site upstream of ATV road, facing northwest (October 15th 2014).
Photo 26 (right): Site 3, newly established benthos community control site upstream of ATV road, facing northeast (October 15th 2014).

3.6.2 Fish Community

No historical fisheries information was found on the tributaries located within the study area (A. Brad, OMNR, pers comm., Dec. 16th 2010), however a list of historical fish species sampled within the study watershed, Grassy Lake (Table 7) obtained from OMNR Grass Lake Wetland Evaluation document (OMNR, 1989).

Table 7. List of Fish Species in Grass Lake (OMNR, 1989).

Family	Common Name	Scientific Name
Centrarchidae	largemouth bass	*Micropterus salmoides*
	pumpkinseed	*Lepomis gibbosus*
Cyprinidae	common carp	*Cyprinus carpio*
Esocidae	northern pike	*Esox lucius*
Percidae	walleye	*Sander vitreus*
	yellow perch	*Perca flavescens*

Grass Lake is located approximately 5 kilometres downstream of the study area. Fish species known to inhabit Grass Lake include a mix of both warm and cool-water species. A list of the fish species captured within Watercourse 1 and 2 during the 2013 fish community sampling have been summarized in Table 8 and shown in Figure 3. Detailed results can be found in Appendix V. Habitat preferences for each species collected by NEA have been provided in Table 9.

Table 8. Fish Community Sampling, Gear, Dates, Efforts and Catch by Site (June 3rd & 4th 2013).

Family Name	Common Name	Scientific Name	Site 1 Sample 1	Site 3 Sample 1	Site 4 Sample 1	Site 5 Sample 1	Site 6 Sample 1	Site 6 Sample 2	Site 6 Sample 3	Site 7 Sample 1
Cyprinidae	Brassy Minnow	*Hybognathus hankinsoni*	0	4	0	0	0	0	0	8
	Creek Chub	*Semotilus atromaculatus*	0	0	0	0	0	2	0	1
	Northern Redbelly Dace	*Chrosomus neogaeus*	1	3	0	10	0	0	0	0
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*	1	0	0	0	0	0	0	0
Gasterosteidae	Brook Stickleback	*Culaea inconstans*	0	0	1	10	0	0	0	0
Umbridae	Central Mudminnow	*Umbra limi*	0	0	0	10	0	0	0	0
Catch Summary										
		Abundance	2	7	1	30	0	2	0	9
		Species Diversity	2	2	1	3	0	1	0	2
Environmental Conditions										
		Air Temperature (°C)	24.0	15	19	19	15.4	15.5	15.4	18
		Stream Temperature (°C)	21.4	13.7	14.5	18.5	23.4	21.8	23.4	23.1
Sample Attributes										
Seine (SN), Minnow Trap (MT), Fyke Net (FN), Mini Fyke Net (MFN)		Gear Type	MT	FN	MT	MFN	SN	MFN	SN	SN
		Gear Details	16’5”, 21” opening, 1.5”	40’ x 5’	16’5”, 21” opening, 1.5”	5' wings 1/4" mesh	15’ x 4’	5' wings 1/4" mesh	15’ x 4’	15’ x 4’
		Site Length (m)	N/A	12	N/A	3	5	3	3	5
		Average Wetted Width (m)	1.5	1.5	3.5	1.5	1.5	1.5	1.5	4
		Average Depth (m)	0.43	1.0	0.69	0.5	0.3	0.3	0.3	0.25

Table 9. Fish Species Habitat Preferences (Becker, 1983) (Scott & Crossman, 1973).

Common Name	Scientific Name	Thermal Regime	Preferred Temp	Spawning Temp	Time Of Spawning	Spawning/Nesting Description
Brassy Minnow	*Hybognathus hankinsoni*	warm	26 °C	14-29 °C	May-July	no nest are constructed, eggs are deposited and fertilized on aquatic vegetation sometimes in flooded marshes
Northern Redbelly Dace	*Phoxinus eos*	cool	25.3 °C	13-21 °C	June-August	no nest are constructed, eggs are deposited and fertilized on filamentous algae
Creek Chub	*Semotilus atromaculatus*	cool	unknown	13-17 °C	May-July	trench like nest 25-30 cm wide 76 cm long excavated in fine gravel
Brook Stickleback	*Culaea inconstans*	cool	23.8 °C	20-27 °C	June-August	globular nests 1.5-5 cm diameter, constructed of organic debris, filamentous algae and/or other materials by the male
Central Mudminnow	*Umbra limi*	warm	29 °C	16-29 °C	May-August	no nest are constructed, eggs are laid directly on leaves of plants in flooded areas
Pumpkinseed	*Lepomis gibbosus*	warm	18-24°C	20-28 °C	May-August	pit nest 10-40 cm in diameter excavated by males

3.6.3 Benthos Community

The benthos community baseline sample locations were established and collected on October 24th 2012. Three sites were established (Sites 1, 2 & 3), three subsamples (A, B and C) were collected within Sites 1 and 3 and two subsamples within Site 2 (Figure 3 and Appendix VI). Benthos community sampling metrics are displayed in Table 10.

As stated in Section 3.6.1, the benthos community control site (Site 3) was re-established and sampled on October 15th 2014 directly upstream (northwest) of the constructed ATV/snowmobile trail. The 2012 and 2014 samples for Site 3 were compared and discussed in this section, analysis and comparisons for the entire benthos community will include Site 1, 2 (2012 collection) and Site 3 (2014 collection).

Site 3 Comparison

Comparisons of the benthos community between the 2012 and 2014 samples show that some families were not collected in 2014 that were in 2012. As well new families that appeared in the 2014 samples were not observed in the 2012 samples. Detailed results have been illustrated in Table 10. The difference of families could be due to the habitat conditions in the 2014 samples. The substrate within all samples had a second dominated of substrate of sand whereas the 2012 was clay (Table 13).

The Hilsenhoff values were very similar between both samples. The environmental sensitivity metrics are also similar with the exception of percent EPT. Ephemeropta only appeared in the 2014 samples (Table 10).

Grass Lake Tributary Benthos Community

The study area benthos community was comprised of 14 orders and 37 families (Table 10). The most abundant order was Diptera which made up 46.9% of all samples combined. The least abundant was Odonata (Dragonfly) (0.35%), Tricoptera and Odonata (Damselflies). Each of these orders making up 0.47% of all samples combined. Of the 46.86% of Diptera, 33% was comprised of the family *Chironomidae*, 11% was *Ceratopogoidae*, 0.95% was *Tabanidae*, 0.35% was *Tipulidae*, 0.7% was *Tipulidae* and the remaining 0.1% was comprised of *Emphididae* and *Simullidae*. Site 02, sample A/B(2) had the highest species diversity (13 families). Site 01, sample C had the lowest species diversity (8 families) (Table 10).

Table 10. Benthos Raw Abundance Data and Community Analysis from Grass Lake Tributary (24-Oct-12 & 15-Oct-14).

Sampling Year	2012			2012		2012			2014			
Site Code	1			2		3						Hilsenhoff Tolerance Value
Sample	1			1		1			2			
SubSample	A	B	C	A/B (1)	A/B (2)	A	B	C	A	B	C	
Amphipoda (Scuds)												
Crangonyctidae	0	0	0	0	22	0	0	0	0	0	0	4
Gammaridae	0	0	0	23	23	0	0	0	0	0	0	4
Hyalellidae	0	0	0	33	13	0	0	0	0	0	0	8
Bivalvia (Clam)												
Sphaeriidae	2	2	0	2	1	0	0	0	5	3	8	8
Coleoptera (Beetles)												
Dysticidae	0	0	0	2	2	0	0	0	0	0	0	5
Haliplidae	0	0	0	0	1	0	0	0	2	1	0	5
Crustacea												
Cladocera	0	0	0	0	0	7	0	0	0	0	0	8
Cyclopoida	0	0	0	0	0	15	1	0	1	0	0	8
Ostracoda	0	0	0	0	0	2	0	0	0	0	0	8
Diptera (Flies)												
Ceratopogoidae	24	5	8	0	0	20	17	4	22	29	10	6
Chironomidae	30	16	16	26	10	61	65	51	67	63	59	6
Dolicholodidae	0	0	0	0	0	2	1	0	0	0	0	4
Empididae	1	0	0	0	0	0	0	0	0	0	0	6
Simuliidae	0	0	1	0	0	0	0	0	0	0	0	6
Stratiomyidae	0	0	0	0	0	2	5	23	0	0	0	7
Tabanidae	1	4	0	0	0	0	1	3	0	2	2	6
Tipulidae	3	0	0	0	0	0	3	0	0	0	0	3

Ephemeroptera (Mayfly)												
Ephemerellidae	0	0	0	0	0	0	0	0	0	3	2	1
Heptageniidae	0	0	0	0	0	0	0	0	2	0	0	4
Siphlonuridae	0	0	0	0	0	0	0	0	0	0	4	7
Hemiptera (True Bugs)												
Corixidae	0	0	1	2	5	0	0	0	0	1	0	5
Notonectidae	0	0	0	0	0	0	1	0	0	0	0	no tolerance value
Hirudinea (Leech)												
Hirudinea	0	1	0	0	2	0	0	0	0	0	3	10
Isopoda (Sowbugs)												
Asellidae	0	0	0	9	18	0	0	0	0	1	0	8
Mollusca-Gastropoda (Snail)												
Basommatophora												
Lymnaeidae	0	0	0	0	0	1	1	0	0	0	0	6
Physidae	19	19	7	0	0	0	0	0	0	0	2	8
Planoribidae	0	0	0	0	1	0	1	0	0	0	0	7
Mesogastropoda												
Hydrobiidae	12	10	4	5	6	0	0	3	0	0	0	7
Odonata (Dragonfly)												
Gomphidae	0	2	0	0	0	0	0	0	0	0	0	1
Libellulidae	0	0	0	0	0	1	2	1	1	0	0	9
Odonata (Damselflies)												
Lestidae	0	0	0	2	2	0	1	3	0	0	0	9
Oligochaeta (Aquatic Worms)												
Tubificidae	7	6	11	0	0	5	0	10	1	1	9	8
Plecoptera (Stoneflies)												

Perlodidae	0	50	68	0	0	0	0	0	0	0	0	2
Tricoptera (Caddisfly)									0			
Glossosomatidae	1	0	0	0	0	0	0	0	0	0	0	0
Limnephilidae	0	0	0	0	0	0	0	2	0	0	1	4
Phryganeidae	0	0	0	1	0	0	1	0	1	0	0	4
OTHER												
Nematomorpha	0	0	0	0	0	2	0	0	0	0	0	no tolerance value
Community Analysis												
Number of Organisms	100	115	116	105	106	118	100	100	101	103	100	
Simpsons Diversity Index	0.20	0.24	0.38	0.21	0.14	0.31	0.45	0.32	0.48	0.45	0.37	
Richness (Number of Taxa)	10	10	8	10	13	11	13	9	9	9	10	
Percent of dominant taxa	30	21.85	78.88	34.65	24.38	71.98	65	51	67.67	64.89	59	
Percent of *Oligochaeta*	7.00	5.22	9.48	0.00	0.00	4.24	0.00	10.00	0.99	0.97	9.00	
Percent of *Chironomidae*	30.00	13.91	13.79	24.76	9.43	51.69	65.00	51.00	66.34	61.17	59.00	
Percent of EPT	1.00	43.48	58.62	0.95	0.00	0.00	1.00	2.00	2.97	2.91	7.00	
Ratio of EPT to *Chironomidae*	0.03	3.13	4.25	0.04	0.00	0.00	0.02	0.04	0.04	0.05	0.12	
Percent of ETO	8.00	5.22	9.48	0.95	0.00	4.24	1.00	12.00	3.96	3.88	16.00	

The most abundant family appearing in all samples was *Chironomidae* which is part of the Diptera (Flies) taxonomic order. They are also known as non-biting midges or chironomids. Chironomids are tolerant to a wide range of water and air temperatures and are found in almost any aquatic ecosystem. Chironomids are considered to be gatherers/collectors feeders. They tend to feed on fine to medium detritus particles on organic substrates. During their entire life cycle, they are heavily preyed upon by young-of-year predaceous fish (Merrit, Cummins, & Berg, 2008).

There were some families were rare across the samples only appearing once within all the samples. Within the Diptera (flies) order, the family *Simuliidae* was only seen in Site 1 subsample C and *Emphidae* was only seen in Site 1 in subsample A. Within the Tricoptera (Caddisfly) order, the family *Glossosomatidae* was also only seen once in Site 1, subsample A. The order Ephemoptera (Mayflies) were only observed in Site 3 (Table 10).

Benthos community composition was assessed using the eight metrics shown in Table 10, Metrics showing environmental sensitivity have been discussed below.

Families of Ephemeroptera, Plecoptera and Trichoptera (EPTs) are considered to be sensitive to pollution, preferring oxygen rich habitats. Higher proportions of these organisms are expected at less impacted sites area (Merrit, Cummins, & Berg, 2008). The percentage of EPTs was variable across the samples, averaging 14.62%, ranging from 0% to 58.62% within the samples (Table 10).

ETOs (Ephemeroptera, Trichoptera and Oligochaeta) are a grouping considered to be environmentally sensitive (Merrit, Cummins, & Berg, 2008). The average percentage of ETO through all eight samples was 5.94% and ranged from 0% to 16.00% (Table 10).

The average proportion of EPT to one Chironomidae was high (0.96), ranging from 0.00 to 4.25%. The high observed values indicate a balance community and is reflective of little environmental stress (Table 10)

Simpsons Diversity Index simply measures the diversity within the sample; zero (0) indicates a low diversity and one (1) indicates a high diversity. The sample that had the lowest diversity was sample A/B (2) in Site 2 with a rating of 0.14 and the sample with the highest diversity was sample A in Site 3 with a rating of 0.48 (Table 10).

The total percentage of each taxonomic family within the entire sampling area, including all three subsample sites has been illustrated in Table 11.

Table 11. Percentage of family level benthic macro-invertebrates sampled in Grass Lake Trib pooled site data from Site 1, Site 2 & Site 3.

Taxa	Total	Percentage (%) of Both Sites
Chironomidae	287	33.92
Perlodidae	118	13.95
Ceratopogoidae	97	11.47
Physidae	47	5.56
Gammaridae	46	5.44
Hyalellidae	46	5.44
Hydrobiidae	37	4.37
Tubificidae	35	4.14
Asellidae	28	3.31
Sphaeriidae	23	2.72
Crangonyctidae	22	2.60
Corixidae	9	1.06
Tabanidae	8	0.95
Hirudinea	6	0.71
Ephemerellidae	5	0.59
Dysticidae	4	0.47
Haliplidae	4	0.47
Siphlonuridae	4	0.47
Lestidae	4	0.47
Tipulidae	3	0.35
Heptageniidae	2	0.24
Gomphidae	2	0.24
Phryganeidae	2	0.24
Cyclopoida	1	0.12
Empididae	1	0.12
Simuliidae	1	0.12
Planoribidae	1	0.12
Libellulidae	1	0.12
Glossosomatidae	1	0.12
Limnephilidae	1	0.12

Water quality was assessed using the Hilsenoff Biotic Index. This index is based on a biotic index value. The higher the biotic index value is the greater amount of organic pollution assumed. The lower the biotic index the less organic pollution assumed.

The majority of the sample location had fair water quality indicating existing baseline aquatic environment was impacted by organic pollution (Table 12). Site 1, subsample B had good water quality indicating there was very low organic pollution. All subsamples within Site 3 had fairly poor water quality, indicating existing baseline aquatic environment was impacted substantially by organic pollution (Table 12).

Table 12. Evaluation of Water Quality using the Biotic Index (Hilsenhoff, 1988).

Sampling Year	Site	Sample	Sub Sample	Hilsenhoff Biotic Index	Water Quality Index	Degree of Organic Pollution
2012	1	1	A	6.53	Fair	Fairly Significant Organic Pollution
			B	4.77	Good	Some Organic Pollution
			C	3.99	Very Good	Possible Slight Organic Pollution
2012	2	1	A/B (1)	6.45	Fair	Fairly Significant Organic Pollution
			A/B (2)	5.88	Fair	Fairly Significant Organic Pollution
2012	3	1	A	6.40	Fair	Fairly Significant Organic Pollution
			B	5.98	Fair	Fairly Significant Organic Pollution
			C	6.54	Fairly Poor	Significant Organic Pollution
2014	3	2	A	6.49	Fairly Poor	Significant Organic Pollution
			B	5.93	Fairly Poor	Significant Organic Pollution
			C	6.42	Fairly Poor	Significant Organic Pollution

Benthos Habitat

The substrate varied at each benthos sampling site. Site 1 substrates were dominated by cobble. Site 2 substrates were mixed with both gravel and detritus and Site 3 substrates were dominated by silt. Depths for all sampling locations ranged from 0.11m to 0.56m (Table 13).

The two most abundant families found within the benthos samples were *Chironomidae* and *Perlodidae* (Table 11). *Chironomidae* can be found in almost any kind of aquatic ecosystem and are very resilient (Merrit, Cummins, & Berg, 2008), thus it is expected that this family would be the most abundant within all samples. The *Perlodidae* family is within the Plecoptera (Stonefly) order. They are typically found in cool waters that have gravel/cobble substrate (McCafferty, 1998). *Perlodidae* were only found in Site 2, subsample B and C (Table 10). This likely due to the dominate substrate found at these two subsample locations namely cobble and gravel, which as discussed above is optimal habitat for Plecoptera (Table 13).

Table 13. Benthos Habitat for Site 1, Site 2 and Site 3 (24-Oct-12 & 15-Oct-14).

Sampling Year	2012			2012		2012			2014		
Site	1			2		3					
Sample	1			1		1			2		
Sub Sample	A	B	C	A/B (1)	A/B (2)	A	B	C	A	B	C
Air Temp °C	12	12	12	13.8	13.8	12.7	12.7	12.7	15.3	15.3	15.3
Water Temp °C	10.7	10.7	10.7	10.2	10.2	10.9	10.9	10.9	15.5	15.5	15.5
Max Depth (m)	0.11	0.20	0.23	0.50	0.5	0.33	0.41	0.29	0.32	0.56	0.34
Wetted Width (m)	2.25	2.65	1.55	8.90	6.80	N/A (wetland)			N/A (wetland)		
Average Velocity (m/sec)	0.25	0.32	0.4	0.04	0.05	0	0	0	0	0	0
Gear Type	kick net			D-net		D-net			D-net		
Sample Method	stationary kick			travelling kick		stationary kick			travelling kick		
Habitat Type	Riffle			Run		Wetland			Wetland		
Dominate Substrate (mm)	Sand (0.06-2)	Cobble (65-250)	Cobble (65-250)	Gravel (2-65)	Detritus (<0.002)	Silt (<0.06-2)	Silt (<0.06-2)	Silt (<0.06-2)	Silt (<0.06-2)	Silt (<0.06-2)	Silt (<0.06-2)
2nd Dominate Substrate	Cobble (65-250)	Gravel (2-65)	Gravel (2-65)	Sand (0.06-2)	Silt (<0.06-2)	Clay (<0.002)	Clay (<0.002)	Clay (<0.002)	Sand (0.06-2)	Sand (0.06-2)	Sand (0.06-2)
Canopy Cover (%)	0-24	0-24	25-49	0-24	0-24	0-24	0-24	0-24	0-24	0-24	0-24
Sample Area	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	5.7	6.5	5.5
Sample Time (sec)	180	180	180	180	180	120	120	120	180	180	180

3.6.4 Surface Water Quality

Surface water quality samples were collected in the fall of 2012 and summer of 2013 (Table 14). Detailed sample information has been provided in Appendix VII and sample locations illustrated in Figure 3.

pH

Local conditions in 2012 and 2013 were alkaline, ranging from 7.08-7.81 in 2012 and 6.90-8.45 in 2013 all of which are within the acceptable pH range of 6.5-8.5 (Energy, 1994). Overall, pH levels were uniform with minor differences in results between samples and years.

pH was taken with a handheld waterproof pH meter, the range is -2.00 to 16.00 and the accuracy at 20°C is ±0.05pH (Hanna Instruments, 1995-2004).

Air Temperature (°C)

The air temperature taken within the study area was ranged from 12.0°C to 13.8 °C in fall of 2012 and from 15.5°C to 24°C in the summer of 2013, which is within the expected seasonal summer temperatures. Air temperature is an important component of water quality as it can be linked to other parameters, such as dissolved oxygen.

Water Temperature (°C)

The water temperature within the study area ranged from 10.2°C to 10.9°C in the fall of 2012 and 14.5°C to 23.1°C in the summer of 2013. The thermal classification for "warm water" is when the water temperatures range from 22°C to 30 °C (Chu, Jones, Piggot, & Buttle, 2009).

Conductivity (us/cm)

Conductivity is the measure of capability of water to pass an electrical current (EPA, 2012). Conductivity within the study area ranged from 209.1us/cm (Site 3) to 1153.0 us/cm (Site 1). The Canadian Council of Ministers of the Environment does not have specific guidelines for Conductivity in relevance to the protection of aquatic life (Canadian Council of Ministers of the Environment, 2002).

Conductivity was taken with an YSI Pro 2030, the sensor range is 0 to 200 mS/cm, with an accuracy of ±0.5% or 0.001 mS/cm (YSI Incorporated, 2010).

Dissolved Oxygen (mg/L)

The lowest acceptable range of dissolved oxygen for cold water biota is 8-10 mg/L and 5-8

mg/L for warm water biota. The dissolved oxygen taken within the study area averaged 11.75 mg/L. The samples taken in 2012 averaged 6.89 mg/L and 10.93 mg/L in 2013. All are higher than the lowest acceptable range for warm and cool water biota (Canadian Council of Ministers of the Environment, 2002).

Turbidity (NTU)

Turbidity is the measure of water transparency or clarity. The lack of clarity is caused by biotic and abiotic suspended or dissolved substances in the water. The more concentrated these substances are the higher the turbidity reading. Turbidity samples were only taken in 2012 during benthos sampling. The turbidity ranged from 0.56-2.09 NTU averaging 1.47 NTU. The turbidity taken in the study area is defined as normal (Energy, 1994).

Total Phosphorus (ppb)

Total phosphorus readings for most uncontaminated freshwater is between 10 to 50 ppb (Environment, 2004). Total phosphorus was only collected in 2012 during benthos sampling. The phosphorus ranged from 14.0-45.0 ppb, averaging 25ppb which is within the acceptable range.

Total Dissolved Solids (TDS) (mg/L):

TDS is defined as the amount of inorganic salt and organic matter that are dissolved in water. TDS concentrations are the sum of cations and anions in the water (Health Canada, 2009). Sources of TDS include: fertilizers, road runoff, industrial discharges and soil erosion (EPA, 2012). TDS within the study area ranged from 168.4 mg/L (Site 7) to 749.0 mg/L (Site 1). The Canadian Council of Ministers of the Environment does not have specific guidelines for TDS in relevance to the protection of aquatic life (Canadian Council of Ministers of the Environment, 2002).

TDS was taken with an YSI Pro 2030. The sensor range is 0 to 200 mS/cm, with an accuracy of ±0.5% or 0.001 mS/cm (YSI Incorporated, 2010).

The surface water quality parameters collected in 2012 and 2013 were within the normal ranges listed above. The baseline data obtained can be used as a baseline and compared to construction and post construction monitoring results to ensure all parameters are kept within the acceptable range.

It should be noted that MTE has conducted surface water quality monitoring at eight stations (five on-site and three off-site) to compare the water chemistry entering the Grass Lake Wetland from on and off-site location (MTE, January 31, 2014).

Table 14. 2012 & 2013 Surface Quality Parameters and Results for Site 1, 2 & 3.

Site	Sample	Date (dd-mmm-yy)	Weather	pH	Air Temp °C	Water Temp °C	Conductivity (us/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Total Phosphorus (ppb)	Total Dissolved Solids (mg/L)
1	1	17-Oct-12	Cloudy	7.81	12.0	10.7	1153.00	11.00	2.09	14.0	749.0
	2	04-Jun-13	Clear	8.04	24	21.4	880	8.45	NA	NA	612
2	1	17-Oct-12	Cloudy	7.08	13.8	10.2	276.00	5.91	0.56	16.0	472.0
3	1	17-Oct-12	Cloudy	7.08	12.7	10.9	265.70	3.77	1.78	45.0	172.7
	2	04-Jun-13	Clear	6.90	13.7	15.0	209.1	1.91	NA	NA	168.3
4	1	04-Jun-13	Clear	8.21	19	14.5	252.2	8.53	NA	NA	205
5	1	04-Jun-13	Clear	8.36	19	18.5	392	22.69	NA	NA	290.4
6	1	04-Jun-13	Clear	7.74	15.5	21.8	251.9	9.99	NA	NA	176.3
7	1	04-Jun-13	Clear	8.45	18	23.1	251.8	14.04	NA	NA	168.4

4.0 Natural Heritage Features

4.1 Significant Wetlands

One provincially significant wetland was identified on or within 120 metres of the site (Grass Lake Provincially Significant Wetland).

According to the Wetland Evaluation (R. Toth & M Townes, 1989), the Grass Lake Wetland Complex contains the following features:

-Composed of three wetland types (0.5% bog, 62.5% swamp and 37% marsh)
-Nesting of colonial water birds (active feeding area)
-Winter cover for wildlife (fox, coyote, rabbits, black bear)
-Significance for fish spawning and rearing
-Resource products (bullfrogs, snapping turtles, furbearers-muskrat, raccoon, beaver, mink, coyote, fox skunk)

There were several wetland areas located on the property (Communities 1, 2, 5, 6 & 7). All communities with the exception of Community 6 (part of the PSW) have not been evaluated by MNR under the Ontario Wetland Evaluation System. GIS data maps provided by MNR do show unevaluated wetlands in some of these areas.

4.2 Significant Habitat for Endangered or Threatened Wildlife Species

Habitat for endangered or threatened species (provincially and nationally) was identified on or within 120 metres of the site (MNR, 2009; NHIC 2009; site visits). Table 15 shows a complete list of habitat for endangered or threatened wildlife species.

4.3 Significant Habitat for Special Concern Wildlife Species

Habitat for special concern species (provincially and nationally) was identified on or within 120 metres of the site (MNR, 2009; NHIC 2009; site visits). Table 15 shows a complete list of habitat for special concern wildlife species.

4.4 Significant Woodlands, Valleylands and Wildlife Habitat

The identification and evaluation of these features is a planning authority responsibility. This exercise has not been completed by the Township or the County.

However, the presence of significant wildlife habitat can be determined during an environmental impact assessment process through use of the criteria and categories in the MNR Significant Wildlife Habitat Technical Guide (MNR, 2000) and the more recent Significant Wildlife Criteria Schedule for Ecoregion 6E (MNRF, Jan. 2015). Some of these categories have been identified by MNR through their GIS mapping. The criteria include four main categories: seasonal concentration areas, rare vegetation communities or specialized habitats for wildlife; habitats of species of concern and animal movement corridors (Table 15).

The Significant Wildlife Criteria Schedule for Ecoregion 6E (MNRF, Jan. 2015) was used to determine the candidate and confirmed Significant Wildlife Habitat located within the study area. Table 15 outlines the confirmed and not confirmed but potential Significant Wildlife Habitat (SWH) within the study area. In order to identify these categories a preliminary screening of all SWH was conducted in table format and can be found in Appendix IX.

Several other Significant Wildlife Habitat criteria were confirmed by NEA and are listed below.

- habitat for area-sensitive bird species (9 woodland and wetland species),
- habitat for endangered or threatened wildlife species (3 species)
- habitat for endangered or threatened plant species (1 species)
- habitat for regionally significant bird species (2 species)
- habitat for regionally significant plant species (8 species)
- Provincially Significant Wetland (Grassy Lake)

Table 15. Potential or Confirmed Significant Wildlife Habitat within the Study area based on Criteria in the SWH Criteria Schedule for Ecoregion 6E (MNRF, 2015)

Seasonal Concentration Areas of Animals			
Significant Wildlife Habitat	Description	Found-Yes	Found-No
Waterfowl Stopover and Staging Areas (Aquatic)	Wetland areas and shorelines associated with sites identified within the SWHTG		No suitable habitat on property-pond to north small
Turtle Wintering Areas	Permanent water bodies where water is deep enough not to freeze and contains soft mud substrates (large wetlands, bogs, fens)	Potential-within wetland areas, especially the pond north of the licensed area	
Reptile Hibernaculum	In sites below frost lines in burrows, rock crevices and other natural locations, areas of broken and fissured rock are preferred	Potential-crevasses in rock and broken rock ledges may provide for hibernacula within rock barren community (13)	
Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)	Nests in live or dead standing trees in wetlands, lakes, islands and peninsulas		-no great blue heron colonies or swallow colonies observed in study area
Deer Yarding Areas	Mixed or deciduous forest with browse available, also agricultural lands. Core deer yard-coniferous (pine, hemlock, cedar, spruce)		Deer yard not identified by MNRF within the study area
Deer Winter Congregation	Deer Congregating in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions		No-MNRF did not consider or map any part of the study area as Deer winter congregation area

Specialized Habitats			
1. Areas that support wildlife species with highly specific habitat requirements 2. Areas with exceptionally high species diversity or community diversity 3. Areas that provide habitat that greatly enhances a species' survival			
Areas that contain a provincially rare vegetation community	Areas that contain a vegetation community that is rare within the planning area	Found-Yes	Found-No
Woodland Raptor Nesting Habitat	All natural or conifer plantation woodland/forest stands-intermediate-aged to mature		No nests were identified during field surveys
Turtle and Lizard Nesting Areas	Shorelines (sand/gravel), wetlands	Possible- along shorelines or trail edges.	
Amphibian Breeding Habitat (Woodland)	Forests; often associated with wetlands, but may be in upland forests;	Yes-Confirmation of greater than 20 individuals of the main listed species (SPPE) within the PSW and northern wetland	

Habitat of Species of Conservation Concern			
Wildlife	Habitat Criteria	Found-Yes	Found-No
Marsh Bird Breeding Habitat	Nesting in wetlands		No confirmed nesting waterfowl were identified
Special Concern and Rare Wildlife Species	A special concern species inventoried within the study area	Yes-Snapping turtle, wood thrush, common nighthawk and eastern wood-pewee	

Animal Movement Corridors			
Habitat	Habitat Criteria	Found-Yes	Found-No
Amphibian Movement Corridor	Breeding habitat confirmed, movement between terrestrial and breeding habitat identified	Possible-breeding habitat confirmed and corridors for movement	

Deer Movement Corridor	Confirmed Deer Wintering Habitat with corridors that lead to deer wintering habitat unbroken by roads, 200m wide		No confirmed Deer Wintering Habitat by MNRF

4.5 Vegetation

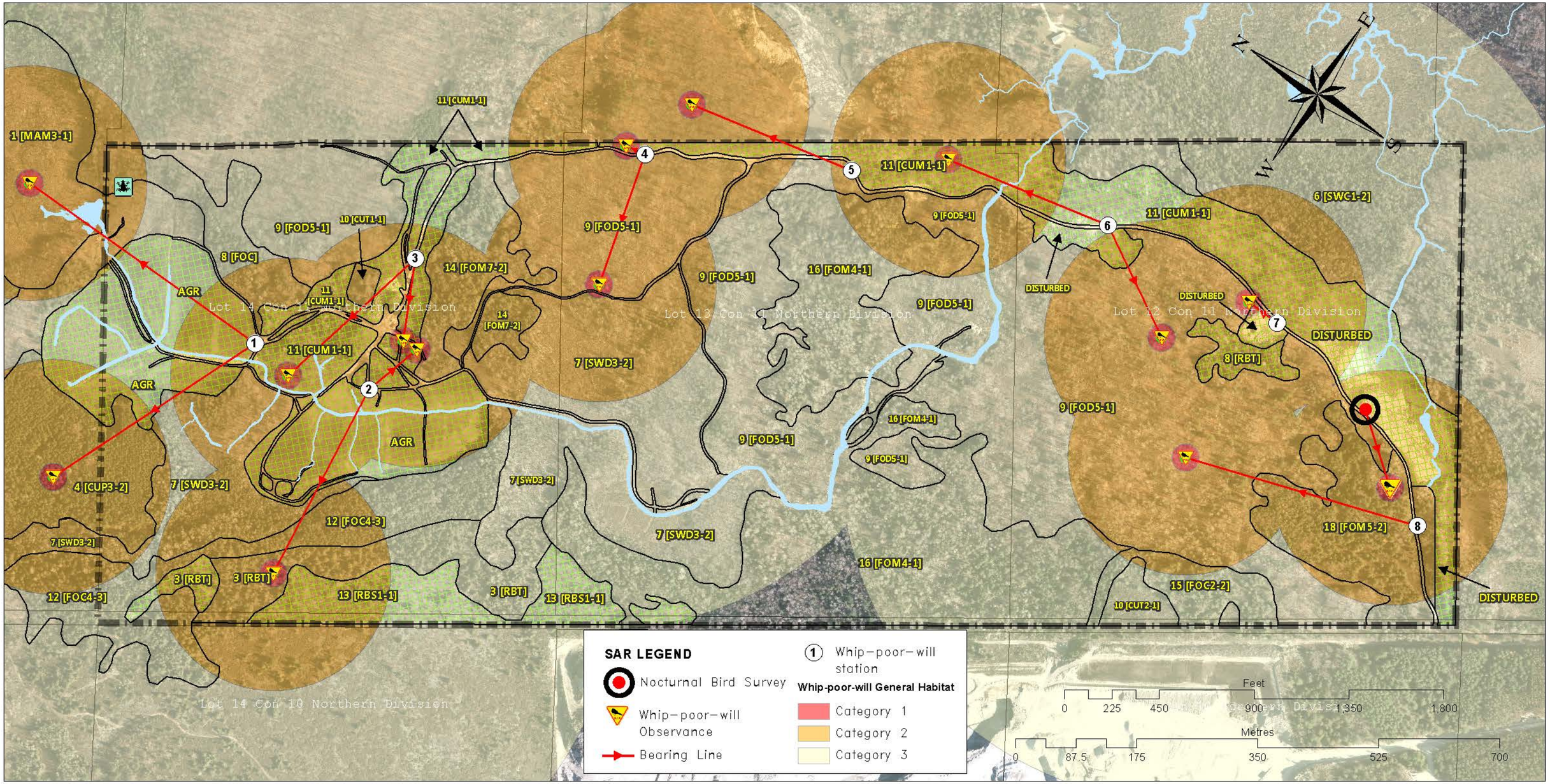
A review of the list of species identified by NEA found that one species, the butternut, was significant on a national or provincial level (COSEWIC, 2017; COSSARO, 2017; SARA, 2017) (Appendix I-B). Eight regionally rare species according to Riley (1989) were found on the property (Appendix I-B). These species included meadow horsetail (*Equisetum pratense*), black walnut (*Juglans nigra*), purple-flowering raspberry (*Rubus odoratus*), racemed milkwort (*Polygala polygama*), European wood-sorrel (*Oxalis stricta*), wild geranium (*Geranium maculatum*), white heath aster (*Aster pilosus var. pilosus*) and tall goldenrod (*Solidago altissima*).

There are no significant vegetation communities on the property as per the list of rare vegetation community types (Bakowsky, 1997).

4.6 Birds

A review of the bird species list (Appendix II) found nine (9) area sensitive species within the study area. Area sensitive species are species that require a minimum hectarage of contiguous suitable habitat to successfully breed (MNR, 2000). The species recorded included yellow-bellied sapsucker (*Sphyrapicus varius*), blue-headed vireo (*Vireo solitarius*), red-breasted nuthatch (*Sitta canadensis*), black-throated blue warbler (*Dendroica caerulescens*), black-throated green warbler (*Dendroica virens*), veery (*Catharus fuscescens*), winter wren (*Troglodytes troglodytes*), ovenbird (*Seiurus aurocapillus*) and scarlet tanager (*Piranga olivacea*).

Four federally and/or provincially significant species were identified during NEA surveys: eastern wood-pewee (*Contopus virens*), wood thrush (*Hylocichla mustelina*), common nighthawk (*Chordeiles minor*) and whip-poor-will (*Antrostomus vociferous*). The wood thrush and eastern wood pewee have been observed using the forested areas of the property. The common nighthawk and whip-poor-will were identified scattered throughout the property (Figure 4).



