



**NATURAL ENVIRONMENT
REPORT LEVEL I & II**

BRAESIDE QUARRY EXPANSION

**TOWNSHIP OF McNAB/BRAESIDE
COUNTY OF RENFREW**

Skelton Brumwell
& ASSOCIATES INC.



Revised December 2, 2011

NATURAL ENVIRONMENT REPORT LEVEL I & II

BRAESIDE QUARRY EXPANSION

TOWNSHIP OF McNAB/ BRAESIDE

COUNTY OF RENFREW

P/N 05-2033

November 21, 2007

Revised December 2, 2011

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Prepared for: Miller Paving Ltd.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	i
NATURAL ENVIRONMENT REPORT LEVEL I.....	1
1.0 INTRODUCTION	1
Figure 1: Location	2
1.1 Proposed Development	3
2.0 PLANNING BACKGROUND.....	3
2.1 Aggregate Resources Act (ARA)	3
2.2 Provincial Policy Statement (PPS)	3
Figure 2: Existing Features	4
2.3 County of Renfrew Official Plan	5
2.4 Township of McNab/Braeside Official Plan	5
Figure 3: Official Plan Schedule	6
3.0 METHODS.....	7
3.1 Background Research.....	7
3.2 Field Investigations	7
3.2.1 Vegetation.....	8
3.2.2 Terrestrial Fauna	8
3.2.3 Aquatic Features	9
4.0 NATURAL ENVIRONMENT.....	10
4.1 Vegetation	10
4.1.1 Forest Cover.....	10
4.1.2 Vegetation Communities	10
Figure 4: Forest Cover.....	11
Figure 5: Habitats.....	12
4.1.3 Vascular Flora.....	13
4.2 Wildlife	14
4.2.1 Breeding Birds	14
4.2.2 Amphibians and Reptiles	15
4.2.3 Other Wildlife	15
4.3 Wetlands.....	16
Figure 6 – County of Renfrew Draft	17
Figure 7 – Distance to SE Wetland	18
4.4 Aquatic Features.....	19
5.0 PHYSICAL DESCRIPTION.....	20
5.1 Geology and Soils	20
5.2 Topography and Drainage	21

6.0	ANALYSIS OF NATURAL HERITAGE FEATURES	21
6.1	Significant Wetlands	21
6.2	Significant Habitat of Endangered or Threatened Species	21
6.3	Significant Woodlands	21
6.4	Significant Valleylands	22
6.5	Significant Wildlife Habitat	22
6.6	Significant Areas of Natural and Scientific Interest (ANSI)	23
	Figure 8: Significant Wildlife Area	24
6.7	Fish Habitat	25
6.8	Summary of Natural Heritage Features	25
	NATURAL ENVIRONMENT REPORT LEVEL II	26
7.0	IMPACT ASSESSMENT AND MITIGATION MEASURES	26
7.1	Significant Wildlife Habitat	26
	Figure 9: Significant Wildlife Protection Area	28
7.2	Significant Woodlands	29
7.3	Fisheries	30
7.4	Monitoring	31
8.0	CONCLUSIONS	32
	REFERENCES	34

APPENDIX A

Curriculum Vitae- Kyle Fleming

APPENDIX B

Natural Environment Assessment:
Braeside Quarry Expansion Area
Brunton Consulting Services October, 2007

APPENDIX C

Fisheries Assessment- Muncaster Environmental Planning

APPENDIX D

Summary- Peer Review Response
Peer Review Comments- Golder Associates
(March 2, 2009; January 19, 2011; August 16, 2011)
Responses to Peer Review- Skelton Brumwell & Associates/Brunton Consulting
(December 8, 2009; March 21, 2011)

EXECUTIVE SUMMARY

Skelton, Brumwell & Associates Inc./Brunton Consulting was retained by Miller Paving Limited in October, 2005 to provide natural environmental services for preparation of a Natural Environment Report (NER) related to the proposed expansion of the Braeside Quarry and installation and operation an asphalt plant.

The Aggregate Resources Act (ARA) requires as part of the license application, a Natural Environment Report (NER). Level I of this report identifies the presence of any natural heritage features or functions within the area to be licensed or adjacent lands (120 metres). Level II assesses potential impacts of the proposed license and makes recommendations for mitigation measures to ensure no negative impacts. The Township of McNab/Braeside requires an Environmental Impact Study (EIS) relative to rezoning and an Official Plan amendment. This NER covers the requirements for the EIS as outlined in the Township Official Plan.

The NER Level I, through background documentation, extensive field investigations and analysis, identified three (3) natural heritage features within the subject property. These are:

- Significant Wildlife Habitat
 - seasonal concentration areas (deer winter yard);
 - rare vegetation communities (Alvar);
 - specialized habitat (Habitat for area-sensitive species, amphibian woodland breeding ponds); and
 - an animal movement corridor.
- Significant Woodlands
- Contribution to Fish Habitat.

The Level II report outlined mitigation measures to ensure no negative impacts per the Provincial Policy Statement on these natural heritage features or their ecological functions. These mitigation measures were identification and protection of a Significant Wildlife Protection Area which contains virtually all of the significant natural features and functions of the study area and provides for a self-sustaining representation of these features; a 150 metre wildlife corridor to allow for the local and regional dispersal of various flora and fauna and prevent the isolation of populations on a daily or seasonal basis which is to be left undisturbed and vegetated; and a Monitoring Plan to ensure the extent and quality of the Significant Wildlife Protection Area is maintained.

Through the implementation of mitigation measures in the Level II report and the Hydrological Investigation, the proposed quarry expansion and asphalt plant will have no anticipated negative impacts on natural heritage features and functions.

NATURAL ENVIRONMENT REPORT LEVEL I & II
BRAESIDE QUARRY EXPANSION
TOWNSHIP OF McNAB/BRAESIDE
COUNTY OF RENFREW

P/N 05-2033

Revised December 2, 2011

NATURAL ENVIRONMENT REPORT LEVEL I

1.0 INTRODUCTION

Skelton, Brumwell & Associates Inc. was retained by Miller Paving Limited in October, 2005 to provide natural environmental services for preparation of a Natural Environment Report (NER) related to the proposed expansion of the Braeside Quarry and installation and operation an asphalt plant.

The expansion of the existing quarry requires a rezoning of the expansion area and a licence to permit aggregate extraction. A proposed asphalt plant requires an Official Plan Amendment, Zoning By-law Amendment, approval of the Site Plan under the Aggregate Resources Act, and a Certificate of Approval for the asphalt plant. An application for rezoning the property was submitted to the Township in 2007.

A Natural Environment Report Level I & II (November 21-2007) was submitted in support of the rezoning application and formed part of the Aggregate Resources Act (ARA) application. Golder Associates was retained by the Township of McNab/Braeside to conduct a qualified peer review of the NER for Township reference on the rezoning application.

Golder provided peer review comments on the NER in correspondence dated March 2, 2009. Skelton, Brumwell and Brunton Consulting prepared and submitted a response to the Golder Comments dated December 8, 2009, and a supplement dated March 21, 2011. The response provided additional clarification and information based on further field studies and analysis by Skelton Brumwell & Associates, Brunton Consulting and Gorrell Resource Investigations.

Golder Associates accepted the response and supplement in correspondence dated August 16, 2011. The NER has been revised to incorporate additional information and fieldwork completed



**NATURAL ENVIRONMENT
REPORT LEVEL I
BRAESIDE QUARRY EXPANSION**

**FIGURE 1
LOCATION**

Scale 1: 30,000

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SOURCE: GOOGLE MAPS

since the 2007 Report, and to include the results of the peer review. Copies of peer review comments and responses are included in Appendix D.

1.1 Proposed Development

The proposed quarry expansion and asphalt plant is located in Part of Lots 16 and 17, Concession A, Geographic Township of McNab, Township of McNab/Braeside, and County of Renfrew.

The existing licensed Quarry is 29.7 ha. The area to be licensed by this application is 103.0 ha for a combined area of 132.7 ha. The area to be extracted within the expanded licensed area is 68.4 ha. The proposed asphalt plant is in the northwest corner of the proposed expanded area of extraction.

The location of the subject property is shown on Figure 1 and the Existing Features are shown on Figure 2. All figures and descriptions of features within the Level I & II reports are described using site north.

2.0 PLANNING BACKGROUND

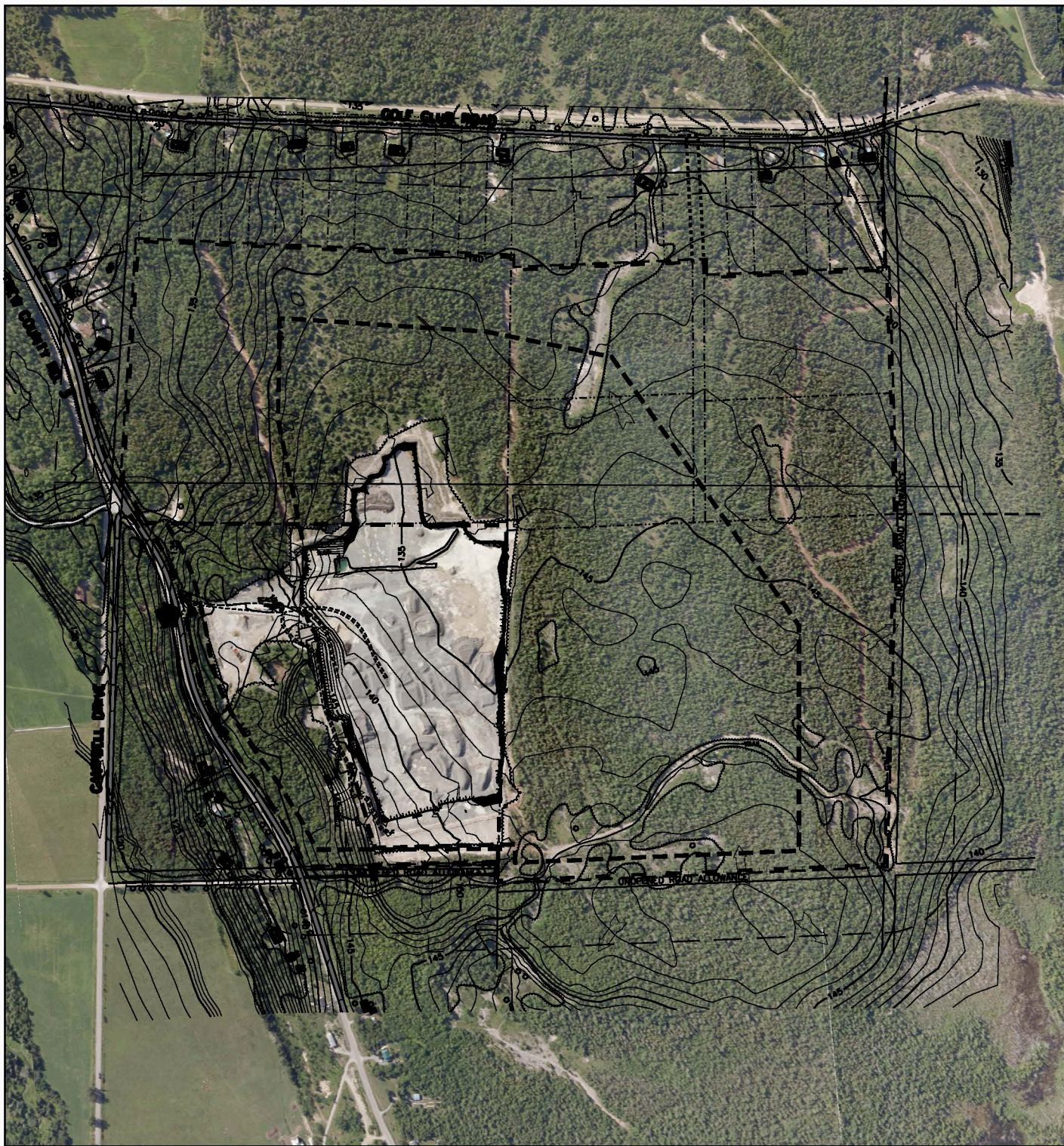
2.1 Aggregate Resources Act (ARA)

The Township of McNab/Braeside is designated under the Aggregate Resources Act (ARA). The Natural Environment Report has been prepared in accordance with the Provincial Standards under the ARA for pit and quarry planning and related operations. Level I of the report identifies natural heritage features identified in the Provincial Policy Statement (PPS) on the subject and adjacent lands. The Level II part of this report identifies potential impacts and mitigation measures for those identified natural heritage features.

2.2 Provincial Policy Statement (PPS)

The Provincial Policy Statement (PPS) (Ontario Government, 2005) sets the policy foundation for regulating the development and use of land in Ontario. This report deals with Section 2.1 Natural Heritage. Within Section 2.1, development and site alteration is not permitted in:

- significant wetlands in Ecoregions 5E, 6E and 7E;
- significant habitat of endangered species and threatened species; and
- significant coastal wetlands.



- PROPERTY BOUNDARY / LICENCE
- - - - - LIMIT OF EXTRACTION

**NATURAL ENVIRONMENT
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BRAESIDE QUARRY EXPANSION**

**FIGURE 2
EXISTING FEATURES**

Scale 1:10,000

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SOURCE: MILLER BRAESIDE QUARRY SITE PLAN DRAWING 2 OF 5
PREPARED BY SKELTON BRUMWELL & ASSOCIATES.



Development and site alteration shall not be permitted in:

- significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;
- significant woodlands south and east of the Canadian Shield;
- significant valleylands south and east of the Canadian Shield;
- significant wildlife habitat; and
- significant areas of natural and scientific interest.

unless it can be demonstrated that there will be no negative impacts on those features or their functions.

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

Development and site alteration is also not permitted on adjacent lands to the natural heritage features listed above unless the ecological functions of the adjacent lands has been evaluated and it can be proven that there will be no negative impacts on the natural features or their functions.

2.3 County of Renfrew Official Plan

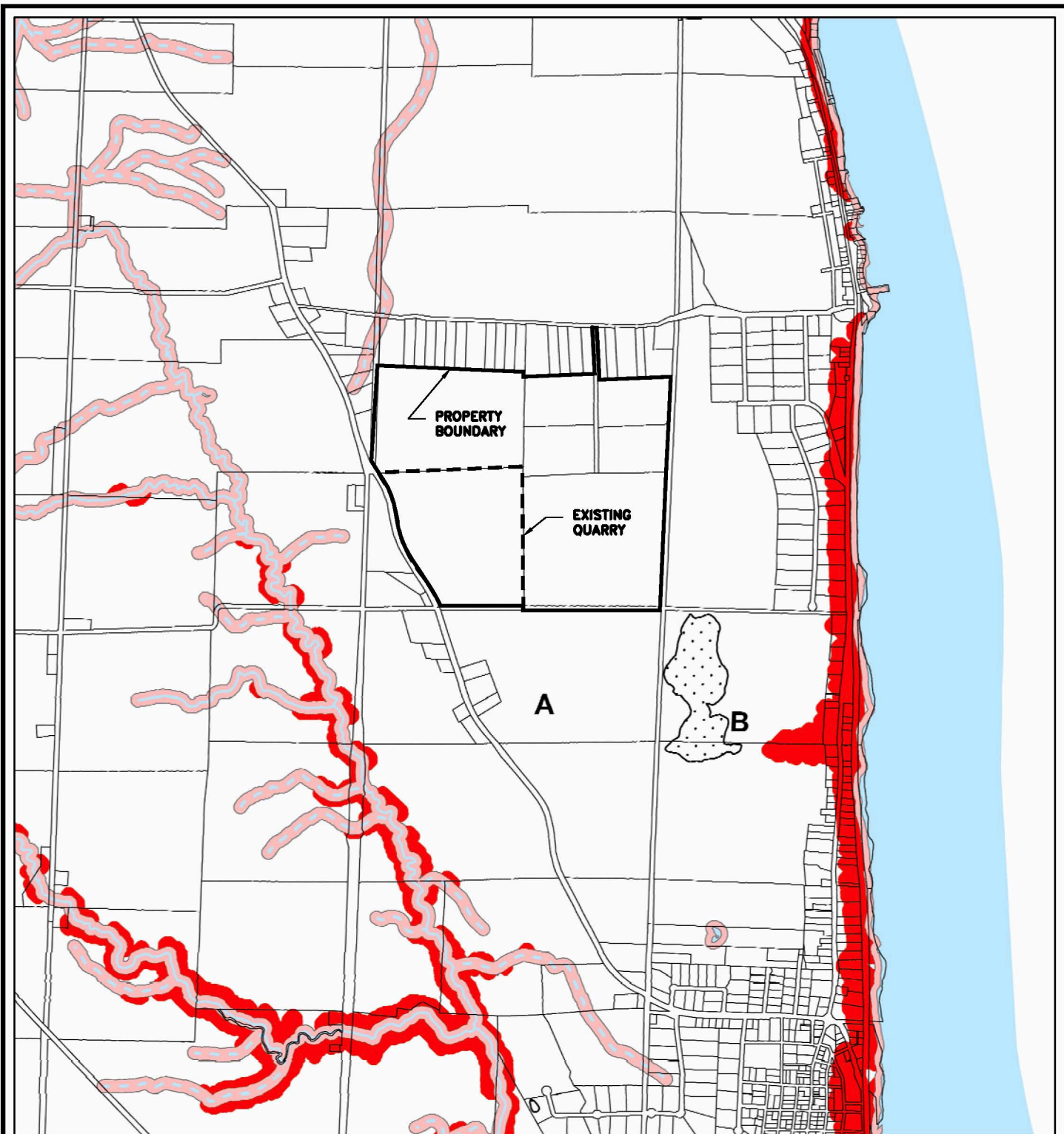
The County of Renfrew Official Plan was adopted in 2002 and approved by the Minister of Municipal Affairs and Housing in 2003 with Modifications. One of the Ministry Modification directs that approved local Official Plans, such as Township of McNab/Braeside, apply.



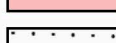
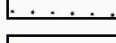
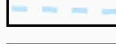
The intent of the County policies for Environmental Protection and requirement for an Environmental Impact Study (EIS) is covered in the Township Official Plan and addressed in this NER.

2.4 Township of McNab/Braeside Official Plan

The subject lands are designated Mineral Aggregate in Schedule A of the Official Plan. No natural areas or significant features have been identified within the Official Plan Schedule "B" as shown on Figure 3. A local wetland is identified on adjacent lands to the southeast and an intermittent watercourse to the northwest.

This report satisfies requirements for an Environmental Impact Study (EIS) as described in section 9.6 of the Official Plan.



-  STEEP SLOPES
-  VALLEY LANDS
-  LOCAL WETLAND
-  WATERLINE - INTERMITTENT
-  WATERLINE - PERMANENT



**NATURAL ENVIRONMENT
REPORT LEVEL I
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**FIGURE 3
NATURAL AREAS & SIGNIFICANT FEATURES**

Scale 1:25,000

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SOURCE: McNAB/BRAESIDE OFFICIAL PLAN SCHEDULE 'B'

3.0 METHODS

The purpose of the Level I & II report is to identify natural heritage features and functions on the subject property and within 120 metres on adjacent lands to determine the potential for negative impacts from the proposed quarry expansion. Adjacent lands not owned by Miller Paving were investigated using available mapping, aerial photography and road side observations.

Preparation of this study involves review of background documents, field investigations, consultation with government officials and analysis.

The Level I & II report is largely based on the Natural Environment Existing Conditions (Brunton 2007- revised 2011) (referred to in this report as Brunton (2011)) prepared by Brunton Consulting Services included as Appendix B. This assessment provides the basis for identification of terrestrial natural heritage features and functions on or adjacent to the proposed quarry and recommends mitigation measures for potential impacts.

3.1 Background Research

Background research was completed to identify natural heritage features and functions on/or adjacent to the subject property. These documents/sources listed below along with consultation with provincial agencies provided additional resources for this study:

- Ministry of Natural Resources (MNR) Natural Heritage Information Centre (NHIC);
- Township of McNab/Braeside Official Plan;
- County of Renfrew Official Plan;
- ortho photography of the area;
- consultation with the MNR-Pembroke District;
- Correspondence on fisheries assessment by Muncaster Environmental Planning (2009);
- Natural Environment Existing Conditions: Braeside Quarry Expansion Area. Brunton (2011);
- Hydrological Investigation: Braeside Quarry Proposed Expansion, Skelton Brumwell (2011); and
- Hydrogeological Assessment- Gorrell Investigations (2011).

3.2 Field Investigations

A preliminary site visit was conducted by Skelton Brumwell on September 19, 2005 to become familiarized with the site and to develop a work plan for the NER.

Terrestrial field investigations were largely completed by Dan Brunton, Brunton Consulting Services to evaluate natural environment conditions and ecological significance within and adjacent to the study area. Where noted, Skelton Brumwell assisted with terrestrial investigations.

Skelton Brumwell completed a Hydrological Investigation to evaluate contributions to aquatic features within and adjacent to the study area. Fisheries investigations of off-site watercourses were completed by Muncaster Consulting.

3.2.1 Vegetation

Vascular plant inventories were originally conducted by Brunton Consulting on June 8-2006 and June 31-2006. These dates are sufficiently spaced apart to provide an indication of diversity across the growing season. The geographic extent of habitats was identified through a review of ortho photography and on-site inspection.

Subsequently, 10 additional visits have been completed between August 27-2008 and June 1-2011 to continue monitoring the site and gather additional biophysical data.

A detailed account of methodology is found in the Brunton (2011) in Appendix B of this report.

Vegetation communities within the proposed expansion area were identified by using ortho photography and field investigations. Communities were classified into the most appropriate unit based on the Southern Ontario Vegetation Classification system.

The significance of the vegetation communities was determined using Natural Heritage Information Centre's (NHIC) database, regional literature and databases, and personal knowledge of regional and local communities.

3.2.2 Terrestrial Fauna

Faunal data collection focussed on potentially significant species in 2006 rather than collecting comprehensive data on representative or common species. This reflected the greater amount of interpretable data obtainable by investing more time on flora and vegetation communities as expressed by the MNR in pre-consultation discussions.

Subsequent to peer review comments, breeding bird surveys were undertaken on June 1-2009 and June 2-2011 to compliment incidental observations made by Brunton Consulting during site visits from 2006-2011 and to increase the biophysical knowledge of the property.

Incidental observations were also made during field investigations for mammals and herptiles (amphibians and reptiles) during field investigations through observations of physical evidence (scats, tracks) for mammals and for shelter, feeding and breeding sites (e.g. vernal pools, beneath logs, rocks, etc.).

The NHIC database, literature and personal knowledge (Dan Brunton) were used to determine if any species detected were provincially, regionally or locally rare to the region.

3.2.3 Aquatic Features

Pre-consultation discussions were held with the MNR-Pembroke District to obtain background documentation and mapping of watercourses on the subject and adjacent lands. The MNR staff stated to their knowledge there were no watercourses on the subject property but groundwater discharge from the subject property at the base of the Braeside Plateau contributes water to Ryan Creek, which drains into Dochart Creek, a known cold-water fishery.

A Hydrological Investigation (Skelton Brumwell) was prepared to investigate the contribution of discharge from the proposed expansion area and existing quarry to Ryan Creek.

Fisheries investigations were completed for Ryan Creek by Muncaster Environmental Planning (Appendix C). These investigations were completed in 2008 & 2009 to determine appropriate thermals requirements associated with the discharge outlet of dewatering from the quarry and the type of fish habitat present in Ryan Creek at the drainage outlet.

Drainage from the expansion area to identified local wetlands on adjacent lands to the southeast and northwest was also investigated through the NER, Hydrological and Hydrogeological studies.

Observations were made for signs of vernal pooling, groundwater discharge areas and unidentified watercourses within the property during field investigations for the NER.

4.0 NATURAL ENVIRONMENT

4.1 Vegetation

4.1.1 Forest Cover

Forested areas on the subject property are part of a larger corridor across the Braeside Plateau as seen in Google Satellite imagery (Figure 4). This is one of the larger forested areas in the region and provides corridor functions and interior habitat for wildlife.

Total forest cover on the plateau has been calculated as 924.06 ha, which does not take into account significant fragmentation (i.e. residences, roads, etc.). The proposed area of extraction encompasses 50.41 ha or 5.5% of the forest cover.

4.1.2 Vegetation Communities

Vegetation communities are summarized in Table 1 and shown on Figure 5. Brunton (2011) (Appendix B) provides further description and photos for each community.

Habitat Polygon	Habitat Type (ELC Ecosite(s))	Total Area (ha)
1	Developed (Transformed)	28.1
2	Cultural Meadow and Thicket (CUM1; CUT1)	9.5
3	Alvar Glade and Pavement (ALO1; ALS1)	2.4
4	Alvar Coniferous Forest (ALT1)	56.7
5	Young Upland Mixed Forest (FOM5-2)	15.5
6	Mature Upland Mixed Forest (FOM4)	4.7
7	Upland Coniferous Forest and Scrub (FOC2)	10
8	Coniferous Swamp Forest (SWC3)	3.5
9	Mixed Swamp Forest (SWM)	2.3



LEGEND

- - - - - PROPOSED EXPANSION AREA
- EXISTING QUARRY
- LIMIT OF FOREST COVER



**NATURAL ENVIRONMENT
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BRAESIDE QUARRY EXPANSION**

**FIGURE 4
FOREST COVER**

Scale 1: 40,000

P/N 2033 NOV. 2011

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Source: Google Maps

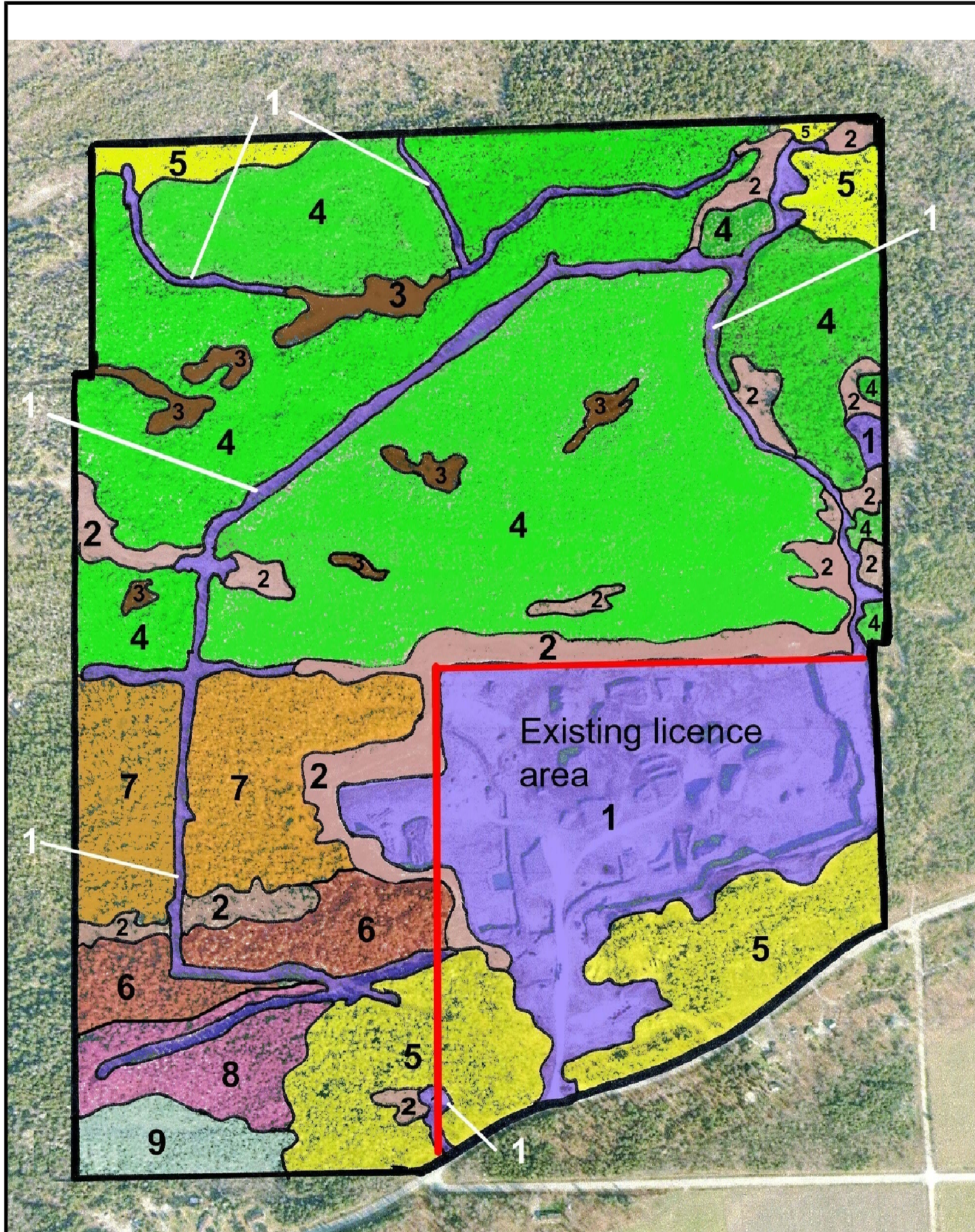


Table 1: Habitats/Vegetation Communities of Braeside Quarry Expansion Area

Habitat Polygon	Habitat Type (ELC Ecosite(s))	Total Area (ha)
1	Developed (Transformed)	28.1
2	Cultural Meadow and Thicket (CUM1; CUT1)	9.5
3	Alvar Glade and Pavement (ALO1; ALS1)	2.4
4	Alvar Coniferous Forest (ALT1)	56.7
5	Young Upland Mixed Forest (FOM5-2)	15.5
6	Mature Upland Mixed Forest (FOM4)	4.7
7	Upland Coniferous Forest and Scrub (FOC2)	10
8	Coniferous Swamp Forest (SWC3)	3.5
9	Mixed Swamp Forest (SWM)	2.3

Source: Brunton Property Habitats 03 - July 2009



NATURAL ENVIRONMENT
REPORT LEVEL I
BRAESIDE QUARRY EXPANSION

FIGURE 5
REVISED HABITATS

N.T.S.