LEGEND

- Water Line
- Water Polygon
- Lot Fabric
- Property Boundary
- Vegetation Community
- Open Areas

ELC TYPES (1st Approximation)

CODE	DESCRIPTION	CODE	DESCRIPTION
CUM1-1	Dry-moist old field meadow	SWC1-2	White cedar-conifer mineral conifer swamp
CUP3-2	White pine conifer plantation	SWD3-2	Silver maple mineral deciduous swamp
CUT2-1	Common juniper cultural alvar thicket	SWT2-1	Alder mineral thicket swamp
FOC	Dry-fresh white cedar conifer thicket		
FOC2-2	Dry-fresh white cedar conifer forest		
FOC4-3	Fresh-moist white cedar-balsam fir conifer		
FOD5-1	Dry-fresh sugar maple deciduous forest		
FOD7-2	Fresh-moist ash lowland deciduous forest		
FOM4-1	Dry-fresh white cedar-white birch mixed		
FOM5-2	Dry-fresh poplar mixed forest		
FOM7-2	Fresh-moist white cedar-hardwood mixed		
MAM3-1	Bluejoint organic meadow marsh		
RBS1-1	Common juniper carbonate thrub rock		
RBT	Treed rock barren		
SWC	Coniferous swamp		

FIGURE 4: SPECIES-AT-RISK SURVEYS- EASTERN WHIP-POOR-WILL

Pt Lots 12,13 & 14, Con 11 Northern Division
Township of Severn
County of Simcoe
Midhurst District

1 cm = 55 meters

UTM Zone 17
WKID: 26917 Authority: EPSG
Transverse Mercator
GCS North American 1983, ESRI ArcGIS 10.1

REVISIONS

NO	BY	DATE	DESCRIPTION
1	W.P.	28/01/2015	Initial map creation.

CONTACT: Will Pridham
PHONE: 1 (705)-878-9399
EMAIL: wpridham@niblett.ca

PROJECT NO: 10-015
PROJECT DESCR: Severn Quarry
CLIENT: N/A
DWG NO: 10015_SAR1

NIBLETT ENVIRONMENTAL ASSOCIATES INC.
www.niblett.ca

Two regionally rare bird species were recorded, according to the regionally rare lists in the wetland evaluation manual (MNRF, 2013, Appendix 5). These were blue-headed vireo (*Vireo solitarius*) and dark eyed Junco (*Junco hyemalis*). A Tennessee warbler (*Vermivora peregrina*) was recorded in April of 2010, which is during the migration period.

The blue-headed vireo prefers a large temperate forests with a mix of evergreen trees and deciduous under growth. This species was found in the south-west portion of the property within the forested area.

The dark eyed junco prefers breeding in coniferous or mixed forested areas. This species was found in the northern portions of the property in the juniper thicket.

The Tennessee warbler prefers coniferous forests, mixed conifer-deciduous forests, early successional woodlands and boreal bogs and is not a breeding bird on this site.

4.7 Other Wildlife

There were no other significant wildlife species identified in the study area (Appendix III and Appendix IV).

4.8 Fish and Fish Habitat

During NEA's literature review no provincially and/or nationally rare species were documented within the study area through the NHIC database (COSEWIC, 2017) (OMNR, 2012) (SARA, 2017) (SARO, 2017).

4.9 Species At Risk

Species identified in Table 16 are from the list NEA generated by searching the NHIC site within a 10 km radius of the study area and from a list provided by MNR. Species at Risk species identified by MNRF for which there is possible habitat are identified by underlining. Additional bird species listed in the Ontario Breeding Bird Atlas as found in the larger study area (10 km radius) were also added to this list in bold print. The status is based on the latest available lists on the government websites (June 2017-COSSARO and May 2017-COSEWIC).

Table 16. Species at Risk and Potential Habitat in the Study Area (COSEWIC, 2017; COSSARO, 2017)

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
*Sensitive Species	N/A	END	END	N/A	Yes- suitable habitat present however none were observed on the property during NEA investigations (intensive multi-season searches)
Blanding's Turtle	*Emydoidea blandingii*	END	THR	Forest and meadow habitats and marshes, will travel long distances in search of mates and new habitats	None-NHIC Records were reviewed for a 10km Radius. No records were found within 4km of the Study area and no suitable wetlands/water bodies were identified within 2km from an occurrence (Does not meet habitat criteria for Blanding's turtle habitat in the General Habitat Description).
Broad Beech fern	*Phegopteris hexagonoptera*	SC	SC	Prefers rich soils in deciduous forests (Maple-Beech)	None

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Common Five-lined skink	*Plestiodon fasciatus pop. 2*	SC	SC	Open shoreline with rock outcrops, clearings and open woodlands	None
Eastern musk turtle	*Sternotherus odoratus*	SC	THR	Prefers shallow, slow-moving waters	Yes- possible habitat present in pond off-property
Northern map turtle	*Graptemys geographica*	SC	SC	Lives in large rivers and lakes	None
*Snapping turtle	*Chelydra serpentine*	SC	SC	Inhabits shallow ponds, shallow lakes, or streams with some living in brackish environments, such as estuaries.	Yes-habitat present north of the property and lands to east. No nests found on site. None observed.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
*Spotted turtle	*Clemmys guttata*	END	END	Inhabits bogs, fens and shallow wetlands with tussocks or hummocks	Possible habitat to north off-site, however beaver dam abandoned occasionally, dense grasses and shrubs establish and covering muddy substrate, no recent records of spotted in this area (NHIC)
*Eastern hog-nosed snake	*Heterodon platirhinos*	THR	THR	Inhabit sandy, well-drained habitats such as beaches and dry woods with access to swamps	Possible, portions of property with sandy soils and/or near swamps. No individuals, hibernacula or oviposition sites found.
*Eastern ribbonsnake	*Thamnophis sauritus*	SC	SC	Found close to water, especially in marshes	Yes, possible near wetland areas

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
*Eastern massasauga rattlesnake	*Sistrurus catenatus*	THR	THR	Found in forests, meadows, shoreline habitats, wetlands, rock barrens, grasslands and old fields near water. Rarely 50km away from Great Lakes	Yes, possible in rock barren in northeast portion of property. No snakes observed.
*Butternut	*Juglans cinerea*	END	END	Found scattered at low density in forests.	Yes-several trees found on the western and northern portions of the property
***Cerulean warbler**	*Dendroica cerulean*	END	THR	Prefers mature deciduous forest with large specimen trees. Preferred woodlands are contiguous areas of greater than ten hectares.	None, no mature forest on site
***Bobolink**	*Dolichonyx oryzivorus*	THR	THR	Prefers tall, grassy meadows and ditches, hayfields and some croplands	None. No open field with grasses found on site.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Common Nighthawk	*Chordeiles minor*	THR	SC	Typically found in open areas such as sand dunes, recently logged or burned over areas, pastures, open forest, gravel roads, rocky outcrops and rocky barrens, and even military bases and airports	Yes-Five individuals identified during evening surveys in spring of 2014. Foraging habitat but no evidence of nesting or roosting sites on property. Most suitable habitat for nests on ledge or open rock barrens.
Whip-poor-will	*Antrostomus vociferus*	THR	THR	Can be found in areas with a mix of open and forested areas within open woodlands or openings in more mature, deciduous, coniferous and mixed forests. It forages in these open areas and uses forested areas for roosting (resting and sleeping) and nesting	Yes-Thirteen individuals identified during evening surveys in 2014 and one in 2013.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Chimney Swift	*Chaetura pelagica*	THR	THR	Found within 1 km of a waterbody and, as its name implies, predominantly nests within old chimneys in urban and suburban areas.	None. No buildings on site and no large dbh cavity trees with suitable access or nest opportunities.
***Canada Warbler**	*Cardellina canadensis*	THR	SC	Breeds in deciduous and coniferous forests, usually wet forests with a well-developed dense shrub layer	None recorded during surveys.
Barn Swallow	*Hirundo rustica*	THR	THR	Prefers open rural and urban areas where bridges, culverts and buildings are found near rivers, lakes, marshes or ponds.	None. No buildings on site.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Golden-winged Warbler	*Vermivora chrysoptera*	THR	SC	Found in early successional habitat of old fields with low deciduous trees bordered by wooded swamps; alder bogs; and shrubby clearings amidst deciduous forests. It requires greater than 10 ha of suitable habitat	None. No suitable shrub habitat present on property.
Eastern meadowlark	*Sturnella magna*	THR	THR	Prefers grassy meadows and pastures; also in some croplands, weedy fields, grassy roadsides and old orchards.	None. No open grassland present on property.
***Olive-sided flycatcher**	*Contopus cooperi*	THR	SC	Found along natural forest edges and openings with snags, breeding habitat is coniferous or mixed forests adjacent rivers or wetlands	None observed or heard during field surveys.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Red-headed woodpecker	*Melanerpes erythrocephalus*	THR	SC	Pine savannahs and other open forests with clear understories, open pine plantations, treerows in agriculture areas	None observed or heard on site.
Eastern wood-pewee	*Contopus virens*	THR	SC	Deciduous forest and woodland	Yes-Identified during NEA surveys in swamp and open selectively logged areas.
Bank swallow	*Riparia riparia*	THR	NARTHR	Streamside banks	None. No eroding banks on site.
Wood thrush	*Hylocichla mustelina*	THR	SC	Deciduous and mixed forests with large trees, moderate understory, shade and abundant leaf litter	Yes-Identified during NEA surveys in woodlands.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Least bittern	*Ixobrychus exilis*	THR	THR	Nests in large freshwater marshes interspersed with open water and dense emergent vegetation. They require marshes of at least 5 ha in size	None. No cattail marsh on property or in wetland to north.
Bat species: **-Eastern small footed myotis** **-Little brown myotis** **-Northern myotis** **-Tri-coloured bat**	*Myotis leibii* *Myotis lucifugus* *Myotis septentrionalis* *Perimyotis subflavus*		END	Variable habitat needs, hibernacula and bat maternity trees are key habitats	Preliminary review of data found no Myotis species

4.10 Significant Areas of Natural and Scientific Interest (ANSI's)

There is no provincially significant or regionally significant Life Science or Earth Science ANSI's within the study area or the adjacent lands.

4.11 Other Features

There are no other conservation designations on the property.

There is a Provincially Significant wetland (Grass Lake) located on and adjacent to the property and is within the minimum area of influence (120m).

5.0 Conclusions

The Aggregate Resources of Ontario Provincial Standards requires that a Level 1 Natural Heritage Report be completed to determine whether any of the listed significant features exist on or within 120 metres of the site (Government of Ontario, 1997). According to the manual, a Natural Environment Level 2 report or impact assessment should be completed where the Level 1 report identifies any significant features.

The Level 1 study identified the presence of five Species at Risk (Table 17):

Table 17. Species at Risk identified during surveys in Study Area

Common Name	Scientific Name	National status	Provincial status
Butternut	*Juglans cinerea*	N-END	P-END
Common nighthawk	*Chordeiles minor*	N-THR	P-SC
Eastern whip-poor-will	*Antrostomus vociferus*	N-THR	P-THR
Eastern wood-pewee	*Contopus virens*	N-SC	NAR
Wood thrush	*Hylocichla mustelina*	N-THR	NAR

The Level 1 study also identified the presence of eight (8) regionally rare vegetation species (Table 18).

This study also found that there is significant wildlife habitat or potential for SWH on or within 120 m of the licensed area (Table 18). The features identified through the literature and our field visits include:

- Turtle Wintering Areas (Potential)
- Reptile Hibernaculum
- Turtle and Lizard Nesting areas (Potential
- Amphibian Breeding Habitat (Woodland)(Confirmed)
- Special Concern and Rare Wildlife Species (Confirmed)
- Amphibian Movement Corridor (Potential)
- Provincially Significant Wetland (Grassy Lake)

Other Wildlife Habitat NEA identified included

- Habitat for area-sensitive bird species (9 species),

- Habitat for regionally rare bird species (2 species)
- Fish and fish habitat

Several Species at Risk were also found on or adjacent to the property or there is suitable habitat present (Table 18). These species included snapping turtle, eastern hog-nosed snake, eastern ribbon snake, eastern massasauga rattlesnake, restricted species, musk turtle, whip-poor-will, butternut, common nighthawk, eastern wood-pewee, wood thrush, and spotted turtle.

NEA concludes that a Level 2 study is required for the development of these lands. The Level 2 report should determine whether there will be *"any negative impacts on the natural features or ecological functions for which the area is identified and any proposed preventative, mitigative or remedial measures"* (Government of Ontario, 1997).

The Level 2 report will focus on the significant natural features and significant species and habitats determined within this report. As determined above, habitat or species presence on the property for the following species and/or habitats will be examined in further detail in the Level 2 report.

Table 18. Significant Natural Features, Significant Species and Their Habitats.

Category	Species
Presence of Species at Risk (on property)	• Butternut • Common nighthawk • Eastern whip-poor-will • Eastern wood-pewee • Wood thrush
Habitat for Species at Risk	• Snapping turtle • Eastern hog-nosed snake • Sensitive plant species • Spotted turtle • Eastern ribbonsnake • Eastern massasauga rattlesnake • Musk turtle
Area Sensitive Bird Species	9 species
Regionally Rare Vegetation Species	8 species
Significant Wildlife Habitat	• Turtle Wintering Area (potential) • Reptile Hibernaculum (potential) • Turtle and Lizard nesting Areas (potential) • Amphibian breeding habitat (woodland)(confirmed) • Special Concern and Rare Wildlife Species (confirmed) • Amphibian Movement Corridors (potential)
Provincially Significant Wetland (Grassy Lake)	n/a
Fish and Fish Habitat	Fish and Benthos Community

6.0 References

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Appendix I-A: Plant Species by Community

APPENDIX I - A Plant Species by Community

Families and genera for the plant species found in this appendix are listed in taxonomic order. The species are listed alphabetically by its scientific name within each genus.

Three standard reference works were used for the botanical nomenclature and taxonomy (Newmaster et. al., 1998; Gleason and Cronquist 1991; Voss 1980; 1985). Other published works for botanical names included; ferns (Cody and Britton 1989); grasses (Dore and McNeill 1980); orchids (Whiting and Catling 1986); shrubs (Soper and Heimburger 1982) and trees (Farrar 1995).

Total: Number of communities where plant species was recorded
X : Plant species recorded

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PEAT MOSS FAMILY	*SPHAGNACEAE*																
sphagnum moss species	*Sphagnum spp.*	1									X						
CLUBMOSS FAMILY	*LYCOPODIACEAE*																
common clubmoss	*Lycopodium clavatum*	1												X			
ground-pine	*Lycopodium obscurum*	1				X											
HORSETAIL FAMILY	*EQUISETACEAE*																
field horsetail	*Equisetum arvense*	4						X	X		X		X				
water horsetail	*Equisetum fluviatile*	1	X														
meadow horsetail	*Equisetum pratense*	2						X	X								
wood horsetail	*Equisetum sylvaticum*	1							X								
ADDER'S-TONGUE FAMILY	*OPHIOGLOSSACEAE*																
rattlesnake fern	*Botrychium virginianum*	2												X			

			COMMUNITY NUMBER															
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ROYAL FERN FAMILY	*OSMUNDACEAE*																	
cinnamon fern	*Osmunda cinnamonea*	2							X		X							
interrupted fern	*Osmunda claytoniana*	2						X										
royal fern	*Osmunda regalis var.spectabilis*	2		X					X									
MAIDENHAIR FERN FAMILY	*PTERIDACEAE*																	
northern maidenhair fern	*Adiantum pedatum*	2						X			X							
BRACKEN FERN FAMILY	*DENNSTAEDTIACEAE*																	
hay-scented fern	*Dennstaedtia punctilobula*	2		X							X							
eastern bracken fern	*Pteridium aquilinum*	10			X	X			X		X	X	X	X		X		
BEECH FERN FAMILY	*THELYPTERIDAE*																	
northern beech fern	*Phegopteris connectilis*	2		X					X									
marsh fern	*Thelypteris palustris*	1	X															
SPLEENWORT FAMILY	*ASPLENIACEAE*																	
walking fern	*Asplenium rhizophyllum*	2			X									X				
maidenhair spleenwort	*Asplenium trichomanes ssp.quadrivalen*	6			X						X			X	X		X	
WOOD FERN FAMILY	*DRYOPTERIDACEAE*																	
northern lady fern	*Athyrium filix-femina*	2									X						X	
bulbet bladder fern	*Cystopteris bulbifera*	2		X										X				
spinulose wood-fern	*Dryopteris carthusiana*	9				X	X	X			X			X		X		
evergreen wood-fern	*Dryopteris intermedia*	3						X	X									
marginal wood-fern	*Dryopteris marginalis*	4			X	X					X			X				
oak fern	*Gymnocarpium dryopteris*	5		X	X						X			X				
ostrich fern	*Matteuccia struthiopteris*	4	X	X					X		X							
sensitive fern	*Onoclea sensibilis*	7	X	X			X		X				X			X		
Christmas fern	*Polystichum acrostichoides*	5		X					X		X							
POLYPODY FAMILY	*POLYPODIACEAE*																	
rock polypody fern	*Polypodium virginianum*	2									X							

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PINE FAMILY	*PINACEAE*																
balsam fir	*Abies balsamea*	13	X	X	X	X		X	X		X			X		X	X
tamarack	*Larix laricina*	3	X			X		X									
white spruce	*Picea glauca*	12	X			X		X	X		X	X	X	X	X	X	X
red pine	*Pinus resinosa*	1															
eastern white pine	*Pinus strobus*	13		X	X	X			X	X	X	X	X		X	X	X
Scot's pine	*Pinus sylvestris*	1											X				
eastern hemlock	*Tsuga canadensis*	3		X							X						
CYPRESS FAMILY	*CUPRESSACEAE*																
common juniper	*Juniperus communis var. depressa*	9	X		X				X		X	X	X		X	X	
eastern red cedar	*Juniperus virginiana*	3						X				X				X	
eastern white cedar	*Thuja occidentalis*	14	X		X	X	X	X	X	X	X			X	X	X	X
YEW FAMILY	*TAXACEAE*																
American yew	*Taxus canadensis*	1												X			
BUTTERCUP FAMILY	*RANUNCULACEAE*																
white baneberry	*Actaea pachypoda*	2									X			X			
red baneberry	*Actaea rubra*	3						X	X								
Canada anemone	*Anemone canadensis*	3									X	X	X				
thimbleweed	*Anemone virginiana*	6	X						X		X	X	X		X		
wild columbine	*Aquilegia canadensis*	4			X						X	X			X		
marsh marigold	*Caltha palustris*	5	X	X					X		X			X			
virgin's bower	*Clematis virginiana*	4					X		X					X		X	
goldthread	*Coptis trifolia*	1						X									
sharp-lobed hepatica	*Hepatica acutiloba*	3			X						X						
round-lobed hepatica	*Hepatica americana*	3									X	X					
small-flowered buttercup	*Ranunculus abortivus*	3									X		X	X			
tall buttercup	*Ranunculus acris*	3	X									X	X				
early meadow rue	*Thalictrum dioicum*	7			X			X	X		X	X					
tall meadow rue	*Thalictrum pubescens*	4									X			X	X	X	

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
BARBERRY FAMILY	*BERBERIDACEAE*																
blue cohosh	*Caulophyllum giganteum*	3		X													
mayapple	*Podophyllum peltatum*	1		X													
POPPY FAMILY	*PAPAVERACEAE*																
bloodroot	*Sanguinaria canadensis*	1									X						
ELM FAMILY	*ULMACEAE*																
American elm	*Ulmus americana*	10		X	X	X	X		X		X	X		X	X	X	
NETTLE FAMILY	*URTICACEAE*																
false nettle	*Boehmeria cylindrica*	2									X						
wood nettle	*Laportea canadensis*	1							X								
WALNUT FAMILY	*JUGLANDACEAE*																
butternut	*Juglans cinerea*	3									X						
black walnut	*Juglans nigra*	2									X						
BEECH FAMILY	*FAGACEAE*																
American beech	*Fagus grandifolia*	1									X						
white oak	*Quercus alba*	7				X	X		X		X				X	X	
bur oak	*Quercus macrocarpa*	6			X						X	X	X		X	X	
red oak	*Quercus rubra*	10			X	X	X				X	X	X	X	X	X	X
oak	*Quercus sp*	1												X			
BIRCH FAMILY	*BETULACEAE*																
speckled alder	*Alnus rugosa*	6	X				X		X		X			X		X	
yellow birch	*Betula alleghaniensis Britt.*	4	X	X					X		X						
white birch	*Betula papyrifera*	13	X		X	X			X		X	X		X	X	X	X
blue beech	*Carpinus caroliniana*	1									X						
beaked hazel	*Corylus cornuta*	2									X						
ironwood	*Ostrya virginiana*	4			X						X						X

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PINK FAMILY	*CARYOPHYLLACEAE*																
Deptford pink	*Dianthus armeria*	1									X						
bladder campion	*Silene vulgaris*	1										X					
common chickweed	*Stellaria media*	1													X		
BUCKWHEAT FAMILY	*POLYGONACEAE*																
curled dock	*Rumex crispus*	2									X	X					
bitter dock	*Rumex obtusifolius*	1											X				
ST. JOHN'S-WORT FAMILY	*GUTTIFERAE*																
common St. John's-wort	*Hypericum perforatum*	2							X		X						
marsh St. John's-wort	*Triadenum fraseri*	2	X						X								
LINDEN FAMILY	*TILIACEAE*																
American basswood	*Tilia americana*	10	X	X	X	X			X		X	X			X	X	
VIOLET FAMILY	*VIOLACEAE*																
dog violet	*Viola conspersa*	3						X			X						
lance-leaved violet	*Viola lanceolata*	1									X						
northern white violet	*Viola macloskeyi*	1															
downy yellow violet	*Viola pubescens*	1										X					
long-spurred violet	*Viola rostrata*	2				X					X						
GOURD FAMILY	*CUCURBITACEAE*																
wild cucumber	*Echinocystis lobata*	1							X								
WILLOW FAMILY	*SALICACEAE*																
balsam poplar	*Populus balsamifera*	10		X	X	X	X		X		X		X	X			X
large-toothed aspen	*Populus grandidentata*	6									X	X	X		X	X	
trembling aspen	*Populus tremuloides*	12	X	X	X		X		X		X	X		X	X	X	
Bebb's willow	*Salix bebbiana*	1	X														
pussy willow	*Salix discolor*	3	X									X				X	
slender willow	*Salix petiolaris*	3	X				X						X				

			COMMUNITY NUMBER															
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
MUSTARD FAMILY	*BRASSICACEAE*																	
tower mustard	*Arabis glabra*	2			X						X						
Pennsylvania bittercress	*Cardamine pensylvanica*	1															
wild mustard	*Sinapsis arvensis*	3	X				X						X				
HEATH FAMILY	*ERICACEAE*																	
common bearberry	*Arctostaphylos uva-ursi*	2												X	X		
trailing arbutus	*Epigaea repens*	1									X						
lowbush blueberry	*Vaccinium angustifolium*	2			X										X		
INDIAN PIPE FAMILY	*MONOTROPACEAE*																	
indian pipe	*Monotropa uniflora*	1																
PRIMROSE FAMILY	*PRIMULACEAE*																	
fringed loosestrife	*Lysimachia ciliata*	1														X		
moneywort	*Lysimachia nummularia*	2																
starflower	*Trientalis borealis*	4			X			X						X				
GOOSEBERRY FAMILY	*GROSSULARIACEAE*																	
prickly gooseberry	*Ribes cynosbati*	5			X	X					X				X			
smooth gooseberry	*Ribes hirtellum*	1									X							
bristly black currant	*Ribes lacustre*	2									X			X				
swamp red currant	*Ribes triste Pallas*	1												X				
ORPINE FAMILY	*CRASSULACEAE*																	
mossy stonecrop	*Sedum acre*	4			X						X		X		X			
SAXIFRAGE FAMILY	*SAXIFRAGACEAE*																	
naked miterwort	*Mitella nuda*	2						X										
early saxifrage	*Saxifraga virginiensis*	2											X		X			
foam flower	*Tiarella cordifolia*	4						X	X		X			X				

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ROSE FAMILY	*ROSACEAE*																
agrimony	*Agrimonia gryposepela*	3									X	X	X				
downy serviceberry	*Amelanchier arborea*	2											X		X		
hawthorn species	*Crataegus spp.*	6				X					X	X	X			X	
woodland strawberry	*Fragaria vesca*	3			X						X			X			
common strawberry	*Fragaria virginiana*	12	X	X	X	X	X				X	X	X		X	X	
yellow avens	*Geum aleppicum*	6			X		X		X		X					X	
white avens	*Geum canadense*	2									X						
silvery cinquefoil	*Potentilla argentea*	1													X		
rough cinquefoil	*Potentilla norvegica*	2			X										X		
marsh cinquefoil	*Potentilla palustris*	1	X														
sulfur cinquefoil	*Potentilla recta*	6					X		X			X	X		X		
Canada plum	*Prunus nigra*	1									X						
pin cherry	*Prunus pensylvanica*	4										X			X	X	
black cherry	*Prunus serotina*	5		X							X				X		
choke cherry	*Prunus virginiana*	7			X				X		X	X	X		X	X	
smooth rose	*Rosa blanda*	3					X					X			X		
rugosa rose	*Rosa rugosa*	1														X	
Alleghany blackberry	*Rubus allegheniensis*	5			X		X		X		X						
wild red raspberry	*Rubus idaeus*	12	X		X	X	X		X		X	X	X		X	X	
purple-flowering raspberry	*Rubus odoratus*	1									X						
dwarf raspberry	*Rubus pubescens*	5		X				X	X					X		X	
narrow-leaved meadowsweet	*Spiraea alba*	4	X			X	X		X								
barren strawberry	*Waldsteinia fragarioides*	3									X				X	X	

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PEA FAMILY	*FABACEAE*																
crown-vetch	*Coronilla varia*	2	X									X					
bird's-foot trefoil	*Lotus corniculatus*	1											X				
black medick	*Medicago lupulina*	1									X						
white sweet-clover	*Melilotus alba*	3			X				X			X					
low hop clover	*Trifolium agrarium*	3			X						X						
red clover	*Trifolium pratense*	6	X						X			X	X			X	
white clover	*Trifolium repens*	3							X		X	X					
cow vetch	*Vicia cracca*	2											X				
OLEASTER FAMILY	*ELAEAGNACEAE*																
buffalo berry	*Shepherdia canadensis*	3									X				X	X	
MEZEREUM FAMILY	*THYMELAECEAE*																
leatherwood	*Dirca palustris*	4			X						X						
EVENING PRIMROSE FAMILY	*ONAGRACEAE*																
dwarf enchanter's nightshade	*Circaea alpina*	1															
Canada enchanter's nightshade	*Circaea lutetiana L. ssp.canadensis*	3							X		X						
common evening primrose	*Oenothera biennis*	1							X								
DOGWOOD FAMILY	*CORNACEAE*																
alternate-leaf dogwood	*Cornus alternifolia*	3			X				X		X						
bunchberry	*Cornus canadensis*	1														X	
round-leaved dogwood	*Cornus rugosa*	3		X											X		
red-osier dogwood	*Cornus stolonifera*	9	X			X	X		X		X	X		X	X	X	
STAFF-TREE FAMILY	*CELASTRACEAE*																
climbing bittersweet	*Celastrus scandens*	1													X		
burning bush	*Euonymus atropurpurea*	2					X						X				
SPURGE FAMILY	*EUPHORBIACEAE*																
cypress spurge	*Euphorbia cyparissias*	1	X														
BUCKTHORN FAMILY	*RHAMNACEAE*																
European buckthorn	*Rhamnus cathartica*	3				X					X					X	

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
GRAPE FAMILY	*VITACEAE*																
Virginia creeper	*Parthenocissus inserta*	5		X	X				X		X						
wild grape	*Vitis riparia*	1									X						
MILKWORT FAMILY	*POLYGALACEAE*																
fringed polygala	*Polygala paucifolia*	4			X						X				X		
racemed milkwort	*Polygala polygama*	1													X		
MAPLE FAMILY	*ACERACEAE*																
Manitoba maple	*Acer negundo*	1				X											
striped maple	*Acer pensylvanicum*	1												X			
Norway maple	*Acer platanoides*	1									X						
red maple	*Acer rubrum*	8	X	X	X		X		X		X			X			
silver maple	*Acer saccharinum*	4	X				X		X							X	
sugar maple	*Acer saccharum ssp.saccharum*	12	X		X	X					X	X	X	X	X	X	
Freeman's maple	*Acer x freemanii*	2							X							X	
CASHEW FAMILY	*ANACARDIACEAE*																
western poison-ivy	*Rhus rydbergii*	11		X	X	X			X		X	X		X		X	X
staghorn sumac	*Rhus typhina*	6			X		X				X	X			X	X	
WOOD-SORREL FAMILY	*OXALIDACEAE*																
European wood-sorrel	*Oxalis stricta*	1											X				
GERANIUM FAMILY	*GERANIACEAE*																
Bicknell's crane's-bill	*Geranium bicknellii*	1													X		
wild geranium	*Geranium maculatum*	2			X						X						
herb Robert	*Geranium robertianum*	1									X						
TOUCH-ME-NOT FAMILY	*BALSAMINACEAE*																
spotted jewelweed	*Impatiens capensis*	6	X	X			X		X		X					X	
GINSENG FAMILY	*ARALIACEAE*																
wild sarsaparilla	*Aralia nudicaulis*	10		X	X	X		X	X		X			X		X	
spikenard	*Aralia racemosa*	1							X								

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CARROT FAMILY	*APIACEAE*																
Queen-Anne's lace	*Daucus carota*	8			X				X		X	X	X			X	
woolly sweet cicely	*Osmorhiza claytonii*	2			X						X						
black snakeroot	*Sanicula marilandica*	5			X	X					X			X			
GENTIAN FAMILY	*GENTIANACEAE*																
bottle gentian	*Gentiana andrewsii*	1									X						
DOGBANE FAMILY	*APOCYNACEAE*																
spreading dogbane	*Apocynum androsaemifolium*	5				X			X		X		X			X	
MILKWEED FAMILY	*ASCLEPIADACEAE*																
swamp milkweed	*Asclepias incarnata*	1	X														
common milkweed	*Asclepias syriaca*	2									X		X				
swallow-wort	*Cynanchum rossicum*	1									X						
NIGHTSHADE FAMILY	*SOLANACEAE*																
bitter nightshade	*Solanum dulcamara*	6	X	X					X		X					X	
black nightshade	*Solanum nigrum*	1				X											
WATERLEAF FAMILY	*HYDROPHYLLACEAE*																
Virginia waterleaf	*Hydrophyllum virginianum*	2									X		X				
BORAGE FAMILY	*BORAGINACEAE*																
American gromwell	*Lithospermum latifolium*	2									X			X			
common gromwell	*Lithospermum officinale*	4					X					X			X		
LOPSEED FAMILY	*PHRYMACEAE*																
lopseed	*Phryma leptostachya*	1															

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
MINT FAMILY	*LAMIACEAE*																
wild basil	*Clinopodium vulgare*	6				X					X	X	X				
ground ivy	*Glechoma hederacea*	2										X		X			
American water-horehound	*Lycopus americanus*	2						X									
wild mint	*Mentha arvensis*	5	X				X		X		X			X			
spear mint	*Mentha spicata*	2									X						
wild bergamot	*Monarda fistulosa*	2									X	X					
wild marjoram	*Origanum vulgare*	4									X		X		X		
heal-all	*Prunella vulgaris ssp. Lanceolata*	6	X						X		X				X		
PLANTAIN FAMILY	*PLANTAGINACEAE*																
narrow-leaved plantain	*Plantago lanceolata*	6	X						X		X	X	X				
broad-leaved plantain	*Plantago major*	7	X						X		X	X	X			X	
Rugel's plantain	*Plantago rugelii*	2										X	X				
OLIVE FAMILY	*OLEACEAE*																
white ash	*Fraxinus americana*	10				X			X		X	X	X		X	X	X
black ash	*Fraxinus nigra*	8	X	X		X	X	X	X		X					X	
green ash	*Fraxinus pennsylvanica var. subintegerri*	6	X						X		X					X	
lilac	*Syringa vulgaris*	1										X					
FIGWORT FAMILY	*SCROPHULARIACEAE*																
square-stemmed monkeyflower	*Mimulus ringens*	1	X														
wood betony	*Pedicularis canadensis*	1									X						
hairy beardtongue	*Penstemon hirsutus*	1									X						
common mullein	*Verbascum thapsus*	9	X		X				X		X	X	X		X		
HAREBELL FAMILY	*CAMPANULACEAE*																
marsh bellflower	*Campanula aparinoides*	1					X										
Indian tobacco	*Lobelia inflata*	1							X								

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
MADDER FAMILY	*RUBIACEAE*																
rough bedstraw	*Galium asprellum*	3	X						X								
white bedstraw	*Galium mollugo*	4									X		X	X			
marsh bedstraw	*Galium palustre*	2					X		X								
creeping partridge-berry	*Mitchella repens*	2									X			X			
HONEYSUCKLE FAMILY	*CAPRIFOLIACEAE*																
bush-honeysuckle	*Diervilla lonicera*	1															
fly honeysuckle	*Lonicera canadensis*	3				X							X		X		
limber honeysuckle	*Lonicera dioica*	2											X		X		
honeysuckle	*Lonicera spp. E*	1									X						
tartarian honeysuckle	*Lonicera tatarica*	3			X						X			X			
common elderberry	*Sambucus canadensis*	1									X						
red-berried elderberry	*Sambucus racemosa*	1									X						
snowberry	*Symphoricarpos albus*	3									X				X	X	
narrow-leaved horse-gentian	*Triosteum angustifolium*	1															
scarlet-fruited horse-gentian	*Triosteum aurantiacum*	2									X						
nannyberry	*Viburnum lentago*	2	X						X								
downy arrow-wood	*Viburnum rafinesquianum*	7			X						X	X	X		X	X	
high bush cranberry	*Viburnum trilobium*	1										X					

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ASTER FAMILY	*ASTERACEAE*																
common yarrow	*Achillea millefolium*	9	X		X				X		X	X	X			X	
common ragweed	*Ambrosia artemisiifolia L.*	5							X			X	X	X		X	
pearly everlasting	*Anaphalis margaritacea*	1											X				
common burdock	*Arctium minus*	1									X						
marsh beggar-ticks	*Bidens frondosa*	1							X								
ox-eye daisy	*Chrysanthemum leucanthemum*	9	X		X		X		X		X	X	X		X		
chicory	*Cichorium intybus*	1										X					
bull thistle	*Cirsium vulgare*	4							X		X	X					
daisy fleabane	*Erigeron annuus*	1											X				
Philadelphia fleabane	*Erigeron philadelphicus ssp. philadelphic*	6			X				X		X	X				X	
spotted joe-pyeweed	*Eupatorium maculatum*	4	X				X		X							X	
boneset	*Eupatorium perfoliatum*	2	X				X										
white snakeroot	*Eupatorium rugosum*	1									X						
large-leaved aster	*Eurybia macrophylla*	6			X				X		X			X	X	X	
grass-leaved goldenrod	*Euthamia graminifolia*	3					X				X					X	
orange hawkweed	*Hieracium aurantiacum*	1										X					
field hawkweed	*Hieracium caepitosum ssp.caespitosum*	1											X				
mouse ear hawkweed	*Hieracium pilosella*	1													X		
king devil hawkweed	*Hieracium x florbundum*	1													X		
wild lettuce	*Lactuca canadensis*	7		X	X				X		X			X			
white lettuce	*Prenanthes alba*	2									X					X	
black-eyed Susan	*Rudbeckia hirta*	2										X	X				
balsam ragwort	*Senecio pauperculus*	1													X		
tall goldenrod	*Solidago altissima*	4									X	X					
Canada goldenrod	*Solidago canadensis*	8					X				X	X	X		X	X	
early goldenrod	*Solidago juncea*	4					X				X		X			X	
gray goldenrod	*Solidago nemoralis ssp. Nemoralis*	5							X			X	X		X	X	
rough goldenrod	*Solidago rugosa ssp. rugosa*	1									X						

			COMMUNITY NUMBER														
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
field sow thistle	*Sonchus arvensis ssp.arvensis*	1															
spiny-leaved sow thistle	*Sonchus asper*	1										X					
heart-leaved aster	*Symphyotrichum cordifolium*	7		X							X		X	X	X	X	
panicled aster	*Symphyotrichum lanceolatum ssp.hespe*	2					X									X	
calico aster	*Symphyotrichum lateriflorum var.laterifl*	5									X	X				X	
New England aster	*Symphyotrichum novae- angliae*	4	X				X		X								
white heath aster	*Symphyotrichum pilosum var.pilosum*	1															
purple-stemmed aster	*Symphyotrichum puniceum*	2	X										X				
arrow-leaved aster	*Symphyotrichum urophyllum*	1										X					
common dandelion	*Taraxacum officinale*	4									X	X	X				
goat's-beard	*Tragopogon dubius*	2										X	X				
coltsfoot	*Tussilago farfara*	4	X											X			
WATER-PLANTAIN FAMILY	*ALISMATACEAE*																
broad-leaved arrowhead	*Sagittaria latifolia*	1	X														
ARUM FAMILY	*ARACEAE*																
Jack-in-the-pulpit	*Arisaema triphyllum*	4		X					X		X						
DUCKWEED FAMILY	*LEMNACEAE*																
common duckweed	*Lemna minor*	1	X														
SEDGE FAMILY	*CYPERACEAE*																
yellow sedge	*Carex flava*	2	X										X				
few-seeded sedge	*Carex oligosperma*	1													X		
Pennsylvania sedge	*Carex pensylvanica*	4	X								X					X	
plantain-leaved sedge	*Carex plantaginea*	1															
awl-fruited sedge	*Carex stipata*	1	X														
tussock sedge	*Carex stricta*	2	X	X													
greenish sedge	*Carex viridula*	1					X										
hard-stemmed bulrush	*Scirpus acutus*	1									X						
wool-grass	*Scirpus cyperinus*	4	X				X		X				X				
softstem bulrush	*Scirpus validus*	2	X						X								

			COMMUNITY NUMBER															
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
GRASS FAMILY	*POACEAE*																	
redtop	*Agrostis gigantea*	1	X															
rough hair grass	*Agrostis scabra*	1							X									
fringed brome grass	*Bromus ciliatus*	1											X					
awnless brome grass	*Bromus inermis ssp.inermis*	1											X					
Canada bluejoint grass	*Calamagrostis canadensis*	1	X															
orchard grass	*Dactylis glomerata*	1	X															
poverty oatgrass	*Danthonia spicata*	2									X		X					
bottle-brush grass	*Elymus hystrix*	2			X						X							
fowl manna grass	*Glyceria striata*	1	X															
rice cut grass	*Leersia oryzoides*	1	X															
reed canary grass	*Phalaris arundinacea*	4	X			X							X			X		
timothy	*Phleum pratense*	5							X		X	X				X		
CATTAIL FAMILY	*TYPHACEAE*																	
narrow-leaved cattail	*Typha angustifolia*	1	X															
common cattail	*Typha latifolia*	1	X															
LILY FAMILY	*LILIACEAE*																	
asparagus	*Asparagus officinalis*	1														X		
bluebead lily	*Clintonia borealis*	2												X				
trout lily	*Erythronium americanum ssp. american*	2				X					X							
tiger lily	*Lilium lancifolium*	1									X							
Canada mayflower	*Maianthemum canadense*	10			X	X			X		X			X		X	X	
Indian cucumber-root	*Medeola virginiana*	1									X							
hairy Solomon's seal	*Polygonatum pubescens*	3									X							
false Solomon's seal	*Smilacina racemosa*	5		X	X	X			X		X							
rose-twisted stalk	*Streptopus roseus*	4			X						X							
purple trillium	*Trillium erectum*	3						X			X							
white trillium	*Trillium grandiflorum*	5		X	X				X		X							
large-flowered bellwort	*Uvularia grandiflora*	3									X			X				

			COMMUNITY NUMBER															
Common Name	***Scientific Name***	**Total**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
IRIS FAMILY	*IRIDACEAE*																	
wild blue flag	*Iris versicolor*	2	X				X											
little blue-eyed grass	*Sisyrinchium montanum*	2	X								X							
ORCHID FAMILY	*ORCHIDACEAE*																	
helleborine	*Epipactis helleborine*	9		X		X		X	X		X			X			X	
northern green orchis	*Platanthera hyperborea*	1							X									
Total Number of Plant Species	309		71	37	60	39	41	24	92	2	164	68	68	54	60	70	14	
			Number of Plant Species Per Community															

APPENDIX I - A Communities 16-18

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
PEAT MOSS FAMILY	*SPHAGNACEAE*				
sphagnum moss species	*Sphagnum spp.*	1			
CLUBMOSS FAMILY	*LYCOPODIACEAE*				
common clubmoss	*Lycopodium clavatum*	1			
ground-pine	*Lycopodium obscurum*	1			
HORSETAIL FAMILY	*EQUISETACEAE*				
field horsetail	*Equisetum arvense*	4			
water horsetail	*Equisetum fluviatile*	1			
meadow horsetail	*Equisetum pratense*	2			
wood horsetail	*Equisetum sylvaticum*	1			
ADDER'S-TONGUE FAMILY	*OPHIOGLOSSACEAE*				
rattlesnake fern	*Botrychium virginianum*	2	X		
ROYAL FERN FAMILY	*OSMUNDACEAE*				
cinnamon fern	*Osmunda cinnamonea*	2			
interrupted fern	*Osmunda claytoniana*	2		X	
royal fern	*Osmunda regalis var.spectabilis*	2			
MAIDENHAIR FERN FAMILY	*PTERIDACEAE*				
northern maidenhair fern	*Adiantum pedatum*	2			
BRACKEN FERN FAMILY	*DENNSTAEDTIACEAE*				
hay-scented fern	*Dennstaedtia punctilobula*	2			
eastern bracken fern	*Pteridium aquilinum*	10	X		X
BEECH FERN FAMILY	*THELYPTERIDAE*				
northern beech fern	*Phegopteris connectilis*	2			

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
marsh fern	*Thelypteris palustris*	1			
SPLEENWORT FAMILY	*ASPLENIACEAE*				
walking fern	*Asplenium rhizophyllum*	2			
maidenhair spleenwort	*Asplenium trichomanes ssp.quadrival*	6	X		
WOOD FERN FAMILY	*DRYOPTERIDACEAE*				
northern lady fern	*Athyrium filix-femina*	2			
bulbet bladder fern	*Cystopteris bulbifera*	2			
spinulose wood-fern	*Dryopteris carthusiana*	9	X	X	X
evergreen wood-fern	*Dryopteris intermedia*	3		X	
marginal wood-fern	*Dryopteris marginalis*	4			
oak fern	*Gymnocarpium dryopteris*	5		X	
ostrich fern	*Matteuccia struthiopteris*	4			
sensitive fern	*Onoclea sensibilis*	7			X
Christmas fern	*Polystichum acrostichoides*	5	X		X
POLYPODY FAMILY	*POLYPODIACEAE*				
rock polypody fern	*Polypodium virginianum*	2	X		
PINE FAMILY	*PINACEAE*				
balsam fir	*Abies balsamea*	13	X	X	X
tamarack	*Larix laricina*	3			
white spruce	*Picea glauca*	12	X		
red pine	*Pinus resinosa*	1	X		
eastern white pine	*Pinus strobus*	13	X		X
Scot's pine	*Pinus sylvestris*	1			
eastern hemlock	*Tsuga canadensis*	3	X		
CYPRESS FAMILY	*CUPRESSACEAE*				
common juniper	*Juniperus communis var. depressa*	9			X
eastern red cedar	*Juniperus virginiana*	3			
eastern white cedar	*Thuja occidentalis*	14	X		X
YEW FAMILY	*TAXACEAE*				

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
American yew	*Taxus canadensis*	1			
BUTTERCUP FAMILY	*RANUNCULACEAE*				
white baneberry	*Actaea pachypoda*	2			
red baneberry	*Actaea rubra*	3		X	
Canada anemone	*Anemone canadensis*	3			
thimbleweed	*Anemone virginiana*	6			
wild columbine	*Aquilegia canadensis*	4			
marsh marigold	*Caltha palustris*	5			
virgin's bower	*Clematis virginiana*	4			
goldthread	*Coptis trifolia*	1			
sharp-lobed hepatica	*Hepatica acutiloba*	3	X		
round-lobed hepatica	*Hepatica americana*	3	X		
small-flowered buttercup	*Ranunculus abortivus*	3			
tall buttercup	*Ranunculus acris*	3			
early meadow rue	*Thalictrum dioicum*	7	X	X	
tall meadow rue	*Thalictrum pubescens*	4			
BARBERRY FAMILY	*BERBERIDACEAE*				
blue cohosh	*Caulophyllum giganteum*	3	X	X	
mayapple	*Podophyllum peltatum*	1			
POPPY FAMILY	*PAPAVERACEAE*				
bloodroot	*Sanguinaria canadensis*	1			
ELM FAMILY	*ULMACEAE*				
American elm	*Ulmus americana*	10			
NETTLE FAMILY	*URTICACEAE*				
false nettle	*Boehmeria cylindrica*	2	X		
wood nettle	*Laportea canadensis*	1			
WALNUT FAMILY	*JUGLANDACEAE*				
butternut	*Juglans cinerea*	3	X		X
black walnut	*Juglans nigra*	2			X

		COMMUNITY NUMBER			
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
BEECH FAMILY	*FAGACEAE*				
American beech	*Fagus grandifolia*	1			
white oak	*Quercus alba*	7			X
bur oak	*Quercus macrocarpa*	6			
red oak	*Quercus rubra*	10			
oak	*Quercus sp*	1			
BIRCH FAMILY	*BETULACEAE*				
speckled alder	*Alnus rugosa*	6			
yellow birch	*Betula alleghaniensis Britt.*	4			
white birch	*Betula papyrifera*	13	X	X	X
blue beech	*Carpinus caroliniana*	1			
beaked hazel	*Corylus cornuta*	2			X
ironwood	*Ostrya virginiana*	4	X		
PINK FAMILY	*CARYOPHYLLACEAE*				
Deptford pink	*Dianthus armeria*	1			
bladder campion	*Silene vulgaris*	1			
common chickweed	*Stellaria media*	1			
BUCKWHEAT FAMILY	*POLYGONACEAE*				
curled dock	*Rumex crispus*	2			
bitter dock	*Rumex obtusifolius*	1			
ST. JOHN'S-WORT FAMILY	*GUTTIFERAE*				
common St. John's-wort	*Hypericum perforatum*	2			
marsh St. John's-wort	*Triadenum fraseri*	2			
LINDEN FAMILY	*TILIACEAE*				
American basswood	*Tilia americana*	10	X		
VIOLET FAMILY	*VIOLACEAE*				
dog violet	*Viola conspersa*	3	X		
lance-leaved violet	*Viola lanceolata*	1			
northern white violet	*Viola macloskeyi*	1		X	

		COMMUNITY NUMBER			
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
downy yellow violet	*Viola pubescens*	1			
long-spurred violet	*Viola rostrata*	2			
GOURD FAMILY	*CUCURBITACEAE*				
wild cucumber	*Echinocystis lobata*	1			
WILLOW FAMILY	*SALICACEAE*				
balsam poplar	*Populus balsamifera*	10	X		
large-toothed aspen	*Populus grandidentata*	6			X
trembling aspen	*Populus tremuloides*	12	X		X
Bebb's willow	*Salix bebbiana*	1			
pussy willow	*Salix discolor*	3			
slender willow	*Salix petiolaris*	3			
MUSTARD FAMILY	*BRASSICACEAE*				
tower mustard	*Arabis glabra*	2			
Pennsylvania bittercress	*Cardamine pensylvanica*	1			X
wild mustard	*Sinapsis arvensis*	3			
HEATH FAMILY	*ERICACEAE*				
common bearberry	*Arctostaphylos uva-ursi*	2			
trailing arbutus	*Epigaea repens*	1			
lowbush blueberry	*Vaccinium angustifolium*	2			
INDIAN PIPE FAMILY	*MONOTROPACEAE*				
indian pipe	*Monotropa uniflora*	1	X		
PRIMROSE FAMILY	*PRIMULACEAE*				
fringed loosestrife	*Lysimachia ciliata*	1			
moneywort	*Lysimachia nummularia*	2	X		X
starflower	*Trientalis borealis*	4		X	
GOOSEBERRY FAMILY	*GROSSULARIACEAE*				
prickly gooseberry	*Ribes cynosbati*	5			X
smooth gooseberry	*Ribes hirtellum*	1			
bristly black currant	*Ribes lacustre*	2			

		COMMUNITY NUMBER			
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
swamp red currant	*Ribes triste Pallas*	1			
ORPINE FAMILY	*CRASSULACEAE*				
mossy stonecrop	*Sedum acre*	4			
SAXIFRAGE FAMILY	*SAXIFRAGACEAE*				
naked miterwort	*Mitella nuda*	2	X		
early saxifrage	*Saxifraga virginiensis*	2			
foam flower	*Tiarella cordifolia*	4			
ROSE FAMILY	*ROSACEAE*				
agrimony	*Agrimonia gryposepela*	3			
downy serviceberry	*Amelanchier arborea*	2			
hawthorn species	*Crataegus spp.*	6			X
woodland strawberry	*Fragaria vesca*	3			
common strawberry	*Fragaria virginiana*	12	X		X
yellow avens	*Geum aleppicum*	6	X		
white avens	*Geum canadense*	2	X		
silvery cinquefoil	*Potentilla argentea*	1			
rough cinquefoil	*Potentilla norvegica*	2			
marsh cinquefoil	*Potentilla palustris*	1			
sulfur cinquefoil	*Potentilla recta*	6	X		
Canada plum	*Prunus nigra*	1			
pin cherry	*Prunus pensylvanica*	4			X
black cherry	*Prunus serotina*	5	X		X
choke cherry	*Prunus virginiana*	7			
smooth rose	*Rosa blanda*	3			
rugosa rose	*Rosa rugosa*	1			
Alleghany blackberry	*Rubus allegheniensis*	5			X
wild red raspberry	*Rubus idaeus*	12	X		X
purple-flowering raspberry	*Rubus odoratus*	1			
dwarf raspberry	*Rubus pubescens*	5			

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
narrow-leaved meadowsweet	*Spiraea alba*	4			
barren strawberry	*Waldsteinia fragarioides*	3			
PEA FAMILY	*FABACEAE*				
crown-vetch	*Coronilla varia*	2			
bird's-foot trefoil	*Lotus corniculatus*	1			
black medick	*Medicago lupulina*	1			
white sweet-clover	*Melilotus alba*	3			
low hop clover	*Trifolium agrarium*	3			X
red clover	*Trifolium pratense*	6			X
white clover	*Trifolium repens*	3			
cow vetch	*Vicia cracca*	2			X
OLEASTER FAMILY	*ELAEAGNACEAE*				
buffalo berry	*Shepherdia canadensis*	3			
MEZEREUM FAMILY	*THYMELAECEAE*				
leatherwood	*Dirca palustris*	4	X		X
EVENING PRIMROSE FAMILY	*ONAGRACEAE*				
dwarf enchanter's nightshade	*Circaea alpina*	1	X		
Canada enchanter's nightshade	*Circaea lutetiana L. ssp.canadensis*	3	X		
common evening primrose	*Oenothera biennis*	1			
DOGWOOD FAMILY	*CORNACEAE*				
alternate-leaf dogwood	*Cornus alternifolia*	3			
bunchberry	*Cornus canadensis*	1			
round-leaved dogwood	*Cornus rugosa*	3	X		
red-osier dogwood	*Cornus stolonifera*	9			
STAFF-TREE FAMILY	*CELASTRACEAE*				
climbing bittersweet	*Celastrus scandens*	1			
burning bush	*Euonymus atropurpurea*	2			
SPURGE FAMILY	*EUPHORBIACEAE*				
cypress spurge	*Euphorbia cyparissias*	1			

		COMMUNITY NUMBER			
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
BUCKTHORN FAMILY	*RHAMNACEAE*				
European buckthorn	*Rhamnus cathartica*	3			
GRAPE FAMILY	*VITACEAE*				
Virginia creeper	*Parthenocissus inserta*	5			X
wild grape	*Vitis riparia*	1			
MILKWORT FAMILY	*POLYGALACEAE*				
fringed polygala	*Polygala paucifolia*	4	X		
racemed milkwort	*Polygala polygama*	1			
MAPLE FAMILY	*ACERACEAE*				
Manitoba maple	*Acer negundo*	1			
striped maple	*Acer pensylvanicum*	1			
Norway maple	*Acer platanoides*	1			
red maple	*Acer rubrum*	8		X	
silver maple	*Acer saccharinum*	4			
sugar maple	*Acer saccharum ssp.saccharum*	12	X	X	X
Freeman's maple	*Acer x freemanii*	2			
CASHEW FAMILY	*ANACARDIACEAE*				
western poison-ivy	*Rhus rydbergii*	11	X		X
staghorn sumac	*Rhus typhina*	6			
WOOD-SORREL FAMILY	*OXALIDACEAE*				
European wood-sorrel	*Oxalis stricta*	1			
GERANIUM FAMILY	*GERANIACEAE*				
Bicknell's crane's-bill	*Geranium bicknellii*	1			
wild geranium	*Geranium maculatum*	2			
herb Robert	*Geranium robertianum*	1			
TOUCH-ME-NOT FAMILY	*BALSAMINACEAE*				
spotted jewelweed	*Impatiens capensis*	6			
GINSENG FAMILY	*ARALIACEAE*				
wild sarsaparilla	*Aralia nudicaulis*	10	X	X	

		COMMUNITY NUMBER			
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
spikenard	*Aralia racemosa*	1			
CARROT FAMILY	*APIACEAE*				
Queen-Anne's lace	*Daucus carota*	8	X		X
woolly sweet cicely	*Osmorhiza claytonii*	2			
black snakeroot	*Sanicula marilandica*	5	X		
GENTIAN FAMILY	*GENTIANACEAE*				
bottle gentian	*Gentiana andrewsii*	1			
DOGBANE FAMILY	*APOCYNACEAE*				
spreading dogbane	*Apocynum androsaemifolium*	5			
MILKWEED FAMILY	*ASCLEPIADACEAE*				
swamp milkweed	*Asclepias incarnata*	1			
common milkweed	*Asclepias syriaca*	2			
swallow-wort	*Cynanchum rossicum*	1			
NIGHTSHADE FAMILY	*SOLANACEAE*				
bitter nightshade	*Solanum dulcamara*	6	X		
black nightshade	*Solanum nigrum*	1			
WATERLEAF FAMILY	*HYDROPHYLLACEAE*				
Virginia waterleaf	*Hydrophyllum virginianum*	2			
BORAGE FAMILY	*BORAGINACEAE*				
American gromwell	*Lithospermum latifolium*	2			
common gromwell	*Lithospermum officinale*	4	X		
LOPSEED FAMILY	*PHRYMACEAE*				
lopseed	*Phryma leptostachya*	1	X		
MINT FAMILY	*LAMIACEAE*				
wild basil	*Clinopodium vulgare*	6	X		X
ground ivy	*Glechoma hederacea*	2			
American water-horehound	*Lycopus americanus*	2	X		
wild mint	*Mentha arvensis*	5			
spear mint	*Mentha spicata*	2	X		

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
wild bergamot	*Monarda fistulosa*	2			
wild marjoram	*Origanum vulgare*	4	X		
heal-all	*Prunella vulgaris ssp. Lanceolata*	6	X		X
PLANTAIN FAMILY	*PLANTAGINACEAE*				
narrow-leaved plantain	*Plantago lanceolata*	6			X
broad-leaved plantain	*Plantago major*	7			X
Rugel's plantain	*Plantago rugelii*	2			
OLIVE FAMILY	*OLEACEAE*				
white ash	*Fraxinus americana*	10	X		X
black ash	*Fraxinus nigra*	8			
green ash	*Fraxinus pennsylvanica var. subintege*	6	X	X	
lilac	*Syringa vulgaris*	1			
FIGWORT FAMILY	*SCROPHULARIACEAE*				
square-stemmed monkeyflower	*Mimulus ringens*	1			
wood betony	*Pedicularis canadensis*	1			
hairy beardtongue	*Penstemon hirsutus*	1			
common mullein	*Verbascum thapsus*	9	X		X
HAREBELL FAMILY	*CAMPANULACEAE*				
marsh bellflower	*Campanula aparinoides*	1			
Indian tobacco	*Lobelia inflata*	1			
MADDER FAMILY	*RUBIACEAE*				
rough bedstraw	*Galium asprellum*	3	X		
white bedstraw	*Galium mollugo*	4			X
marsh bedstraw	*Galium palustre*	2			
creeping partridge-berry	*Mitchella repens*	2			
HONEYSUCKLE FAMILY	*CAPRIFOLIACEAE*				
bush-honeysuckle	*Diervilla lonicera*	1	X		
fly honeysuckle	*Lonicera canadensis*	3			
limber honeysuckle	*Lonicera dioica*	2			

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
honeysuckle	*Lonicera spp. E*	1			
tartarian honeysuckle	*Lonicera tatarica*	3			
common elderberry	*Sambucus canadensis*	1			
red-berried elderberry	*Sambucus racemosa*	1			
snowberry	*Symphoricarpos albus*	3			
narrow-leaved horse-gentian	*Triosteum angustifolium*	1	X		
scarlet-fruited horse-gentian	*Triosteum aurantiacum*	2	X		
nannyberry	*Viburnum lentago*	2			
downy arrow-wood	*Viburnum rafinesquianum*	7	X		
high bush cranberry	*Viburnum trilobium*	1			
ASTER FAMILY	*ASTERACEAE*				
common yarrow	*Achillea millefolium*	9	X		X
common ragweed	*Ambrosia artemisiifolia L.*	5			
pearly everlasting	*Anaphalis margaritacea*	1			
common burdock	*Arctium minus*	1			
marsh beggar-ticks	*Bidens frondosa*	1			
ox-eye daisy	*Chrysanthemum leucanthemum*	9	X		
chicory	*Cichorium intybus*	1			
bull thistle	*Cirsium vulgare*	4	X		
daisy fleabane	*Erigeron annuus*	1			
Philadelphia fleabane	*Erigeron philadelphicus ssp. philadelp*	6	X		
spotted joe-pyeweed	*Eupatorium maculatum*	4			
boneset	*Eupatorium perfoliatum*	2			
white snakeroot	*Eupatorium rugosum*	1			
large-leaved aster	*Eurybia macrophylla*	6			
grass-leaved goldenrod	*Euthamia graminifolia*	3			
orange hawkweed	*Hieracium aurantiacum*	1			
field hawkweed	*Hieracium caepitosum ssp.caespitosu*	1			
mouse ear hawkweed	*Hieracium pilosella*	1			

		COMMUNITY NUMBER			
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
king devil hawkweed	*Hieracium x florbundum*	1			
wild lettuce	*Lactuca canadensis*	7	X		X
white lettuce	*Prenanthes alba*	2			
black-eyed Susan	*Rudbeckia hirta*	2			
balsam ragwort	*Senecio pauperculus*	1			
tall goldenrod	*Solidago altissima*	4	X		X
Canada goldenrod	*Solidago canadensis*	8	X		X
early goldenrod	*Solidago juncea*	4			
gray goldenrod	*Solidago nemoralis ssp. Nemoralis*	5			
rough goldenrod	*Solidago rugosa ssp. rugosa*	1			
field sow thistle	*Sonchus arvensis ssp.arvensis*	1	X		
spiny-leaved sow thistle	*Sonchus asper*	1			
heart-leaved aster	*Symphyotrichum cordifolium*	7	X		
panicled aster	*Symphyotrichum lanceolatum ssp.hes*	2			
calico aster	*Symphyotrichum lateriflorum var.late*	5	X		X
New England aster	*Symphyotrichum novae- angliae*	4	X		
white heath aster	*Symphyotrichum pilosum var.pilosum*	1	X		
purple-stemmed aster	*Symphyotrichum puniceum*	2			
arrow-leaved aster	*Symphyotrichum urophyllum*	1			
common dandelion	*Taraxacum officinale*	4	X		
goat's-beard	*Tragopogon dubius*	2			
coltsfoot	*Tussilago farfara*	4	X		X
WATER-PLANTAIN FAMILY	*ALISMATACEAE*				
broad-leaved arrowhead	*Sagittaria latifolia*	1			
ARUM FAMILY	*ARACEAE*				
Jack-in-the-pulpit	*Arisaema triphyllum*	4	X		
DUCKWEED FAMILY	*LEMNACEAE*				
common duckweed	*Lemna minor*	1			
SEDGE FAMILY	*CYPERACEAE*				

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
yellow sedge	*Carex flava*	2			
few-seeded sedge	*Carex oligosperma*	1			
Pennsylvania sedge	*Carex pensylvanica*	4	X		
plantain-leaved sedge	*Carex plantaginea*	1	X		
awl-fruited sedge	*Carex stipata*	1			
tussock sedge	*Carex stricta*	2			
greenish sedge	*Carex viridula*	1			
hard-stemmed bulrush	*Scirpus acutus*	1			
wool-grass	*Scirpus cyperinus*	4			
softstem bulrush	*Scirpus validus*	2			
GRASS FAMILY	*POACEAE*				
redtop	*Agrostis gigantea*	1			
rough hair grass	*Agrostis scabra*	1			
fringed brome grass	*Bromus ciliatus*	1			
awnless brome grass	*Bromus inermis ssp.inermis*	1			
Canada bluejoint grass	*Calamagrostis canadensis*	1			
orchard grass	*Dactylis glomerata*	1			
poverty oatgrass	*Danthonia spicata*	2			
bottle-brush grass	*Elymus hystrix*	2			
fowl manna grass	*Glyceria striata*	1			
rice cut grass	*Leersia oryzoides*	1			
reed canary grass	*Phalaris arundinacea*	4			
timothy	*Phleum pratense*	5			X
CATTAIL FAMILY	*TYPHACEAE*				
narrow-leaved cattail	*Typha angustifolia*	1			
common cattail	*Typha latifolia*	1			
LILY FAMILY	*LILIACEAE*				
asparagus	*Asparagus officinalis*	1			
bluebead lily	*Clintonia borealis*	2		X	

			COMMUNITY NUMBER		
Common Name	***Scientific Name***	**Total**	**16**	**17**	**18**
trout lily	*Erythronium americanum ssp. americ*	2			
tiger lily	*Lilium lancifolium*	1			
Canada mayflower	*Maianthemum canadense*	10	X	X	X
Indian cucumber-root	*Medeola virginiana*	1			
hairy Solomon's seal	*Polygonatum pubescens*	3	X	X	
false Solomon's seal	*Smilacina racemosa*	5			
rose-twisted stalk	*Streptopus roseus*	4	X	X	
purple trillium	*Trillium erectum*	3		X	
white trillium	*Trillium grandiflorum*	5		X	
large-flowered bellwort	*Uvularia grandiflora*	3		X	
IRIS FAMILY	*IRIDACEAE*				
wild blue flag	*Iris versicolor*	2			
little blue-eyed grass	*Sisyrinchium montanum*	2			
ORCHID FAMILY	*ORCHIDACEAE*				
helleborine	*Epipactis helleborine*	9	X		X
northern green orchis	*Platanthera hyperborea*	1			
Total Number of Plant Species	309		80	22	48

Number of Plant Species Per Community

Appendix I-B: List of Significant Plant Species

APPENDIX I - B List of Significant Plant Species

Plant species observed by NEA with significant status on national, provincial and relevant regional lists are listed with status codes and where applicable the most current year of publication. Three standard reference works were used for the botanical nomenclature and taxonomy (Newmaster et. al., 1998; Gleason and Cronquist 1991; Voss 1980; 1985). Other published works for botanical names included; ferns (Cody and Britton 1989); grasses (Dore and McNeill 1980); orchids (Whiting and Catling 1986); shrubs (Soper and Heimburger 1982) and trees (Farrar 1995).

NATIONAL RANKING **Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Government of Canada**
Species at Risk Act (SARA), SCHEDULE 1 (Subsections 2(1), 42(2) and 68(2)), Government of Canada

PROVINCIAL RANKING **Species at Risk in Ontario (COSSARO), Government of Ontario**
Provincial Rank (SRANK), Natural Heritage Information Center, Government of Ontario

REGIONAL RANKING **Riley, Simcoe** Riley,1989, Simcoe

STATUS CODES

COSEWIC	**END ***	- Endangered Species	***Year of Status Publication included in Code**
COSSARO	**THR ***	- Threatened Species	
SARA	**SC ***	- Species of Concern	
SRANK	**S1**	- Extremely Rare	**Other national or provincial codes not listed**
	S2	- Very Rare	
	S3	- Rare to Uncommon	
Regional Lists	**R**	- Rare native species	**Other Regional codes not listed**
	EXP	- Extirpated native species	

		NATIONAL RANKINGS		PROVINCIAL RANKINGS		REGIONAL RANKINGS				
Common Name	**Scientific Name**	**COSEWIC**	**SARA**	**COSSARO**	**SRank**	**Riley, Simcoe**				
meadow horsetail	Equisetum pratense					R				
butternut	Juglans cinerea	END Apr/14	END Mar/13	END Jun/14	S3?					
black walnut	Juglans nigra					R				
purple-flowering raspberry	Rubus odoratus					R				
racemed milkwort	Polygala polygama					R				
European wood-sorrel	Oxalis stricta					R				
wild geranium	Geranium maculatum					R				

Common Name	Scientific Name	COSEWIC	SARA	COSSARO	SRank	Riley, Simcoe				
tall goldenrod	Solidago altissima					R				
white heath aster	Symphyotrichum pilosum var.pilosum					R				
Plants with Ranking	**Total:** 9 **Status List Totals:**	1	1	1		8	0	0	0	0

Appendix II: Project Bird Status Report

APPENDIX II Bird Status Report

Bird species observed by NEA are listed in the order followed the American Ornithologists' Union (AOU) Check-list of North American birds (7th edition, 1999, 47th Supplement). Common and scientific nomenclature are based on those used by AOU. Breeding status and breeding evidence code are listed when observed. Any significant status for a species on national and provincial lists is displayed as well as those from relevant regional lists.

List Status :

END - endangered	A wildlife species facing imminent extirpation or extinction.
END-R -endangered regulated	A wildlife species facing imminent extirpation or extinction in Ontario which has been regulated under Ontario's Endangered Species Act (ESA).
THR - threatened	A wildlife species likely to become endangered if limiting factors are not reversed.
SC - special concern	A wildlife species that may become threatened or an endangered species because of a combination of biological characteristics and identified threats.
YES - Area Sensitive	A wildlife species that requires large areas of suitable habitat in order to sustain their population numbers.

*** Other status levels are not displayed**

List Sources:

COSEWIC	The Committee on the Status of Endangered Wildlife in Canada, May 2016.
COSSARO	The Committee on the Status of Species at Risk in Ontario, June 2016.
SARA	Species At Risk Act, Schedule 1, Government of Canada, 2016.
Area Sensitive	Significant Wildlife Technical Guide, Appendix C, OMNR, Oct. 2000
Region 6	Southern Ontario Wetland Evaluation Appendix 11B, Version 3.2, March 2013

Breeding Status: (Observed By NEA)

B -species observed in breeding season in suitable habitat with some evidence of breeding (confirmed, probable or possible as per Ontario Breeding Bird Atlas, 2002).

F -species observed in breeding season but no evidence of breeding or suitable nest sites available on the study site (includes flyovers, migrants and foraging colonial breeders).

M -species observed outside of breeding season for that species and in area outside of the known

Breeding Evidence Code: (Observed By NEA)

OBSERVED

X -species observed in its breeding season (no evidence of breeding).

POSSIBLE BREEDING

H -species observed in its breeding season in suitable nesting habitat

S -singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat

PROBABLE BREEDING

P -pair observed in their breeding season in suitable nesting habitat

T -permanent territory presumed through registration of territorial song on at least 2days, a week or more apart, at the same place

D -courtship or display between a male and a female or 2 males, including courtship feeding or copulation

V -visiting probable nest site

A -agitated behaviour or anxiety calls of an adult

B -brood patch on adult female or cloacal protuberance on adult male

N -nest-building or excavation of nest hole

CONFIRMED BREEDING

DD -distraction display or injury feigning

NU -used nest or egg shell found (occupied or laid within the period of study)

FY -recently fledged young or downy young, including young incapable of sustained flight

AE -adults leaving or entering nest site in circumstances indicating occupied nest

FS -adult carrying fecal sac

CF -adult carrying food for young

NE -nest containing eggs

NY -nest with young seen or heard

SOURCE: Ontario Breeding Bird Atlas March 2001

AOU Code	Common Name	Scientific Name	Observed Breeding Status	Breed Evidence Code	COSEWIC	COSSARO	SARA	Area Sensitive	Region 6		
CAGO	Canada Goose	*Branta canadensis*	B	None				No			
WODU	Wood Duck	*Aix sponsa*	B	None				No			
MALL	Mallard	*Anas platyrhynchos*	B	None				No			
COME	Common Merganser	*Mergus merganser*	B	None				No			
RUGR	Ruffed Grouse	*Bonasa umbellus*	B	None				No			
WITU	Wild Turkey	*Meleagris gallopavo*	B	None				No			
COLO	Common Loon	*Gavia immer*	F	None				No			
AMBI	American Bittern	*Botaurus lentiginosus*	B	None				No			
TUVU	Turkey Vulture	*Cathartes aura*	B	None				No			
RSHA	Red-shouldered Hawk	*Buteo lineatus*	B	None			SC	No			
BWHA	Broad-winged Hawk	*Buteo platypterus*	B	None				No			
KILL	Killdeer	*Charadrius vociferus*	B	None				No			
AMWO	American Woodcock	*Scolopax minor*	B	None				No			
HEGU	Herring Gull	*Larus argentatus*	F	None				No			
MODO	Mourning Dove	*Zenaida macroura*	B	None				No			
BAOW	Barred Owl	*Strix varia*	B	None				No			
CONI	Common Nighthawk	*Chordeiles minor*	B	None	THR	SC	THR	No			
WPWI	Eastern whip-poor-will	*Antrostomus vociferus*	B	None	THR	THR	THR	No			
BEKI	Belted Kingfisher	*Megaceryle alcyon*	B	None				No			
YBSS	Yellow-bellied Sapsucker	*Sphyrapicus varius*	B	None				Yes			
DOWO	Downy Woodpecker	*Picoides pubescens*	B	None				No			
HAWO	Hairy Woodpecker	*Picoides villosus*	B	None				No			
NOFL	Northern Flicker	*Colaptes auratus*	B	None				No			
PIWO	Pileated Woodpecker	*Dryocopus pileatus*	B	None				No			
EWPE	Eastern Wood-Pewee	*Contopus virens*	B	None	SC	SC		No			
GCFL	Great Crested Flycatcher	*Myiarchus crinitus*	B	None				No			

EAKI	Eastern Kingbird	*Tyrannus tyrannus*	B	None			No			
BHVI	Blue-headed Vireo	*Vireo solitarius*	B	None			Yes	RS		
REVI	Red-eyed Vireo	*Vireo olivaceus*	B	None			No			
BLJY	Blue Jay	*Cyanocitta cristata*	B	None			No			
AMCR	American Crow	*Corvus brachyrhynchos*	B	None			No			
CORA	Common Raven	*Corvus corax*	B	None			No			
BCCH	Black-capped Chickadee	*Poecile atricapillus*	B	None			No			
RBNU	Red-breasted Nuthatch	*Sitta canadensis*	B	None			Yes			
WBNU	White-breasted Nuthatch	*Sitta carolinensis*	B	None			No			
BRCR	Brown Creeper	*Certhia americana*	B	None			No			
HOWR	House Wren	*Troglodytes aedon*	B	None			No			
WIWR	Winter Wren	*Troglodytes troglodytes*	B	None			Yes			
GCKI	Golden-crowned Kinglet	*Regulus satrapa*	B	None			No			
VEER	Veery	*Catharus fuscescens*	B	None			Yes			
HETH	Hermit Thrush	*Catharus guttatus*	B	None			No			
WOTH	Wood Thrush	*Hylocichla mustelina*	B	None	THR	SC	No			
AMRO	American Robin	*Turdus migratorius*	B	None			No			
CEWX	Cedar Waxwing	*Bombycilla cedrorum*	B	None			No			
TEWA	Tennessee Warbler	*Vermivora peregrina*	M	None			No	RS		
NAWA	Nashville Warbler	*Vermivora ruficapilla*	B	None			No			
YEWA	Yellow Warbler	*Dendroica petechia*	B	None			No			
CSWA	Chestnut-sided Warbler	*Dendroica pensylvanica*	B	None			No			
MAWA	Magnolia Warbler	*Dendroica magnolia*	B	None			No			
BTBW	Black-throated Blue Warb	*Dendroica caerulescens*	B	None			Yes			
BTGW	Black-throated Green Wa	*Dendroica virens*	B	None			Yes			
PIWA	Pine Warbler	*Dendroica pinus*	B	None			No			
BWWA	Black-and-white Warbler	*Mniotilta varia*	B	None			No			
OVEN	Ovenbird	*Seiurus aurocapillus*	B	None			Yes			
NOWA	Northern Waterthrush	*Seiurus noveboracensis*	B	None			No			
MOWA	Mourning Warbler	*Geothlypis philadelphia*	B	None			No			

COYE	Common Yellowthroat	*Geothlypis trichas*	B	None			No					
SCTA	Scarlet Tanager	*Piranga olivacea*	B	None			Yes					
EATO	Eastern Towhee	*Pipilo erythrophthalmus*	B	None			No					
CHSP	Chipping Sparrow	*Spizella passerina*	B	None			No					
SOSP	Song Sparrow	*Melospiza melodia*	B	None			No					
SWSP	Swamp Sparrow	*Melospiza georgiana*	B	None			No					
WTSP	White-throated Sparrow	*Zonotrichia albicollis*	B	None			No					
WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*	M	None			No					
DEJU	Dark-eyed Junco	*Junco hyemalis*	B	None			No	RS				
RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	B	None			No					
INBU	Indigo Bunting	*Passerina cyanea*	B	None			No					
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	B	None			No					
COGR	Common Grackle	*Quiscalus quiscula*	B	None			No					
PUFI	Purple Finch	*Carpodacus purpureus*	B	None			No					
AMGO	American Goldfinch	*Carduelis tristis*	B	None			No					
EVGR	Evening Grosbeak	*Coccothraustes vespertin*	B	None			No					
TOTAL SPECIES OBSERVED:	**72**	**BREEDING SPECIES OBSERVED:**	**68**		**4**	**4**	**3**	**9**	**3**	**0**	**0**	

Appendix III: Herpetozoa Status Report

APPENDIX III Herpetozoa Status Report

Project ID: 10-015

Herpetozoa (amphibian and reptile) species observed by NEA are listed by class then by family taxonomic grouping. These species are identified by the common and scientific name used by the Natural heritage information Centre (NHIC). Any significant status for a species on national and provincial lists is displayed as well as those from relevant regional lists.