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Two habitat types (and three vegetation communities) were identified by Brunton (2011) as provincially (and globally) rare based a list of rare vegetation communities for southern Ontario prepared by the MNR and personal experience in the study area:

- Habitat 3- Alvar Glade and Pavement (Open Alvar (AL01) and Shrub Alvar (ALS1))
- Habitat 4- Alvar Conifer Forest (Treed (ALT1)).

These communities support significant populations of provincially and regionally rare species (See Section 4.1.3 and Brunton (2011)).

Habitat 8- Coniferous Swamp Forest (White Cedar- Conifer Organic Swamp (SWC3) and Habitat 9- Mixed Swamp Forest (Mixed Organics Swamp (SWM)) were identified as wetland communities. These communities were found to support a Provincially Rare plant species (S3), areas of groundwater discharge (seepages) at the base of the Braeside Plateau and provide shading for de-watering operations from the existing and proposed quarry. Despite these features, there is no evidence of significant features or functions at more than a local level.

The remaining communities; Habitats 1, 2, 5, 6, and 7 were found to be common habitats/vegetation communities found throughout southern Renfrew County and in Ontario. There are no rare species, special features or functions which would necessitate further protection.

4.1.3 Vascular Flora

Two occurrences of species of concern were identified on or in the vicinity of the subject lands by NHIC. These were Giant Pinedrops (*Pterospora andromedea*) and a “sensitive species”. The term “sensitive species” is used by the MNR to afford protection of species which may be sensitive to human disturbance. MNR staff stated the “sensitive species” was the Ram’s-Head Lady Slipper (*Cypripedium arietinum*).

Four Provincially Rare species were found within the study area through field investigations:

- Ram’s-head Lady-Slipper (G3S3);
- Hooker’s Rein-orchid (*Platanthera hookeri*) (G4S3);
- Cooper’s Milkvetch (*Astragalus neglectus*) (G4S3), and

- White Ground-cherry (*Leucopphysalis grandiflora*) (G4S3).

A more detailed account of each species within the study area is included in Brunton (2011). Giant Pinedrop was not observed on the subject lands.

Provincially Rare species found on the subject property are not listed by the MNR as Endangered, Threatened or Species of Concern. These species have an SRANK or Provincial Ranking, determined by the MNR, of S3 (as shown above in brackets). This rank is assigned to set protection priorities for rare species in Ontario. Rare species include S1-S3 rankings. S3 ranked species are found to be vulnerable due to restricted range, relatively small populations, recent or widespread declines, or other factors making it vulnerable to extirpation (NHIC n.d.).

In addition to the two Provincially Rare species found, 16 Regionally Rare species were identified. These species are found to be rare within the planning area of Renfrew County.

The diversity of native vascular plants found within the rare alvar communities was found to be high as was the average Coefficient of Conservation (CC) value. This value presents a measure of the ‘naturalness’ of native plant species in a particular area. The high CC for the site demonstrates that invasive species have not had a great impact on vegetation communities and individual native species, and the site has not been significantly degraded through anthropogenic disturbance.

A complete list of vascular plants found on the property is provided in Brunton (2011) (Appendix B).

4.2 Wildlife

The results below are from incidental observations made by Brunton Consulting from 2006-2011 and intensive surveys by Skelton Brumwell in 2009 and 2011.

4.2.1 Breeding Birds

The majority of bird species found within the study area were woodland species common to eastern Ontario and the lower Ottawa Valley. Many of the species observed are Area Sensitive species (OMNR 2000) requiring relatively large areas of natural habitat for successful breeding. These include the Northern Waterthrush (*Seiurus noveboracensis*), Red-Breasted Nuthatch (*Sitta canadensis*), Hairy Woodpecker (*Picoides villosus*), Ovenbird (*Seiurus aurocapillus*), Scarlet

Tanager (*Piranga olivacea*), Pileated Woodpecker (*Dryocopus pileatus*), Black-throated Green Warbler (*Dendroica virens*) and the Evening Grosbeak (*Coccothraustes vespertinus*).

Two rare species to the Arnprior-Braeside area were identified during site visits to the property in 2006 and 2011, being the Evening Grosbeak and Willow Flycatcher. Both species are uncommon for the area and it is unclear if these are resident birds or vagrants as observations were made only once for each species.

None of the species are listed in the Ontario Endangered Species Act (2007). A list of breeding birds detected is included in Brunton (2011) (Appendix B).

4.2.2 Amphibians and Reptiles

Two Species of Concern (S3) were previously identified in the area of the subject lands by the MNR. These are the Eastern Ribbon Snake (*Thamnophis sauritus*) and the Milksnake (*Lampropeltis triangulum*). During field investigations, searches were made for these species, but they were not observed.

Several common amphibian and reptile species were observed within the proposed expansion area including the Leopard Frog (*Rana pipiens*), Green Frog (*Rana clamitans*), Eastern Garter Snake (*Thamnophis sirtalis*), Gray Tree Frog (*Hyla versicolor*), Blue Spotted Salamander (*Ambystoma laterale*) and Eastern Newt (*Notophthalmus viridescens viridescens*).

Ephemeral pools within treed alvar communities were found large populations of Gray Tree Frog and Blue Spotted Salamander. These pools are scattered across the Treed Alvar communities found on the subject property. They are well shaded with a dense closed canopy and retain these pools until late in the summer. Due to the abundance of the pools and observations of large populations of amphibians utilizing them as breeding habitat, they would be considered locally significant habitat for breeding amphibians.

Amphibians, including the Eastern Newt and Gray Tree Frog were also found in artificial pools created by clearing of internal roadways along the proposed limit of extraction.

4.2.3 Other Wildlife

County of Renfrew Official Plan Schedule 2.1, shown on Figure 6, illustrates a Deer Wintering Yard overlay which encompasses the subject lands. During field investigations there was

evidence of heavy deer use within the study area, particularly within treed alvar where coniferous cover is dominant.

Common mammal species observed during field investigations included the Snowshoe Hare (*Lepus americanus*), Woodchuck (*Marmota monax*), Meadow Vole (*Microtus pennsylvanicus*) and the Red Squirrel (*Tamiasciurus hudsonicus*).

4.3 Wetlands

Two wetlands have been identified on the subject and adjacent lands. They are as follows:

Southeast Wetland

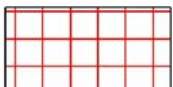
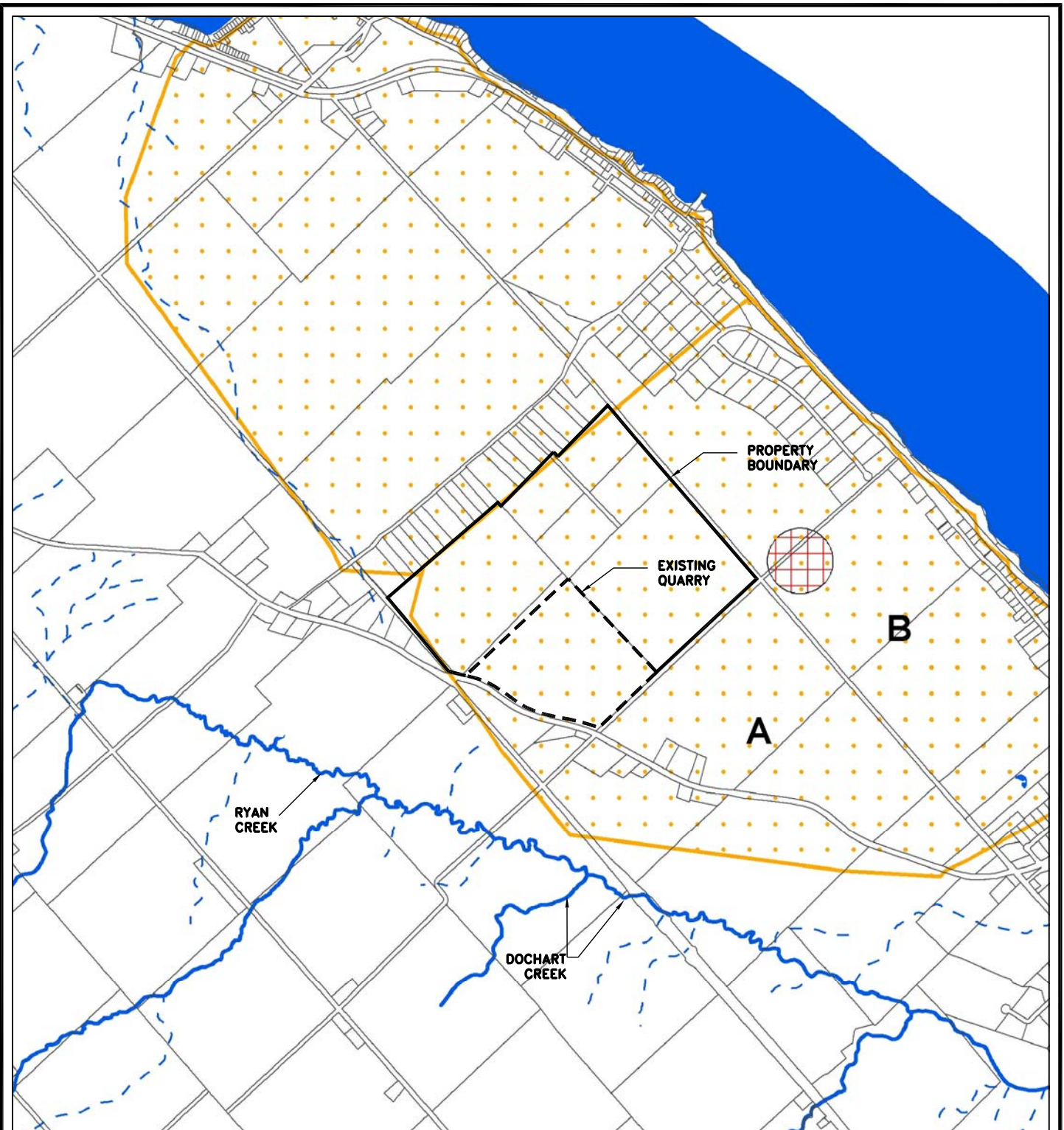
Township of McNab-Braeside Official Plan Schedule B identifies a Local Wetland southeast of the subject property as shown on Figure 6. Using aerial photography, as shown on Figure 7, the limit of the wetland is approximately 114 metres from the property limit and 259 metres from the limit of extraction. The wetland is on private lands and is beyond the extent of detailed natural environment inventories.

The Hydrological Report has identified a drainage area of approximately 80 ha for this wetland, of which, approximately 1 ha or 1% is located within the extraction area of the proposed expansion.

The Hydrogeological study has determined that the wetland has developed due to a bedrock depression which from observations, is largely controlled by beaver activity. Springs were found by Gorrell Investigations between the wetland and the subject property. The recharge area for this spring coincides with the competent bedrock within the 1% drainage area identified in the Hydrological Study.

Northwest Wetland

A wetland was identified through field investigations to be present within the northwest corner of the property extending onto adjacent lands identified in Figure 5 and Section 4.1.2 of this report (Coniferous Swamp Forest and Mixed Swamp Forest).



SENSITIVE AREA OF CONCERN



DEER WINTERING AREA



COLD WATER INTERMITTENT



COLD WATER PERMANENT



**NATURAL ENVIRONMENT
REPORT LEVEL I
BRAESIDE QUARRY EXPANSION**

FIGURE 6

COUNTY OF RENFREW DRAFT
OFFICIAL PLAN SCHEDULE 2.1

Scale 1:25,000±

P/N 2033

NOV. 2011



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EXISTING LICENCE

LIMIT OF EXTRACTION

PROPERTY LINE & LICENCED BOUNDARY

259m

114m

SE WETLAND

NATURAL ENVIRONMENT
REPORT LEVEL I
BRAESIDE QUARRY EXPANSION

FIGURE 7
DISTANCE TO SE WETLAND

Scale 1:5000

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These wetland communities are the result of groundwater seepage at the base of the Braeside Plateau and are fairly isolated and contained. Seepage was found to mix with discharge from the quarry before draining south to Ryan Creek and an un-named drain at Golf Course Road. Extraction within the proposed expansion area will result in a 17% reduction in drainage area for this wetland (springs).

This wetland was found to contain no significant features or ecological functions other than one small population of Ram's-Head Ladyslipper which is well represented in the Habitat 4 (Alvar Forest).

4.4 Aquatic Features

No naturalized watercourses are found directly within the within the proposed expansion area or adjacent lands of 120 metres.

A drainage swale has been constructed and in operation for approximately 35 years (personal communication), which drains across the quarry floor to a holding pond/sump within the extraction area of the existing quarry. This sump typically collects overland flow during the spring and fall and after large storm events. It is pumped out to a constructed drainage swale within the existing quarry which then drains into woodlands/swamp at the northwest corner of the property. This discharge then drains north to an open ditch on County Road 3 which then flows north through a culvert to Campbell Drive, to Carmichael Road and out letting to Ryan Creek.

Due to heavy loam soils (Farmington Loam) along Campbell Drive, only during heavy storm events, does discharge reach Ryan Creek. At all other times, any discharge infiltrates the underlying soils.

Due to beaver activity along County Road 3, discharge may drain west to Golf Course Road. Miller Paving will have these beaver dams removed ensure there is one outlet, being County Road 3.

The MNR does not have specific information for Ryan Creek, but has stated that it drains into Dochart Creek, an identified cold-water fishery. Draft Official Plan Schedule 2.1 (County of

Renfrew 2006) (see Figure 6) shows Ryan Creek as a cold-water watercourse. This identification is based on MNR mapping.

Muncaster Environmental Planning conducted a fisheries investigation of fish habitat in Ryan Creek in proximity to Carmicheal Side Road and Campbell Drive. The investigation concluded that the appropriate ecosystem is pike/darters/sunfish given the potential pike habitat, cool/warm temperatures and lack of suitable trout habitat.

The subject lands are within a groundwater recharge area, as identified in the Official Plan Schedule 2.2 (County of Renfrew 2006). Groundwater seepage areas were observed by Brunton in June 2007, with standing and flowing water, at the southern base of the Braeside plateau in the Mixed Organic swamp. This groundwater appears to mix with discharge from the quarry in the swamp and then drains to Ryan Creek. The closed canopy of the swamp allows for the shading and cooling of the discharge and seepage before it enters the open ditch on County Road #3.

Vernal pooling was observed within swamp areas in the southwestern part of the subject lands as well as in Treed Alvar communities. The dense tree cover and shallow soils over non-fractured limestone allow for vernal pooling to remain into late summer.

5.0 PHYSICAL DESCRIPTION

5.1 Geology and Soils

The subject lands are located on a stratified limestone bedrock plateau which extends east and west paralleling the Ottawa River within the Ottawa Valley Clay Plains (Chapman & Putnam 1966). Thin soils and the scarcity of water on the plateau have discouraged agricultural development.

The Soil Associations of Southern Ontario lists the subject lands as having Renfrew Clay Loam. These are said to be dominantly fine textured soils formed on till or lacustrine sediments.

During field investigations, rock barrens with no soil, open glades with very thin layers of soil, and coniferous forest with thin organic substrate were identified.

A more detailed account regarding the historical geology of the area is included in Brunton (2011) (Appendix B).

5.2 Topography and Drainage

The bench land atop the Braeside Plateau has a topographic classification between hilly and rolling land. A detailed account of drainage on the subject property is included in the Hydrological Investigation.

6.0 ANALYSIS OF NATURAL HERITAGE FEATURES

The following discusses whether any of the seven natural heritage features identified in the PPS are found on or adjacent to the proposed quarry. The identification of these features is the result of background research, fieldwork and analysis.

6.1 Significant Wetlands

A Locally Significant Wetland (Area of Concern) is identified on adjacent lands southeast of the licence boundary of the proposed quarry expansion. It is 114 metres from the license boundary and 259 metres from the limit of extraction. Only 1% of the drainage area to the wetland is found within the proposed expansion area. As this wetland has not been identified as Provincially Significant; the drainage area from the quarry is negligible; and there is 119 metres of mature forest between the licensed area and the wetland, there are no anticipated significant impacts on the wetland.

As no significant impacts are anticipated to this wetland, it will not be addressed in the Level II report. However, subject to the results of a groundwater monitoring program, mitigation measures may be implemented if impacts to springs/groundwater contribution to the wetland are found to occur.

6.2 Significant Habitat of Endangered or Threatened Species

A search of the NHIC database and correspondence with the MNR identified several potential species at risk in the area, but no records specifically for this property. As there are no confirmed records and field investigations found no occurrences of threatened or endangered species within the subject property, Significant Habitat of Endangered or Threatened Species will not be discussed in the Level II report.

6.3 Significant Woodlands

Significant Woodlands have not been identified by the municipality within the subject or adjacent lands. However, woodlands on the property are worthy of consideration as being Significant Woodlands due to the size, rare vegetation community types and linkages (OMNR 1999) with

wetlands and other habitat in the area. Therefore, Significant Woodlands will be discussed in the Level II report.

6.4 Significant Valleylands

There are no valleylands identified within the proposed quarry or on adjacent lands. Significant Valleylands will not be discussed in the Level II report.

6.5 Significant Wildlife Habitat

The evaluation and identification of Significant Wildlife Habitat is divided into four broad categories (OMNR 2000):

- Seasonal concentration areas;
- Rare vegetation communities or specialized habitats for wildlife;
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species; and
- Animal movement corridors.

The Significant Wildlife Habitat Technical Guide (OMNR 2000) details specific types of significant habitat associated within these broad categories. Significant Habitat identified within these categories on the subject and adjacent lands is summarized below.

Provincially Rare species, having a provincial ranking of S3 or lower, were found on the subject property. These species are not directly protected by Provincial legislation and policies; however, they are an indicator of alvar communities which have also been identified as Provincially Rare by the MNR (see Section 4.1).

County Official Plan Schedules, field investigation and air photo analysis confirm the presence of deer wintering yard habitat on the subject and adjacent lands. This specialized habitat is concentrated within the treed alvar communities. The dense conifer forest associated with these communities provides shelter, ease of movement and protection from predators (OMNR 2000).

Woodlands across the Braeside Plateau have been fragmented due to residential development, clearcutting (deforestation) and roadways. Larger intact woodlands found within the plateau and subject property have the ability to support Forest-Area Sensitive species. These species rely on

forest-interior habitat for suitable breeding habitat which must be at least 100 metres from the edge and woodlands ranging from 10-100 + ha.

Vernal pooling identified within Treed Alvar habitat was found to support large populations of breeding amphibians. Due to the extent of these pools across the Treed Alvar communities and associated forest habitat, these pools have been identified as locally important for amphibian populations.

Woodlands on the subject lands are relatively contiguous across the Braeside Plateau. This connectivity across the Plateau allows for the safe and seasonal movement of wildlife from one habitat to another and allow for the dispersal of many wildlife and plant species.

The identification of seasonal concentration areas (deer winter yard); rare vegetation communities (Alvar); specialized habitat (Habitat for area-sensitive species, amphibian woodland breeding ponds); and an animal movement corridor, lay the groundwork for the identification of Significant Wildlife Habitat on the subject property.

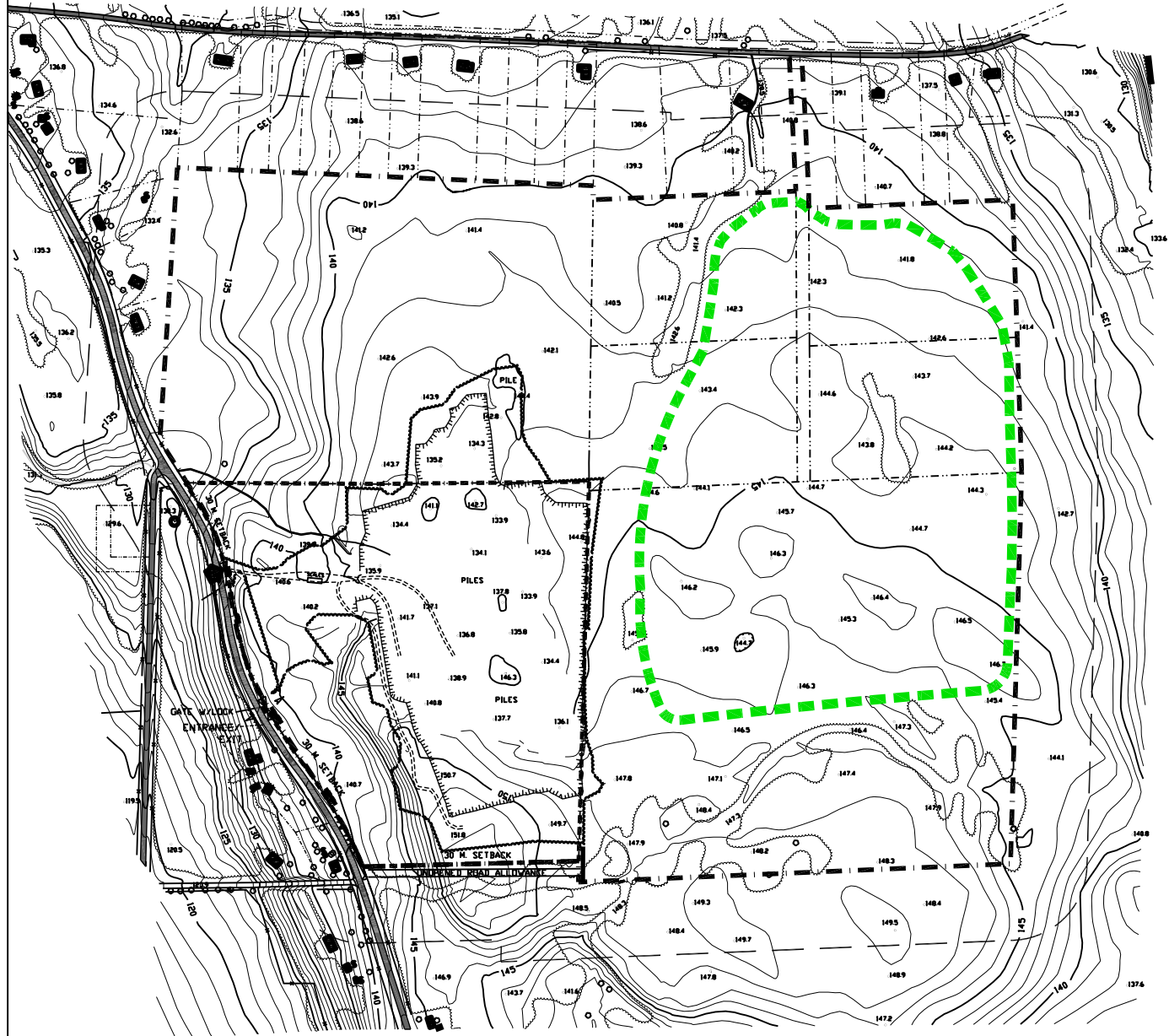
A Significant Wildlife Area has been defined, shown on Figure 8. This Area includes the representation of Provincially Rare plant populations and rare alvar communities on the subject property. This Area also captures identified specialized habitat and seasonal concentration areas.

Swamp forest habitat containing Provincially Rare species and groundwater discharge to Ryan Creek were excluded from the Significant Wildlife Area as it is geographically separated from the core alvar communities, has a low potential to contribute the representation of significant natural features and functions, and was found to only be significant at a local level.

Significant Wildlife Habitat will be discussed in the Level II report.

6.6 Significant Areas of Natural and Scientific Interest (ANSI)

A search of the NHIC and consultation with the MNR found no ANSI's on the subject or adjacent lands. Therefore, ANSI's will not be discussed in the Level II report.



■■■■■ SIGNIFICANT WILDLIFE AREA



**NATURAL ENVIRONMENT
REPORT LEVEL I
BRAESIDE QUARRY EXPANSION**

**FIGURE 8
SIGNIFICANT WILDLIFE AREA**

Scale 1:10,000

P/N 2033

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6.7 Fish Habitat

A review of OBM mapping, consultation with the MNR and field investigations found no fish habitat on the site or adjacent lands. Water discharged from the quarry does contribute to Ryan Creek south of the proposed quarry expansion. As discharge from the quarry enters known fishery and contributes to fish habitat, it will be discussed in the Level II report.

6.8 Summary of Natural Heritage Features

In summary, three natural heritage features were identified on and adjacent to the proposed expansion area. These are:

- Significant Woodlands;
- Significant Wildlife Habitat; and
- Fish Habitat.

Due to the presence of these natural heritage features on and adjacent to the proposed quarry expansion, a Level II report is required. The Level II report will assess potential impacts and recommend mitigation measures to ensure no negative impacts to these features and their functions.

NATURAL ENVIRONMENT REPORT LEVEL II

7.0 IMPACT ASSESSMENT AND MITIGATION MEASURES

Three natural heritage features have been identified through the Level I report:

- Significant Wildlife Habitat;
- Significant Woodlands; and
- Fish Habitat.

This Level II report assesses potential negative impacts as a result of the extraction within the proposed quarry expansion area and operation of an asphalt plant, and provides mitigation measures to ensure no negative impacts to these identified features and their ecological functions.

The PPS defines a negative impact “in regard to other natural heritage features and areas” as “..degradation that threatens the health and integrity of the natural features or ecological functions for which an area is identified due to single, multiple or successive development or site alteration activities.”

The PPS defines a negative impact “in regard to fish habitat” as “the harmful alteration, disruption or destruction of fish habitat, except where, in conjunction with the appropriate authorities, it has been authorized under the Fisheries Act, using the guiding principle of no net loss of productive capacity.”

7.1 Significant Wildlife Habitat

Significant Wildlife Habitat has been identified within the proposed expanded licence area through the Level I report. Specific functions which define this Significant Wildlife Habitat are:

- seasonal concentration areas (deer winter yard);
- rare vegetation communities (Alvar);
- specialized habitat (Habitat for area-sensitive species, amphibian woodland breeding ponds), and
- an animal movement corridor.

The PPS states that “Development and site alteration shall not be permitted in: d) Significant Wildlife Habitat; unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.” Therefore, mitigation measures are needed to

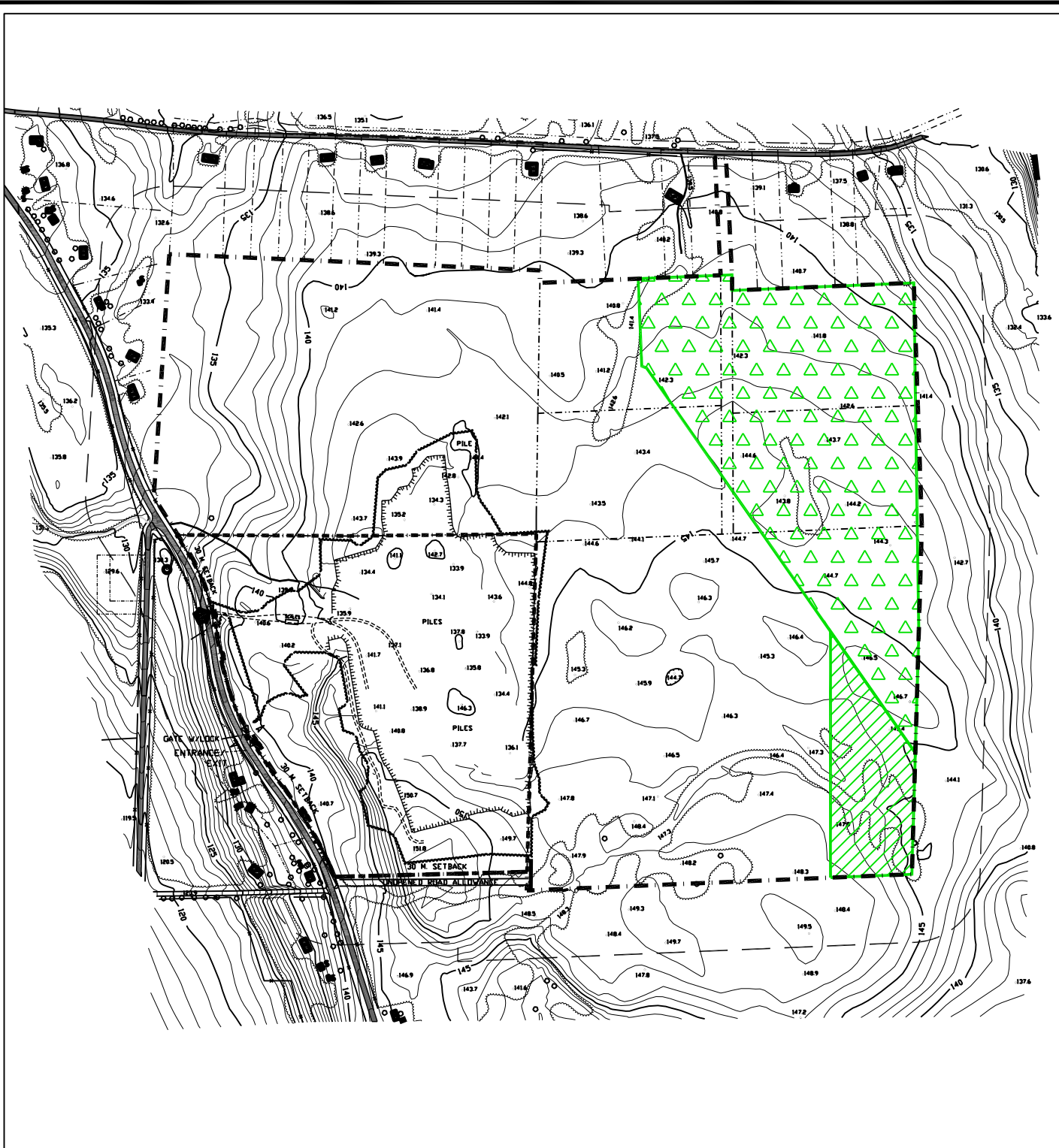
provide for the continued and self-sustaining representation of these features and functions which would satisfy the policies of the PPS.