List Status :

END - endangered	A wildlife species facing imminent extirpation or extinction.
END-R -endangered regulated	A wildlife species facing imminent extirpation or extinction in Ontario which has been regulated under Ontario's Endangered Species Act (ESA).
THR - threatened	A wildlife species likely to become endangered if limiting factors are not reversed.
SC - special concern	A wildlife species that may become threatened or an endangered species because of a combination of biological characteristics and identified threats.
YES - Area Sensitive	A wildlife species that requires large areas of suitable habitat in order to sustain their population numbers.

*** Other status levels are not displayed**

List Sources:

COSEWIC	The Committee on the Status of Endangered Wildlife in Canada, May 2017.
COSSARO	The Committee on the Status of Species at Risk in Ontario, June 2017.
SARA	Species At Risk Act, Schedule 1, Government of Canada, 2017.
Area Sensitive	Significant Wildlife Technical Guide, Appendix C, OMNR, Oct. 2000

Amphibian

Common Name	Scientific Name	COSEWIC	COSSARO	SARA	Area Sensitive
Newts and Old World Salamander	*Salamandridae*				
Red-spotted Newt	*Notophthalmus viridescens viride*				No
Lungless Salamanders	*Plethodontidae*				
Eastern Red-backed Salamander	*Plethodon cinereus*				No
Toads	*Bufonidae*				
American Toad	*Anaxyrus americanus*				No
Treefrogs	*Hylidae*				
Spring Peeper	*Pseudacris crucifer*				No
Gray Treefrog	*Hyla versicolor*				No
True Frogs	*Ranidae*				
Wood Frog	*Lithobates sylvatica*				No
Northern Leopard Frog	*Lithobates pipiens*				No
Mink Frog	*Lithobates septentrionalis*				No
Green Frog	*Lithobates clamitans*				No
American Bullfrog	*Lithobates catesbeiana*				Yes
No. of Species Observed: 10		**0**	**0**	**0**	**1**

Reptiles

Common Name	Scientific Name	COSEWIC	COSSARO	SARA	Area Sensitive
Typical Snakes	*Colubridae*				
Smooth Greensnake	*Opheodrys vernalis*				No
Northern Red-bellied Snake	*Storeria occipitomaculata occipit*				No
Common Gartersnake	*Thamnophis sirtalis*				No
No. of Species Observed: 3		**0**	**0**	**0**	**0**

No. of Species Observed in Project 13

Appendix IV: Mammal Status Report

APPENDIX IV Mammal Status Report

Project ID: 10-015

Mammal species observed by NEA are listed. These species are identified by the common and scientific name used by the Natural heritage information Centre (NHIC). Any significant status for a species on national and provincial lists is displayed as well as those from relevant regional lists.

List Status :

END - endangered	A wildlife species facing imminent extirpation or extinction.
END-R -endangered regulated	A wildlife species facing imminent extirpation or extinction in Ontario which has been regulated under Ontario's Endangered Species Act (ESA).
THR - threatened	A wildlife species likely to become endangered if limiting factors are not reversed.
SC - special concern	A wildlife species that may become threatened or an endangered species because of a combination of biological characteristics and identified threats.
YES - Area Sensitive	A wildlife species that requires large areas of suitable habitat in order to sustain their population numbers.

*** Other status levels are not displayed**

List Sources:

COSEWIC	The Committee on the Status of Endangered Wildlife in Canada, 2017.
COSSARO	The Committee on the Status of Species at Risk in Ontario, 2017.
SARA	Species At Risk Act, Schedule 1, Government of Canada, 2017.
Area Sensitive	Significant Wildlife Technical Guide, Appendix C, OMNR, Oct. 2000

Common Name	Scientific Name	COSEWIC	COSSARO	SARA	Area Sensitive
White-tailed Deer	*Odocoileus virginianus*				No
Red Squirrel	*Tamiasciurus hudsonicus*				No
Red Fox	*Vulpes vulpes*				No
Moose	*Alces alces*				Yes
Long-tailed Weasel	*Mustela frenata*				No
Eastern Chipmunk	*Tamias striatus*				No
Coyote	*Canis latrans*				No
Common Raccoon	*Procyon lotor*				No
Common Porcupine	*Erethizon dorsatum*				No
Black Bear	*Ursus americanus*				No
American Beaver	*Castor canadensis*				No
No. of Species Observed in Project 11		**0**	**0**	**0**	**1**

Appendix V: Detailed Fish Sampling Results, NEA 2013

Appendix V: Detailed Fish Sampling Results

Project : 10-015

Waterbody/Watercourse: Grass Lake Trib

Sample Site: 01 **SiteType:** area **Northing:** 4955746.76 **Easting:** 626538.18

SAMPLE: 10-015_01FC01

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13	04-Jun-13	**Fishing Method:**	Minnow Trap	**Shocker:**		**Location**		
Time	1:07 PM	2:18 PM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4955731	
WaterTemp	19	21.4	**Net Orientation:**		**No.of Anode:**	0	**Easting**	626588	
AirTemp	17	24	**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	sunny	sunny					**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
180	Minnow Family	*Cyprinidae*				
182	Northern Redbelly Dac	*Phoxinus eos*	0	50	1.5	
310	Sunfish Family	*Centrarchidae*				
313	Pumpkinseed	*Lepomis gibbosus*	0	67	5.7	

FISH OBSERVATIONS - BULK

Number of Species in Sample: 2
Number of Fish Collected in Sample: 2

Sample Site: 03

SiteType: area **Northing:** 4956838.77
Easting: 625728.79

SAMPLE: 10-015_03FC01

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13	04-Jun-13	**Fishing Method:**	Fyke Net	**Shocker:**		**Location**		
Time	2:20 PM	10:10 AM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4956828	
WaterTemp	20.2	13.7	**Net Orientation:**		**No.of Anode:**	0	**Easting**	625704	
AirTemp	14.5	15	**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	sunny	sunny, windy					**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
180	Minnow Family	*Cyprinidae*				
182	Northern Redbelly Dac	*Phoxinus eos*	0	54	2.6	
182	Northern Redbelly Dac	*Phoxinus eos*	0	23	1.9	
182	Northern Redbelly Dac	*Phoxinus eos*	0	54	1.7	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	58	1.7	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	54	1.5	

189	Brassy Minnow	*Hybognathus hankinsoni*	0	53	1.3	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	48	1	

FISH OBSERVATIONS - BULK

Number of Species in Sample: 2
Number of Fish Collected in Sample: 7

Sample Site: 04

SiteType: area **Northing:** 4955231 **Easting:** 626781

SAMPLE: 10-015_04FC01

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13	04-Jun-13	**Fishing Method:**	Minnow Trap	**Shocker:**		**Location**		
Time	11:19 AM	3:30 PM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4955231	
WaterTemp	13	14.5	**Net Orientation:**		**No.of Anode:**	0	**Easting**	626781	
AirTemp	11.6	19	**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	partially cloudy	sunny					**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
280	Stickleback Family	*Gasterosteidae*				
281	Brook Stickleback	*Culaea inconstans*	0	54	2	

FISH OBSERVATIONS - BULK

Number of Species in Sample: 1
Number of Fish Collected in Sample: 1

Sample Site: 05

SiteType: area **Northing:** 4955207
Easting: 626669

SAMPLE: 10-015_05FC01

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13	04-Jun-13	**Fishing Method:**	Trap / Hoop N	**Shocker:**		**Location**		
Time	11:49 AM	2:58 PM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4955207	
WaterTemp	12.2	18.5	**Net Orientation:**		**No.of Anode:**	0	**Easting**	626669	
AirTemp	14	19	**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	30% cloud	sunny					**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
140	Mudminnow Family	*Umbridae*				
141	Central Mudminnow	*Umbra limi*	0	110	12.2	
141	Central Mudminnow	*Umbra limi*	0	79	5.2	
141	Central Mudminnow	*Umbra limi*	0	80	7.2	
141	Central Mudminnow	*Umbra limi*	0	55	1.9	
141	Central Mudminnow	*Umbra limi*	0	71	4.2	

141	Central Mudminnow	*Umbra limi*	0	51	1.6	
141	Central Mudminnow	*Umbra limi*	0	55	1.9	
141	Central Mudminnow	*Umbra limi*	0	51	1.6	
141	Central Mudminnow	*Umbra limi*	0	70	3.7	
141	Central Mudminnow	*Umbra limi*	0	82	6.9	
180	Minnow Family	*Cyprinidae*				
182	Northern Redbelly Dac	*Phoxinus eos*	0	49	1.2	
182	Northern Redbelly Dac	*Phoxinus eos*	0	43	0.7	
182	Northern Redbelly Dac	*Phoxinus eos*	0	46	1	
182	Northern Redbelly Dac	*Phoxinus eos*	0	45	1	
182	Northern Redbelly Dac	*Phoxinus eos*	0	45	0.9	
182	Northern Redbelly Dac	*Phoxinus eos*	0	49	1.1	
182	Northern Redbelly Dac	*Phoxinus eos*	0	43	0.9	
182	Northern Redbelly Dac	*Phoxinus eos*	0	42	0.8	
182	Northern Redbelly Dac	*Phoxinus eos*	0	42	0.8	
182	Northern Redbelly Dac	*Phoxinus eos*	0	49	1	
280	Stickleback Family	*Gasterosteidae*				
281	Brook Stickleback	*Culaea inconstans*	0	41	1	
281	Brook Stickleback	*Culaea inconstans*	0	48	1	
281	Brook Stickleback	*Culaea inconstans*	0	40	0.8	
281	Brook Stickleback	*Culaea inconstans*	0	41	0.7	
281	Brook Stickleback	*Culaea inconstans*	0	50	1.2	
281	Brook Stickleback	*Culaea inconstans*	0	54	1.5	
281	Brook Stickleback	*Culaea inconstans*	0	45	1.1	
281	Brook Stickleback	*Culaea inconstans*	0	41	0.8	
281	Brook Stickleback	*Culaea inconstans*	0	49	1.1	
281	Brook Stickleback	*Culaea inconstans*	0	43	0.8	

FISH OBSERVATIONS - BULK

Number of Species in Sample: 3
Number of Fish Collected in Sample: 30

Sample Site: 06

SiteType: point **Northing:** 4956152
Easting: 625821

SAMPLE: 10-015_06FC01

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13		**Fishing Method:**	Beach Seine	**Shocker:**		**Location**		
Time	3:50 PM	4:20 PM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4956152	
WaterTemp	23.4		**Net Orientation:**		**No.of Anode:**	0	**Easting**	625821	
AirTemp	15.4		**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	10% cloud, windy						**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
0	None	-----				
0	None	-----	0			

FISH OBSERVATIONS - BULK

Number of Species in Sample: 0
Number of Fish Collected in Sample: 0

SAMPLE: 10-015_06FC02

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13	04-Jun-13	**Fishing Method:**	Trap / Hoop N	**Shocker:**		**Location**		
Time	4:00 PM	11:19 AM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4956152	
WaterTemp	23.4	21.8	**Net Orientation:**		**No.of Anode:**	0	**Easting**	625821	
AirTemp	15.4	15.5	**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	10% cloud	5% cloud					**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
180	Minnow Family	*Cyprinidae*				
212	Creek Chub	*Semotilus atromaculatus*	0	73	3.5	
212	Creek Chub	*Semotilus atromaculatus*	0	79	6	

FISH OBSERVATIONS - BULK

Number of Species in Sample: 1
Number of Fish Collected in Sample: 2

SAMPLE: 10-015_06FC03

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	03-Jun-13		**Fishing Method:**	Beach Seine	**Shocker:**		**Location**		
Time	3:20 PM	3:40 PM	**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**		
WaterTemp	23.4		**Net Orientation:**		**No.of Anode:**	0	**Easting**		
AirTemp	15.4		**Area Length (m):**	0	**Frequency:**	0	**Longitude**		
Weather	10 %cloud						**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
0	None	-----				
0	None	-----	0			

FISH OBSERVATIONS - BULK

Number of Species in Sample: 0
Number of Fish Collected in Sample: 0

Sample Site: 07

SiteType: point **Northing:** 4955747
Easting: 625920

SAMPLE: 10-015_07FC01

	SET/START	LIFT/STOP	FISHING METHOD		SHOCKING PROPERTIES		SAMPLE/GEAR COORDINATES		
Date	04-Jun-13		**Fishing Method:**	Beach Seine	**Shocker:**		**Location**		
Time	12:30 PM		**Velocity (m/s):**		**ShockTime (sec):**	0	**Northing**	4955747	
WaterTemp	23.1		**Net Orientation:**		**No.of Anode:**	0	**Easting**	625920	
AirTemp	18		**Area Length (m):**		**Frequency:**	0	**Longitude**		
Weather	sunny						**Latitude**		

FISH OBSERVATIONS - INDIVIDUALS

MNR Code	Common Name	Scientific Name	Mesh Size	Total Length (mm)	Weight (g)	Mercury (ug/g)
180	Minnow Family	*Cyprinidae*				
189	Brassy Minnow	*Hybognathus hankinsoni*	0	63	2.3	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	74	3	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	49	1.2	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	54	1.6	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	48	1.1	

189	Brassy Minnow	*Hybognathus hankinsoni*	0	69	2.9	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	69	3.2	
189	Brassy Minnow	*Hybognathus hankinsoni*	0	44	0.9	
212	Creek Chub	*Semotilus atromaculatus*	0	76	5.4	

FISH OBSERVATIONS - BULK

Number of Species in Sample: 2

Number of Fish Collected in Sample: 9

Appendix VI: Benthos Community Detailed Sampling Results, NEA 2012 & 2014

APPENDIX VI: Benthic Sampling Results

PN 10-015

Sample Site: 01

Site Type: area

Waterbody/Watercourse: Grass Lake Trib

Site Northing: 4955746.76

Site Easting: 626538.18

Comments:

UTM's for WQ, Hab, Site Assesment

Sample ID: 10-015_01BI01-C

Date: 24-Oct-12 Start Time: 12:43 PM End Time 12:46 PM Sample Northing
Gear Type Kick Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Riffle	12	10.7	0.4		180	1	110		2.25	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Cobble	Gravel
Random Particle Pick (mm)	
	74
	0.1
	78
	38
	66
	39
	21
	90
	215
	160
Average Particle Size (mm)	78.1
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Absent	Floatibg Algae:	Absent
Rooted Floating	Absent	Filamentous:	Absent
Submergent:	Absent	Attached Algae:	Present
Free Floating:	Absent		

MISCELLANEOUS

% Canopy Cover:	25-49
River Characterization	ntermitter
Collection Comments:	
E=626507.56 N=4955758.29 *Sample Area= 1 x 1m *Limestone pavement present 20% of site	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Ceratopogonidae	Diptera	Flies	8	6.90%
Chironomidae	Diptera	Flies	16	13.79%
Simuliidae	Diptera	Flies	1	0.86%
Corixidae	Hemiptera	True Bugs	1	0.86%
Hydrobiidae	Mollusca-Gastropoda	Snails	4	3.45%
Physidae	Mollusca-Gastropoda	Snails	7	6.03%
Tubificidae	Oligochaeta	Aquatic Worms	11	9.48%
Perlodidae	Plecoptera	Stoneflies	68	58.62%

Number of Benthic Families Identified: 8

Classification Comments	*Total=116 *3 earth worms found in sample *Initial Bucket Volume=5682mL, total Scoops taken=~400mL

Sample ID: 10-015_01BI01-B

Date: 24-Oct-12 Start Time: 12:21 PM End Time 12:24 PM Sample Northing
Gear Type D-Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Riffle	12	10.7	0.4		180	1	205		2.65	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Cobble	Gravel
Random Particle Pick (mm)	
	320
	260
	85
	22
	3
	42
	194
	42
	128
	72
Average Particle Size (mm)	116.8
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Absent	Floatibg Algae:	Absent
Rooted Floating	Absent	Filamentous:	Absent
Submergent:	Absent	Attached Algae:	Present
Free Floating:	Absent		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	ntermitter
Collection Comments:	
E=626524.83 N=4955750.84 *Sample Area: 1 x 1m *flagging tape on left bank on ash tree(pink with black dots)	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Sphaeriidae	Bivalvia	Clam	2	1.75%
Ceratopogonidae	Diptera	Flies	5	4.39%
Chironomidae	Diptera	Flies	16	14.04%
Tabanidae	Diptera	Flies	4	3.51%
Hydrobiidae	Mollusca-Gastropoda	Snails	10	8.77%
Physidae	Mollusca-Gastropoda	Snails	19	16.67%
Gomphidae	Odonata	Dragonflies & Damselfli	2	1.75%
Tubificidae	Oligochaeta	Aquatic Worms	6	5.26%
Perlodidae	Plecoptera	Stoneflies	50	43.86%

Number of Benthic Families Identified: 9

Classification Comments	*Total=115 *Hirudinea=1 *Initial Bucket Volume=5682mL, total Scoops taken=~600mL

Sample ID: 10-015_01BI01-A

Date: 24-Oct-12 Start Time: 11:34 AM End Time 11:50 AM Sample Northing
Gear Type Kick Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Riffle	12	10.7	0.34		180	1	230		1.55	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Gravel
Random Particle Pick (mm)	
	23
	0
	190
	162
	500
	33
	4
	0
	0
	0
Average Particle Size (mm)	91.2
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Absent	Floatibg Algae:	Absent
Rooted Floating	Absent	Filamentous:	Absent
Submergent:	Absent	Attached Algae:	Present
Free Floating:	Absent		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	ntermitter
Collection Comments:	
E=626538.18 N=4955746.76 *Habitat= Run *Sample Area:1 x 1m *Flagging tape on right bank on black ash (pink with black pock-a-dots)	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Sphaeriidae	Bivalvia	Clam	2	2.00%
Elimidae	Coleoptera	Beetles	1	1.00%
Ceratopogonidae	Diptera	Flies	24	24.00%
Chironomidae	Diptera	Flies	30	30.00%
Tipulidae	Diptera	Flies	3	3.00%
Tabanidae	Diptera	Flies	1	1.00%
Hydrobiidae	Mollusca-Gastropoda	Snails	12	12.00%
Physidae	Mollusca-Gastropoda	Snails	19	19.00%
Tubificidae	Oligochaeta	Aquatic Worms	7	7.00%
Glossosomatidae	Trichoptera	Caddisflies	1	1.00%

Number of Benthic Families Identified: 10

Classification Comments	*Total=100 *Millipede found in sample.

*2 terrestrial larvae found in sample, believed to be fruit fly larvae
*Initial Bucket Volume=6819mL, total Scoops taken=~1000mL

Sample Site: 02

Site Type: area

Waterbody/Watercourse: Grass Lake Trib

Site Northing: 4956095.40

Site Easting: 627173.74

Comments:

UTM's for WQ, Hab and Site Ass.

Sample ID: 10-015_02BI01-B

Date: 24-Oct-12 Start Time: 2:05 PM End Time 2:08 PM Sample Northing

Gear Type D-Net Mesh Size: Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
	13.8	10.2	0.05		180	1	505		8.9	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
	Silt
Random Particle Pick (mm)	
	500
	0.05
	0.01
	3
	0.1
	0.05
	2
	4
	0.1
	0.05
Average Particle Size (mm)	50.9
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Present	Floatibg Algae:	Absent
Rooted Floating	Present	Filamentous:	Absent
Submergent:	Present	Attached Algae:	Present
Free Floating:	Absent		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	
E=627173.74 N=4956095.40 *habitat=wetland *sample area= 1 x 8.9(length) m *Substrate= Detritus	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Crangonyctidae	Amphipoda	Scuds	22	21.57%
Gammaridae	Amphipoda	Scuds	23	22.55%
Hyalellidae	Amphipoda	Scuds	13	12.75%
Sphaeriidae	Bivalvia	Clam	1	0.98%
Dysticidae	Coleoptera	Beetles	2	1.96%
Haliplidae	Coleoptera	Beetles	1	0.98%
Chironomidae	Diptera	Flies	10	9.80%
Corixidae	Hemiptera	True Bugs	5	4.90%
Asellidae	Isopoda	Aquatic Sowbugs	18	17.65%
Hydrobiidae	Mollusca-Gastropoda	Snails	6	5.88%
Planoribidae	Mollusca-Gastropoda	Snails	1	0.98%

Number of Benthic Families Identified: 11

Classification Comments	*10-015_02BI-1-A/B (2)*

*Hirudinea=2 *Lestidae=2 *Total=106 *Bucket Volume=5682ml, Total Scoops Taken=1400mL

Sample ID: 10-015_02BI01-A

Date: 24-Oct-12 Start Time: 1:51 PM End Time 2:05 PM Sample Northing
Gear Type D-Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
	13.8	10.2	0.04		180	1	503		6.8	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Gravel	Sand
Random Particle Pick (mm)	
	0.1
	2
	4
	8
	0.1
	4
	5
	2
	3
	13
Average Particle Size (mm)	4.1
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Present	Floatibg Algae:	Absent
Rooted Floating	Present	Filamentous:	Absent
Submergent:	Present	Attached Algae:	Present
Free Floating:	Absent		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	
E=627173.74 N=4956095.40 *habitat=wetland *sample area= 1 x 6.5(length) m	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Gammaridae	Amphipoda	Scuds	23	22.33%
Hyalellidae	Amphipoda	Scuds	33	32.04%
Sphaeriidae	Bivalvia	Clam	2	1.94%
Dysticidae	Coleoptera	Beetles	2	1.94%
Chironomidae	Diptera	Flies	26	25.24%
Corixidae	Hemiptera	True Bugs	2	1.94%
Asellidae	Isopoda	Aquatic Sowbugs	9	8.74%
Hydrobiidae	Mollusca-Gastropoda	Snails	5	4.85%
Phryganeidae	Trichoptera	Caddisflies	1	0.97%

Number of Benthic Families Identified: 9

Classification Comments	*10-015_02BI-1-A/B (1)* *Lestidae=2 *Total=105 *Bucket Volume=5682ml, Total Scoops Taken=600mL

Sample Site: 03

Site Type: area

Waterbody/Watercourse: Grass Lake Trib

Site Northing: 4956838.77

Site Easting: 625728.79

Comments:

UTM's for WQ, Hab and Site Ass.

Sample ID: 10-015_03BI01-C

Date: 24-Oct-12 Start Time: 3:33 PM End Time 3:43 PM Sample Northing
Gear Type D-Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Wetland	12.7	10.9	0		120	1	330	0	2	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Clay
Random Particle Pick (mm)	
	0.05
	0.05
	0.02
	0.01
	0.05
	0.01
	0
	0.05
	0.05
	0.02
Average Particle Size (mm)	0.0
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Abundant	Floatibg Algae:	Present
Rooted Floating	Abundant	Filamentous:	Absent
Submergent:	Abundant	Attached Algae:	Present
Free Floating:	Present		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	
E=625719.05 N=4956842.81 *Hab=Wetland *Sample Area=1 x 3m *Flagging tape on tree upstream of 2nd site	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Ceratopogonidae	Diptera	Flies	4	4.00%
Chironomidae	Diptera	Flies	51	51.00%
Stratiomyidae	Diptera	Flies	23	23.00%
Tabanidae	Diptera	Flies	3	3.00%
Hydrobiidae	Mollusca-Gastropoda	Snails	3	3.00%
Libellulidae	Odonata	Dragonflies & Damselfli	1	1.00%
Tubificidae	Oligochaeta	Aquatic Worms	10	10.00%
Limnephilidae	Trichoptera	Caddisflies	2	2.00%
Lestidae	Odonata	Dragonflies & Damselfli	3	3.00%

Number of Benthic Families Identified: 9

Classification Comments	*Total=100 *Bucket Volume= 6819mL, total scoops taken= 600mL

Sample ID: 10-015_03BI01-B

Date: 24-Oct-12 Start Time: 3:22 PM End Time 3:33 PM Sample Northing
Gear Type D-Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Wetland	12.7	10.9	0		120	1	410	0	2	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Clay
Random Particle Pick (mm)	
	0.05
	0.05
	0.02
	0.01
	0.05
	0.01
	0
	0.05
	0.05
	0.02
Average Particle Size (mm)	0.0
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Abundant	Floatibg Algae:	Present
Rooted Floating	Abundant	Filamentous:	Absent
Submergent:	Abundant	Attached Algae:	Present
Free Floating:	Present		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	
E=625723.42 N=4956842.26 *Hab=Wetland *Sample Area=1 x 2.5m *Flagging tape sedge u/s of 1st site	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Ceratopogonidae	Diptera	Flies	17	17.35%
Chironomidae	Diptera	Flies	65	66.33%
Notonectidae	Hemiptera	True Bugs	1	1.02%
Dolichopodidae	Diptera	Flies	1	1.02%
Stratiomyidae	Diptera	Flies	5	5.10%
Tabanidae	Diptera	Flies	1	1.02%
Tipulidae	Diptera	Flies	3	3.06%
Lymnaeidae	Mollusca-Gastropoda	Snails	1	1.02%
Planoribidae	Mollusca-Gastropoda	Snails	1	1.02%
Libellulidae	Odonata	Dragonflies & Damselfli	2	2.04%
Phryganeidae	Trichoptera	Caddisflies	1	1.02%

Number of Benthic Families Identified: 11

Classification Comments	Lestidae=1

Cyclopoida=1 *Initial Bucket Volume=5682mL, total Scoops taken=~600mL

Sample ID: 10-015_03BI01-A

Date: 24-Oct-12 Start Time: 3:20 PM End Time 3:22 PM Sample Northing

Gear Type D-Net Mesh Size: 500 Sample Easting

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Wetland	12.7	10.9	0		120	1	295	0	2	

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Clay
Random Particle Pick (mm)	
	0.05
	0.05
	0.02
	0.01
	0.05
	0.01
	0
	0.05
	0.05
	0.02
Average Particle Size (mm)	0.0
Particle Pick Count	10

AQUATIC MACROPHYTES and ALGA

Emergent:	Abundant	Floatibg Algae:	Present
Rooted Floating	Abundant	Filamentous:	Absent
Submergent:	Abundant	Attached Algae:	Present
Free Floating:	Present		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	
E=625728.79 N=4956838.77 *Hab=Wetland *Sample Area=1 x 2m *Flagging tape on dead cedar	

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Ceratopogonidae	Diptera	Flies	20	21.28%
Chironomidae	Diptera	Flies	61	64.89%
Stratiomyidae	Diptera	Flies	2	2.13%
Lymnaeidae	Mollusca-Gastropoda	Snails	1	1.06%
Libellulidae	Odonata	Dragonflies & Damselfli	1	1.06%
Tubificidae	Oligochaeta	Aquatic Worms	5	5.32%
Dolichopodidae	Diptera	Flies	2	2.13%
nematomorpha	Nematoda	Worms	2	2.13%

Number of Benthic Families Identified: 8

Classification Comments	Total=119 *Cladocera=7 *Cyclopoida=15 *Ostracod=2 *Unknown=2 (not in total count)

*deer ticks=3 (not in total count) *Initial Bucket Volume=5682mL, total Scoops taken=~200mL

Sample ID: 10-015_03BI02-C

Date: 15-Oct-14 Start Time: 12:00 PM End Time 2:30 PM Sample Northing 4956857

Gear Type D-Net Mesh Size: 500 Sample Easting 625681

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Wetland	15.3	15.5		5.5	180	1	340			

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Sand
Random Particle Pick (mm)	

AQUATIC MACROPHYTES and ALGA

Emergent:	Present	Floatibg Algae:	Absent
Rooted Floating	Absent	Filamentous:	Absent
Submergent:	Abundant	Attached Algae:	Present
Free Floating:	Absent		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	

*Control Site resampled due to an ATV road being constructed in the summer of 2013 right through sampling locations
Other Vegetation Present:
-Organic Matter=2
-Woody Debris=1
-Detritus=2

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Sphaeriidae	Bivalvia	Clam	8	8.00%
Ceratopogonidae	Diptera	Flies	10	10.00%
Chironomidae	Diptera	Flies	59	59.00%
Tabanidae	Diptera	Flies	2	2.00%
Ephemerellidae	Ephemeroptera	Mayflies	2	2.00%
Siphlonuridae	Ephemeroptera	Mayflies	4	4.00%
Glossiphoniidae	Hirudinea	Leeches	3	3.00%
Physidae	Mollusca-Gastropoda	Snails	2	2.00%
Tubificidae	Oligochaeta	Aquatic Worms	9	9.00%
Limnephilidae	Trichoptera	Caddisflies	1	1.00%

Number of Benthic Families Identified: 10

Classification Comments	~7 empty caddis cases found in sample Total Individuals=100 Bucket Volume= 7000mL Scoops Taken=7=1400mL

Sample ID: 10-015_03BI02-B

Date: 15-Oct-14 Start Time: 12:00 PM End Time 2:30 PM Sample Northing 4956853
Gear Type D-Net Mesh Size: 500 Sample Easting 625674

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Wetland	15.3	15.5	0	6.5	180	1	560			

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Sand
Random Particle Pick (mm)	

AQUATIC MACROPHYTES and ALGA

Emergent:	Abundant	Floatibg Algae:	Absent
Rooted Floating	Present	Filamentous:	Absent
Submergent:	Present	Attached Algae:	Absent
Free Floating:	Present		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	

*Control Site resampled due to an ATV road being constructed in the summer of 2013 right through sampling locations
Other Vegetation Present:
-Organic Matter=2
-Woody Debris=2
-Detritus=2

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Sphaeriidae	Bivalvia	Clam	3	2.91%
Haliplidae	Coleoptera	Beetles	1	0.97%
Ceratopogonidae	Diptera	Flies	29	28.16%
Chironomidae	Diptera	Flies	63	61.17%
Tabanidae	Diptera	Flies	1	0.97%
Ephemerellidae	Ephemeroptera	Mayflies	3	2.91%
Corixidae	Hemiptera	True Bugs	1	0.97%
Asellidae	Isopoda	Aquatic Sowbugs	1	0.97%
Tubificidae	Oligochaeta	Aquatic Worms	1	0.97%

Number of Benthic Families Identified: 9

Classification Comments	~4 empty caddis cases found in sample Total Individuals=103 Bucket Volume= 6000mL Scoops Taken=7=1400mL

Sample ID: 10-015_03BI02-A

Date:	15-Oct-14	Start Time:	12:00 PM	End Time	2:30 PM	Sample Northing	4956856
Gear Type	D-Net	Mesh Size:	500			Sample Easting	625670

SAMPLE COLLECTION and SITE DESCRIPTIO

Sample Habitat	Air Temp	Water Temp *C	Velocity (m/sec)	Sampling Distance (m)	Sampling Time (sec)	Grabs	Max Depth	Hydraulic Head (mm)	Wetted Width	Bankful Width (m)
Wetland	15.3	15.5	0	5.7	180	1	320			

SUBSTRATE

Dominant Substrate	2nd Dominant Substrate
Silt	Sand
Random Particle Pick (mm)	

AQUATIC MACROPHYTES and ALGA

Emergent:	Present	Floatibg Algae:	Absent
Rooted Floating	Present	Filamentous:	Absent
Submergent:	Present	Attached Algae:	Present
Free Floating:	Present		

MISCELLANEOUS

% Canopy Cover:	0-24
River Characterization	Permanent
Collection Comments:	

*Control Site resampled due to an ATV road being constructed in the summer of 2013 right through sampling locations
Other Vegetation Present:
-Organic Matter=2
-Woody Debris=1
-Detritus=2

BENTHIC CLASSIFICATION

Family Group (Scientific Name)	Order (Scientific Name)	Order (Common Name)	Quantity	% of Total Counted
Sphaeriidae	Bivalvia	Clam	5	5.00%
Haliplidae	Coleoptera	Beetles	2	2.00%
Ceratopogonidae	Diptera	Flies	21	21.00%
Chironomidae	Diptera	Flies	67	67.00%
Heptageniidae	Ephemeroptera	Mayflies	2	2.00%
Libellulidae	Odonata	Dragonflies & Damselfli	1	1.00%
Tubificidae	Oligochaeta	Aquatic Worms	1	1.00%
Phryganeidae	Trichoptera	Caddisflies	1	1.00%

Number of Benthic Families Identified: 8

Classification Comments	Zooplankton found in sample, Cycllopoida=1 Total Individuals=100 Bucket Volume= 6000mL Scoops Taken=6=1200mL

Appendix VII: Water Quality Results, NEA 2012 & 2013

APPENDIX VII : Water Quality Results

PN 10015

Sample Site 01

Site Type: area
Waterbody/Watercourse: Grass Lake Trib
Northing: 4955746.76
Easting: 626538.18
Comments: UTM's for WQ, Hab, Site Assesment

Sample ID: 10-015_01WQ01

Date: 17-Oct-12
Start Time: 12:50 PM
Water Depth (m)
Velocity (m/s): 0.34
Weather: Cloudy
End Time: 1:20 AM
Sample Depth (m)
Surface Conditions Rippled
Current: Medium (1-4

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
12	10.7	11	7.81	749	14	1153	2.09	Colourless	

Sample ID: 10-015_01WQ02

Date: 04-Jun-13
Start Time: 2:18 PM
Water Depth (m) 0.36
Velocity (m/s): 0.16
Weather: clear
End Time: 2:30 PM
Sample Depth (m) 0.18
Surface Conditions Rippled
Current: Slow (<1 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
24	21.4	8.45	8.04	612		880		Yellow-Brown	0.5

Sample Site 02

Site Type: area
Waterbody/Watercourse: Grass Lake Trib
Northing: 4956095.40
Easting: 627173.74
Comments: UTM's for WQ, Hab and Site Ass.