Through fieldwork and subsequent analysis of concentrations of rare plant species found on the property, a Significant Wildlife Protection Area was identified in Brunton (2011), shown on Figure 9. This Protection Area contains virtually all of the significant natural features and functions of the study area. While individual provincially and regionally rare plants will be lost, the Protection Area is large enough to provide for self-sustaining representation of these populations.

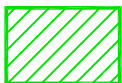
This Significant Wildlife Protection Area has been established due to the exceptional nature of the features and functions found in the Significant Wildlife Area. While protection of a smaller portion of the Significant Wildlife Area would satisfy the requirements of the PPS, there is justification to exceed this provincial standard due to the condition and nature of these features and functions. Miller Paving has agreed to this larger wildlife protection area. The Significant Wildlife Protection Area should be protected to ensure its long-term survival.

An undisturbed corridor of 150 metres has been established from the southern edge of Protection Area along the east property boundary to the south property boundary (Figure 9). This will allow for the local and regional dispersal of various flora and fauna and prevent the isolation of populations on a daily or seasonal basis. While corridors of 50-100 metres can facilitate the movement of generalist species (Environment Canada 2005), larger corridors are necessary for specialist species. Due to the presence of area sensitive species, deer wintering yard and rare plant species, a larger corridor has been established which will be left undisturbed and vegetated.

Extraction outside the Significant Wildlife Protection Area and corridor on the subject property will result in the minor loss of the habitat for area-sensitive species on the subject lands. The identified Significant Wildlife Protection Area will retain 24.3 hectares of woodlands, of which, there is 5.6 hectares of interior forest (total area 100 metres from the edge of the Protection Area). As expressed in Brunton (2011), interior habitat on the subject property has been impacted through the previous removal (clear-cut) of natural forest east of the subject lands and fragmentation by residential development to the north and west.



SIGNIFICANT WILDLIFE PROTECTION AREA TO BE PRESERVED



WILDLIFE CORRIDOR TO REMAIN UNDISTURBED AND VEGETATED



**NATURAL ENVIRONMENT
REPORT LEVEL II
BRAESIDE QUARRY EXPANSION**

**FIGURE 9
MITIGATION MEASURES**

Scale 1:10,000

P/N 2033

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It is anticipated that area sensitive species currently utilizing the subject lands will continue to use of the retained interior habitat. The establishment a corridor to adjacent lands to the south where Interior Forest habitat is present, but fragmented by clearing and roadway activities, has been proposed as well.

The establishment of the wildlife corridor and Protection Area will retain approximately 24.3 hectares of habitat for wintering deer populations on the subject property. The wildlife corridor will allow for the seasonal movement of deer from the subject lands to adjacent lands on the Braeside Plateau. This retained habitat will provide for the continued use of the subject lands by wintering deer populations.

Alvar habitat has been found to be tolerant of adjacent natural disturbance and resistant to non-native influences. A broad protective buffer, usually recommended for less disturbance-tolerant forested habitats is not necessary here. Therefore, no buffer has been recommended adjacent to the Significant Wildlife Area.

The proposed asphalt plant is approximately 500 metres from the Significant Wildlife Protection Area. An Environmental Compliance Approval (ECA) is required for the asphalt plant and this must meet requirements for human health in the surrounding area. We conclude that the environmental protection standards required for an ECA, and the isolation of the asphalt plant (500 metres away) will combine to ensure no significant impacts to the features or functions of the Significant Wildlife Protection Area.

7.2 Significant Woodlands

Woodlands on the Braeside Plateau and subject lands have not been identified as Significant by the municipality. However, these woodlands are worthy of consideration as being Significant due to the size, rare vegetation community types (alvar) and linkages (OMNR 1999) to wetlands and other habitat across the Braeside Plateau. Parts of these woodlands are found within the proposed expanded licence area.

The PPS states that “Development and site alteration shall not be permitted in: b) Significant woodlands south and east of the Canadian Shield; unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.”

The protection of the identified Significant Wildlife Habitat Protection Area and corridor across the property, as discussed above, will retain approximately 21.28 ha of these woodlands. The Protection Area and corridor are sufficiently large enough to ensure the self-sustainability of these Significant Woodlands and their full range of significant features and ecological functions within the subject property.

The 150 metre wildlife corridor will provide a linkage between Significant Woodlands on the subject lands and those on adjacent lands south of the proposed licence area on lands not owned by Miller Paving.

7.3 Fisheries

The Level I report and Hydrological Investigation identified contribution of ground water and de-watering from the proposed quarry expansion area to Ryan Creek, a cold-water fishery identified by the MNR.

De-watering and groundwater from the subject lands must be managed to ensure no negative impacts to fish habitat downstream. An impact to fish habitat would result in a HADD (Harmful Alternation, Disruption or Destruction of fish habitat) and would be in violation of the Federal Fisheries Act.

Muncaster Environmental Planning concluded that the appropriate ecosystem is pike/darters/sunfish given the potential pike habitat, cool/warm temperatures and lack of suitable trout habitat. It further recommended that due to sculpin habitat (specifically Mottled Sculpin), which is an indicator of a coolwater fishery; a water temperature target of 22 C is recommended.

The Hydrological Investigation found that de-watering operations into Ryan Creek will be below the maximum annual water temperature threshold of 22°C, therefore no thermal impacts are anticipated.

The drainage area for Ryan Creek on the subject property is less than 1% of the total drainage area. This portion of the drainage area located on the subject property will not be extracted, thereby eliminating any potential impacts due to reduced runoff or base flow.

Swamp communities resulting from groundwater discharge at the base of Braeside Plateau are found in the northwest corner of the subject property. These communities contribute cold

groundwater and shading for discharge from the proposed expansion area. These communities lie within a 300 metres zoning setback, therefore no extraction will occur. These communities shall remain undisturbed and vegetated to ensure no thermal impacts or loss of groundwater to Ryan Creek. This has been recommended in the Hydrological Investigation as well.

The Hydrological Investigation found that the ultimate de-watering operations will not result in a HADD on fish habitat associated with Ryan Creek. Recommendations including Sediment and Control Measures and Monitoring, and Contingency Plans have been established to ensure that the maximum thermal impact threshold will not be exceeded.

A detailed account of the recommendations is found in the Hydrological Study.

7.4 Monitoring

A monitoring plan has been recommended in Brunton (2011) to ensure the geographic extent of the Significant Wildlife Protection Area is maintained. Monitoring of vegetation structure between the Protection Area and limit of extraction, specifically, to establish if invasive species are becoming established; and monitoring of significant features within the Significant Wildlife Protection Area will ensuring the continuity of rare species populations and quality of the alvar habitat.

The following monitoring and mitigation measures will be implemented on site for protection of the Significant Wildlife Protection Area:

1. A pre-monitoring survey of potentially invasive weed species along the edge of the Significant Wildlife Protection Area shall be conducted to provide baseline information for monitoring and interpretation of results.
2. An annual ground level photographic documentation from pre-determined GPS (Global Positioning System) points along the boundary of the Protection Area. A review of this documentation should be conducted every five years by a qualified person to determine if degradation is occurring as a result of the quarry expansion and if invasive species are becoming established along the edge of the Protection Area and within the alvar.

In the event that the extent of the Protection Area has declined, it is recommended that drought tolerant native conifers be planted along the edge to provide a protective screen

against further loss. If similarly, should significant populations of invasive species become established, it is recommended these be physically removed.

3. To monitor significant features within the SWPA, population counts of two key provincially rare species (Ram's-Head Ladyslipper and Cooper's Milkvetch) be undertaken biannually for a period of ten years. If two consecutive declines in populations of 33% are detected, the MNR or equivalent will be contacted to develop population mitigation measures. Should populations remain stable over the period of 10 years (5 biannual counts), monitoring would then cease. One final population count will occur three years after the final land clearing operation adjacent to boundary of the Significant Wildlife Protection Area.

8.0 CONCLUSIONS

Skelton, Brumwell & Associates Inc. was retained by Miller Paving Limited in October, 2005 to provide environmental services for preparation of a Natural Environment Report relative to its objective to expand the Braeside Quarry.

The study determined that three natural heritage features; Significant Wildlife Habitat, Significant Woodlands and contribution to Fish Habitat, were identified within the proposed expansion area and adjacent lands.

Mitigation measures were recommended to address potential impacts as a result of the proposed quarry expansion. These mitigation measures are summarized below:

- Preservation of the identified Significant Wildlife Protection Area to ensure its long-term survival;
- The recommended monitoring plan is implemented for the continued protection of the Significant Wildlife Protection Area.
- The wildlife corridor remains undisturbed and vegetated.

In conclusion, through the implementation of mitigation measures in the Level II report and the Hydrological Investigation, the proposed quarry expansion and asphalt plant will have no anticipated negative impacts on natural heritage features and functions.

All of which is respectfully submitted,

SKELTON, BRUMWELL & ASSOCIATES INC.

BRUNTON CONSULTING SERVICES

Per:

Per:



Kyle Fleming, BSc (Wildlife)

Daniel F. Brunton

Ecologist

JKF/slc

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APPENDIX A
Curriculum Vitae- Kyle Fleming

**Kyle Fleming, B.Sc. (Wildlife), Dip. Fish and Wildlife Tech.
Ecologist**

EDUCATION

Bachelor of Science in Wildlife Biology (2002)

University of Northern British Columbia

Diploma in Fish and Wildlife Technology (1998)

Sir Sandford Fleming College

PROFESSIONAL BACKGROUND

Skelton Brumwell & Associates Inc. (Barrie, ON)

Ecologist- May 2004-present

Kyle has over 10 years experience conducting field inventories of flora and fauna in wetland and terrestrial environments and identifying natural heritage features and functions. He is a Qualified Wetland Evaluator by the MNR, is trained and experienced in the use of Ecological Land Classification (ELC), and has been qualified as an expert at the Ontario Municipal Board.

Kyle has completed studies throughout Central and Southern Ontario, and the United States; including projects on the Oak Ridges Moraine, Niagara Escarpment, for Species at Risk and within Provincially Significant Wetlands. His work is readily accepted by municipalities and conservation authorities, and he is very familiar with their requirements and procedures. He is also well versed in municipal, provincial and federal policies and legislation.

Hamer Environmental L.P. (Mt. Vernon, WA, USA)

Project Supervisor/Field Biologist- April-August 2003

Responsible for supervising and managing a threatened seabird monitoring project on state lands.

Aqua Terre Solutions Inc. (Toronto, ON)

Environmental Technician- November-January 2002-2003.

Hamer Environmental L.P. (Mt. Vernon, WA, USA)

Field Biologist- April-August 2002.

Conducted threatened seabird surveys on state lands to determine presence/absence relative to forestry activities.

University of Washington (Seattle, WA., USA)

Field Technician- June-August 2001.

Research project on nest predation of threatened seabirds and impacts of forestry practices on nesting sites.

City of Barrie, Environmental Services. (Barrie, ON)

Junior Environmental Officer- May-August 2000.

Water sampling, investigations of pollution concerns and public consultation.

**Kyle Fleming, B.Sc. (Wildlife), Dip. Fish and Wildlife Tech.
Ecologist**

CERTIFICATIONS

Ontario Wetland Evaluation Training Course, 2004.

*OPPI- The Planner at the Ontario Municipal Board
Seminar, 2006*

Ecological Land Classification for Southern Ontario
Training Course, 2005.

Ministry of Natural Resources (MNR) Butternut
Assessment Course, 2009.

**Kyle Fleming, B.Sc. (Wildlife), Dip. Fish and Wildlife Tech.
Ecologist**

KEY PROJECTS (AGGREGATES)

Miller Paving Ltd.- Natural Environment Report (NER) Level I & II (Township of Minden Hills)

NER was prepared in accordance with the Aggregate Resources Act (ARA) for a wayside quarry adjacent to an existing licensed pit. Natural heritage features included Provincially Significant Wetlands (PSW), Significant Wildlife Habitat and Significant Woodlands. Mitigation measures were recommended to avoid impacts to these features and their related ecological functions.

Robinson-Kovacs Pit- Natural Heritage Evaluation (Oak Ridges Moraine)

A natural heritage evaluation was prepared in accordance with the Oak Ridges Moraine Conservation Plan for an amendment to the Site Plan of an existing gravel pit.

Miller Paving Ltd.- Natural Environment Report Level I & II (Township of McNab-Braeside)

NER completed in support of major site plan amendment for expansion of quarry under ARA. Significant Wildlife Habitat was identified which included provincially rare plant species, amphibian woodland ponds, area sensitive bird habitat and deer wintering habitat.

Earth Resources Ltd.- Natural Environment Report Level I & II (Township of Galway-Harvey- Cavendish)

NER completed in support of new aggregate pit within Crown Land permit. Significant Wildlife Habitat (Great Blue Heron nesting site) and significant wetlands were identified and mitigation measures recommended for their protection.

Universal Sand & Gravel- Natural Environment Report Level I & II (Township of Garafraxa)

Natural Environment Report completed in support of a major site plan amendment for a small woodlot which had remain undisturbed. Field investigations were focused on this woodlot and identified butternut trees. The butternut trees were assessed using standard protocols. NER was accepted by MNR and the Township.

Hillway Equipment Ltd- Butternut Assessment (Township of Oro Medonte)

An assessment was completed to Ministry of Natural Resource' standards for endangered butternut trees found within an existing pit. The assessment found the trees to be "unretainable" and could be removed.

**Kyle Fleming, B.Sc. (Wildlife), Dip. Fish and Wildlife Tech.
Ecologist**

KEY PROJECTS (AGGREGATES)

Miller Paving Ltd.- Species at Risk Assessment (All of Ontario)

A species at risk assessment was completed for 64 aggregate properties in Ontario to determine potential for habitat of endangered or threatened species listed in the Endangered Species Act (2007). An exemption agreement with the MNR was completed each site identified as having potential habitat. These agreements included conducting surveys for species within appropriate habitat, exclusion fencing, timing of certain operations and training of site staff.

**Kyle Fleming, B.Sc. (Wildlife), Dip. Fish and Wildlife Tech.
Ecologist**

KEY PROJECTS (URBAN AND RURAL DEVELOPMENT)

Environmental Impact Study (EIS)- Rural Severances (Township of Oro- Medonte)

An EIS was prepared as part of a rezoning and official plan amendment to sever seven residential lots. Fieldwork identified the presence of Significant Wildlife Habitat (Species of Conservation Concern) within the property. Habitat was delineated and avoided as part of the conditions of the severance.

EIS- Rural Severance (Township of Clearview)

As part of a condition for severance of a large rural lot, an EIS was prepared. The EIS identified wildlife corridors functions, area sensitive habitat and locally significant wetland.

EIS- Rezoning (Township of Essa)

An EIS was prepared as part of an application for rezoning of a rural residential property to institutional use (church). Wetlands, significant woodlands and a cold-water stream were identified and setbacks established for protection of these features.

EIS- Building Permit (Township of Oro-Medonte)

In conjunction with the landowner and NVCA, development of a rural property was completed to avoid any impacts to significant woodlands and the habitat of endangered species.

Rare Species Surveys- Southshore Woods (Town of Innisfil)

Rare species surveys were conducted as part of Site Plan Control for 3 residential lots in the Town of Innisfil. The purpose of the surveys was to locate any populations of these rare species and avoid any impacts through proper placement of buildings and associated services.

Environmental Review Update and Tree Preservation Plan- Subdivision (Township of Severn)

An update to a previously completed Review for a residential subdivision along the Severn River was completed as part of Draft Plan conditions. Mitigation measures were recommended to avoid impacts to sensitive habitat. In addition, a tree preservation plan was developed to retain portions of wildlife habitat on the property and the rural aesthetics of the area.

**Kyle Fleming, B.Sc. (Wildlife), Dip. Fish and Wildlife Tech.
Ecologist**

Scoped EIS and Wetland Delineation- Skyline Development Inc. (Township of Tay)

Skelton Brumwell assisted with the completion of a Scoped EIS as required for clearance of Draft Plan conditions for waterfront redevelopment in the Town of Port McNicoll. Further to this work, SBA also assisted with the development of a Shoreline Buffer & Management Plan and completed wetland delineation of Provincially Significant Coastal Wetlands to the satisfaction of the Ministry of Natural Resources.

Natural Heritage Evaluation- Lakeridge Ski Resort (Town of Uxbridge and the Oak Ridges Moraine)

Required as part of rezoning application to permit four-season recreation use, a Natural Heritage Evaluation was completed per policies of the Official Plan and Oak Ridges Moraine Conservation Plan. The Evaluation was scoped to areas of new recreation uses.

Preliminary Species at Risk Assessment- Rural Development (District of Muskoka)

Due to the potential presence of the habitat of a threatened species, a Preliminary Species at Risk Assessment was completed for four rural severances. Potential habitat was identified and setbacks recommended for its protection.

EIS Update- Senior's Centre (Township of Severn)

Prior to final development of a site plan for a senior's centre in the town of Severn Falls, an update to a previously completed EIS was required. The EIS found the presence of a threatened species. The habitat of this species was delineated and all development was located outside this area. Further mitigation measures were recommended to ensure no impacts to this species.

Environmental Evaluation- Shoreline Residential Severances (Township of Georgian Bay)

An evaluation was completed in support of an application to sever two shoreline residential lots on Six Mile Lake. Field investigations and analysis identified appropriate setbacks and mitigation measures for the protection of fish habitat and water quality with the Lake.

Tree Inventory and Butternut Assessment (Town of Innisfil)

A tree inventory was required for development of commercial site in the Town of Innisfil. The inventory provided a detailed account of tree species, size and health relative to areas proposed to be disturbed. During the surveys, endangered butternut trees were found and assessed using standardized protocols.

Natural Heritage Development Review- Big Chute (Crown Lands)

Field investigations and a review of background documentation was completed to determine the opportunities and constraints for construction of a cottage road through Crown Lands. Recommendations for placement of the road were made to avoid impacts to sensitive natural features.

APPENDIX B

Natural Environment Assessment:

Braeside Quarry Expansion Area

Brunton Consulting Services October, 2007

Brunton Consulting Services

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Natural environment existing conditions:

Braeside Quarry Expansion area



August 2011

**Natural environment existing conditions assessment
(Revised): Braeside Quarry expansion area, McNab -
Braeside Township, Renfrew County**

Daniel F. Brunton,

Brunton Consulting Services,
Ottawa, Ontario

August 2011

Prepared for:
Miller Group Inc.,
Markham, Ontario

Signed:



Daniel F. Brunton, Brunton Consulting Services

Table of Contents

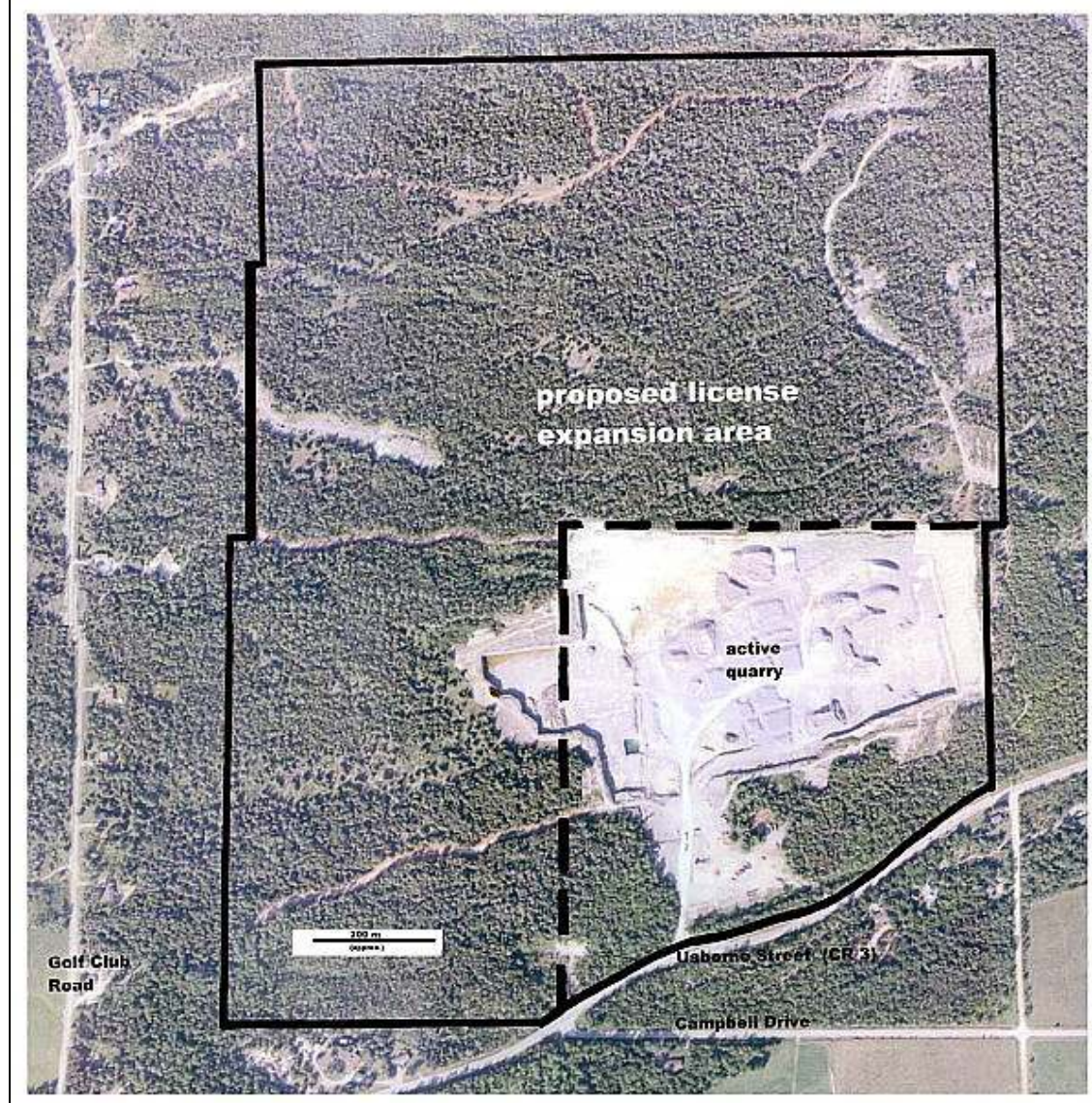
1. <u>INTRODUCTION AND OBJECTIVES</u>	4
2. <u>SITE CONTEXT</u>	7
3. <u>NATURAL ENVIRONMENT FEATURES AND FUNCTIONS</u>	9
3.1 HABITATS	9
3.1.1 Habitat 1: Developed (Transformed)	11
3.1.2 Habitat 2: Cultural Meadow and Thicket	11
3.1.3 Habitat 3: Alvar Glades and Pavement	12
3.1.4 Habitat 4: Alvar Conifer Forest	14
3.1.5 Habitat 5: Young Upland Mixed Forest	16
3.1.6 Habitat 6: Mature Upland Mixed Forest	16
3.1.7 Habitat 7: Upland Coniferous Forest and Scrub	17
3.1.8 Habitat 8: Coniferous Swamp Forest	18
3.1.9 Habitat 9: Mixed Swamp Forest	19
3.2 VASCULAR FLORA	20
3.3 FAUNA	20
3.3.1 Breeding Birds	21
3.3.2 Other Fauna	21
4. <u>SIGNIFICANT FEATURES AND FUNCTIONS</u>	22
4.1 SIGNIFICANT VEGETATION.....	22
4.2 SIGNIFICANT FLORA	22
4.2.1 Provincially Significant Flora	23
4.2.2 Regionally Significant Flora	27
4.3 SIGNIFICANT FAUNA.....	28
4.3.1 Amphibians and Reptiles	28
4.3.2 Breeding Birds	29

4.4 SIGNIFICANT ECOLOGICAL FUNCTIONS.	30
5. <u>Impact Assessment and Conclusions</u>.....	32
5.1 SIGNIFICANCE CONCLUSIONS.	32
5.2 SIGNIFICANCE WILDLIFE AREA.	33
5.3 MITIGATION OPPORTUNITIES	34
5.4 MONITORING OF MITIGATION MEASURES	36
5.5 ECOLOGICAL RESEARCH OPPORTUNITIES	37
6. <u>REFERENCES CITED</u>.....	38
APPENDIX 1: Native Vascular Plant Species	42
APPENDIX 2: Vascular Plant Collections and Observations	55
APPENDIX 3: Faunal Observations	81
APPENDIX 4: Daniel Brunton résumé	83

1. Introduction and Objectives

This natural environment assessment is part of the evaluation process for the proposed expansion of the Braeside Quarry licence within the 161 ha Miller Paving Ltd. property north of Usborne Street/ Renfrew County Road 3 (Figure 1). The investigation most directly addresses the footprint of the property but also extends outward to consider implications for the ecological functions of adjacent natural landscape areas. The present investigation does not include consideration of fish or fish habitat questions.

Figure 1: Braeside Quarry Property and Licence Expansion Area



The natural environment assessment of the Braeside Quarry Property Expansion Area is undertaken within a study team lead contracted by Miller Group and lead by Skelton Brumwell & Associates. Since 2006 the assessment has involved both on-site and off-site research and analysis as well as considerable consultation with resource specialists, planners and regulatory agency personnel. The natural environment assessment addresses only the proposed expansion area as the existing licence area has almost entirely largely transformed from a natural condition by several decades of aggregate extraction.

Following a review of aerial photography, reference to available biophysical information on the general area (including documentation of previous personal findings) and discussion with project personnel at Skelton Brumwell and Miller Paving, all habitats within the study area were directly examined. These field studies were focussed largely upon the 103 ha of the proposed licence expansion.

Initial on-site inspections were conducted by Daniel F. Brunton on 8 June and 31 July 2006. These dates were sufficiently far apart to provide a good indication of the variation of wildlife features and functions across the growing season within the study area. Written notes were taken to document the vegetation and natural features present. A draft report was prepared in November 2006. Subsequent to discussions with project team members and with Ontario Ministry of Natural Resources resource specialists during a September 2007 pre-consultation, a revised report (Brunton 2007) was prepared. That preliminary report provided the biophysical framework upon which the Natural Environment Report Level I & II required by the Aggregate Resources Act Level I (Skelton Brumwell 2007) was based.

A peer review of this and other technical analyses was conducted for the County of Renfrew in 2009 - 2011 by Golder Associates, leading to further refinements and research (Fleming and Brunton 2009). As well between 2007 and 2011, considerable additional on site and off-site research has been conducted. These data, including significant contributions of faunal data by Kyle Fleming of Skelton Brumwell Associates, was incorporated within the present revised natural environment assessment.

Important biophysical site data have been documented in the course of investigations conducted during 10 site visits between 27 August 2008 and 1 June 2011 subsequent to the 2007 preliminary natural environment assessment. Particularly valuable site visit investigations were conducted on 2 June 2009 and 1 June 2011, during a reconnaissance inspection on 4 June 2009 with representatives from the community based FACT-MB group, and in a significant areas review with Pembroke District and Peterborough Office Ontario Ministry of Natural Resources specialists.

Particular attention was paid during all field investigations to the possible presence of Endangered or Threatened Species (SAR) scheduled with the federal or provincial Species At Risk Acts, the occurrence of which could require specific conservation/ protection actions. All SAR and other provincially significant vascular plant species and vertebrate fauna known to occur in the Ottawa Valley in habitats such as those found in the study area, were considered. This investigation not only included the identification of all native plant species encountered but included the observation of physical evidence (scats, tracks) for mammals and the searching of potential shelter or feeding sites (e.g. beneath logs, rocks, etc.) for amphibian and reptile species.

Digital photography of landscapes and features was obtained in the course of all field studies, a number of which are utilized in this report. Voucher specimens were secured to support and verify determinations of suspected or confirmed significant plant species whenever possible. Vouchers were not obtained if doing so would reduce the particular native plant population by more than 5%. Such collections are referenced by the Brunton accession number (between 16,622 and 17,878) following mention of that species or record in Appendix 1. These vouchers are maintained and available for inspection in the Brunton herbarium and replicated in a number of public collections. Comprehensive collection data and observations on other significant vascular plant occurrences are also detailed in Appendix 2.

The present study represents a substantial enhancement and refinement of the preliminary natural environment report (Brunton 2007). The objective of the present study, over and above updating and refining the findings and conclusions of that preliminary assessment, are as follows:

- to evaluate natural environment conditions and ecological significance within and adjacent to the Braeside Quarry expansion area;
- to identify potential impacts of the proposed licence expansion on the apparent and potential natural environment values in adjacent areas;
- to identify ecologically appropriate mitigation opportunities, if and as appropriate.

Where subsequent investigations have not significantly altered our previous information and understanding, the text and figures employed in Brunton (2007) are used in this document as well.

2. Site context

The study area forms a component of a high, level plateau of limestone bedrock paralleling the Ottawa River west of Braeside. This 2 - 3 km wide plateau extends 3 - 4 km eastward and westward of the Braeside Quarry (Richard 1984) and drops steeply to the Ottawa River shore (northward) and towards Ryan Creek (southward). The thin soils and scarcity of standing water across the plateau has discouraged agricultural development (Chapman and Putnam 1984), resulting in the continuation of a largely forested landscape here. The fire tolerant/ dependent vegetation has a high proportion of coniferous forest that is sparse in places, with small, open glades being common features throughout the landscape. Extensive, naturally occurring meadows and rock barrens are present as well. A number of these features combine to form alvar vegetation.

Like similar limestone plateaus such as the Panmure Alvar in western Ottawa, the Burnt Lands in Ottawa/ Lanark, the Clay Bank Alvar in Lanark/ Renfrew (White 1997, Brunton 1986, Brunton 1988, respectively), the Braeside plateau is one of the highest elevation areas of the lower Ottawa Valley (ca. 150 m asl). It was amongst the first dry land to emerge from Champlain Sea flooding that followed deglaciation of the lower Ottawa Valley.