Sample ID: 10-015_02WQ01

Date: 24-Oct-12 Start Time: 12:43 PM Water Depth (m) Velocity (m/s): 0
Weather: overcast End Time: 12:46 PM Sample Depth (m) Surface Conditions Calm
Current: Slow (<1 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
13.8	10.2	5.91	7.08	472	16	276	0.56	Colourless	

Sample Site 03

Site Type: area
Waterbody/Watercourse: Grass Lake Trib
Northing: 4956838.77
Easting: 625728.79
Comments: UTM's for WQ, Hab and Site Ass.

Sample ID: 10-015_03WQ01

Date: 24-Oct-12 Start Time: 2:47 PM Water Depth (m) Velocity (m/s): 0
Weather: overcast End Time: 3:00 PM Sample Depth (m) Surface Conditions Calm
Current:

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
12.7	10.9	3.77	7.08	172.7	45	265.7	1.78	Turbid	

Sample ID: 10-015_03WQ02

Date: 04-Jun-13 Start Time: 10:01 AM Water Depth (m) 0.4 Velocity (m/s): 0
Weather: sunny, windy End Time: Sample Depth (m) 0.2 Surface Conditions Calm
Current: Still (0 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
13.7	15	1.91	6.9	168.3		209.1	1.01	Tannin	0.1

Sample Site 04

Site Type: area
Waterbody/Watercourse: Grass Lake Trib
Northing: 4955231
Easting: 626781
Comments:

Sample ID: 10-015_04WQ01

Date: 04-Jun-13
Weather: sunny
Start Time: 3:00 PM
End Time: 3:44 PM
Water Depth (m) 0.69
Sample Depth (m) 0.2
Velocity (m/s): 0
Surface Conditions Calm
Current: Still (0 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
19	14.5	8.53	8.21	205		252.2		Turbid	0.2

Sample Site 05

Site Type: area
Waterbody/Watercourse: Grass Lake Trib
Northing: 4955207
Easting: 626669
Comments:

Sample ID: 10-015_05WQ01

Date: 24-Jun-13
Weather: sunny
Start Time: 2:58 PM
End Time:
Water Depth (m) 0.4
Sample Depth (m) 0.2
Velocity (m/s):
Surface Conditions Calm
Current: Still (0 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
19	18.5	22.69	8.36	290.4		392		Yellow-Brown	0.2

Sample Site 07

Site Type: point
Waterbody/Watercourse: Grass Lake Trib
Northing: 4955747
Easting: 625920
Comments:

Sample ID: 10-015_07WQ01

Date: 04-Jun-13
Weather: sunny
Start Time: 12:30 PM
End Time: 1:10 PM
Water Depth (m) 0.2
Sample Depth (m) 0.1
Velocity (m/s): 0.1
Surface Conditions Calm
Current: Slow (<1 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
18	23.1	14.04	8.45	168.4		251.8		Colourless	0.1

Sample Site 06

Site Type: point
Waterbody/Watercourse: Grass Lake Trib
Northing: 4956152
Easting: 625821
Comments:

Sample ID: 10-015_06WQ01

Date: 04-Jun-13
Start Time: 11:36 AM
Water Depth (m) 0.13
Velocity (m/s): 0.12
Weather: sunny
End Time:
Sample Depth (m) 0.1
Surface Conditions Calm
Current: Slow (<1 m/s)

Air Temp *C	Water Temp *C	DO2 (mg/L)	pH	TDS (mg/s)	Phosporus (ppb)	Conductivity (us/cm)	Turbidity (NTU)	Water Colour	Salinity (ppt)
15.5	21.8	9.99	7.74	176.3		251.9	11.1	Yellow-Brown	0.1

Appendix VIII: Curriculum Vitae – Chris Ellingwood

Niblett Environmental Associates Inc.
Biological Consultants

J. Christopher Ellingwood

President and Sr. Terrestrial/Wetland Biologist

Education

Terrain & Water Resources Technologist
Fleming College, Lindsay, 1996
Dean's List & President's Honour Roll

Bachelor of Environmental Studies (B.E.S.)
University of Waterloo, 1985

Employment History

2009-present	Niblett Environmental Associates, President
1996-present	Niblett Environmental Associates, Sr. Terrestrial & Wetland Biologist
1996-2009	Fleming College, Instructor Part-time, ecology, environmental assessment
1997-2000	Acres & Associates Environmental Ltd., part time, Biologist
1996	The Greer Galloway Group, Biologist
1996	J.E. Hanna and Associates, Biologist
1988-93	Canadian Wildlife Service, Conservation & Protection, Ontario & Atlantic Regions, Biologist and biological technician
1986-88	Canadian Nature Federation
1984-85	Federation of Ontario Naturalists, Atlas biologist
1983	Ontario Ministry of Natural Resources, Biologist

55 MARY STREET WEST, Suite 112 LINDSAY, ONTARIO K9V 5Z6
Tel (705) 878-9399 Fax (705) 878-9390 Email: cellingwood@niblett.ca

Experience

Housing and Recreational Developments

Mr. Ellingwood has completed numerous (1800 +) Environmental Impact Studies (EIS) for plans of subdivision, severances, golf courses, institutional and commercial developments across Ontario. Locations of projects include most of Eastern and Central Ontario. In most cases the EIS was requested by the Municipality or Township due to the proximity of the development to a provincially significant wetland (adjacent lands). Impact studies included detailed biological inventories of vegetation, birds, mammals, reptiles and amphibians and fish. Assessments included determining compliance with Provincial Policy Statement guidelines for significant features such as wetlands, ANSI's, woodlands, valleylands and wildlife habitat. Numerous wetland boundary delineations and wetland re-evaluations have also been conducted for developments (300 +) using the Ontario Wetland Evaluation System Southern Manual (Third Edition). He has also conducted tree preservation/conservation plans to meet municipal requirements.

Natural Resource Planning

Municipal Planning - He has completed the natural environment component of Functional Planning Studies, Secondary Plans, expansion areas and annexation lands in Peterborough, Kanata, Orleans and Craighurst. Studies included assessment of existing natural heritage features, constraints and recommendations. He has worked on the natural heritage policies for municipal official plan update in Haliburton. He has completed numerous peer reviews of EIS reports for municipalities.

Wetland Restoration and Design

NEA has completed a number of projects involving restoration of wetlands and creation of new compensation wetlands. This includes biological inventories and ecological function analysis, design, site plant lists, habitat structure design, construction supervision, wildlife salvages and long term post-construction monitoring. Projects completed to date include 0.3-1.7 acre wetlands in Peterborough, Bowmanville, Courtice, Ottawa and Fenelon Falls. Wetlands are designed specifically for replacement of unevaluated wetlands and include spring breeding frog habitat. In all cases we work closely with the landscape architects, engineers, contractors and planners on the approval process and the site design. He is currently constructing a wetland compensation project, in cooperation with Fleming College.

Biological Inventories

NEA has a full time staff of professional fisheries and aquatic biologists, terrestrial/wetland biologists and GIS expert with extensive experience as consultants and previous work at government agencies.

As such we are very familiar with most government protocols and have training to complete a wide range of biological inventories.

Examples include Marsh Monitoring Program, Forest Bird Monitoring Program, Breeding Bird Survey, Grassland Bird Surveys, Species at Risk surveys (bobolink, meadowlark, loggerhead shrike, whip-poor-will, Benthic Monitoring Program, BioMap benthic sampling, Ontario Stream Assessment Protocol, MTO/DFO fish sampling, Ontario Wetland Evaluation System, Ecological Land Classification, Butternut Health Assessments.

Botanical inventories

Botanical inventories are conducted for all projects to describe the vegetation communities using ELC, as well as for identification of all species and to determine if regional, provincial or federal significant species are present. Specialized/targeted inventories are conducted for wetlands (fens, bogs), Great Lakes coastal marshes/pannes, alvars, rock barrens and limestone ridges. Targeted surveys are also conducted for rare plants such as American ginseng, as well as long term monitoring and health assessments under ESA permits.

Plant salvages, restoration and monitoring

Projects regularly include the need to salvage or transplant regionally rare species, rehabilitate or restore sites and monitor these works. NEA has conducted numerous plant salvages, including supervising the removal, identifying transplant locations and monitoring the success. This includes wetland, alvar plants, orchids, ferns and regionally rare species.

Wetland Studies - Mr. Ellingwood has conducted Environmental Impact Studies (EIS) according to the Wetlands Policy Statement and Provincial Policy Statement for plans of subdivision, utilities and commercial developments adjacent to or within provincially significant wetlands throughout southern and northern Ontario. Studies include delineating wetland boundaries and biological inventories of wetlands (plants, birds, reptiles, amphibians, fish); performing impact assessment of aggregate pit water discharge on wetland ecosystems (Kemptville, ON); littoral zone and wetland mapping and inventory for High Falls Redevelopment Project Public Information Package (Wawa, ON); completing full wetland re-evaluation for Fernbank wetland, Stittsville using third edition manual, Southern Ontario; and completing two wetland evaluations on Michipicoten River, using Northern Manual. He is a certified wetland evaluator (MNR supported course through Sir Sandford Fleming College), summer 1996. He was an instructor for wetland evaluation courses, Sir Sandford Fleming College, Lindsay annually 1996-2009.

Species At Risk - He has conducted baseline inventories for Species At Risk for numerous properties and projects in Ontario. He developed and completed mitigation plans and long term monitoring projects where Species At Risk or sensitive species were involved. Projects include annual heronry monitoring program for a decorative limestone quarry as part of their license conditions and loggerhead shrike habitat monitoring in the Carden Plain for a quarry. He is also a certified MNR butternut health assessor (trained Aug. 2009

and recertified 2015). He is currently working for several developers in Ottawa completing impact studies on the effects of high rise construction on a nesting pair of Peregrine Falcons.

ESA permits, mitigation plans and monitoring programs have been designed for various species including eastern hog-nose snake, American ginseng, Blanding's turtles, snapping turtles, loggerhead shrike, five-lined skink, milk snake, least bittern, bobolink, eastern meadowlark, barn swallow, gray ratsnake, map turtles and whip-poor-will.

He has extensive experience with the Endangered Species Act and regulations including the documentation necessary for Species At Risk permits using the transition policies, Overall Benefit Permit, Notice of Activity and Registration. He has obtained authorizations from MNRF for several projects after submitting Information Gathering Forms, Avoidance Alternatives, impact studies and mitigation plans/planting plans.

Blanding's turtle: He is currently working on several projects where Blanding's turtle are key issues. His role includes basking surveys, identification of overwintering sites, nest searches, habitat classification, use of trail cameras to monitor crossings and foraging ponds and preparation of General Habitat Description mapping using MNRF protocols (Category 1, 2 and 3). There are a number of quarries, residential/cottage developments and other projects where Blanding's turtle mitigation measures, protection measures, education and wildlife crossing structures are part of the ESA negotiation and approvals. Use of restrictive fencing and other measures are part of those project approvals.

Avifaunal Studies - He has undertaken baseline studies of seabird movement through the Northumberland Strait, New Brunswick. He has conducted long term monitoring of waterfowl brood production in a constructed wetland, Sackville, N.B. as well as long term monitoring of bird movement through Innis Point Bird Observatory, Kanata, ON. He was co-ordinator of the 1988 Ottawa Peregrine Falcon Reintroduction Program and worked on the Toronto Peregrine Falcon Reintroduction Program (1983).

Municipal Infrastructure Projects

Bridges and Culverts- He has conducted numerous projects involving municipal infrastructure such as bridges and culverts on rural roads, highways, entrances and side roads. Our role includes checking culvert for Species At Risk (barn swallows) and other bird species, fish habitat, mussels, bats and other wildlife. Reporting includes Environmental Study Reports, technical reports and engineering assessments. We have completed this type of survey for MTO, City of Ottawa (Bytown Bridges, Minto Bridges), York Region, County of Peterborough, City of Kawartha Lakes and contractors for crossing replacements, repairs and removal. We complete Species at Risk compensation plans, fish salvage and Fisheries Act authorizations, as well as construction and post-construction. monitoring, plantings and shoreline restoration measures.

Water Supply - Mr. Ellingwood has conducted the natural heritage component of Class EA's for Municipal Water Projects for water mains and water intake structures in Whitby,

Pickering, Ingleside, Kagawong, Peterborough, North Glengarry and Elizabethtown, Ontario. He was responsible for determination of impact of alternative routings on flora and fauna, significant features such as wetlands and Species At Risk. Current projects include the Orleans Watermain Link, Glengarry Water Main in Eastern Ontario, North Kanata water main and the Otonabee Water Main in Peterborough.

Sewage/Wastewater - Mr. Ellingwood has conducted the natural heritage component of Class EA for Municipal Wastewater Projects for sewage effluent discharge pipes in Lancaster and Lindsay, as well as trunk sewers and pollution control plant and STP upgrades and expansions. He was responsible for determination of impact of alternative routings on flora and fauna and significant features. He has completed benthic data collection (biomonitoring) using the BioMap protocols for the Lindsay STP under their C of A since 2004.

Municipal Solid Waste - Mr. Ellingwood has conducted impact assessments under the Environmental Assessment Act for landfill expansions in North Lancaster, Township of Charlottenburgh and Moose Creek. He was responsible for the natural environment component data collection and impact assessment and baseline data collection. He has conducted benthic monitoring for landfills at Moose Creek, Bracebridge and Lindsay.

Transportation - He has conducted natural environment studies including examination of significant features and plants and animals and impact assessment for new roads and improvements to existing roads. Numerous provincial highway construction projects (Schedule B and C) for the Ministry of Transportation Ontario have been completed under the Class EA for Provincial Transportation Facilities. Municipal road projects include intersection and road widening as well as extensions of road in new urban areas. Projects include Salem Road extension, Ajax; Rossland Road extension, Oshawa; Rideau River Collector, Ottawa; Bensfort Road upgrades and the Nassau Mills Road bridge, in Peterborough; and Bytown Bridge reconstruction in Ottawa. Our role includes identifying constraints, recommending mitigation measures and designing rehabilitation and compensation, as well as obtaining environmental clearances from MTO, MNR and DFO. He has also conducted an evaluation of environmental impacts of a proposed runway expansion to the Peterborough airport under CEAA. He worked on the east-west Ottawa Light Rapid Transit (LRT) EA for a new transit link and public transportation system.

Stormwater Management - He has assessed the impact of stormwater management facilities on the natural environment during review of numerous plans of subdivision and commercial buildings.

Renewable Energy

Hydroelectric - Mr. Ellingwood has conducted baseline wetland inventories for proposed increases in headpond elevations for upgrades to existing hydroelectric facilities in High Falls, Michipicoten River. He has completed work on a 2.5 MW run-of-the-river facility in Peterborough that involved extensive field inventories, CEAA screening and design,

permitting, construction and monitoring of a compensatory wetland and amphibian pond. Currently working on two run-of-the-river facilities in Elliot Lake and Norland where Species at Risk, wildlife habitat, wetlands and aquatic habitat are key issues.

Dams and other Water Control Structures - He has conducted baseline wetland evaluations for proposed removal and repairs to two dams on the Big East River under a Class EA for MNR Projects. The impact assessment of the design options included detailed plant, bird, mammal and herpetile surveys and wetland community delineation.

Wind Power Generation - He has completed bird surveys for proposed wind power projects on Wolfe Island (Kingston), for Stelco (Port Dover) and the Huron-Kinloss Windpower Project (Kincardine). Mr. Ellingwood was involved in detailed spring and fall migration surveys of waterfowl and passerines, as well overwintering raptors surveys. He also conducted detailed breeding bird surveys using Point Count methodologies and area searches for all optioned properties, hydro connections and turbine locations.

Solar Power- He is currently working on 3 sites in south-central Ontario for proposed solar facilities. He has MNR training (Jan. 2011 and 2013) in preparation of the Natural Heritage Assessment reporting and is familiar with the Renewable Energy Act and project types. Work includes multi-season inventories for birds, plants, woodlands, rare species, amphibians, fish and wildlife as per established protocols; as well as preparation of the impact study and other documentation (Records Review, Site Investigation, Evaluation of Significance, EIS, Oak Ridges Moraine compliance, Monitoring plan, watercourse evaluation and Species at Risk permitting). He acts as the project manager for the NHA.

Aggregate Permits and Licenses

Pits and Quarries - He has conducted numerous Natural Environment Level 1and Level 2 Technical Reports as per the Aggregate Resources Act and the Aggregate Resources of Ontario Provincial Standards. Project sites include aggregate pits, quarries, aggregate permits and wayside pits throughout Central and Eastern Ontario. He has also been involved in municipal peer reviews of Level 1 and 2 reports. Projects include dimensional stone quarries in the Buckhorn, Bobcaygeon and Peterborough area. Key issues addressed by NEA included Species at Risk (snakes, turtles, alvars and rare plants and butternut trees), fish habitat, provincially significant wetlands, unevaluated wetlands, amphibian habitat and woodlands and groundwater seepage zones. Our work included working with the study team on the phasing, mitigation measures, rehabilitation plan, plantings and species list and recommendations/notes regarding potential effects on Species at Risk during the operation. Species where additional targeted surveys and mitigation was required to date include: eastern hognose snake, loggerhead shrike, bobolink, eastern meadowlark, barn swallow, Blanding's turtle, snapping turtle, whip-poor-will, common nighthawk, five-lined skink and least bittern. Our role includes pre-consultation meetings, public meetings, study team discussions, peer review responses and OMB hearings as an expert witness.

Oak Ridges Moraine

He is a specialist in the Oak Ridges Moraine Conservation Plan and assessing impacts of developments, severances, lot expansions, additions and building permits within the ORM and preparation of Natural Heritage Evaluations (120+). He has worked in many municipalities where ORM zoning by-laws are in place and require specific processes including pre-consultation meetings.

Expert Testimony

Mr. Ellingwood has testified as an expert witness at numerous Ontario Municipal Board Hearings, specifically: a proposed Commercial and Demolition (C& D) waste disposal site in Peterborough County; Ferma Quarry in Kirkfield; Quarry Forest subdivision in Orleans; Westwood subdivision in Stittsville; Campitelli subdivision in Ajax; Miller severances at Stony Lake; Lang severances in Peterborough county; OPA in Glengarry for a wetland designation; Gilson Point subdivision in City of Kawartha Lakes; recent Joint hearing for expropriation and rezoning to district park for the Municipality of Clarington; Dewdney quarry in Harvey Township, Stonescape II Quarry in Buckhorn and OPA 76-Ottawa. Experience includes pre-hearing meetings, negotiations for settlements, testimony at hearing, site visits and expert advice on provincially significant wetlands, ANSI's, wildlife habitat, alvars and Species at Risk (e.g. Loggerhead shrike, Blanding's turtles, hognose snake, whip-poor-will, least bittern and bobolink/meadowlark).

Teaching Experience

Mr. Ellingwood was a part-time instructor at Sir Sandford Fleming College, Frost Campus, Lindsay Ontario in the Terrain and Water Resources and Fish and Wildlife Programs from 1996-2009. Courses taught included Applied Ecology, Environmental Applications, Bioengineering, Environmental Principles, Wetland Evaluation Course, Environmental Planning and Impact Assessment and Bird Studies.

Volunteer Activities

Mr. Ellingwood is involved annually in various volunteer projects including the Ontario Breeding Bird Survey, Forest Bird Monitoring Survey, Breeding Bird Census, Ontario Breeding Bird Atlas, Maritime Breeding Bird Atlas, Ontario Marsh Monitoring Program (amphibian and bird surveys), Spring Red-shouldered Hawk and Woodpecker Survey, Nocturnal Owl Survey, Ontario Nest Record Scheme, Christmas Bird Counts, Ontario Rare Breeding Bird Program, Project Feederwatch, Canadian Lakes Loon Survey, Loggerhead Shrike Survey (1987), Couchiching Conservancy volunteer monitoring Shrike Survey, Ontario Grassland Bird Survey, Central Ontario Whip-poor-will survey and the Peregrine Falcon Reintroduction Program.

He acted as Regional Coordinator (Region 14) for the second Ontario Breeding Bird Atlas project (2001-2005) and is currently the volunteer regional coordinator for Bird Studies Canada's Marsh Monitoring Program in the Kawartha Lakes area. He is also the coordinator for the Lindsay Christmas Bird Count.

He regularly conducts workshops for birding by ear, leads nature tours and participates in the Carden Challenge (a 24 hr birding event) in the Carden Plain.

APPENDIX IX: Candidate Significant Wildlife Habitat

Appendix IX: Candidate Significant Wildlife Habitat-EcoRegion 6E

Candidate Significant Wildlife Habitat- Eco-Region 6E			
Wildlife Habitat	**Present in or within 120m of proposed license**	**Rationale**	**Carried forward to determine Confirmed SWH through field visit.**
Waterfowl Stopover and Staging Areas (Terrestrial)	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Waterfowl Stopover and Staging Areas (Aquatic)	Yes	Two ELC Ecosite Codes relevant to this property (MAM3 & SWD)	Yes
Shorebird Migratory Stopover Area	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Raptor Wintering Area	No	Study area does not contain any field communities suitable for Raptor wintering areas	No
Bat Hibernacula	No	No observed caves, horizontal mine shafts or limestone bedrock present within the study area	No
Maternity Colonies	No	Forests present are early successional forests with no dominant trees greater than 80 years	No
Bat Migratory Stopover Area	No	No records	No
Turtle Wintering Areas	Possible	Contains suitable habitat for turtle wintering areas within wetland community 1	Yes
Reptile Hibernaculum	Possible	Rock barren present including areas of broken rock, wetlands	Yes
Colonial-Nesting Bird Breeding Habitat (Bank and Cliff)	No	No soil or sand banks, cliffs were made of rock	No
Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)	Possible	ELC Ecosite Codes relevant to this wildlife habitat (SWD)	Yes
Colonially-Nesting Bird Breeding Habitat (Ground)	No	Not located on an island or peninsula	No
Deer Yarding Areas	Yes	ELC Ecosite Codes relevant to this wildlife habitat within communities 6,9,14 & 16	No
Migratory Butterfly Stopover	No	No large open field meadows with milkweed	No
Land Bird Migratory Stopover	No	Not within 5km of Lake Ontario	No
Deer Winter Congregation Area	Possible	Potential for Deer yard therefore possible Winter Congregation Area	Yes
Cliffs and Talus Slopes	No	No ELC Ecosite Codes relevant	No

		to this wildlife habitat	
Sand Barren	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Alvar	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Old Growth Forest	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Tall Grass Prairie	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Savannah	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Waterfowl Nesting Area	No	No large diameter trees, forests present in early succession	No
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	No	Pond and wetlands and forested area located within the study area however no super canopy trees	No
Woodland Raptor Nesting Habitat	Yes	Greater than 30 ha of SWC and SWD with at least 10 ha of interior habitat	Yes
Turtle and Lizard Nesting Areas	Possible	Limited sand and gravel for turtle nesting, however wetlands exist	Yes
Seeps and Springs	No	No Seeps or Springs	No
Amphibian Breeding Habitat (Woodland)	Possible	Presence of a wetland and pond >500m2 adjacent a woodland	Yes
Amphibian Breeding Habitat (Wetland)	No	wetlands are closer than 120m to woodlands	No
Mast Producing Areas	No	No mast producing tree species	No
Marsh Bird Breeding Habitat	Possible	Wetlands found within study area	Yes
Open Country Bird Breeding Habitat	No	No large grasslands present within the study area	No
Shrub/Early Successional Bird Habitat	No	No ELC Ecosite Codes relevant to this wildlife habitat	No
Special Concern and Rare Wildlife Species	Possible	Special concern species found on property	Yes
Amphibian Movement Corridor	Possible	Possible amphibian breeding areas	Yes
Deer Movement Corridor	Possible	Possible Deer wintering habitat	Yes

NATURAL ENVIRONMENT
LEVEL 2 TECHNICAL REPORT

CUMBERLAND QUARRY
LOTS 12, 13 &14, CONCESSION 11
SEVERN TOWNSHIP, COUNTY OF SIMCOE

ACKNOWLEDGEMENT

The following NEA staff contributed to this project:

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CUMBERLAND QUARRY
LOTS 12, 13 &14, CONCESSION 11
SEVERN TOWNSHIP
COUNTY OF SIMCOE

1.0 Introduction

1.1 Study Rationale

Niblett Environmental Associates Inc. (NEA) was retained by Severn Aggregates Limited to complete a Natural Environment Level 2 Technical Report for a proposed quarry in Severn Township, County of Simcoe.

The Aggregate Resources Act and the Aggregate Resources of Ontario Provincial Standards manual (Government of Ontario, 1997) require the completion of a Natural Environment Level 1 Technical Report to determine whether any significant natural heritage features exist on or within 120 metres of the site of a proposed quarry. The OMNRF Lands and Waters Branch provide a policy document dealing specifically with Aggregate Permit Applications: Natural Environment Report Standards (Policy AR2.01.07, March 2006) which provides a detailed outline of the required report content.

The Level 1 report completed by NEA (March 2013) identified the presence of Species at Risk (SARO) on the Site as well as habitat for other species at risk (Special Concern), regionally rare vegetation species and area sensitive bird species. Two significant wildlife habitat features were also confirmed on the Site. According to the Provincial Standards manual, a Natural Environment Level 2, or impact assessment, should be completed where the Level 1 report identified any such features on or within 120 metres of the site. The Level 2 report should determine whether there will be *any negative impacts on the natural features or ecological functions for which the area is identified and any proposed preventative, mitigative or remedial measures* (Government of Ontario, 1997).

The Level 1 study found that there is significant wildlife and/or associated habitat on the Site. The features identified through the literature and our field visits within the study area are included in Table 1. The wetlands found within the study area include Communities 1, 2, 5, 6 and 7. All communities with the exception of Community 6 (part of the PSW) have

not been evaluated by OMNRF under the Ontario Wetland Evaluation System.

This Level 2 report will examine the potential ecological impacts of the proposed aggregate operation on the natural features and their ecological functions. It also provides mitigation measures to avoid and reduce potential impacts. Recommendations to be incorporated into the rehabilitation plan are made, including site plan notes. The impact assessment will focus on the tree and vegetation clearing, watercourse alteration, blasting, loss of habitat for identified species, and the presence of significant wildlife habitat features.

The Site is designated as "Greenland" In the Simcoe County Official Plan, but is identified as a "High Potential Mineral Aggregate Resource" in Schedule 5.2.1, and an Official Plan Amendment to the County Plan is not required.

1.2 Study Area

The proposed quarry is for limestone extraction on Part Lots 12, 13 and 14, Concession 11, in the Township of Severn, County of Simcoe hereby referred to as the 'Site'. The Site is located north of Orillia fronting Nichols Line, The proposed licensed area encompasses approximately 138 hectares with an extraction area of approximately 118.5 hectares.

The Site is owned by 1662947 Ontario Inc. and the present activities include the restoration of farmlands and forestry. Severn Aggregates Inc. (the applicant) has entered into an Exclusive Agreement with the Land Ownership to pursue licensing of the Site to extract and market the limestone resource.

The 'study area' for the identification of significant species and natural heritage features extended a minimum of 120 m beyond the boundary of the proposed licensed area as per the requirements of the Aggregate Resources Act Provincial Standards and policy AR 2.01.07 (Government of Ontario, 1997). The study area includes the County Lands to the north of the Site which encompasses a ponded area, swamp and forest. The Walker's Severn Pines Quarry lands were not visited as this is an active quarry operation.

Table 1. Significant Natural Features, Significant Species and their Habitats within Study Area for Discussion

Category	Species
Presence of Species at Risk (on Site)	Butternut Common nighthawk Eastern whip-poor-will Eastern wood-pewee Wood thrush
Possible Habitat for Species at Risk	Snapping turtle Eastern hog-nosed snake Sensitive plant species Spotted turtle Eastern ribbonsnake Massasauga rattlesnake Musk turtle
Area Sensitive Bird Species	9 species
Regionally Rare Vegetation Species	8 Species
Significant Wildlife Habitat	Turtle Wintering Area (potential) Reptile Hibernaculum (potential) Turtle and Reptile nesting Areas (potential) Amphibian breeding habitat (woodland)(confirmed) Special Concern and Rare Wildlife Species (confirmed) Amphibian Movement Corridors (potential)
Provincially Significant Wetland (Grassy Lake)	n/a
Fish and Fish Habitat	Fish and Benthos Community

2.0 Applicable Policies

2.1 Provincial Policy Statement (2014)

The extent of Natural Heritage features found on or adjacent to the study area have been investigated within this EIS (Figure 1 of the Level 1 Report) and specifically Sections 2.1.4 - 2.1.8 of the Provincial Policy Statement (2014) apply to this project.

2.1.4 Development and site alteration shall not be permitted in:

- *a) significant wetlands in Ecoregions 5E, 6E and 7E1; and*
- *b) significant coastal wetlands.*

2.1.5 Development and site alteration shall not be permitted in:

- *a) significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E[1];*
- *b) significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)[1];*
- *c) significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)[1];*
- *d) significant wildlife habitat;*
- *e) significant areas of natural and scientific interest; and*
- *f) coastal wetlands in Ecoregions 5E, 6E and 7E[1] that are not subject to policy 2.1.4(b)*

unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

2.1.6 Development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements.

2.1.7 Development and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.

2.1.8 Development and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been

demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

2.2 Overview of County and Township Policies

(1) County Official Plan (November 2008)

a. Designated Greenland according to Schedule 5.1 Land Use Designations
b. Bedrock Aggregate Resources are identified according to Schedule 5.2.1 High Potential Mineral Aggregate Resources
c. A PSW is identified according to Schedule 5.2.2 Evaluated Wetlands
d. Schedule 5.4 Natural Heritage System identifies Moonstone Hill under Oro Moraine (OM7) and Matchedash Lake/Severn Corridor under Rocklands (R3), these are identified as part of a Natural Heritage Unit

(2) County Official Plan (January 2013) (parts of this OP are approved and parts are still under appeal)

a. Designated Greenland according to Schedule 5.1 Land Use Designations – this Schedule is under appeal
b. Bedrock Aggregate Resources are identified according to Schedule 5.2.1 High Potential Mineral Aggregate Resources
c. A PSW is identified according to Schedule 5.2.2 Evaluated Wetlands – this Schedule is under appeal

(Where a schedule or section of the OP is under appeal to refer to the 2008 OP for direction)

(3) Township of Severn Official Plan

a. Designated Greenland according to Schedule A South – Land Use
b. On an Existing Major Haul Route according to Schedule B Transportation & Servicing
c. The Site has been identified with an overlay designation of Bedrock Aggregate Resources according to Schedule C Aggregate Resource Potential Area
d. A PSW is identified in the south east corner according to Schedule F Environmentally Sensitive Areas

2.3 Township of Severn (2005)

Section C 9.4.5.2

- *Development and site alteration is not permitted within significant wetlands, significant habitat of endangered species and threatened species or significant coastal wetlands;*
- *Development and site alteration is not permitted within significant woodlands, significant valleylands, significant wildlife habitat and significant areas of natural and scientific interest unless it can be demonstrated that there will be no negative impact on the identified natural features and their ecological functions;*
- *Development and site alteration within fish habitat is not permitted except in accordance with provincial and federal requirements;*
- *Development and site alteration shall not be permitted on adjacent lands to significant natural heritage features and areas identified above unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the significant natural features or their ecological functions.*

Section D in the OP defines adjacent lands.

Nothing in Section C1 (and its subsections C1.1 to C1.7 inclusive) of this Plan applies to applications to establish new, or expanded, mineral aggregate operations or to the operation of existing pits or quarries legally licenced pursuant to the Aggregate Resources Act. Natural heritage policy applicable to mineral aggregate proposals is found separately in Section C9 of this Plan.

Section C9.1: c) ensure that new mineral aggregate operations are located where there will be no negative impact on significant natural heritage features and their ecological functions taking into account any proposed mitigation measures, rehabilitation and environmental enhancements;

Section C 9.3 Permitted Uses

Permitted uses on lands designated “Licenced Pit or Quarry” are limited to:

a) the extraction of stone, gravel, sand and other aggregates and associated operations such as crushing, screening, washing and aggregate storage and the recycling of used concrete and asphalt;
b) agricultural operations;
c) essential transportation and utility facilities;

d) forestry and resource management uses;
e) archaeological activities; and
f) accessory structures.

2.4 Simcoe County (2007)

Appendix IA of the OP states an EIS is required:

-for development proposed within the Greenlands Designation Appendix IC of the OP

An EIS shall include the following where appropriate:

- *a description of the physical features on the Site including buildings, structures, soils, vegetation, wildlife , topography, watercourses/water bodies and other relevant features (what is on the Site?)*
- *a summary of the development proposal including a detailed drawing of the proposed development (what is being proposed and where?)*
- *a description of the potential impacts of the development on the physical features of the site (what impact will this change have?)*
- *a review of alternative development options and alternative methods of mitigating the impacts of the development proposed (why is the development form proposed the most appropriate and what are the best measures available to protect the features of the site?)*
- *exploration of opportunities for environmental enhancement (how can the environment be improved?); and*
- *implementation and monitoring Plan (how will this development be established including mitigation measures and enhancements and how will it be ensured that the environmental characteristics and features will be maintained?).*

It should be noted that the County does not require an "Official Plan Amendment" for this Site, only the Township of Severn requires an application to amend the Official Plan and Zoning Bylaw.

3.0 Study Methodology

The methods for collecting the biological field data were outlined in the Level 1 report. The Level 2 report only addresses the significant features identified in the Level 1 report and the potential impact on those natural features. The data collected during the Level 1 study (natural features) was overlaid on a topographic map and the draft operational plan. The impact of the proposed licensed area and extraction area on each of the natural features was assessed individually.

Mitigation measures and options for protecting or retaining these features were examined and alternatives reviewed. Mitigation measures have been included in the design for the proposed quarry based on the requirement in the Provincial Standards to ensure there will not be "*any negative impacts on the natural features or ecological functions for which the area is identified"* (Government of Ontario, 1997).

4.0 Site Plan Development

Site plans have been developed for the proposed quarry. NEA biologists have been providing advice on the setbacks, buffers, rehabilitation plan drawing and notes, and the phasing of the rehabilitation.

The extraction area encompasses approximately 118.5 hectares with the total licensed area of 138 hectares, including portions of Lots 12, 13 and 14.

The quarry will be extracted in nine phases starting in the southern portion of the proposed licensed area with Phases 1 and 2 and progressing north (refer to the operational plan and sequencing of rehab). Phase 1A includes the Processing, Shipping and Recycling Area. The land in each phase will be progressively rehabilitated.

The main gates are in the southwest portion of Lot 12 off of Nichols Line and will be used to access the Processing, Shipping and Recycling Area (Phase 1A).

There is an existing intermittent watercourse (Watercourse 1) that enters the Site at the north inlet which flows across the Site and exists at a point along the eastern boundary. This watercourse will be realigned in stages as part of the operational plan for the proposed quarry such that a new drainage channel will be constructed on the quarry floor that will mimic Watercourse 1 and provide fish habitat post-quarry (Refer to Stages of Operational Plan – Sheets 6, 7, and 8).

A 90 m buffer is incorporated into the operational plan in the northern portion of the proposed licensed area. This area will be used to develop a tree nursery, and the construction of a habitat linkage that will connect the new drainage channel to the northern inlet. This habitat linkage will be carved into the limestone rock face inside the 90 metre buffer and allow for fish in this area to access the new drainage channel and the downstream outlet along the eastern boundary. Further details regarding this habitat link and the benefits to fish habitat are described in Section 7.4.

Included in the operational plan for the proposed quarry is a Wetland Compensation Plan that will be used to ensure wetlands removed during extraction are successfully recreated in a timely manner so that impacts on wetland and wildlife habitat are avoided. Further details regarding the Wetland Compensation Plan are presented in Section 7.3.1.

Table 2. Phases and the Number of Years to Completion.