At about 10,000 years B. P. the emerging Braeside plateau, like those other high limestone bedrock areas, would have been exposed to the cold, dry subarctic conditions present in these post-glacial times longer than any other, lower sites in the lower Ottawa Valley a.s.l. (Dadswell 1974). A freshwater body, Lake Lampsilis, was formed by the meltwater of the decaying glaciers. It remained in lower elevation portions of the lower and middle Ottawa Valley until ca. 8000 years B. P. (Harington 1989), by which time the land had rebounded sufficiently to drain the lake. The result was an enlarged version of the Ottawa River through which the Great Lakes Region drained, ecologically connecting the Ottawa Valley with habitats and species now typically found well north and west of here. Much of the lower elevation areas of lower Ottawa Valley below the height of the Braeside plateau remained inundated for centuries longer.

The landscape and climate conditions in place in the study area today were fully established by about 5,000 - 6,000 years B. P. (Occhiotti 1987). By this time the Braeside plateau and areas like it, however, would have had a well-established forest vegetation that included strong representation of western and northern elements.

As noted previously, the demanding site conditions of the Braeside plateau has historically discouraged agricultural development. Beyond the industrial activity of the Braeside Quarry,

development on the plateau predominantly remains low density rural estate residential housing. There are relatively few crossing roads. A large recreational complex (golf course) also exists to the west of the Braeside Quarry property.

3. Natural Environment Features and Functions

The known natural assets and characteristics in and adjacent to the Braeside Quarry expansion area are described below. Faunal data typically offer lower returns of interpretable data than can be expected from a comparable investment of study resources in the investigation of floristic, habitat and ecological function values.

Accordingly, faunal observations focus on identifying potentially significant species and habitats rather than providing a comprehensive review of common and representative taxa. The documentation of faunal data (see Appendix 3) was substantially enhanced by recent observation from biologist Kyle Fleming of Skeleton Brumwell.

3.1 HABITATS

Nine natural habitats were identified in the Braeside Quarry expansion study area (Figure 2). This is two more than are described in Brunton (2007) which did not include the transformed habitat of the existing licence area and some open Cultural habitat areas within alvar glade. Consideration of these severely disturbed landscape elements was undertaken as part of the response to the 2009 peer review process.

A listing of the apparently most appropriate vegetation units of the Southern Ontario Vegetation Classification system (Lee et al. 1998) is noted within these habitat descriptions to assist in the consideration of the study area in a southern Ontario context.

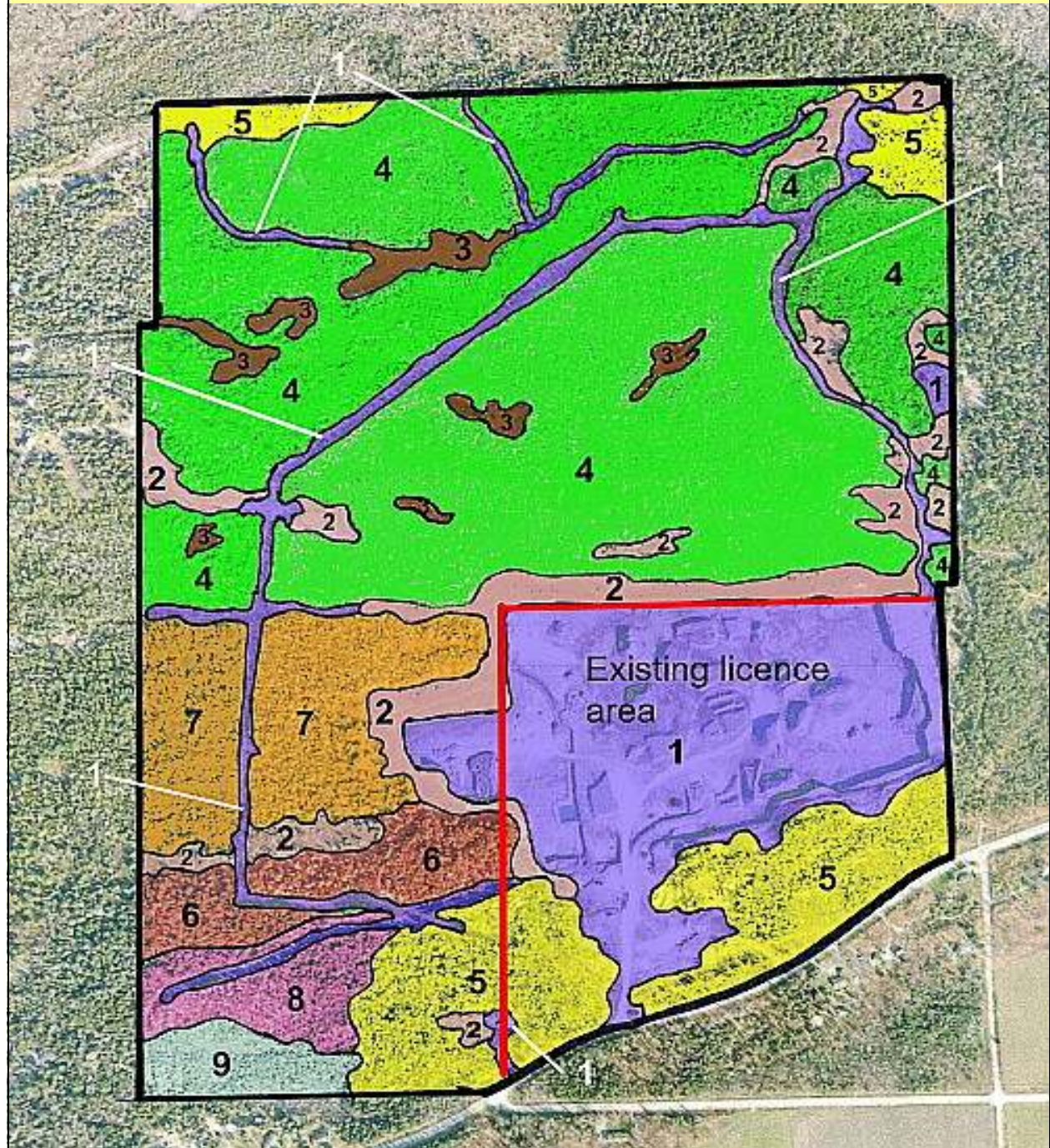
The habitats noted in the Braeside Quarry expansion area are depicted in Figure 2. The areal extent of each is as follows:

Habitat 1 - Developed (Transformed)	28.1 ha
Habitat 2 - Cultural Meadow and Thicket	9.5 ha
Habitat 3 - Alvar Glade and Pavement	2.4 ha
Habitat 4 - Alvar Coniferous Forest	56.7 ha
Habitat 5 - Young Upland Mixed Forest	15.5 ha
Habitat 6 - Mature Upland Mixed Forest	4.7 ha
Habitat 7 - Upland Coniferous Forest and Scrub	10.0 ha
Habitat 8 - Coniferous Swamp Forest	3.5 ha
Habitat 9 - Mixed Swamp Forest	2.3 ha

Figure 2: habitats of the Braeside Quarry expansion area

Habitat 1 - Developed (Transformed)
Habitat 2 - Cultural Meadow and Thicket
Habitat 3 - Alvar Glade and Pavement
Habitat 4 - Alvar Coniferous Forest
Habitat 5 - Young Upland Mixed Forest

Habitat 6 - Mature Upland Mixed Forest
Habitat 7 - Upland Coniferous Forest and Scrub
Habitat 8 - Coniferous Swamp Forest
Habitat 9 - Mixed Swamp Forest



3.1.1 Habitat 1: Developed (Transformed) - no vegetation equivalent in Lee et al (1998)

The existing quarry operation has been active for several decades, creating a substantial area of cleared land and a deep depression into the limestone bedrock (Figure 3). Precipitation and seepage contribute water into the pit. This water is pumped into the Ryan Creek drainage system through a drainage channel to the south.

In addition to the active quarry site, transformed landscape occurs along roadways, including along the right-of-way of the recently (2007) cut track that delimits the perimeter of the proposed expanded expansion area (Figure 4).

These areas possess no natural habitat and contribute virtually no natural features nor do enhance natural functions within the Braeside Quarry expansion area. The vertical rock faces of the quarry, however, potentially present nesting and roosting opportunities to cliff-nesting birds such as Common Ravens and Red-tailed Hawks. That benefit would likely not occur until aggregate extraction activities were well removed from the rock-faces in question.

Figure 3: Active Braeside Quarry



Figure 4: Extraction area perimeter roadway



3.1.2 Habitat 2: Cultural Meadow and Thicket - CUM1 and CUT1 vegetation of Lee et al (1998)

Small examples of predominantly non-native vegetation have developed in regenerating areas that

have been cleared of their natural vegetation by industrial activities (Figure 5). These are located along the shrubby edges of the existing quarry and, to a lesser degree in sterile meadows (former agricultural clearings?) north-westward towards Golf Club Road. These areas possess an abundance of weedy vegetation and were not considered to be of sufficient natural significance to warrant description in Brunton (2007). Regeneration of recently disturbed (2007) alvar habitat along the excavation perimeter track, however, has been found to include spontaneous populations of significant vascular plants species, including Provincially Rare species (see 4.2 *Significant Flora*, below).

Figure 5: regenerating meadow-like disturbed area north of existing quarry



3.1.3 Habitat 3: Alvar Glade and Pavement - Open Alvar (ALO1) and Shrub Alvar (ALS1) vegetation of Lee et al (1998)

Open glades - natural moss and lichen dominated treeless clearings - are common throughout the coniferous alvar forest habitat (Figure 6), rarely occurring in large enough sites to be mappable on Figure 2. There are dozens of such clearings, however, within the Braeside Quarry expansion study area. They tend to occur in the driest of sites and are a consequence of slower vegetation regeneration following disturbance (natural fire) than is the case in the adjacent woodland habitat. Accordingly, the greater light levels here support a substantially larger floristic diversity than that of the adjacent woodland. This is particularly the case where the substrate consists of exceptionally thin soil or irregularly moss-covered limestone bedrock flats, forming rock barrens or pavement.

Figure 6: Lichen-dominated glade within cedar-fir-spruce alvar forest



Open alvar bedrock pavements typically grade into shrubby alvar glades and into the edges of coniferous alvar forest, forming a complicated intermingling of the various alvar elements. Alvar pavements often occur in slight depressions into the bedrock that are subject to late winter/ spring flooding. This provides an additional, if seasonally-restricted water supply in an otherwise commonly droughted landscape.

Alvar pavement and glade habitats are dependent on natural disturbance. A unique combination of natural fire, seasonal flooding, extreme summer drought and intense winter freezing (Catling et al 1975, Brunton 1986, Catling and Brownell 1985, Catling and Brownell 1988) suppresses less well adapted vegetation competition. Such habitat in the study area and elsewhere in southern Ontario has also been impacted by development and agricultural activities such as roadways and rough pastures. Such natural opening presented readily available pasture in pioneer days and offered easier initial access through dense conifer forest.

Alvar pavements and glades usually support a significant component of non-native plant species as a result of artificial site disturbance and due to sharing a similar site ecology with some particularly hardy weeds. The most common invasive, non-native weeds of alvar pavement in the Braeside Quarry expansion study area are Spotted Knapweed (*Centaurea stobe*), Cypress Spurge (*Euphorbia cyparissias*), Yellow Hawkweed (*Hieracium piloselloides*), Wire Grass (*Poa compressa*) and Thyme-leaved Sandwort (*Arenaria serpyllifolia*).

The considerable floristic diversity of such alvar glades and pavements consists of a wide variety of specialized, colourful (Figure 7) and/ or frequently rare taxa. Species typical of such habitat in the study area include Upland Goldenrod (*Solidago ptarmicoides*), False Pennyroyal (*Trichostema brachiatum*), Wiry Panic-grass (*Panicum flexile*), Richardson's Sedge (*Carex richardsonii*), Bearberry (*Arctostaphylos uva-ursi*), Yellow Ladyslipper (*Cypripedium parviflorum*), Groundsel (*Packeria pauperculus*), Gray Goldenrod (*Solidago nemoralis*), Poverty-grass (*Danthonia spicatum*), Common St. John's-wort (*Hypericum perforatum*), Cooper's Milkvetch (*Astragalus neglectus*), Hairy Beard-tongue (*Penstemon hirsutus*), Seneca Snakeroot (*Polygala senega*), Yellow Hawkweed (*Hieracium piloselloides*), Purslane Speedwell (*Veronica peregrina* ssp. *xalopensis*) and Pussy-toes (*Antennaria howellii*).

Limited faunal diversity was observed in the glades or pavement habitat, with virtually no breeding bird species noted. Seasonally flooded pools at pavement edges were observed to support breeding frog and salamander populations, however (see 4.3 *Significant Fauna*, below).

This is a rare vegetation and habitat considered to be Provincially (Globally¹) Rare (Bakowsky 1996) and found elsewhere in eastern Ontario only in western Ottawa and in northern Lanark and southern Renfrew Counties (see 4.1 *Significant Vegetation*, below).

3.1.4 **Habitat 4: Alvar Conifer Forest** - Treed Alvar (ALT1) vegetation of Lee et al (1998)

The largest natural habitat area in the Braeside Quarry expansion study area is a remarkably homogeneous, submature to mature coniferous forest. The microtopography is considerable, with small depressions often being seasonally flooded due to the limited surface drainage provided by a largely impervious substrate and by a level parent material. The resulting ‘wetlettes’ are found commonly within the otherwise dry, thin substrate over limestone bedrock.

The dominant forest cover is overwhelming a dense growth of White Cedar (*Thuja occidentalis*) and Balsam Fir (*Abies balsamea*), with Trembling Aspen (*Populus tremuloides*) and White Spruce (*Picea glauca*) being locally important co-dominants (Figure 7). The habitat is remarkably free of non-native and invasive plant species, indicative of a largely pristine natural condition.

The undergrowth in the Alvar Coniferous Forest habitat is typically composed of a dense growth of canopy saplings mixed with a limited variety of low native shrubs and herbaceous plants, often with a high proportion of moss and lichen at particular dry sites (Figure 8). The floristic diversity of the ground vegetation is greater in and around the wetlettes that are scattered across the habitat. At dry sites with pure cedar dominance, however, little ground vegetation succeeds beneath the deep shade of the canopy and in the sterile needle-litter substrate that has developed.

Treed Alvar (ALT1 vegetation of Lee et al. (1998)) in the study area, as it in other major alvar complexes in the Ottawa Valley such as the Burnt Lands (Ottawa - Lanark County) and Clay Bank (Lanark-Renfrew Counties), is closest in

Figure 7: Dense Alvar Coniferous Forest



¹ ‘Globally Rare’ designation is a technical description of the status of this natural value but it presents no additional regulatory implication in regards to satisfying Ontario Provincial Planning Policy (OPPS) requirements (Ontario 2005) beyond those already met by addressing Provincially Rare status.

composition to the White Cedar - White Spruce - Philadelphia Panic Grass Tree Alvar vegetation of Bakowsky (1996). Elements of Jack Pine - White Cedar - Common Juniper Treed Alvar vegetation are represented as well.