Phase	Area (ha)	Years to Completion	Operational Activities	Rehabilitation
1A/1B	24	11	Processing, shipping, recycling area created and scales for duration of project.	8.0 ha to be used to create open field meadow while the remaining 5.5 ha will be used to service ongoing agricultural and forestry activities and remain as rock platform.
2	16	9	Excavated, new drainage channel constructed to drain runoff from active area, forest removed. At least 2 territories of Whip-poor-will (WPWI removed	Create partial wetland using organics from Community 17 found in Phase 3A. Create forest connection east to west across site along new drainage channel. Create Whip-poor-will habitat in open field meadow area.

Phase	Area (ha)	Years to Completion	Operational Activities	Rehabilitation
3A/3B	26.5	25	Excavated, Walker's Severn Pines Quarry discharge water diverted into new drainage channel, created on quarry floor and connected to north inlet using a habitat linkage (need to submit plans for habitat linkage to MNRF before extraction in Phase 3B commences), forest and wetland removed. At least 1 territory of WPWI removed. Butternut trees to be removed (need Notice of Butternut Impact form completed prior to clearing).	Create forest connection east to west across site along new drainage channel. Develop agricultural soils and farmland. Habitat Linkage created. Create forest along western and northern portions of phases. Butternut trees compensated/replaced.
4A	13.5	8	Excavated, forest removed. Butternut trees to be removed (need Notice of Butternut Impact form completed prior to clearing)	Create remainder of wetland using organics from community 17 in Phase 4B along new drainage channel and forest corridor. Finish forest connection east to west across site along new drainage channel. Rehabilitate to Open field meadow, which can be used for whip-poor-will habitat.
4B	14.5	10	Excavated, forest and part of Community 7 wetland removed. At least 2 territories of WPWI removed.	Create forest along eastern edge and slope. Rehabilitate to agriculture. Create forest along eastern portions of phase.
4C	12	10	Excavated, forest and wetland removed. At least two territories of WPWI removed.	Create forest along eastern edge and slope and southwest portion. Rehabilitate to agriculture. Create forest along eastern portions of phase.

Phase	Area (ha)	Years to Completion	Operational Activities	Rehabilitation
4D	12	9	Excavated, forest and wetland removed. At least two territories of WPWI removed.	Create forest along eastern edge and northern edges and slopes. Rehabilitate to agriculture. Create forest along eastern portions of phase.

5.0 Impact Assessment

5.1 Species at Risk

The following information is taken from Table 11 in the Level 1 report and includes only those species for which suitable habitat may be present on the site or that were found during our surveys.

Species identified by an asterisk (*) in Table 3 below, are from the list NEA generated by searching the NHIC site and Make-a-Map; Natural Heritage Features GIS system within a 10 km radius of the study area. A list of Species at Risk identified by OMNRF for which there is possible habitat is also outlined in Table 3 identified by underlining. Species in bold were identified in the Ontario Breeding Bird Atlas as found in the larger study area (10 x 10 km atlas squares km radius). More detailed descriptions of the habitat preferences and the potential impacts on the habitat for each species are provided in Section 5.2.

Table 3. Species at Risk compiled from NHIC, OMNRF and Ontario Breeding Bird Atlas.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
*Sensitive Species	N/A	END	END	N/A	Yes- habitat present however none were observed on the Site during NEA investigations despite intensive multi-season searches

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Blanding's Turtle	*Emydoidea blandingii*	THR	THR	Forest and open field meadow habitats and marshes, will travel long distances in search of mates and new habitats	None-NHIC Records were reviewed for a 10km Radius. No records were found within 4km of the Study area and no suitable wetlands/water bodies were identified within 2km from an occurrence (Not meeting habitat criteria for Blanding's turtle habitat in the General Habitat Description).
Broad Beech fern	*Phegopteris hexagonoptera*	SC	SC	Prefers rich soils in deciduous forests (Maple-Beech)	None
Common Five-lined skink	*Plestiodon fasciatus pop. 2*	SC	SC	Open shoreline with rock outcrops, clearings and open woodlands	None

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Eastern musk turtle	*Sternotherus odoratus*	SC	THR	Prefers shallow, slow-moving waters	Yes- possible habitat present on the northern portion of the Site and adjacent property
Northern map turtle	*Graptemys geographica*	SC	SC	Lives in large rivers and lakes	None
*Snapping turtle	*Chelydra serpentine*	SC	SC	Inhabits shallow ponds, shallow lakes, or streams with some living in brackish environments, such as estuaries.	Yes-habitat present on the northern portion of the Site and lands to east. No nests found on site. None observed.
*Spotted turtle	*Clemmys guttata*	END	END	Inhabits bogs, fens and shallow wetlands with tussocks or hummocks	Possible habitat to north, however beaver dam abandoned occasionally, dense grasses and shrubs establish and covering muddy substrate, no recent records of spotted in this area (NHIC)

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
*Eastern hog-nosed snake	*Heterodon platirhinos*	THR	THR	Inhabit sandy, well-drained habitats such as beaches and dry woods with access to swamps	Possible, portions of Site with sandy soils and/or near swamps. No individuals, hibernacula or oviposition sites found.
*Eastern ribbonsnake	*Thamnophis sauritus*	SC	SC	Found close to water, especially in marshes	Yes, possibly near wetland areas
*Eastern massasauga rattlesnake	*Sistrurus catenatus*	THR	THR	Found in forests, meadows, shoreline habitats, wetlands, rock barrens, grasslands and old fields near water. Rarely 50km away from Great Lakes	Yes, possible in rock barren in northwest portion of the Site. No snakes observed,
*Butternut	*Juglans cinerea*	END	END	Found scattered at low density in forests.	Yes-several trees found on the western and northern portions of the Site

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
***Cerulean warbler**	*Dendroica cerulean*	END	THR	Prefers mature deciduous forest with large specimen trees. Preferred woodlands are contiguous areas of greater than ten hectares.	None, no mature forest on site
***Bobolink**	*Dolichonyx oryzivorus*	THR	THR	Prefers tall, grassy meadows and ditches, hayfields and some croplands	None. No open field with grasses found on site.
Common Nighthawk	*Chordeiles minor*	THR	SC	Typically found in open areas such as sand dunes, recently logged or burned over areas, pastures, open forest, gravel roads, rocky outcrops and rocky barrens, and even military bases and airports	Yes-Five individuals identified during evening surveys in spring of 2014. Foraging habitat but no evidence of nesting or roosting sites on Site. Most suitable habitat for nests on ledge or open rock barrens.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Whip-poor-will	*Antrostomus vociferus*	THR	THR	Can be found in areas with a mix of open and forested areas within open woodlands or openings in more mature, deciduous, coniferous and mixed forests. It forages in these open areas and uses forested areas for roosting (resting and sleeping) and nesting	Yes-Thirteen individuals identified during evening surveys in 2014 and one in 2013.
Chimney Swift	*Chaetura pelagica*	THR	THR	Found within 1 km of a waterbody and, as its name implies, predominantly nests within old chimneys in urban and suburban areas.	None. No building on site and no large dbh cavity trees with suitable access or nest opportunities.
***Canada Warbler**	*Cardellina canadensis*	THR	SC	Breeds in deciduous and coniferous forests, usually wet forests with a well-developed dense shrub layer	Yes-Possible habitat within the forested areas of the Site (cedar swamps). None recorded during surveys.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Barn Swallow	*Hirundo rustica*	THR	NAR	Prefers open rural and urban areas where bridges, culverts and buildings are found near rivers, lakes, marshes or ponds.	None. No buildings on site.
Golden-winged Warbler	*Vermivora chrysoptera*	THR	SC	Found in early successional habitat of old fields with low deciduous trees bordered by wooded swamps; alder bogs; and shrubby clearings amidst deciduous forests. It requires greater than 10 ha of suitable habitat	None. No suitable shrub habitat present on Site.
Eastern meadowlark	*Sturnella magna*	THR	THR	Prefers grassy meadows and pastures; also in some croplands, weedy fields, grassy roadsides and old orchards.	None. No open grassland present on Site. In

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
***Olive-sided flycatcher**	*Contopus cooperi*	THR	SC	Found along natural forest edges and openings with snags, breeding habitat is coniferous or mixed forests adjacent rivers or wetlands	Possible in swamp to north of Site or other swamps on site. None observed or heard during field surveys.
Red-headed woodpecker	*Melanerpes erythrocephalus*	THR	SC	Pine savannahs and other open forests with clear understories, open pine plantations, tree rows in agriculture areas	Possible-Within selectively logged forested areas and fencerow. None observed or heard on site.
Eastern wood-pewee	*Contopus virens*	THR	NAR	Deciduous forest and woodland	Yes-Identified during NEA surveys in swamp and open selectively logged areas.
Bank swallow	*Riparia riparia*	THR	NAR	Streamside banks	None. No eroding banks on site.
Wood thrush	*Hylocichla mustelina*	THR	NAR	Deciduous and mixed forests with large trees, moderate understory, shade and abundant leaf litter	Yes-Identified during NEA surveys in woodlands.

Common Name	Latin Name	Status (National)	Status (Provincial)	Preferred Habitat	Habitat Present
Least bittern	*Ixobrychus exilis*	THR	THR	Nests in large freshwater marshes interspersed with open water and dense emergent vegetation. They require marshes of at least 5 ha in size	None. No cattail marsh on Site or in wetland to north.
Bat species -Eastern small footed myotis -Little brown myotis -Northern myotis -Tri-coloured bat	*Myotis leibii* *Myotis lucifugus* *Myotis septentrionalis* *Perimyotis subflavus*		END	Variable habitat needs, hibernacula and bat maternity trees are key habitats	Preliminary review of data found no Myotis species

5.2 Potential Habitat for Species at Risk

5.2.1 Butternut

Butternut trees are found in a variety of woodland and edge habitats, but are in serious decline due to a fungal disease known as butternut canker. The endangered status and specific assessments protocols are in place for this species. A total of 13 trees were originally assessed on the Site or within the 120 m study area in May of 2010 but were re-assessed a second time on August 29, 2013. Six retainable butternut trees were identified (Category 2). Of the six retainable trees, five of them contained 100% canopy cover. Little canker was identified on these trees. The remaining seven trees were heavily cankered and all were found to be not retainable (Category 1).

Four retainable (Category 2) butternut trees were identified within the proposed licensed boundary and extraction area. Three of the four retainable trees found in the licensed boundary were suckers off of stumps that had been cut during logging operations. These saplings were growing from the original stump and were all around 1cm dbh. A permit is

required from OMNRF to remove the Category 2 retainable trees. The remaining nine (9) trees were found outside of the extraction limits but within the 120 m study area. They will not be negatively impacted by this quarry. No achivable trees (Category 3) were documented within the study area. Butternut plantings are required as part of the OMNRF permitting process and will be incorporated into the rehabilitation plan. Suitable habitat will be chosen for the required plantings. However the applicant will have these trees reassessed prior to reaching the phase to which they are located and will apply for a permit/ Notice of Butternut Impact Assessment forms required at that time.

5.2.2 Snapping Turtle

The snapping turtle inhabits ponds, lakes or streams. Although none were observed, there is potential for this species to inhabit the pond area and swamp north of the Site on lands owned by the County of Simcoe. Standing water existed within this pond year round with a sand based road and disturbed soils in close proximity that could provide nesting opportunities. The species was not recorded on the Site by NEA, nor reported by the OMNRF-NHIC on the Site.

The ponded area and swamp located on lands owned by the County of Simcoe to the north of the Site was the most suitable habitat for the snapping turtle foraging and possibly as overwintering habitat due the depth of the water and soft bottom substrates. The extraction area does not extend into the pond site. A 90 m buffer is incorporated into the operational plan and defines the northern limit of the licensed area. The sand based road adjacent to the pond area and swamp on lands owned by the County of Simcoe is maintained as a snowmobile trail. There is no anticipated negative impact to the snapping turtle from the quarry operation.

5.2.3 Eastern Musk Turtle

The eastern musk turtle is largely confined to Georgian Bay and the southern edge of the Precambrian Shield. Georgian Bay is located approximately 33km west of the Site. The eastern musk turtle record was likely from that area. The pond area and swamp north of the Site is not considered suitable musk turtle habitat due to its isolated nature, lack of flowing water or permanent watercourse and lack of logs or emergent vegetation. No turtles were observed during our surveys.

5.2.4 Spotted Turtle

The spotted turtle inhabits small, shallow bodies of water including bogs, marshes, fens, and small ponds. The turtles move to land to lay their eggs. There is limited potential for this species to exist within the ponded area and swamp on lands owned by the County of Simcoe to the north of the Site (Community 1). As the wetland was observed to be dry most of the year and was regenerating into a meadow marsh due to decreased beaver activity, the shallow aquatic flooded emergent wetland preferred by the species is not present. The ponded area is relatively small and is a remnant of the former larger pond that was once present when beaver were active and not being managed. This wetland area is off the Site and outside of the proposed extraction area and licensed boundary. In addition approximately 90 meters exists between the proposed extraction area and the pond. The pond is located upstream of the proposed licensed quarry.

5.2.5 Eastern Hog-nosed Snake

The eastern hog-nosed snake prefers sandy, well-drained habitats including beaches and dry woods with access to wet areas such as swamps. The Site contained a portion of the snake habitat requirements in that it contained various swamps and marshes. However the soils were not sandy as preferred by this species for laying their eggs in burrows and hibernation. Overall, the soils are very shallow with exposed rock near the surface over most of the Site. This species was not observed on the Site during field visits and has not been observed by the landowner. No hibernacula or oviposition sites were identified during our surveys.

The rehabilitation plan includes forests and wetland to be created after each phase. The PSW and surrounding area provides suitable wetland habitat for the eastern hog-nosed snake. Habitat will continue to exist, once vegetation is re-established as part of the progressive rehabilitation, on and adjacent to the Site during all phases of operation. It is possible that hog-nosed snake would find habitats on this Site, post-rehabilitation. Mitigation measures and monitoring by the licensee have been included, in the event a hog-nosed snake does cross the site or find habitat post-rehabilitation.

5.2.6 Eastern Ribbonsnake

The ribbon snake is found close to water, especially marshes. The Site supports habitat in proximity to wetlands as they exist on and adjacent to the Site. There is suitable habitat for this species on the Site, however none were found during any field visits. The closest marsh to the Site is on lands owned by the County of Simcoe north of the Site a minimum 90 meters from the proposed extraction area. There is no anticipated negative impact to the

eastern ribbon snake from the quarry operation. Post-rehabilitation, this species may find habitat in the new shallow wetlands to be constructed as part of the rehabilitation plan.

5.2.7 Eastern Massasauga

The eastern massasauga is found near water and within 50km of the Great Lakes. This snake is also found in pine forests, meadows, shoreline habitats, wetlands, sand barrens and dunes, rock barrens, grasslands and old fields. Potential habitat exists for this species on the Site. The Site is within 50km of Georgian Bay, at approximately 33 km. Distribution maps from NHIC (Feb, 29, 2012) show records just a few kilometres to the northwest and north of this Site. Several of the habitat characteristics are found on the Site including rocky forests, rock barrens and old fields. No individuals were observed of this species however during NEA field visits or reported by the landowner.

The rehabilitation plan includes the re-creation of forest, wetland, rock outcrops and open field meadow habitats. Habitat will continue to exist once vegetation is established, on and adjacent to the Site during all phases of operation. The final elevation of the quarry floor will have exposed rock and other habitat features that may provide habitat for this species. Natural fissures in the rock post-construction may provide potential hibernacula for this species. The licensee and staff will be provided identification sheets for this species and measures are in place to document occurrences (see Section 8.8).

5.2.8 Eastern Whip-poor-will

Whip-poor-wills can be found in areas with a mix of open and forested areas within open woodlands or openings in more mature, deciduous, coniferous and mixed forests. It forages in these open areas and uses forested areas for roosting (resting and sleeping) and nesting.

Targeted surveys for this species and for possible nest sites were part of the field program. There is a mixture of open and forested areas and thus would support roosting and nesting habitats. Thirteen (13) individuals were identified during NEA field surveys throughout the Site. As such Category 2 and 3 habitat, as per the MNRF General Habitat Description, is present over most of the Site. An Overall Benefit Permit under the Ontario Endangered Species Act will be required from MNRF for altering the habitat of this species. The necessary forms, including the Information Gathering Form will be submitted as part of the ESA approval process.

Habitat will be created through the rehabilitation program proposed. The forested corridors with deciduous and coniferous trees and open field meadows proposed as part of the rehabilitation plan, once established, will provide suitable habitat for the whip-poor-

will. The areas most frequented by the whip-poor-will on the north, south and eastern edges of the Site are where these forest pockets are proposed (Refer to Rehabilitation Plan – sheet 5 of 8 for locations and Section 6.4.2 for detail rehabilitation measures). The rehabilitation plan has been specifically designed to mimic the existing conditions of the Site. After progressive rehabilitation, the new habitat will provide the ideal conditions for this species being a mixture of forested blocks and open meadows. The rehabilitation plan and additional overall benefit measures will be provided to MNRF as part of the overall benefit permit.

5.2.9 Common Nighthawk

Nighthawks require open field habitats for foraging and will nest on natural open habitats, such as sand dunes, beaches, recently burned-over areas, pastures, exposed rocky outcrops, rock barrens, and rooftops for nesting. Like many aerial insect-eating birds this species has declined across its range. Habitat degradation through changes in land use and forest practices re forest fires, as well as global declines in insect populations, the main prey for nighthawks, are the suspected cause (OMNR fact sheet).

Targeted surveys for this species and for possible nest sites were part of our field program. Suitable habitat exists within the woodland clearings, rock outcrops and logged forests. During surveys on June 9, 2014, five common nighthawks were identified flying over the Site hunting for insects. These birds were mostly identified on the north western limits of the Site around the rock barren identified and on the adjacent property to the west.

Habitat for this species may be created through the rehabilitation of the quarry. The rehab plan includes creating open field/grassland, rock barren and forest habitats. This species may find suitable foraging habitat and/or nesting habitat on various portions of the Site at different times, as the extraction activities are phased in and rehabilitation plans implemented.

5.2.10 Eastern Wood-Pewee

This species breeds in all woodland types and winters in partially cleared shrubby habitats and secondary forests. This species was identified on the Site within the forested habitats in several locations. The logged areas, dense stands of forest and open subcanopy nature of some of the forest communities, provides ideal habitat for this species. The habitats will be removed as part of the clearing and extraction phases. This species is not listed under the Ontario Endangered Species Act and compensation or permitting for removal of habitat is not required.

The rehabilitation plan includes the re-creation of forests. Habitat for this species will occur in the future, once vegetation is established on the rehabilitated areas in each phase.

It is recommended that clearing and grubbing be done outside of the peak breeding bird window (April 15th –August 15th) and if clearing must be conducting during this time a qualified bird biologist should conduct a nest search for any evidence of active nests within the area to cleared.

5.2.11 Wood Thrush

This species breeds in deciduous and mixed forests in areas with large trees, moderate understory abundant in leaf litter and shade present. The habitats will be removed as part of the clearing and extraction phases. This species was found on the Site during our field inventories.

The rehabilitation plan includes the re-creation of forests. Habitat for this species will occur in the future, once vegetation is established on the rehabilitated areas in each phase.

5.2.12 Sensitive Species

This sensitive plant species is protected by the OMNRF therefore the species name will not be disclosed in this document. In general there was potential habitat for this species on the north-western portion of the Site along the forested ledge. Even with multi-season targeted surveys for this species over several years, no plants were observed during NEA field visits.

5.3 Rare Vegetation Species

Eight (8) regionally rare species were found within the study area. These included meadow horsetail (*Equisetum pratense*), black walnut (*Juglans nigra*), purple-flowering raspberry (*Rubus odoratus*), racemed milkwort (*Polygala polygama*), European wood-sorrel (*Oxalis stricta*), wild geranium (*Geranium maculatum*), white heath aster (*Aster pilosus var. pilosus*) and tall goldenrod (*Solidago altissima*).

The presence of rare species on this site is due to the diversity of community types providing opportunity for many species.

All of the species were located within the proposed licensed area. For the protection of these species re-location is recommended when possible. The need for a salvage plan to provide for the continued presence of these species in the watershed and transplanting the specimens will be discussed with OMNRF.

5.4 Provincially Significant Wetland and Unevaluated Wetlands.

The wetlands are located on the northern and southern portions of the study area Site (Communities 1, 2, 5, 6 & 7). The largest wetland being Community 6 (the PSW).

The existing watercourse #1 flows through all wetlands on the Site connecting them hydrologically by surface water. The water runs south through the Site emptying into the PSW (Community 6). As indicated in the Hydrogeological Investigation (MTE, 2014) the PSW has several sources of water inputs including the watercourse that runs through the Site. The watercourse receives 76% of its base flow from the active Walkers Severn Pines Quarry (pumped discharge water) to the west and 17% from the unevaluated wetland to the north (NEA's Community 1) (MTE, 2014). It is important to maintain inputs and outputs from wetland Communities 1 and 6 in order to maintain the hydrological and ecological conditions that currently exist. It is recommended that the surface water contributions continue to the PSW throughout the life of the quarry. As identified in the Water Budget, MTE predicts the total discharge from the site will increase by 3% with a 1 % increase in total average discharge at full operation and will not adversely affect the PSW (MTE, 2014) NEA supports the conclusion that so long as a continued connection of surface water is maintained from Community 1 to Community 6 there were be no negative impacts to the PSW.

Maintenance of the hydrological function of the PSW is the prime objective. The minor change in the flow will not result in increased water levels in the PSW. The vegetation communities, plant species and nature of the wetland will not be impacted by the slight increase in volumes. The large size of this riverine wetland will absorb the slight increase and with a permanent inflow and outflow from the wetland, level changes would not occur.

A wetland area (Community 7) exists in the central and northern portions of the Site and also extends beyond the Site boundary onto lands owned by the County of Simcoe. This wetland area exists in the proposed extraction area and therefore will be removed. This wetland was a permanent feature however as it was located in the central portions of the extraction area and if preserved, would become an isolated feature. Retaining this wetland with extraction on all sides would likely not protect the wetland as it would dry up with no water source and be a raised island. Upon extraction the containment of water within an area to form a wetland was not an option as the water table is located too far beneath the

ground and water would percolate through the cracks in the rock. The limestone quarry is below-water- table as per the regulations and the license application. The rehabilitation plan incorporates the creation of wetland within the west-central portions of the Site. This wetland will replace the habitat that was lost within community 7 as a result of the quarry operations. It should be noted that the registered landowners of the Site are in the process of restoring farmlands, which will eventually include these areas on the Site, to reinstate historical farming use. The remaining wetlands (Community, 1, 2 & 5) identified north of the Site on lands owned by the County of Simcoe will not be negatively impacted by the quarry. Site Community 1 and 2 were found adjacent to one another. No impacts will occur so long as source water outputs continue to occur from this wetland, southwards. NEA recommends the source water movement north to south be maintained in order to maintain wetland conditions. Community 5 was an isolated wetland pocket with no obvious connection by surface water to any of the other wetland features. This wetland will continue to exist after the quarry begins operation.

5.5 Significant Wildlife Habitat

The following sections address the criteria for features identified as Significant Wildlife Habitat. The habitat preferences and details of the criteria in terms of confirmation requirements are taken from the MNRF SWH Criteria Schedules for Ecoregion 6E (MNRF, 2016).

5.5.1 Habitat for Area-sensitive Bird Species

The Significant Wildlife Habitat (SWH) Technical Guide (OMNR, 2000) identifies habitat for area sensitive species as a priority for preservation. It specifically discusses forest fragmentation, edge effects and grassland habitat.

A review of the bird list from our field inventories found that nine (9) area sensitive species were observed. Areas sensitive (AS) species are those that require a minimum hectarage of contiguous suitable habitat to successfully breed (OMNR, 2000). The species included yellow-bellied sapsucker (*Sphyrapicus varius*), blue-headed vireo (*Vireo solitarius*), red-breasted nuthatch (*Sitta canadensis*), winter wren (*Troglodytes troglodytes*), veery (*Catharus fuxcenscens*), black-throated blue warbler (*Dendroica caerulescens*), black-throated green warbler (*Dendroica virens*), ovenbird (*Seiurus aurocapillus*) and scarlet tanager (*Piranga olivacea*).

The presence of area sensitive species is due to the large contiguous forest and wetland areas in this part of the Township where few roads are present. The proposed extraction

area would remove forest cover and rock barren areas on the Site during the phasing and operational life of the quarry. The progressive rehabilitation plan and phasing of the cuts would limit the amount of mature forest cut at any one time. The impact on the area sensitive species would be a direct loss of habitat. The habitat is presently disturbed through long term selective logging and other works. The rehabilitation plan includes recreating a diversity of habitats that will re-establish habitat for most of these species over time.

A nine phase sequence of extraction and progressive rehabilitation operations will be followed. In all phases, progressive rehabilitation leading to final rehabilitation will follow the extraction operations from south to north and will occur in both extraction and processing areas. As such the amount of disturbed land within the operation will be restricted to parts of each phase.

The rehabilitation plan includes reforestation of portions of the site, while other portions will allow for the regeneration of fields and meadows. Agriculture fields will also be incorporated into the rehabilitation plan in the central and northern portions of the Site. The Site is currently a mix of wetland, forest and field habitats, the functions of the field and grassland communities cannot be overlooked, as they are as necessary to some species as forest is to others. While reforestation is a long term restoration goal (20-50 years to mature) it will allow these wildlife species to reoccupy this Site in the future, especially the species at risk that inhabit the site currently (whip-poor-will, common nighthawk). The design of this progressive rehabilitation plan allows for the species to inhabit other areas of the Site while overburden clearing is being conducted in one extraction area. The species will continue to find habitat in areas where the extraction is not actively taking place. Large tracts of forest are suitable habitat for forest dwelling species, particularly area sensitive species such as warblers, vireos and tanagers.

5.5.2 Amphibian Woodland Breeding Ponds

The Significant Wildlife Habitat technical guide notes that the greatest significance would be assigned to woodland ponds that support a high diversity of species, species of conservation concern and high numbers of amphibians (2000).

There were five wetland communities in the study area (Communities 1, 2, 5, 6 & 7) as seen in Figure 2 (Level 1 Report). As stated in the Significant Wildlife Habitat Manual (2000),

Woodland amphibian ponds are:

…unpolluted, and contain a variety of vegetation structure, both in and around the edge of the pond, for egg-laying and calling by frogs. The best adjacent habitats are closed-canopy woodlands with rather dense undergrowth that maintains a damp environment. Moist fallen logs are another important habitat component required by salamanders. Site with several ponds and/or ponds close to creeks are especially valuable.

Communities 1, 2, and 5 are all found north of the Site on lands owned by the County of Simcoe. Since these communities are located outside the extraction area, they will not be impacted by the quarry. These Communities meet the above definition of "Woodland amphibian ponds". Community 1 is a large marsh with a beaver pond on the south edge of the wetland. This pond contained standing water and was optimal for amphibian breeding conditions. Both coniferous and deciduous woodlands surrounded the edges of this wetland (Community 2). Those habitats are used for foraging and overwintering by some of the amphibian species.

Community 2 was located on the west side of Community 1 on lands owned by the County of Simcoe.

Community 5 was a swamp area that contained woodland surrounding it. Some standing water existed and fallen logs were present in this community. A large diversity of plant species were recorded in this area providing a large diversity of habitats.

Community 6 is the provincially significant wetland and is designated as a swamp. This community crosses the southeast corner of the Site. Some standing water existed within this wetland with mature trees growing throughout. This community would provide suitable habitat for amphibian breeding. This community will remain outside the extraction area for the proposed quarry and protected by a 30 meter setback.

Community 7 is found on the north and central portions of the Site. This community is not suitable for amphibian breeding. The registered lands owners of the Site are in the process of restoring farmlands, which will eventually include these areas, to reinstate historical farming use of the Site.

Amphibian species observed throughout surveys included northern leopard frog, spring peeper, green frog, gray treefrog, American toad, wood frog, American bullfrog, red-spotted newt and eastern red-backed salamander.

The proposed quarry is to extract aggregate from the water table. Communities 1, 2, 5 (north of licensed boundary on County lands will not be directly or indirectly impacted as they are well outside the extraction area and upstream of the site. Community 6 (Grass Lake PSW) will not be affected by the quarry as surface water flow is being maintained throughout the Site. All wetlands suitable for amphibian breeding were found outside of the proposed licensed boundary and were confirmed to contain amphibians. Frog species on the Site were low in number due to lack of seasonally ponded areas and the fractured surface rock.

5.5.3 Turtle Wintering Area

The Significant Wildlife Habitat Eco Region Criteria Schedule notes that turtle wintering habitat will have water deep enough not to freeze and soft substrates (MNR, 2011). One vegetation community on the Site met the candidate criteria (Community 1).

Community 1 was a large meadow marsh with a beaver pond in the middle. The beaver pond offered optimal conditions for over wintering turtles and contained water deep enough not to freeze. Being a beaver pond the substrates were soft and ideal for burrowing.

NEA determined there was potential habitat for turtle wintering, we could not confirm the "presence of five over-wintering painted turtles or one or more Northern map turtles or snapping turtle wintering within the wetland" as per the MNR criteria definition. However we can assume the painted turtles that were captured in this pond during our surveys were overwintering. The entire Community 1 was considered Significant Wildlife Habitat due to the lack of surveys to confirm otherwise.

Community 1 is just north of the Site and will not be impacted as a result of the quarry. There is a setback from the licensed boundary to the extraction area at the northern limit of the site. Some grading will occur in that area to accommodate the changes in slope, drainage along the watercourse and erosion control measures. This will not impact on the continued presence of the ponded area.

5.5.4 Reptile Hibernaculum

The Significant Wildlife Habitat Ecoregion Criteria Schedule (MNR, 2011) identifies reptile hibernaculum as:

Sites below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line. Wetlands can also be important over-wintering habitat in conifer or

shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover.

Community 13 and 8 would provide suitable habitat for reptile hibernaculum. Both vegetation communities were rock barren areas and contained rock crevices and fissured rock ideal for reptile hibernaculum. To confirm reptile hibernaculum the presence of a minimum of five individual snakes of one species or two or more snake species must be identified. Although the criteria above was not confirmed, the candidate criteria habitat was met.

The rock barren communities identified as suitable habitat for reptile hibernaculum were located on the western limits of the Site and within the south central portion of the Site. The small south central pocket (Community 8) will be removed as a result of the quarry with the larger portion of Community 13 to be retained outside of the licensed boundary. No snake hibernaculum were confirmed within Community 8 based on our surveys.

A portion of Community 13 including the main ledge feature will be removed as part of the operation. Although no concentrations of snake were observed on the ledge or the rock barren, habitat may still be present for use as a hibernacula. Site personnel should be aware of any concentrations of snakes during extraction of that ledge and the rock barren. If snakes are encountered, work should cease in that area until MNRF is contacted. Hibernacula are typically used from October 1st to March 31st. Limiting excavation and blasting in that time period on the ledge should be included as a timing restriction on the license.

5.5.5 Turtle Nesting Areas

The MNRF Significant Wildlife Habitat Criteria Schedule for Ecoregion 6E defines turtle nesting as areas close to water and away from roads with sand and gravel turtles where are able to dig in. These habitats were identified on the subject Site. Habitats were identified surrounding Community 1 on the northern limits of the Site.

In order to confirm SWH the presence of five or more nesting turtles, one or more Northern map turtle or snapping turtle nesting must be determined. No nesting turtles were identified using this area and therefore significant wildlife habitat could not be confirmed. Because suitable habitat was identified but not confirmed, this area was considered significant anyways. Community 1 was identified north of the Site line and will not be located within the licensed boundary or extraction area. This habitat will remain and will not be affected as a result of the quarry.

5.5.6 Special Concern and Rare Wildlife Species

Three special concern species were identified on the Site: the common nighthawk, the eastern wood-pewee and the wood thrush. Both eastern wood-pewee and wood thrush were identified within the forest communities (Communities 8, 9, 12, 14 to 18).

A total of eight common nighthawks were identified flying over the Site. Birds were identified in Communities 7 and 9. Community 7 was a silver maple swamp and the birds were identified foraging on insects high over this community that borders the agricultural fields. The additional birds were identified along the eastern edge of Community 9 adjacent to the access road and open field area foraging.

The quarry will require the removal of portions of vegetation communities listed above. The progressive rehabilitation plan has incorporated habitat creation in order to minimize the impact on the species and maximize the amount of habitat at any given time. A detailed discussion can be found in Section 7.1.2 regarding compensation measures for the whip-poor-will which will also be similar for common nighthawk. The progressive rehabilitation plan is outlined in Section 7.0.

Nesting habitat is most suitable in the open rock barren communities. Although this habitat will be removed in phase 3A and 3B, rock barren will be present during all stages of the quarry operation as phases are stripped and excavated, including creation of ledges. Those areas may provide short term nesting and roosting habitat for common nighthawk.

Wood thrush and eastern wood-pewee habitat will remain in the later phases until those areas are extracted. As part of the progressive rehabilitation, new habitat will be created for these species in the long term.

5.5.7 Amphibian Movement Corridors

The Significant Wildlife Habitat Eco Region Criteria Schedule defines amphibian movement corridors as movement corridors between confirmed amphibian breeding habitats. Amphibian breeding (woodland) has been confirmed within the PSW (Community 6) and within the beaver pond (marsh) (Community 1).

Although amphibian movement corridors were not confirmed through our surveys and drift fence surveys were not conducted, there are potential corridors between upland summer foraging habitats and the seasonal breeding pools/ponds. The key ponded areas are located north and east of the proposed licensed area. Summer foraging habitat is likely on the Site and will be removed in phases. As such disruption to corridors may occur but

will be reinstated as part of the rehabilitation measures, along with the creation of wetlands on the site and reinstatement of the watercourse that will provide new breeding habitat.

5.6 Fish and Fish Habitat

Fish sampling confirmed the presence of fish and fish habitat in Watercourse 1 and 2. Aquatic habitat assessment confirmed Watercourse 1 and 2 provide direct fish habitat for five bait fish species brassy minnow *(Hybognathus hankinsoni),* creek chub *(Semotilus atromaculatus)*, northern redbelly dace (*Phoxinus eos)*, central mudminnow (*Umbra limi)*, brook stickleback (*Culaea inconstans)* and one gamefish species, pumpkinseed (*Lepomis gibbosus*).

The fish species collected are common to the local and regional watersheds and are not considered at risk under the provincial or federal legislation. Individual fish and their habitat are protected under the Federal Fisheries Act, as administered solely through the Department of Fisheries and Oceans and unless authorized through a permit, no person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.

Alteration to Fish Habitat

Fish habitat in Ontario is managed and protected under the Federal Fisheries Act, as administered by the Department of Fisheries and Oceans. Unless authorized through a permit, no person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery or to fish that support such a fishery.

The proposed quarry extraction requires removal and relocation of Watercourse 1 which functions as fish habitat. The Federal Fisheries Act requires that projects avoid causing serious harm to fish unless authorized by the Minister of Fisheries and Oceans Canada (DFO). This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery and includes Watercourse 1 and 2 within the study area.

Watercourse 1 will be removed and reconstructed approximately 40 m parallel to the original watercourse location. In order for this to be achieved, Phases 2, 3a and 3b will be extracted within 20 metres from the existing Watercourse 1 channel, leaving the Watercourse 1 and a corridor intact. As each phase is extracted, the new drainage channel

will be progressively rehabilitated.

The surface water management (SWM) pond will be constructed in conjunction with Phase 2 extraction. The pond will be installed at the discharge point along the east boundary line, capturing all flows from the new drainage channel.

As Phase 2 extraction progresses in a westerly direction, the new drainage channel will be constructed at the inlet of the SWM Pond and move westerly at approximately 20 metres from the excavated rock face. In total, the new drainage channel will be located approximately 40 metres from Watercourse 1. As discussed in the Hydrogeological Investigation (MTE, November 28, 2014), the upper 5 metres of the Gull River Formation drains within hours of spring runoff or large precipitation events, causing the watercourse to have intermittent surface water, therefore hydrologically, it is predicted the removal of surrounding lands due to extraction will not dehydrate Watercourse 1.

It is estimated that Phase 2, 3a, 3b will take 34 years or more to complete extraction. Therefore the new drainage channel and its riparian habitat will have 34 years to re-establish through active and passive rehabilitation before the upstream flows are redirected into the new drainage channel. However, the southern half of the new drainage channel (Phase 2) will be receiving discharge waters from the adjacent western quarry, Severn Pines once Phase 3A is completed. The discharge water from the Walker's Severn Pines quarry contributes up to 76% of the existing base flow for the downstream PSW (Community 6) (MTE, November 28, 2014).

The hydrological function and connection of Watercourse 1 from the north inlet will be maintained through Phase 2, and 3a until the extraction of Phase 3b is completed and the new drainage channel is fully constructed, including construction of the new habitat linkage, which will be carved into the limestone rock face inside the 90 metre buffer zone. At this point, the flow will be redirected from the existing watercourse to the new drainage channel, connecting and maintaining surface flow and upstream inputs across the Site to the existing SWM Pond and outlet along the eastern Site boundary. Phase 4a extraction will begin once the new drainage channel has been connected to the north inlet and is functioning as designed.

The quarry floor will follow the Shadow Lake Formation at an average elevation of 216 masl. The design of the new watercourse will maintain a bottom elevation ranging from 214 masl to 214.5 masl to accommodate fish habitat compensation features such as pool-run sequences and fish overwintering habitat.

Culverts will be installed across the new watercourse to provide access for quarry machinery. The number of culvert crossings will be minimized.

The progressive rehabilitation methods used to create the new drainage channel will greatly reduce the short term impacts of relocating the watercourse. The new drainage channel will provide a barrier free habitat for non-jumping fish species, connecting the PSW to the upstream fish habitat north of the Site which is currently not available due to existing culverts at the north inlet and natural cascades at the eastern outlet.

The channel morphology features will include riffles/runs, pools, shallow wetlands and typical stream features. In addition to inverted root wads and sweepers which will provide in-stream woody debris. Aquatic substrate will also be designed to provide to support the fish community and will include the following particles; silt, sand, gravel, cobble and boulders. Therefore, the new drainage channel will offset the removal of the existing Watercourse 1 by providing equal or greater area of productive fish habitat by providing a diversity of breading, nursery, feeding and overwintering fish habitat.

DFO Self-Assessment

The Fisheries Act requires projects avoid causing serious harm to fish habitat unless authorized by the Minister of Fisheries and Oceans Canada. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery and this includes Watercourse 1 and 2. To determine if a project requires DFO staff review, a *DFO Self-Assessment* must be completed to determine if serious harm can be avoided through avoidance and mitigation measures. If a project cannot avoid serious harm a *Request for Review* document must be submitted to DFO staff, where they will determine the appropriate next steps based on project impacts.

Based on the self-assessment criteria, the relocation of Watercourse 1 will cause serious harm to fish habitat and will require the project to be reviewed by DFO staff. Based on the above project description, the project cannot avoid, mitigate and/or offset harm to fish habitat part of recreational fishery.

Serious harm to individual fish can be avoided through proper implementation of a Fish Salvage Plan (Section 5.6) and essential measures to avoid serious harm to fish given our knowledge of the proposed work plan and construction techniques (Section 7.0). Additional measures to avoid harm and general fish protection information can be found on DFO's website http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html to support continued compliance with the Fisheries Act.

To determine if a Fisheries Act Authorization will be required, the next step in the process once initial review of the application is provided by MNRF, will be to provide DFO staff with a completed "Request for Review" document. The Request for Review Document details the existing conditions, impacts and project description and information needed for DFO to understand the project. A DFO biologist will be assigned to project and will confirm whether an authorization is required to carry on the project works, undertaking or activity. If serious harm cannot be avoided and an authorization is required, they will work with the applicant to develop an offsetting plan and submission of the an "Application for Paragraph 35(2)(b) Fisheries Act Authorization" Prior to the issuance of an authorization, a Letter of Credit must be provided to cover the cost for implementing all elements of an offsetting plan, including monitoring. Two line limits apply to DFO staff when reviewing applications. DFO has 60 calendar days to determine if an application is complete and notify the applicant from the date of receipt. The Minister has 90 days to use an authorization or notify the applicant that the authorization is denied from the date of the notification that the application is complete. The time limits for the review of the application may cease to apply under specific circumstances apply, see Section Schedule 1. Subsection 8(1) of the Fisheries Act Application Regulations for specifics.

5.7 Other Impacts From Quarry Activity

The key activities of the quarry development and operation that have the potential to impact on the natural features noted above include:

- clearing of forest cover
- road construction
- noise attenuation barriers
- excavation; noise, dust and heavy equipment
- sediment and construction runoff
- change of grading and landform
- blasting
- road or accidental mortality

5.7.1 Clearing of Vegetation

The logging of the forest will occur prior to overburden stripping in each phase. The progressive rehabilitation plan shows a phasing from south to north with rehabilitation occurring after each of the nine phases. Forest clearing can remove nesting sites of breeding birds protected under the Migratory Birds Convention Act. It is recommended that clearing occur outside of the peak breeding bird season, acknowledged by Environment Canada to be from April 15th to August 15th. If clearing must be conducting

during this time, a qualified bird biologist should conduct a nest search for any evidence of active nests within the area to be cleared.

Clearing should occur in phases and only as necessary for the active extraction operations. This will minimize the area of cleared forest and maintain habitat for eastern wood-pewee, wood thrush, eastern whip-poor-will, common nighthawk, deer and other wildlife and plants throughout the life of the quarry.

The recommended rehabilitation of the quarry after extraction in each phase includes forests, wetland, and establishing open field meadow habitats. As well, one large area of land in the central and northern portions of the Site will be rehabilitated to agriculture to reinstate historical farming use of the Site. The open field/meadows will be seeded with native grasses but also be allowed to re-establish naturally. This will reinstate natural pre-construction forest cover and connectivity/linkages in that area while maintaining the existing biodiversity provided by the other habitat types.

There will be a loss of woodland habitat due to clearing within each phase. The plan includes a number of phases that cover relatively small areas. In this way the amount of habitat loss and vegetation clearing will be limited at any one time (25 hectares on average). As the progressive rehab continues in subsequent phases the age structure of the vegetation, in particular the forest blocks will be staggered, creating a mixture of early-late successional forest habitat.

Connectivity of forested areas will be maintained throughout the Site over the different phases. A linear forested block will connect the proposed forest on the south end of the Site to the forest on the eastern edge of the Site. This will act as an important long term corridor for wildlife moving east-west, once established.

5.7.2 Road Construction

The current access from Nichols Line will be utilized as the main entrance/exit to the quarry over its life time. Internal roads will be constructed as required to accommodate the various operational and rehabilitation activities throughout the life of the quarry. Any internal road deemed to be no longer required for agriculture, forestry, or aggregate use, will be eliminated.

5.7.3 Noise Attenuation Barriers

Noise attenuation barriers will be used to mitigate potential noise impacts to adjacent sensitive receptors. As stated in the Noise Report completed by Valcoustics Canada Ltd.

(2017), a noise attenuation barrier means a wall, berm, wall/berm combination or similar structure. The minimum surface density (face weight) of a sound barrier is 20 Kg/m^2. The barrier must be structurally sound, appropriately designed to withstand wind and snow load, and constructed without cracks or surface gaps. Any gaps under the barrier that are necessary for drainage purposes should be minimized and localized, so that the acoustical performance of the barrier is marinated. Sound barriers can be constructed from a variety of materials including wood, masonry, composites, etc. provided the above requirements are met. For the proposed quarry, consideration is being given to using berms, containers, straw bales and noise curtains for the sound barriers.

Noise Attenuation Barriers will be constructed in stages according to the phases of operation. As an added measure of protection, there will be a designated area in the eastern portion of Phase 2 and 4a closest to the resident located at 2670 Sparrow Lake Road where drilling and hauling will not occur at the same time.

If alternate noise mitigation measures are to be implemented, they are to be reviewed by a qualified acoustical consultant to ensure the MOECC's noise guideline limits will be met.

5.7.4 Excavation; Noise, Dust and Heavy Equipment

No sensitive bird species or colonies (great blue heron) or wildlife areas are present in this area that would be directly or indirectly impacted by extraction activities and the noise generated.

The noise from quarries and generation of dust can also impact on wildlife populations. However there were no significant or sensitive wildlife found within 120m of the Site. As private lands are located on all sides of the Site, NEA was unable to access some of these areas for our field inventories. No records of sensitive species including great-blue heron colonies or nesting hawks were identified within 1km of the licensed area that may be impacted by noise or dust. Currently licensed quarries are found on either side of the Site (east and west).

5.7.5 Sediment/Construction Runoff

The Class A Category 2 license is for extraction below the existing water table. As each Phase is extracted, dewatering by natural seepage and gravity from the rock face will occur. As discussed in the MTE 2014 Report (MTE, November 28, 2014), there will be no mechanical devices used to manage or control the combined surface water and ground water drainage from the excavation area.

Surface water management ponds and other best management practices will be incorporated into the operation to management surface water during extraction. The hydrology report and operation plan provides details on the sediment control measures (MTE, November 28, 2014).

A comprehensive sediment and erosion control plan should be developed for each phase of the extraction and progressive rehabilitation (See Section 9.5 for a list of requirements to be included in the Sediment and Erosion Control Plan). An evaluation of the erosion potential should be developed with an understanding of the soil erodibility, surface slope and gradients, length of slopes, and local precipitation. A professional biologist should be consulted during the development of the plan.

5.7.6 Change of Grading and Landforms

The change of grading and landforms to the Site will temporarily lead to a loss of wildlife habitat and vegetation cover within that particular phase area. The rehabilitation plan has been designed to replace the habitat that previously existed and enhance what existed prior to the extraction (wetland, forest area, field habitat). The progressive rehabilitation plan will allow for species to find suitable habitat on other sections of the Site throughout the extraction processes while it is occurring on one.

As the depth of extraction (Shadow Lake Formation) is reached, top soil/overburden and organic material will be spread at variable depths. Refer to Site Plans page 5 of 8 for final rehabilitation elevations. Habitat will be enhanced and will create variable topography which will promote and contribute to micro habitat development, topsoil development and moisture retention.

5.7.7 Blasting

Blasting will occur on the Site as the quarry stone is extracted. Impacts on wildlife, sensitive receptors and fish can occur from blasting activities. As there are several species at risk on the property, disturbance to nesting and behaviour patterns can occur. Generally blasting should be limited to a minimum during the peak breeding bird season (April 15th – July 15th). Blasts do tend to be very short events with disturbance from the noise predominantly. Although birds such as herons are more sensitive to these sudden sharp noises, most birds are adaptable and are more prone to abandon from repeatedly being disturbed by sharp and random noises. There are no specific sensitive receptors, such as great-blue heron colonies within 500 m of the study area.

All blasting activities will follow the project blasting plan detailed in the blasting impact analysis completed by Explotech (2017). All blasting activities will incorporate as many Department of Fisheries and Oceans Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters mitigation measures as possible (Wright & Hopky, 1998). NEA has provided the relevant project guidelines in the Mitigation Section 10.

5.7.8 Road or Accidental Mortality

The quarry staff will be trained by a qualified biologist in the identification and proper handling for the relocation of turtles (snapping turtle, eastern musk turtle and spotted turtle) or snakes (eastern hog-nosed snake, eastern ribbonsnake and eastern massasauga rattlesnake), out of harm's way if they are found within the quarry operating area or roads. Silt fencing (restrictive fencing) will be installed to limit access to active excavation areas to limit these species at risk from accessing the site including stock piles, road edges or cover.

Signs will be posted and information provided to individuals entering the quarry site to identify the presence of the Species at Risk.

6.0 Rehabilitation Plan

6.1 Overview of Rehabilitation Plan

The rehabilitation plan prepared for this quarry operation includes reforestation, creating field meadows, wetland and agricultural lands. This will reinstate the existing vegetation cover and roughly equal percentage of each habitat. The diversity of mixed forest, meadow and wetland habitat will reinstate the variety of plants and wildlife habitat currently present.

The rehabilitation plan will include use of stockpiled topsoil, overburden and unmarketable limestone to create stable slopes on the vertical face. Due to the thin layer of overburden in this area sufficient material to cover the entire excavation area may not be possible. This plan will reconnect the forest to the east and proposed forest pocket to the west providing a wildlife corridor across the Site. The area should be levelled with unmarketable limestone and soils from the excavation process to fill in fissures and fractures for the creation of forested areas and open field meadows. This material will contain a seed bank that will regenerate in those areas. Seeding with a native seed mixture will also be conducted as part of the rehabilitation plan. The creation of forested areas, open field meadows and wetland in the central portion of the Site will create a wide variety of habitats post-rehabilitation. The agricultural lands can be planted in a variety of crops,

which could include hayfields. Those areas will provide habitat for several grassland species, currently not found on this Site; namely bobolink and meadowlark and potentially other grassland birds. In order to prevent harm to nesting grassland birds including SAR (bobolink and meadowlark) cutting restrictions in the peak breeding bird season (April 15th –August 15th) will be implemented.

The overall details of the final rehabilitation plan are shown on the large scale submitted drawings (5).

Four forested areas will be created as part of the rehabilitation plan. The size and shape vary depending on each pocket. Approximately one third of the Site will be re-forested with less than a third being open field meadow habitat and wetland covering approximately 8 Hectares. The remainder of the Site will be comprised of agricultural fields.

The forested areas will be comprised of sugar maple, eastern white pine, eastern hemlock, eastern white cedar, white birch, red oak and red maple. It is recommended that 70% of the species within each forest pocket be planted in coniferous and 30% be deciduous, to re-establish what existed prior to clearing. The pockets will be arranged in order to re-establish the corridors that existed prior to excavation. A forest corridor with a minimum of 100 m width will connect the east and west sides of the Site to act as a linkage across the Site. This has been located along the new drainage channel. Available topsoil, overburden and organic material soils will be utilized and organic material will be spread at variable depths on the forest pockets and a thin layer of soil spread 15 meters beyond the forest blocks in all directions to create successive habitats.

The open field meadow habitats will be planted with a native grass mix to diversify the wildlife habitat on the Site. Meadow habitats are currently limited to cleared areas, agricultural fields and open disturbed habitats in the licensed area.

The new drainage channel will continue to run through the site from the north to south and contain wetland and forested sections. This will maintain the runoff to the provincially significant wetland.

Final quarry faces and limits of extraction will be progressively sloped (infilling and cut/fill). Overburden and topsoil applied, graded, seeded with grass seed conducive to tree planting and planted with clumps of trees, sloping of final excavation faces will be at a minimum 2:1. Overburden and topsoil removed for extractive purposes will be spread over the final extractive floor, graded, seeded with grass seed conducive to pasturing and planting of trees and planted with stands of trees. Material may be imported that includes

biodegradable materials such as soil and organic soil. This will be used for rehabilitation purposes and for enhancing the agricultural fields.

This rehabilitation plan will reinstate the natural wildlife corridors, wildlife habitat and native forest on the Site post-extraction.

Habitat for Species at Risk will be enhanced including habitat for whip-poor-will and common nighthawk. The re-forested areas will be comprised of similar species to what existed prior to the quarry operation in order to attract whip-poor-will and common nighthawk back into that area. The mixture of open field meadow and forested habitats will provide suitable habitat for these species. Phasing will minimize the cleared and active quarry area to around 25 ha at any given point, with the existing habitat in future phases left untouched until the phase is reached, and progressive rehabilitation re-creating habitats, all at the same time.

6.2 Rare Vegetation Salvage Plan

As mentioned in Section 5.3, there are eight (8) regionally rare species were found within the proposed licensed area. The presence of rare species on this Site is due to the diversity of community types providing opportunity for many species. In order to mitigate any potential impacts to these species, re-location is recommended when possible. The need for a salvage plan to provide for the continued presence of these species in the watershed and transplanting the specimens will be discussed with OMNRF.

6.3 Fish Salvage Plan

To avoid serious impacts to individual fish, they will be removed from all watercourses prior to any in-water work. Specifically, the proposed quarry extraction requires removal and relocation of Watercourse 1, which directly supports fish. To avoid the mortality of individual fish from the extraction process, mitigation measures must be implemented, including a Fish Salvage Plan.

<u>Fish Salvage Plan Requirements</u>

1. A professional biologist will design and implement a site specific fish salvage plan based on final project detailed design for the fish bearing watercourses present at the time of extraction.
2. The plan will incorporate the removal and relocation of fish occupying the fish habitat within the extraction area. Fish may need to be relocated again, should flooding occur on the site.

3. Fish will be relocated to similar habitat of equal or greater value within the same watershed.
4. Fish salvage efforts should not be conducted during the winter or ice conditions to enhance individual survivorship.
5. Salvaged fish habitat will be isolated to prevent the movement of fish back into the habitat using fish screens, berms or site specific appropriate measures that maintain flow and prevent fish movement.

A Fish Salvage Plan will be submitted to the MNRF for approval prior to extraction in Phase 3B.

NEA performed a DFO Self-Assessment to determine the projects potential to cause serious harm to fish and fish habitat in Section 1.1.1. Refer to the self-assessment section for fish impact discussion and findings.

6.4 Species at Risk Management Plan

6.4.1 Herpetozoa (Snakes and Turtles with Exception of Eastern Hog-nosed Snake)

The presence of snapping turtle was not confirmed through our field surveys. However the ponded area and swamp north of the Site on lands owned by the County of Simcoe (Community 1) would provide habitat for this species.

To protect any turtles (Snapping turtle, eastern musk, spotted turtle) or snakes (eastern ribbonsnake and eastern massasauga rattlesnake) that may enter the extracting area, the following recommendations are made.

- A biologist check the initial excavation phase area to be stripped and excavated prior to the overburden removal and provide Species At Risk training to quarry staff
- Quarry staff to be briefed on the Species at Risk that may be found in the area and contingency/response protocols established and reviewed (during initial inspection).
- The contingency/response protocols can include the need for additional visual searches of the quarry during nesting season. If there are multiple sightings of turtles/snakes, the need for restrictive fencing can be discussed with OMNRF.
- Daily checks of wetlands and adjacent lands be conducted during the turtle's nesting season (early to mid-summer) by trained site staff.
- Daily checks of the area should be conducted in search for SAR snakes.

- If a turtle/snake is found, the species is to be confirmed and avoided temporarily or the turtle/snake be relocated outside the active quarry area. OMNRF will be contacted regarding any Species at Risk sightings and issues.
- All persons who enter the site be provided Information on Species at Risk, this includes all employees or contractors on site
- The licensee shall install signs on site at suitable locations to identify the possible presence of snapping turtle, eastern musk turtle, spotted turtle, eastern hog-nosed snake, eastern ribbonsnake and eastern massasauga rattlesnake).
- The licensee will keep records of the search dates, personnel and times and action taken in a log book

It is easier for birds to avoid excavation areas and equipment as they are more mobile than reptiles, however additional information on bird species such as whip-poor-will, common nighthawk, Canada warbler, olive-sided flycatcher, red-headed woodpecker, eastern wood-pewee and wood thrush will also be provided to the operator. It is recommended that clearing and grubbing be done outside of the peak breeding bird window (April 15th – August 15th) and if clearing must be conducting during this timing window, a qualified bird biologist should conduct a nest search for any evidence of active nests within the area to cleared.

6.4.2 Whip-poor-will

An analysis of the current vegetation community types in the licensed area found that the Site is mostly forested with small openings, which provides habitat for whip-poor-will. The rehabilitation plan's key objective will be to recreate whip-poor-will habitat in the forest and open field meadows. Although other measures and features are included in the rehabilitation, the reforestation and open field meadows are designed specifically for whip-poor-will habitat. The forest and open field meadows will however attract other species and provide habitat for many of the wildlife species currently found on the Site.

The overlay of the approximate centre of the territories (Category 2 GHD habitat) with the phased rehabilitation plan show that the following number of territories or part of a territory will be impacted by the proposed aggregate extraction (Figure 4-Level 1).

The main impact from the aggregate operation will be the temporary loss of habitat for those pairs. The operating life of each phase is estimated to be 5-15 years, and the tonnage could be up to 500 000 tons under a Class A license. As such the loss of habitat will be phased with a plan to rehabilitate progressively to pre-disturbance conditions in terms of the habitat type.

All of the approximate centres of the territories of the birds identified overlap the adjacent properties, with the exception of the one pair in the centre of the licensed area. The Category 2 and 3 habitat however does overlap the properties to the east and west. Although this aggregate license will include rehabilitation measures, it is unclear if the licensed quarries to the east and west have any measures in place to recreate whip-poor-will habitat. The rehabilitation measures undertaken on the Site are designed to maximize the habitat for whip-poor-wills The Site on its own could still support 4-8 pairs of whip-poor-wills, post-rehabilitation, in our opinion.

Whip-poor-will habitat in general is a combination of forest for nesting, roosting and some foraging and openings (rock, field, pasture, wetlands) for foraging. The rehabilitation plan was designed to maintain a similar percentage of forest versus openings and within the habitat description criteria found in the literature. Recreating the conditions for whip-poor-wills is possible based on the habitat requirements. Wilson and Watts (2008) found birds used clear cut areas in timber harvesting sites to a certain distance and recommended smaller tracts be cut to maximize the ratio of forest edge and regenerating cutover areas. This has been our observation as well, where high densities of whip-poor-will are found using the new forest edge and open space created by clear-cut areas, less than 3 years old.

To ensure all key aspects of the territory requirements are recreated, the following is a list of the criteria applied.

- Maximize forest area (min. 33% forest cover post-rehab)
- Maximize length of forest edge perimeter for nesting, cover and roosting
- New forest blocks with different forest types, similar to current species composition and diversity (pure conifer stands, mixed stands and deciduous) with 2-3 yr. old stock
- Align forest blocks to keep mix of open foraging and woodland nesting habitat
- 100m distances created of open meadow for foraging
- All forest outside of licensed area will remain on Site, currently used as part of territories of known pairs in the larger area.
- Plant meadow habitat with a native meadow mix with species pollinated by moths and maximize all life stages of moths
- Woody debris/leaf litter accumulation and regeneration between forest blocks over time
- Woody debris placed in forests, to be used as roost sites
- Plant juniper in some of open space to add to diversity

- 3-9 acre territories overlapping licensed area to be recreated by adding habitat elements removed
- Forest blocks oriented to allow penetration of moonlight for better foraging
- Invasive species monitoring and occasional brushing of undesired species such as sumac, weeds

6.4.3 Butternut

Six retainable (Category 2) butternut trees were found within the study area. Butternut trees were identified in Communities 2, 3, 4 and 7 (Figure 2 - Level 1 report). The butternut health assessment found four (4) trees within the proposed extraction area that were determined to be Category 2 (retainable) under the OMNRF health matrix.

Based on the diameter of the trees, the ESA regulation requires different ratios of replacement. For the six Category 2 trees the total replacement/compensation number is 15.

The five small trees (less than 1 cm dbh) suckering from the cut stumps cannot be relocated, which is a typical compensation measure. The small trees will be replaced at a 2:1 ratio, as a result. The sixth tree at 6 cm dbh requires a 5:1 ratio.

Regulation 248 allows up to 10 trees to be removed with applicable compensation and the completion of the Notice of Activity form. OMNRF has 30 days to comment and/or audit the butternut assessment.

The recommended location for the compensation plantings is within the 90 m buffer at the north end of the licensed area. This is the best location for the following reasons:

- This area is not within the extraction area of the operation,
- This area is immediately adjacent to the County forest where butternuts were found.
- This area contains ideal habitat with limestone based soils, sandy topsoil, moist soils, partially forested with gaps in the canopy and a regenerating community.
- This area is found in a good long term location for the butternut trees as no work will occur in this part of the Site.
- Access for long term monitoring is available

The trees will be planted using standard planting techniques and monitored annually for 5 years to ensure they establish and grow. An annual monitoring report will be sent OMNRF as per the Notice of Activity. Trees will be re-assessed prior to clearing in the case that the health of the tree has changed since the last time it was assessed.

6.4.4 Eastern Hog-nosed Snake

The eastern hog-nosed snake is listed as threatened in Ontario (COSSARO, 2017) and threatened in Canada (COSEWIC, 2017; SARA, 2017). It is also protected in Ontario under the Endangered Species Act (May 14, 2013). The ESA affords protection to the animal and its habitat. The hog-nosed snake is found throughout central Ontario in a variety of habitats on and off the Shield. Peterborough, Simcoe, Muskoka, Kawartha Lakes, Haliburton and Parry Sound are within the range of this species.

This species habitat preference includes sandy areas with fields and forests. Sandy areas are required for hibernacula and nest sites. Individual snakes have a broad territory and can travel several kilometres over a period of weeks. The snakes are active foragers, hunting mostly at night for toads, which make up almost 90% of their diet. Toads are common in a variety of habitats from rural areas and forests to wetlands and open fields. They are most active at night when calling activity, mating and foraging occurs.

The key habitat features required by hog-nosed snake include:

- Sandy areas for nest sites
- Sandy and rocky sites for diurnal dens and overwintering hibernacula
- Population of toads
- Forest and field habitats for foraging
- Large contiguous habitat with few roads

The main impacts responsible for the decline of snakes in Ontario and throughout its range include persecution by public, road mortality and forest fragmentation.

The proposed quarry extraction area will encompass approximately 118 ha of limestone rock, field, coniferous forest, deciduous forest and former cattle pasture. Of these habitats, the fields and forested areas would be the preferred habitat for the snakes. Toads which are the main prey item are also found in these habitats.

The maintenance of hog-nosed snake habitat and long term protection for the local population can be achieved through limiting the disturbed area, mitigative measures, operational procedures and habitat enhancement measures as part of the progressive rehabilitation.

The rehabilitation plan includes an end use of the site as meadow and forest, as currently exists on the site.

The creation of blocks of forest and open field as part of the rehabilitation plan will also recreate a diversity of habitats for this species. It is recommended that the forest blocks include two features specifically designed for snakes and also turtles. This includes a sand feature approximately 60 cm deep and 3 x 3 metres that will provide a possible nesting site. Many snakes and turtles utilize sandy areas for nest sites. The second feature is the construction of snake hibernacula and rock piles using available limestone blocks. Two sand piles and two hibernacula will be constructed as part of the rehabilitation plan.

6.5 Wetland Compensation Plan

The provincially significant wetland is protected and is entirely outside the extraction area with a minimum 30 m setback. The remaining wetlands are unevaluated. The wetland north of the Site on lands owned by the County of Simcoe will be protected using a 90 m buffer. The remaining unevaluated wetlands are within the extraction area for the proposed license. To ensure that the ecological functions of those wetlands is re-instated after extraction of those phases of the operation, an analysis of the existing wetlands was conducted for the purpose of designing the rehabilitation plan.

6.5.1 Wetland Creation

The current habitat includes swamps and meadow marshes, approximately 8 ha. The current wetlands on-Site are located along Watercourse 1 and provide wildlife habitat, flood attenuation, water quality improvements and habitat for a diversity of plants and trees. The rehabilitation plan includes the creation of wetlands with the same ecological functions but also other enhanced functions. This is proposed at the south end of the new drainage channel in Phases 2, 3A, and 4A. The benefit to the downstream watershed will be the attenuation of runoff/flooding, filtering of fine sediments and wildlife functions.

It is our plan to create a more diverse wetland plant community in the compensatory wetland that will include:

- All organic soils, topsoil and vegetation within the existing wetlands being removed
- Amphibian breeding habitat in vernal pools within compensatory wetland
- Wildlife habitat for amphibians, reptiles, birds and mammals
- Mixture of meadow marsh, cattail marsh, willow thicket swamp and treed swamp in compensation area
- Habitat for breeding and overwintering for turtles, frogs and salamanders
- Woody debris as basking, cover and nesting sites
- Contiguous wetland with access of wildlife to water source, habitat, nesting sites

and other natural habitats (forested valley, fields)

The criteria to be applied to the design of the wetlands will be:

1. Create a shallow area with year-round to seasonal water levels.
2. Use shallow slope of final grade of quarry floor to assist in trapping water and allowing ponding. Allow water table to maintain deeper areas
3. Create deeper pools or cut channels (up to 1.3 m) to facilitate flooding that would permit wood frog breeding and green frog habitat.
4. Transplant organics from the wetlands to be removed in each phase into the new compensation area after completion of that phase and spread in variable depths to 0.3 to 0.5 m on average.
5. Maintain input of surface water from snowmelt/runoff from catchment area upstream and intercept groundwater table.
6. Maintain open meadow around ponds for amphibian habitat
7. Place logs in water to act as sunning sites for frogs and possible turtles.
8. Design with low berming along edges and greater than 5:1 slopes.
9. Size wetland to compensate for a ratio of greater than 1:1.
10. Design hydrological regime for seasonal flooding, and permanent ponds
11. Maintain water in parts of wetland, particularly the vernal pools for up to 15 weeks.
12. Seed area with native meadow mix to create marsh habitats
13. Create pit and mound topography in portions and plant mounds with native swamp tree and shrub species, to create a hummocky swamp condition.

The new wetland will be constructed in phases as the progressive rehabilitation occurs in that area. Wetlands will be constructed during the rehabilitation of phases 2, 3A and 4A. The wetland will overlap the new drainage channel to take advantage of spring flooding. As the new drainage channel is progressively constructed, water will flow through each phase to the new wetland areas). This water will be in the form of groundwater from the active quarry face and surface water collected on the quarry floor from spring runoff and rain events. The wetland soils and grading in the wetland rehabilitation areas will hold the moisture and create conditions suitable for wetland growth and establishment.

This design will also allow time for the new wetlands to stabilize and vegetation to establish. Plantings will be completed and all grading surrounding the wetland completed in the fall season. This will limit the impacts of grading and sedimentation on the wetland and allow the water to stabilize and sediments to settle out. This will allow frogs time to find the ponds and use it as a new breeding site in the next spring season. From past experience, the wetland will attract frogs naturally and there is no need to transfer adults or tadpoles from other sites. The watercourse already acts as a corridor for movement of

aquatic species such as newts and frogs.

Natural regeneration, seeding, planting and transplanting are the preferred method of vegetation establishment in the new wetland. The seed bank, transplanted vegetation and natural seed dispersal will allow this area to regenerate quickly (by first summer) in a high diversity of wetland vegetation.

The clearing and grading for each phase and the Site preparation activities must occur outside the breeding period of the frogs in the existing wetlands on Site. This will minimize the loss of adult and overwintering tadpoles and be conducted when those areas are virtually empty of spring frog species. Clearing and grading should occur outside the March 30th-July 30th period. The wetland should also not be cleared and trees cut within the peak breeding bird nesting season of April 15th to August 15th. If clearing must be conducting during this time a qualified bird biologist should conduct a nest search for any evidence of active nests within the area to be cleared.

The new wetlands will be constructed on the Shadow Lake Formation which is composed of Shale bedrock. This bedrock has a low permeability, which will allow wetlands to hold water. In the event that unexpected fissures or crevasses are encountered, they will be filled with waste rock and soil and can be compacted using heavy equipment. There is a seasonal high water table that will allow the area to flood seasonally from groundwater, in addition to the surface water sources. Final grades of the rock elevation and maintaining a grade that allows water to pond and not drain out are key to the success of the wetland.

6.6 Watercourse and Fish Habitat Rehabilitation Plan

Watercourse 1 provided direct fish habitat for baitfish species that support a downstream recreational fishery. The rehabilitation plan includes the creation of a new drainage channel with the same ecological and fish habitat functions as Watercourse 1 but also other enhanced functions, such as upstream connection for non-jumping fish species to the north inlet via a habitat linkage, overwintering habitat, enhanced cover and in-stream habitat structure complexity.

The rehabilitation plan will have the new drainage channel designed as a sinuous channel with both high and low flow channels to accommodate seasonal water level fluctuations. The average channel wetted width will vary between be 0.8 -2.5 m and provide an average water depth of 0.1-1.5m.

The channel morphology will vary based on habitat type. Five channel cross-sections have been selected to ensure a diversity of habitat types and they include; typical stream, pool,

riffle, shallow wetland #1 (pit and mounds) and shallow wetland #2 (10:1 slope).

The northern portion of the new drainage channel upstream of the proposed wetlands (Phase 3a, 3b, 4d, 4c, 4b) will be designed with riffle/run, pool and typical stream cross sections. Moving south into the created wetlands the channel will be designed with shallow wetland #1 -pit and mounds and shallow wetland #2-10:1 slope to provide flooding shallow waters for the wetland vegetation. In this area, one or more channel restrictions will be installed to back up water and increase the water retention time to create suitable wetland hydraulic conditions. In addition, smaller tributaries or veins may be created off the main stream to deliver surface flows throughout the entire wetland area. A professional geomorphologist will be consulted on the new drainage channel design to ensure the recommended channel morphology design and available flows will provide the desired habitat described within the rehabilitation plan.

Multiple large pools (1-3m deep) will be created along the new drainage channel as overwintering habitat for fish, invertebrates and general aquatic life, both upstream and downstream of the wetland. The channel substrate and morphology will reflect that of habitat found downstream: silt, sand, organic material with sorted sections of gravel, cobble and sparse boulders.

Sweepers and inverted root wads (i.e. woody debris) will be placed in the wetland and riparian edge habitat of the new drainage channel to increase aquatic habitat complexity and micro-habitat diversity. The large on-line wetland complex will incorporate the adjacent quarry outlet waters and provide high quality nursery, foraging and breeding and feeding habitat for fish.

Fascines:
The rope-like bundle of live native willow cuttings will be used as a stream bank erosion control measure and a habitat improvement measures. Fascines will be installed along the entire length of both banks of the new drainage channel, as a part of the phased progressive rehabilitation. An information sheet has been provided as Appendix I.

Sweepers:
Sweeper trees mimic natural fallen trees and provide habitat for aquatic and terrestrial insects. The tree crown provided in-stream cover and food in the form of aquatic insects. Entire cedar trees (crown, trunk and roots) should be salvaged and stock piled to be used as sweeper trees. Sweeper trees should be installed along the entire new drainage channel. An information sheet has been provided as Appendix II.

Standing Root Wads/Stumps:
Root wads will be installed within the wetland habitat between the high and low flow channel elevations to create in-water habitat complexity and diversity, as well as provide terrestrial habitat for insects and birds. Root wads mimic dead trees, "snags", and storm damage that would be present in a natural wetland. An information sheet has been provided as Appendix III.

The bottom elevation of the new drainage channel will match the existing inlet and outlet of Watercourse 1 to allow fish movement over multiple seasons. The riparian edge will be a minimum of 15m wide and contiguous along the entire new drainage channel, including agricultural lands. The riparian edge to be planted with local native plant species common within the watershed (as per wetland and vegetation recommendations provided within this report). To minimize stream bank erosion and build the riparian edge fascines and riparian buffer plantings will be installed during the spring and or fall of each progressive rehabilitation phase.

Buffer Plantings:
Each phase will be progressively rehabilitated as per the Stages of Operation Plans (Refer to sheets 6, 7, and 8 of the Site Plans). The riparian zone will be planted using native shrub and trees species for a minimum of 30m from the high water mark unless specified otherwise within the rehabilitation plan (i.e. wetland and forest compensation plans).

7.0 Mitigation

7.1 General

The Project Manager and Contractor are obligated to ensure that all mitigation measures are strictly observed.

All measures must be carried out to the satisfaction of Ontario Ministry of Natural Recourse and Forestry and any agencies they deem necessary.

Take proactive measures to prevent any construction debris and deleterious substances such as soil and other debris from entering any off-Site natural features.

7.2 Work Timing Restrictions

1. No in-water works between March 15th and July 15th to protect spring spawning fish species and their life history processes.
2. All tree clearing required for construction access prior to extraction should be completed outside the Peak Breeding Bird season of April 15th to August 15th as per Environment Canada guidelines. If clearing must be conducting during this time, a qualified bird biologist should conduct a nest search for any evidence of active nests within the area to be cleared.
3. Cutting restrictions during Peak Breeding Bird season (April 15th-August 15th) may be placed on agricultural activities if hay crops are grown on-Site.
4. The clearing and grading of existing wetlands on-Site for each phase must occur outside the breeding period of frogs (March 30th -July 30th).
5. Excavation and blasting on the rock ledge in Phase 3A and Phase 3B must occur outside the snake hibernacula period (October 1-March 31). If snakes are encountered on this rock ledge, work should cease in that area until MNRF is contacted. Site personnel must be aware of any concentrations of snakes during extraction of this ledge and the rock barren.

7.3 Site Access

1. Check heavy equipment, machinery and tools prior to entering the work site to ensure they are clean, and free of leaks.

2. All heavy equipment, machinery, and tools required for the work shall be regularly inspected and maintained to avoid leakage of fuels and liquids, and shall be stored in

a manner that prevents any deleterious substance from entering the soil, or nearby watercourses.

3. All heavy equipment, machinery and tools used or maintained for the purpose of this project shall be operated in a manner that prevents any deleterious substance from entering soil or nearby waterbodies.

4. Any stockpiled materials will be stored and stabilized away from the water above the high water mark at a minimum of 30m where possible.

5. Adhere to noise requirements as per the Noise Mitigation Measures identified in the Noise Report by Valcoustics (2017).

6. The Project Manager/Contractor shall restrict any deleterious substances asdefined in the Canadian Fisheries Act (such as silt), caused by the work from entering off-Site waterbodies.

7. Site access to be limited to the designated access roads.

7.4 Refuelling and Spill Response

1. Vehicle and equipment refuelling shall be conducted on impermeable pads/pans within the defined staging area.

2. An emergency spill kit shall be kept on site, and employed immediately should a spill occur. In the case of a spill, the Ontario Spill Action Center shall be notified immediately at 1-800-268-6060. All provincial and federal regulations shall be adhered to.

3. Maintain an adequate supply of clean-up materials on-Site. Construction crews will be fully trained in their use to ensure timely and effective responses to spill incidents.

4. Refuelling and maintenance of equipment shall be conducted off slopes and away from water bodies on impermeable pads to allow full containment of spills at a recommended distance of a minimum of 30 meters from a waterbody or wetland.

7.5 Sediment and Erosion Control Plan

A Sediment and Erosion Control Plan will be required prior to Site preparation. The following items should be included in the plan:

1. Sediment control measures shall be installed prior to site preparation, and shall be maintained throughout the project and each Phase to prevent the entry/outward flow of sediment into off-Site waterbodies.

2. At a minimum all sediment and erosion control measures shall be installed, maintained and removed in accordance with the Ontario Provincial Standard Specification (OPSS) standards for Temporary Erosion and Sediment Control Measures (OPSS 577).

3. All sediment and erosion control measures shall be inspected daily during the extraction by the site inspector and periodically thereafter to ensure they are functioning properly, maintained and upgraded as required.

4. In the event that sediment and erosion control measures are not functioning, the construction supervisor shall address the sediment/erosion problem, which could include alternative control measures.

5. Remove accumulated sediment prior to removing sediment control measures and in a way that prevents the escape or suspension of sediments.

6. In the event the temporary erosion and sediment control measures fail, a contingency plan will be in place, kept on-Site and followed. Contingency measure(s) will include a list of key personal to be contacted. Additional erosion and sediment control materials (i.e. sand bags, stop logs, straw bales, erosion control blankets, heavily duty silt fence shall be stockpiled and easily accessible from the Site in the event of an emergency.

7. Fascines can be used as a stream bank erosion control measure and a habitat improvement measures. Fascines will be installed along the entire length of both banks of the new drainage channel, as a part of the phased progressive rehabilitation. An information sheet has been provided as Appendix I.

7.6 Fish Salvage

The proposed quarry requires removal and relocation of Watercourse 1 which directly supports fish. To avoid the mortality of individual fish from the extraction process, the following mitigation measures will be implemented prior to extraction.

1. A professional biologist will design and implement a Fish Salvage Plan prior to extraction in Phase 3B.
2. The plan will incorporate the removal and relocation of fish occupying the fish habitat within the extraction area.
3. Fish will be relocated to similar habitat of equal or greater value within the same watershed.
4. Fish salvage efforts should not be conducted during the winter or ice conditions to enhance individual survivorship.
5. Salvaged fish habitat will be isolated to prevent the movement of fish back into the habitat using fish screens, berms or site specific appropriate measures that maintain flow and prevent fish movement.
6. Fish collection permits may be required by the Ministry of Natural Resources and Forestry.
7. Consultation with the DFO will be required to determine if a Fisheries Act Authorization/offsetting will be required.

7.7 Blasting

1. Blasting shall be done in accordance with the Blast Impact Analysis completed by Explotech (2017).
2. Whenever feasible, schedule different noisy activities (e.g. blasting and excavating) to occur at the same time.

3. Provide mitigation measures for noise and dust suppression to minimize airborne dust during excavating activities, prior to clearing, backfilling, compacting, or grading, and during blasting.

4. Maintain noise-reduction devices (e.g. mufflers) in good working order on vehicles and equipment.

5. Conduct blasting to minimize the occurrence and velocity of flyrock (e.g. blast mats) and ground vibration to safe levels.

6. If possible, subdivide large charges into a series of smaller discrete detonations, using time-delay detonation to reduce to a series of smaller discrete events.

7. Blasting mats to be used to ensure the 100kPa overpressure criteria is achieved.

8. A silt curtain will be deployed to disrupt shock waves.

9. Blasting will be avoided on windy days to minimize the suspension of fine sediment into the water column and ensure sediment control measures are not disturbed.

10. The removed blasting material (bedrock) will be removed from the site and stored a minimum of 30m from any watercourse high water mark.

11. Where possible, blasting should occur outside the breeding bird season to avoid negative impact to local breeding birds.

12. When blasting close to active spawning beds, blasting should occur outside the spawning period for fish (March-15 - July 15)

Blasting Guidelines, per DFO Guidelines (Wright & Hopky, 1998)

1. Blasting guidelines are intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives. The use of confined or, in particular, unconfined explosives in or near Canadian fisheries waters is discouraged, and proponents are encouraged to utilize other potentially less destructive methods wherever possible.

2. No use of ammonium nitrate-fuel oil mixtures occurs in or near water due to the production of toxic by-products (ammonia). ***Note:*** *The deposit of deleterious substances into waters frequented by fish is prohibited under Section 34(1) of the Fisheries Act, unless otherwise permitted by regulation. There is no regulation pursuant to the Fisheries Act that permits the deposit of by-products resulting from the use of ammonium nitrate-fuel oil mixtures.*

3. After loading a charge in a hole, the hole is to be back-filled (stemmed) with angular gravel to the level of the substrate/water interface or the hole collapsed to confine the force of the explosion to the formation being fractured. The angular gravel is to have a particle size of approximately $1/12^{th}$ the diameter of the borehole.

4. All “shock-tubes" and detonation wires are to be recovered and removed after each blast.

5. No explosive is to be detonated in or near fish habitat that produces or is likely to produce an instantaneous pressure change (i.e. overpressure) greater than 100 kPa (14.5 psi) in the swim bladder of a fish. ***Notes:*** *For confined explosives, setback distances from the land-water interface (e.g. the shoreline), or burial depths from fish habitat (e.g. from under the riverbed) that will ensure that explosive charges meet the 100 kPa overpressure guidelines.*

6. If a confined explosive is to be detonated close to the substrate-water interface (such as in trenching or demolition), the set-back distance closely approximates the theoretical lethal range within which 50% of the fish may be killed or injured.

7. Consequently, the 100 kPa guideline is not likely to be met in those situations where, because of the design constraints of the project, it is also likely not possible or practical to ‘adjust' the setback distance as a means to meet the 100 kPa guideline. For example, preparation of a trench for a pipeline crossing typically requires no more than a below grade burial depth of about 2m. Therefore, the weight of explosive charge per delay will have to be adjusted in an effort to meet the 100 kPa guideline.

7.8 Species at Risk Management Plan

As discussed in Section 6.4, a Species At Risk Management Plan will be submitted in support of an Overall Benefit Permit from the MNRF before extraction proceeds. The points below may be considered as part of the plan:

1. A biologist should check the initial excavation area to be stripped and excavated prior to the overburden removal and provide Species At Risk training to quarry staff.

2. Quarry staff to be briefed on the Species at Risk that may be found in the area and any contingency/response protocols specified in the Species At Risk Management Plan should be reviewed (during initial inspection). The contingency/response protocols can include the need for additional visual searches of the quarry during nesting season. If there are multiple sightings of turtles/snakes, the need for restrictive fencing can be discussed with MNRF.

3. The quarry staff will be trained in the identification and proper handling of SAR including the relocation of turtles (snapping turtle, eastern musk turtle and spotted turtle) or snakes (eastern hog-nosed snake, eastern ribbonsnake and eastern massasauga rattlesnake), out of harm's way if they are found within the quarry operating area or roads.

4. If a turtle/snake is found, the turtle is to be confirmed and avoided temporarily or the turtle/snake be relocated outside the active quarry area. MNRF will be contacted regarding snapping turtle sightings and issues.

5. Daily checks of wetlands and adjacent lands should be conducted during the turtle's nesting season (early to mid-summer) by trained quarry staff.

6. Daily checks of the area should be conducted by quarry staff in search for SAR snakes.

7. All persons who enter the Site be provided Information on Species At Risk, this includes all employees or contractors on-Site.

8. The licensee shall install signs on-Site at suitable locations to identify the possible presence of snapping turtle, eastern musk turtle, spotted turtle, eastern hog-nosed snake, eastern ribbonsnake and eastern massasauga rattlesnake).

9. The licensee to keep records of the search dates, personnel and times and action taken.

10. Have butternut trees re-assessed prior to clearing, and apply for a permit/Notice of Butternut Impact Assessment as required at that time.

Included in the Species At Risk Management Plan will be measures to enhance or create habitat for Species At Risk. The following measures could be included in the plan to create habitat for Species At Risk:

1. Three clean sand piles will be placed on the northern end of the extraction area (Phases 3b and 4d) to a depth of 60 cm in a 3 by 3 metre area.

2. Three rock piles/ snake hibernacula will be constructed in Phases 1, 2b & 3b. They will consist of excavations and piles of flat limestone slabs and woody debris randomly piled to maximize spaces and cover.

7.9 Rare Vegetation Salvage Plan

As mentioned in Section 6.2, there are eight (8) regionally rare species were found within the proposed licensed area. The presence of rare species on this Site is due to the diversity of community types providing opportunity for many species. In order to mitigate any potential impacts to these species, re-location is recommended when possible. The need for a salvage plan to provide for the continued presence of these species in the watershed and transplanting the specimens will be discussed with OMNRF.

7.10 Wetland Compensation Plan

To mitigate the removal of wetlands during extraction, a Wetland Compensation Plan will be implemented as part of the rehabilitation plan for the quarry. The rehabilitation plan includes the creation of wetlands with the same ecological functions but also other enhanced functions as described in Section 6.5.

7.11 Natural Environment Monitoring Plan

A natural environment monitoring plan should be developed and implemented by a professional biologist to evaluate the success of progressive rehabilitation and the mitigation measures put in place to ensure no negative impacts to the natural environment including:

- The Sediment and Erosion Control Plan;
- The Fish Salvage Plan;
- Species At Risk Management Plan;
- The Rare Vegetation Salvage Plan;
- The Wetland Compensation Plan; and
- The health of the PSW on the Site.

The plan would also identify staff roles, responsibility, contacts and reporting plans for all mitigation, recommendation, and future monitoring requirements related to the natural environment at an operational level.

8.0 Recommendations

8.1 Sediment and Erosion Control Plan

A comprehensive Sediment and Erosion Control Plan should be developed for each phase of the extraction and progressive rehabilitation. An evaluation of the erosion potential should be developed with an understanding of the soil erodibility, surface slope and gradients, length of slopes, and local precipitation. A professional biologist should be consulted during the development of the plan.

8.2 Species at Risk (SAR)

1. Retain a qualified biologist to design and implement a Species At Risk Management Plan as per Sections 6.4 and 7.8 of this report.

2. Should any SAR be encountered during work related activities, or if there is potential to negatively impact SAR, or wildlife more generally, contact a qualified biologist or MNRF immediately for advice on how to proceed.

8.3 Fish and Fish Habitat

1. Efforts will be made to enhance fish habitat through implementation of the new drainage channel through a phased rehabilitation approach. A Fish Salvage Plan should be developed and submitted to the MNRF and the DFO to determine if a fisheries act authorization will be required.

8.4 Rehabilitation

1. The rehabilitation plan will include: reforestation resulting in the development of an east to west corridor through the southern portion of the Site, as well as recreating wetlands, establishing agricultural fields and open field meadow habitats.

2. Reforestation should include only native tree and shrub species indigenous to the Orillia area and be derived from stock from local nurseries or on site nursery stock.

3. Forested areas as shown in the rehabilitation plan will be created on the quarry floor. After the resource has been extracted, the quarry faces will be sloped utilizing available topsoil/overburden, imported clean inert fill, and/or unmarketable limestone.

4. Topsoil/overburden will be spread at variable depths in the forest blocks and a thin layer of soil spread 15 metres beyond the forest in all directions to create successional habitats.

5. Forests should be planted with a mixture of coniferous and deciduous trees that include appropriate native species currently found on site that include, sugar maple, eastern white cedar, eastern white pine, eastern hemlock, white birch, red oak and red maple. Within forested areas 70% of trees should be coniferous and 30% deciduous.

6. Quarry operational phasing and progressive rehabilitation schedules be coordinated to limit the area of disturbed tree cover at any one time.

7. The area outside the forested areas on the quarry floor should be graded as necessary following the topography of the Shadow Lake Formation with fine aggregate to fill in the fissures and crevasses and uneven surfaces and those areas should be seeded with a native grass species suitable to the dry conditions.

8. A diverse wetland be constructed in the central portion of the Site along the new drainage channel, that includes meadow marsh, marsh and swamp habitats.

8.5 Monitoring

As mentioned in Section 7.11, a natural environment monitoring plan should be developed and implemented by a professional biologist to evaluate the success of ongoing progressive rehabilitation. This plan will also identify the staff roles, responsibility, contacts and reporting plans for all mitigation, recommendations, monitoring project requirements related to the natural environment at an operational level.

9.0 Conclusions

The development of a quarry on the Site will not have a long term impact on the identified Species at Risk and other natural features identified, if the compensation measures, mitigation measures and recommendations are followed.

The quarry will have no negative impacts on the provincially significant Grass Lake wetland provided the 30 m setback and mitigation measures are implemented. Hydrological functions will be maintained and flows and water quality outletting to the PSW from the on–site watercourse have been controlled through rehabilitation efforts. A water balance calculation confirmed the runoff and flows will be similar pre to post-construction. NEA has recommended a 30 m setbacks from the Provincially Significant Wetland, a 90 m buffer from the pond/swamp located on lands owned by the County of Simcoe north of the Site.

The phasing of the extraction coupled with the rehabilitation, will replace the existing habitats post-extraction. It is anticipated that there will be no negative impact on the natural features and ecological functions of these features within the study area, if the recommendations in this report are implemented.

10.0 Notes Section

The following is a list of notes to be included on the Site Plan for the proposed quarry:

1. Prior to any site preparation, retain a qualified biologist to develop a Species At Risk Management Plan and obtain an Endangered Species Act Permit (overall benefit permit) from MNRF.

2. Prior to extraction in Phase 2, retain a qualified biologist to develop a Wetland Compensation Plan.

3. Retain a qualified biologist to develop a Rare Vegetation Salvage Plan in consultation with MNRF for salvaging and transplanting regionally rare plants.

4. Prior to the relocation of Watercourse 1, retain a qualified biologist to develop and implement a Fish Salvage Plan. This plan will be submitted to the MNRF and the DFO to determine if a fisheries act authorization will be required.

5. Prior to Site preparation of each stage shown on sheets 6 through 8 of the Site Plans, design and implement a Sediment and Erosion Control Plan.

6. Maintain surface water flows to the PSW during extraction.

7. Ensure clearing and grubbing of each phase occurs outside the peak breeding bird period (April 15th - August 15th). If clearing must be conducting during this time, a qualified bird biologist should conduct a nest search for any evidence of active nests within the area to be cleared.

8. As extraction proceeds, progressively rehabilitate the new drainage channel as per the rehabilitation plan.

9. Prior to clearing areas with butternut trees, assess the health of the butternut trees. Submit a notice of butternut impact form under the endangered species act to the MNRF for those butternut trees identified as Category 2 (retainable). Replace butternut trees as required by the MNRF permit at a ratio of 15:1 in the 90m buffer.

10. Cutting restrictions during peak breeding bird season (April 15th - August 15th) may be placed on agricultural activities if hay crops are grown on-Site.

11.0 References

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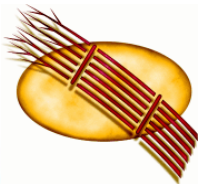
Appendix I. Fascines: Ontario Streams Information Sheet

(http://www.ontariostreams.on.ca/PDF/OSRM/Tech9.pdf)

Fascines



Description

Fascines can be best described as a rope-shaped bundle of live cuttings, lashed together with twine. Fascines have many other names including brush wattles, faggots, wattles, wattling bundles, and live fascines. Fascines grow rapidly when constructed from live materials. The resulting root systems work well to secure soils and to hold the fascine in place. They are simple and effective, require little time to build and can be installed with little site disturbance.

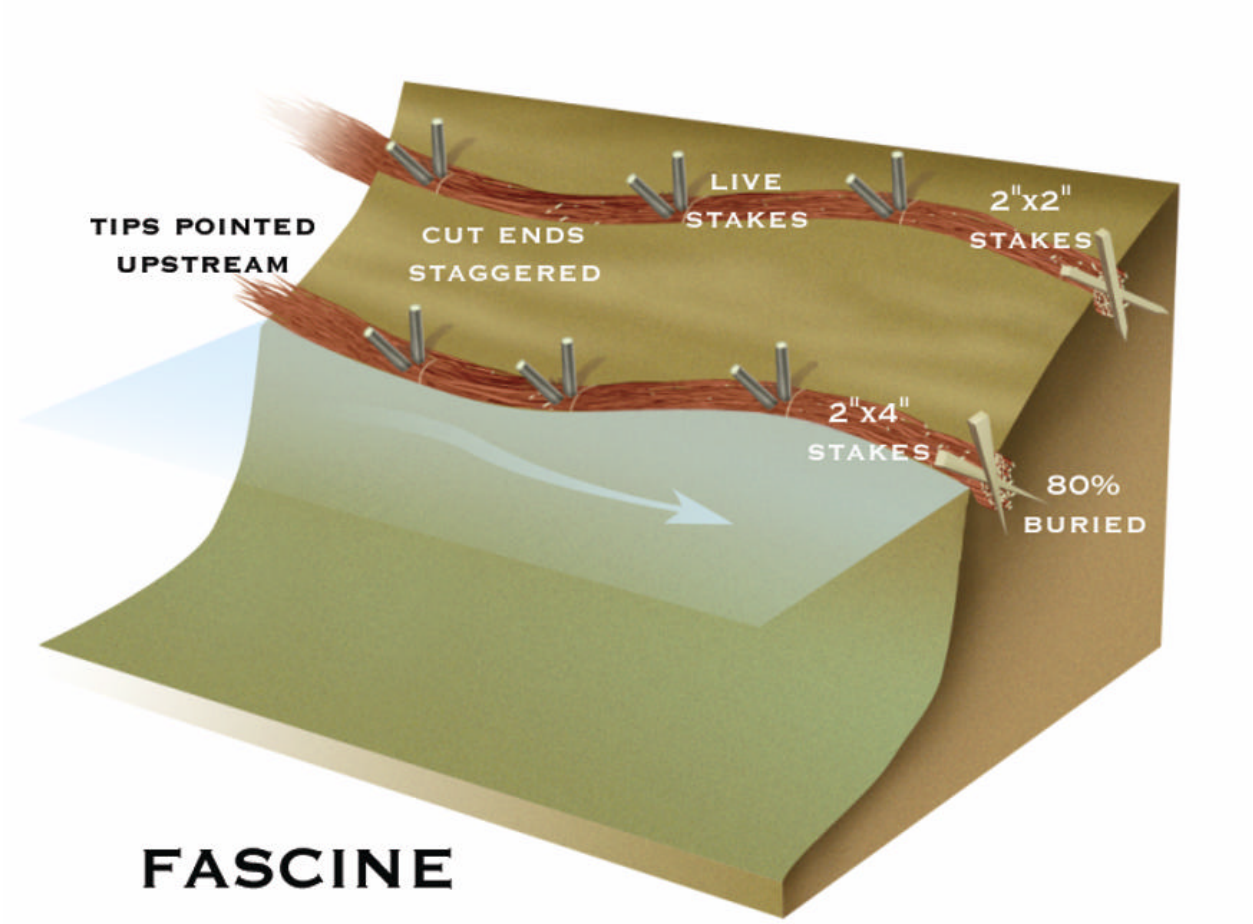
Purpose

Fascines can be used to perform a wide variety of functions. They can be used on their own to provide erosion protection on small streams, and to bench eroded slopes or gullies. They are very effective in preventing surface erosion. They can also be used in conjunction with many other soil bioengineering techniques, habitat improvement measures or conventional methods of erosion control. Structurally, fascines can provide immediate protection once installed. This feature is enhanced once the fascine begins to grow.

Application

When used on their own as a streambank erosion control measure, fascines are placed in a shallow trench excavated at the waters edge, typically along the outside bends of small streams. Fascines can be used to stabilize slopes where the toe or base of the slope is stable or protected. In this case the fascines would be installed across the slope to reduce runoff and trap sediment. Fascines can also be used as drains to conduct runoff or bank seeps.

When used on stream banks, fascines should be restricted to sites that are experiencing surface erosion (shallow sloughing of soil) **NOT** mass wasting (mass wasting is when large, deep sections of a slope shift, or fail at the same time). Nor should they be used in situations where they would experience rapid undercutting, such as along the outside bends of deep pools cut into soils that are highly erosive. This method is best suited to small streams less than 5 metres wide with bank heights less than 1.5 metres. Fascines in this function can be used in most channel types. In conjunction with other methods, fascines can be used to protect the toe of brush mattresses, and the top leading edge of cribwalls. They can also be used to "soften" existing rock rip-rap, gabion baskets, or concrete blocks, by placing them along the top edge of the stone, or if possible, along the waters edge.



Construction Guidelines

Make sure the toe is stable when using fascines on slopes. If the toe is not stable, erosion can move up the slope, undermining the fascines and causing failure. Should the toe be experiencing erosion, you will need to remedy the situation by using one of the other appropriate methods in this manual. Once this has been addressed, you can then place the fascines on the slope. The following steps should be followed when placing fascines on slopes:

- install the first fascine at the bottom of the slope.
- move upslope, placing fascines using the recommended spacing of 1 metre for 1:1 slopes (height:vertical), 1.5 metre for 2:1, 2 metres for 3:1, and 3 metres for 4:1 slopes.
- on dry slopes fascines can be placed level or on contour.
- on wet slopes fascines can be placed on slight angles to facilitate drainage of runoff.
- place long straw on the slope between fascines (on slopes 1.5:1 or flatter), steeper

slopes would require the use of an erosion control fabric. This fabric would be anchored in place by tucking the leading edge into the trench, and staking the fascine on top.

To build a fascine:

1. Harvest and stockpile an assortment (being different species, ages and lengths) of live, dormant cuttings. Fascines can be built from a wide range of cuttings, but are best built from slim relatively unbranched cuttings (coppice) because they are the easiest to work with and produce the densest fascines. If the cuttings have multiple, hard to bend side branches, prune them, being sure to use the trimmings

2. Fascines are easier to build in a set of saw horses. Lay the cuttings on the sawhorses, with the growing tips facing in the same direction, and with the cut ends staggered throughout.

3. Tightly tie the fascines together tight with rope or twine. The distance between ties can vary. You should be able to carry, bend, and not be able to pull apart, a properly tied fascine. If your first attempt fails, make sure the cut ends are staggered, and that the ties are tight, and frequent. Fascines can be constructed in varying lengths and diameters, but work best if they are tied so they are dense.

To install a fascine:

1. Dig a shallow trench, slightly less wide and deep than the diameter of the fascine. The fascine should be approximately 20% exposed once installed.

2. Place the fascine in the trench, and stake into place. The growing tips should point upstream, or if placed on angles on slopes, pointed uphill. There are several methods of staking. Livestakes are recommended as they will grow, providing extra strength in the long run for the structure. In compact soils such as clays and clay/shales, UNTREATED 2"x2" stakes, or 2"x4"s cut on a diagonal work well. Place the stakes every 1-1.5 metres. You should not be able to lift the fascine out of the trench.

3. Care should be taken to make sure the upstream end of the fascine is "returned" to the streambank. This means tucking the upstream end into the bank, and staking it securely so that the current cannot dislodge it. If the upstream end of the fascine is pulled away the entire structure could fail.

4. Bury the fascine by placing soil around and on top of it, tamping gently into place. Make sure you fill in all of the air spaces. Large air spaces around the fascine should be avoided, as they will promote desiccation of the live material.

Materials

- rope or twine, strong enough to tie the fascines together, and resilient enough to

last 1 year. Hemp rope, heavy bailer twine, or plastic utility cord are good examples.

- ample quantities of live cuttings, for example a 4 m long fascine 25 cm in diameter will use approximately 5 bundles of cuttings (bundles being 20-30 cm in diameter, and 2 m long). Fascines should be constructed with a minimum of 2 different species. This will optimize the chances of successful growth.

  Recommended species:
  Small streams - Heartleaf willow, Sandbar willow, Shining willow, Pussy willow, all of the dogwoods.
  Large streams - Black willow, Peachleaf willow, Pussy willow, Sandbar willow, Heartleaf willow, Carolina poplar, Balsam poplar, all of the dogwoods.

- shovels, rakes, deadblow and sledge hammers, pruning shears, utility knife, sawhorses.
- stakes, depending upon the application, from live stakes, to untreated 2"x2"s, to 2"x4"s cut into wedges.
- straw (for mulching on slopes), or an erosion control blanket (jute, coir, or a straw mix).

Cost and Maintenance Needs

Fascines cost very little, especially if the live materials are cut for free. Costs can be reduced even further if livestakes are used to anchor the fascine. The main expense is the time required to harvest live cuttings, transport them, and construct the fascines. Time required to install varies from 0.5 - 1 hour per linear metre. Fascines should be inspected periodically in the first year. Once the fascine is growing, they require little maintenance.

Integration

Fascines can be easily integrated into many types of projects such as:

- brush mattresses
- live crib walls
- log/brush shelters
- rock rip-rap
- joint planting
- native material revetment

Demonstrations

This type of habitat structure has been applied in the following demonstration projects:

- Project #15, Black Ash Creek Rehabilitation Project
- Project #24, Brault Property

- Project #42, Soper Park - Mill Creek
- Project #44, Strausberg Creek
- Project #46, Kolb Creek
- Project #47, Schneider Creek
- Project #50, Colonial Creek
- Project #51, Bechtel Park
- Project #64, Highland Creek Rehabilitation Project
- Project #91, Tioga Wildlife Area - Pine River
- Project #93, Glen Huron
- Project #94, Martin Property - MacIntyre Creek
- Project #100, Scott's Plains Park
- Project #113, Harvey Brown's
- Project #114, Curcio's Bypass
- Project #115, Dixon Hill Tributary
- Project #117, Harding Property
- Project #121, Christian Blind Mission

For more information

Please refer to the following authors and their respective publications located in the bibliography:

Gray and Sotir, 1996
Schiechtl and Stern, 1996
210-EFH, 1992

Appendix II. Sweepers: Ontario Streams Information Sheet

(http://www.ontariostreams.on.ca/PDF/OSRM/Tech5.pdf)

Sweepers

Description

A fallen cedar tree, partially submerged in water, provides an abundance of nooks and crannies for aquatic insects. Natural sweepers are common in the upper reaches of Ontario rivers like the Sydenham, Saugeen, Nottawasaga and Credit. The branches collect twigs and needles amongst other pieces of organic debris which add to habitat complexity. The greater the number of branches, the greater the accumulation of debris. These secluded spaces provide cover for juvenile fish and a wealth of insect forage for them. Once colonized with a bounty of life, larger fish are attracted to the prospect of engulfing an unsuspecting minnow. The sweeper, sometimes referred to as a submerged brush shelter, is used to mimic this natural habitat by introducing a thick mass of instream cover in the form of an entire tree, crown or large branches.

Purpose

Sweepers are used to attract juvenile fish by providing dense cover and food in the form of aquatic organisms. Cut locally and cabled in place, they can be used to create nursery cover where it is limited and deflect bank erosion. Eastern white cedar or hemlock are the proven species for durability and longevity although white spruce can be used with less confidence in surviving several years. In contrast with other woody cover structures, sweepers tend to be most suited for streams that have high flows, serious sediment movement, or potential for ice damage.

Application

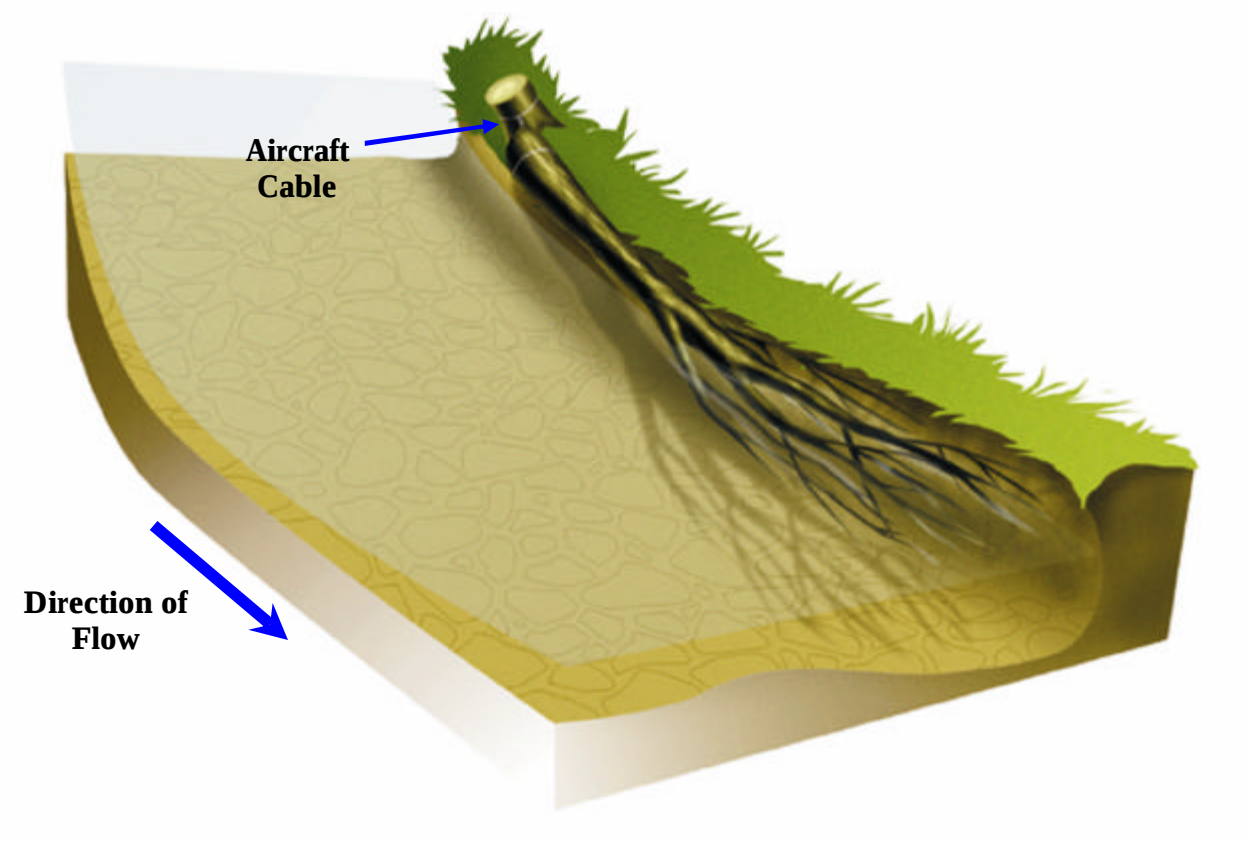
There is a great deal more flexibility in the application of this type of cover structure when we consider location and channel characteristics. Sweepers are well suited to a variety of streams and rivers that exhibit fluctuating water levels, inherent ice accumulation and moderate bedload. Target reaches have sparse cover. They can be placed on the outside of a meander or along a straight section of channel. A single point of attachment to the bank allows the sweeper to move up and down with the flow while deflecting the erosive energy of the water away from the bank.

Having determined your basic knowledge of the physical characteristics within a reach of stream, determining suitability and placement is relatively easy. These structures work equally well in meanders or straight sections. In watercourses containing bedrock, cobble, gravel, sand or silt/clay base as the dominant substrate combined with slopes less than 4% and light to moderate bedload, sweepers are well suited in straight reaches. The meanders within B, C, E and F channels composed of substrates of bedrock, cobble or silt/clay are where placement should be focused along the outside of a bend.

Construction Guidelines

Sweepers are natural and inexpensive habitat enhancements that are anchored to the bank of the

river using steel posts and aircraft cable or simply cabled to the stump from where it fell. Cedar or hemlock are the species which are most resilient to decay although hardwoods will also suffice. Sweepers should have at least a 15 to 40 cm butt diameter and 4.0 metres or more in length. More branches mean more cover and be sure to orient the tree in the current such that the branches trail downstream.



There are two ways of securing a sweeper. The hinged method involves selecting a tree that leans toward the edge of the river. Using a chainsaw, cut toward the river to the point where it starts to fall. Be sure to step back well away from the tree at this point. As it falls, the remaining uncut section will act as a hinge and secure the tree to the stump. Wrapping and securing aircraft cable to the stump and tree will provide additional strength.

In the second method, a previously cut tree is dragged to the site. Using a 1.5 cm diameter wood auger, drill a hole through the trunk at least 20 cm from the thickest end. Insert a 3.0 metre long piece of aircraft cable through the hole, around the trunk and back through the other end of the hole. Be careful to leave a 10 cm section for the crimp to the main cable. Using the crimping tool, fasten them together and fix the wrapped section of cable to the trunk with the fence staples. You should have 1-1.5 m of cable leftover. The anchor should be secured to the bank between the low flow and bankfull elevations. This prevents the sweeper from being deposited outside of the bankfull channel after a flood. Pound the 2.0 metre T bar post into the bank at a slight angle upstream. A 10 cm section of post with a pre-drilled 0.6 cm diameter hole located 5 cm from the top should remain for cable attachment. Drag the sweeper into position and carefully insert cable

through the hole in the anchor, just enough to loop around and crimp. There should be 0.5 - 1.0 metre of cable between the T bar post and the butt of the sweeper. Once released, it should float freely in the current.

Materials

You will need the following tools for installing sweepers:

- sledge hammer and post pounder
- chainsaw and personal safety gear
- drill with 1.5 cm auger bit, at least 30 cm long
- 3.0 metres of 0.3 cm diameter stainless steel aircraft cable
- matching 0.3 cm diameter crimps or clamps
- crimping tool or cable cutting tool and pliers
- cedar, hemlock or hardwood trees at least 4.0 metres long, 15-40 cm diameter with dense branches
- 2.0 metre T bar post
- hammer and 3.5 cm fencing staples

Cost and Maintenance Needs

Sweepers are a natural and cost-effective technique that can be easily installed by a crew of two in an hour. Cost is less than $15.00 per unit. The expected life of the structure is 3 to 5 years provided the recommended type of wood is used. Expect the submerged portion of the sweeper to become waterlogged in time. Frequent monitoring is needed to ensure proper installation and continued function.

Integration

Sweepers can be integrated into other stream rehabilitation projects such as:

- cabled log jams
- native material bank revetments
- live crib walls
- L.U.N.K.E.R.S.
- log cover

Demonstrations

This type of habitat structure has been applied in the following demonstration projects:

- Project #14, Bighead River Demonstration Project
- Project #91, Tioga Wildlife Area - Pine River
- Project #94, Martin Property - MacIntyre Creek

- Project #104, Collingwood Shipyards - CSL Property
- Project #109, Morningside Tributary Aquatic Habitat Rehabilitation Project
- Project #113, Harvey Brown's
- Project #117, Harding Property
- Project #123, Rocky Saugeen Silt Spill Rehabilitation Project

For More Information

Please refer to the following authors and their respective publications located in the bibliography:

Buchanan, R. A. , D. A. Scruton and T. C. Anderson 1989
Forder, D. R. et al, 1997
Rosgen, D. 1996

Appendix III. Inverted Root Wad

Inverted Root Wad

Section View