This forest vegetation, characterized by a semi-open canopy (50 - 75% cover), typically overtops a dense growth of low, dryland, often calciphylic shrubs and herbs such as Bearberry (*Arctostaphylos uva-ursi*)

and Ebony Sedge (*Carex eburnea*) growing in moss and Reindeer (*Cladina*) lichen mats in gaps and small glades scattered abundantly between canopy trees. Canopy saplings often form dense stands along such edges as well, making the undergrowth nearly impenetrable in places. Ground vegetation beneath the areas of continuous canopy is typically sparse, consisting of sedges (*Carex eburnea*, *C. castanea*, *C. gracillima*), Canada Mayflower (*Maianthemum canadense*), Fringed Polygala (*Polygala pauciflora*), Ram's-head Ladyslipper (*Cypripedium arietinum*) and Poison-ivy (*Toxicodendron rydbergii*).

The occurrence of natural fire in this unusually dry habitat is indicated by the abundance of ancient burned stumps. This natural disturbance has historically been important in maintaining the semi-open canopy of Treed Alvar (Catling et al, 1975, Brunton 1986, Catling and Brownell 1995, Catling and Sinclair 2002). The high density of Common Juniper shrubbery and of canopy seedlings in some areas may reflect the unnatural exclusion of natural fire from many such alvars areas in recent decades (Brunton 1986, Catling and Sinclair 2002).

Alvar Coniferous Forest habitat occurs on level to gently sloping limestone bedrock with only a thin covering of dry, sandy soil. The abundant tiny 'wetlettes' within the habitat are often dominated by moss (including *Sphagnum*) and support a variety of typical wetland herbaceous and shrub species. They are contained, however, within what is predominately an upland habitat.

Faunal activity is limited within this homogenous, typically dry woodland. Few breeding birds and no adult amphibian or reptile species were noted, although amphibians do frequent adjacent, more open habitats and there is evidence of the use of the wetlettes as breeding pools (see 4.3 *Significant Fauna*, below).

Figure 8: dense Alvar Coniferous Forest habitat and associated glade



The abundance of browsing evidence and the frequency of droppings indicates that this habitat is heavily utilized by White-tailed Deer. Such continuous conifer habitat is also known to be at least potentially important to wintering northern passerines in the Ottawa Valley; that includes bird species such as crossbills, northern woodpeckers and small raptors.

As with the Alvar Glade and Pavement habitat described above, this is a rare vegetation that is considered to be Provincially (Globally) Rare (Bakowsky 1996) and found elsewhere in eastern Ontario only in western Ottawa, and in northern Lanark and southern Renfrew Counties (see 4.1 *Significant Vegetation*, below).

3.1.5 Habitat 5: Young Upland Mixed Forest - Poplar Mixed Forest (FOM5-2) vegetation of Lee et al (1998)

Areas in the northeastern and southeastern corners of the study area are dominated by young, disturbed mixed forest in mesic to moist sandy soil over limestone bedrock, the area to the south also supporting a thin layer of swampy peaty substrate in wetter sites. The dominant forest canopy species are Trembling Aspen, White Cedar and White Spruce with scattered Red Maple and Balsam Fir. Areas of more mature forest growth, both deciduous and mixed, occur within the habitat. Wetter sites, especially in the southern area, grade towards swamp habitat.

The ground vegetation of this habitat is typically a tangled undergrowth of canopy seedlings and native shrubs and herbs. Typical ground species include Wild Sarsaparilla (*Aralia nudicaulis*), Bracken (*Pteridium aquilinum*), Poison-ivy (*Toxicodendron rydbergii*), Sensitive Fern (*Onoclea sensibilis*), Coltsfoot (*Petasites frigidus*) and Large-leaved Aster (*Eurybia macrophylla*).

This unremarkable habitat found throughout southern Renfrew County and the adjacent City of Ottawa reflects a substantial history of disturbance, with frequent evidence of rough roadways (tracks) and other tree removal activity. No significant features or functions were noted in the habitat.

3.1.6 Habitat 6: Mature Upland Mixed Forest - White Cedar-Poplar Mixed Forest (FOM4) vegetation of Lee et al (1998)

A tall mixed forest of White Spruce, Trembling Aspen and White Cedar dominates the south-sloping, relatively deep soil area marking the southern edge of the Braeside limestone plateau. Canopy seedlings and smaller second growth trees characterize the sub-canopy over a dense ground vegetation of shrub and herbaceous species found throughout the forested areas of the

study area. These include Canada Mayflower (*Maianthemum canadense*), Large-leaved Aster (*Eurybia macrophylla*), Ebony Sedge (*Carex eburnea*), Bracken (*Pteridium aquilinum*), Fringed Polygala (*Polygala pauciflora*), Wild Sarsaparilla (*Aralia nudicaulis*), Bunchberry (*Cornus canadensis*) and Poison-ivy (*Toxicodendron rydbergii*). The vegetation grades into the more disturbed coniferous forest adjacent to the north (see Habitat 7, below) and supports many of the same sub-canopy and ground species.

The habitat has been impacted by the recent (2007) clearing of an interior access road that tracks the perimeter of the proposed extraction area. Vegetation disturbance from the development of this roadway more directly affects the adjacent coniferous swamp habitat (see Habitat 8, below).

Although supporting some large individual White Spruce trees, this is relatively small example of an unexceptional forest vegetation found commonly across southern Renfrew County (personal observation) and appears to support no intrinsically significant features or functions.

3.1.7 Habitat 7: Upland Coniferous Forest and Scrub - Pine Coniferous Forest (FOC2) vegetation of Lee et al (1998) [10.0 ha].

Scrubby clearings dominated by Common Juniper (*Juniperus communis*) represent regenerating areas of the otherwise large block of disturbed upland coniferous forest of submature to mature White Spruce and White Pine (Figure 9). White Cedar groves and clumps of Trembling Aspen are scattered throughout the level site in dry till substrate. No standing water was evident during the field inspection nor was there an indication of extensive seasonal wet areas, even in the scrubby clearings.

Ground vegetation is a mixture of common native shrub and herb species noted across the study area, and the largely non-native ‘weedy’ species established in open (most severely disturbed) sites. These include Fireweed (*Epilobium angustifolium*), White Sweet-clover (*Melilotus alba*), Hairy Beard-tongue (*Penstemon hirsuta*), Canada Goldenrod (*Solidago canadensis*), Bracken (*Pteridium aquilinum*), Viper’s-bugloss (*Echium vulgare*),

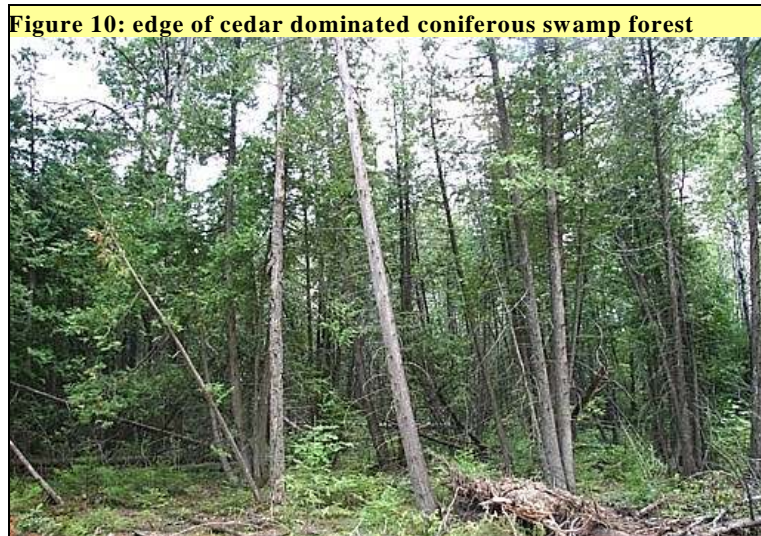


Red-osier Dogwood (*Cornus sericeous*), Yellow hawkweed (*Hieracium piloselloides*) and Heart-leaved Aster (*Symphiotrichum cordatum*).

This habitat gives the appearance of an area recovering from extensive former agricultural clearing. It represents a substantially disturbed example of a common forest and scrub vegetation occurring across southern Renfrew County and appears to support no intrinsically significant features or functions.

3.1.8 **Habitat 8: Coniferous Swamp Forest** - White Cedar- Conifer Organic Swamp (SWC3) vegetation of Lee et al (1998)

The dense submature to mature White Cedar and Balsam Fir canopy of this swamp forest grows in saturated organic substrate with active seepages of cold, flowing and standing water scattered throughout (Figure 10). It occurs in a large area below the southern edge of the Braeside limestone plateau in the southern portion of the study area as well as in numerous small stands in wetter places (wetlettes) within the Alvar Coniferous Forest (Habitat 4) to the north. The sub-canopy varies from a dense tangle of native shrubs and canopy seedlings (notably at the edges of the habitat), to an open, sparsely vegetated organic mat beneath the closed canopy at the centre of the habitat.



Ground vegetation is characterized by such moisture tolerant species as Three-seeded Sedge (*Carex trisperma*), Two-seeded Sedge (*Carex disperma*), Golden Sedge (*Carex aurea*), Coltsfoot (*Petasites frigidus*), Spikenard (*Aralia racemosa*), Dwarf Scouring-rush (*Equisetum scirpoides*), Bishop's-cap (*Mitella nuda*) and Poison-ivy (*Toxicodendron rydbergii*).

Faunal activity within the habitat is limited, although the presence of breeding species such as Winter Wren and Pileated Woodpecker that are indicative of more mature, natural habitat implies more potential for significant faunal species than was noted in more disturbed areas elsewhere on the subject property.

This is a relatively common forest vegetation across southern Renfrew County. It supports a stand of the provincially rare Ram's-head Ladyslipper (*Cypripedium arietinum*) (see 4.2 *Significant Flora*, below), however. It also contributes a measure of surface water protection as well.

3.1.9 **Habitat 9: Mixed Swamp Forest** - Mixed Organics Swamp (SWM) vegetation of Lee et al (1998).

This constitutes the wettest habitat in the study area, with standing and flowing water commonly in evidence from seepage areas at the southern base of the Braeside limestone plateau (Figure 11). Submature and mature swamp forest dominate the saturated organic substrate, with White Cedar and Black Ash (*Fraxinus nigra*) being most common. Red Maple, Balsam Fir and Trembling Aspen are present as well, with several small Eastern Hemlock (*Tsuga canadensis*) groves along the drier northeastern edge of the habitat. It shares in common many of the same native shrub and herb species with the adjacent coniferous swamp forest (Habitat 8, above). It also supports true aquatic species such as Water Speedwell (*Veronica anagallis-aquatica*), Monkey-flower (*Mimulus ringens*) and Pennsylvania Bitter-cress (*Cardamine pensylvanica*).

Figure 11: Seepage pool with Water Speedwell and Monkey-flower plants



Other characteristic wetland tolerant ground vegetation includes Northern Green Orchid (*Platanthera aquilonis*), Spikenard (*Aralia racemosa*), Beggar-ticks (*Bidens frondosa*), Manna-grass (*Glyceria striata*), Dwarf Scouring-rush (*Equisetum scirpoides*), Starflower (*Trientalis borealis*), Bishop's-cap (*Mitella nuda*) and Poison-ivy (*Toxicodendron rydbergii*).

This habitat along with the similar coniferous swamp forest adjacent to it, contributes to the maintenance of local surface water quality and flow characteristics and supports at least one regionally significant plant population (Water Speedwell - see 4.2 *Significant Flora*, below). It a common habitat throughout Renfrew County and the Ottawa Valley, however, with no evidence of other intrinsically significant features and functions at more than a local level.

3.2 VASCULAR FLORA

The diversity of the native vascular flora of the study is considerable, given the relatively limited habitat variation and minimal aquatic habitat elements present here. Appendix 1 lists all the ca. 205 native plant taxa known from the study area. A number of these are highly habitat-specific. Others are exceptionally rare (see 4.2 *Significant Flora*, below).

Appendix 2 provides the details of vascular plant collections obtained during the course of the field investigations as well as providing supporting information concerning the observation of additional populations of significant plants for which vouchers were not obtained.

The overall level of ecological integrity of the native flora is high. The average Coefficient of Conservatism (CC) rating for the study area is 5.19². By comparison, none of almost 200 sites recently examined in a City of Ottawa assessment of potential natural areas produced an average CC value this high. While comparison of these were urban and suburban areas that may not offer an equivalent match with the larger, more rural Braeside Quarry expansion property, it does provide a useful general indication of relative ecological significance of this large, relatively pristine natural area.

The presence of invasive non-native plant species - a serious challenge to native biodiversity in natural areas across Canada and throughout the world (White et al. 1993) - does not appear to be substantial in the Braeside Quarry expansion study area. While non-native invasive shrubs such as Tartarian Honeysuckle (*Lonicera tartarica*), Glossy Buckthorn (*Frangula alnus*) and Black Buckthorn (*Rhamnus cathartica*) are present along woodland edges, and a number of herbaceous weeds are evident in alvar pavement habitat (see above), challenging site conditions appear to suppress most invasive populations to minimal levels.

Appendix 3 lists the terrestrial vertebrate fauna noted in the Braeside Quarry expansion area between 2006 and 2011.

3.3 FAUNA

As noted above, the gathering of faunal data was conducted opportunistically and focussed on

¹ The Coefficient of Conservatism rating (Oldham et al., 1995) provides a rating of the 'naturalness' of native plant species (i.e. the degree to which each species requires relatively pristine conditions) in southern Ontario on a scale of 0 (lowest) to 10 (highest). Species with a CC rating of seven or more are considered to be representative of high quality natural habitats.

identifying potentially significant species rather than representative or common animals. This reflected the greater amount of interpretable information that can be gathered by investing project assessment time primarily on the analysis of flora and vegetation.

3.3.1 Breeding Birds

The majority of bird species observed in the study area are common woodland species in eastern Ontario and the lower Ottawa Valley. As was expected, no colonial nesting species were found. Similarly, a number of species observed and potentially breeding here are known to prefer or require extensive woodland habitats for reproductive success (Area Dependent Species). Such species noted in the study area included Northern Waterthrush, Red-breasted Nuthatch, Hairy Woodpecker, Ovenbird, Scarlet Tanager, Pileated Woodpecker, Black-throated Green Warbler and Evening Grosbeak. The diversity of breeding birds noted here between 2006 and 2011 (Appendix 3) is otherwise unremarkable for an extensive woodland area of southeastern Ontario.

3.3.2 Other Fauna

Only common mammal species such as White-tailed Deer, Snowshoe Hare, Woodchuck, Meadow Vole and Red Squirrel were observed in the study area. As noted above, evidence that White-tailed Deer heavily utilize the study area was observed. The coniferous forest portions of the property would undoubtedly qualify for 'deer year' designation (wintering concentration area).

Increasingly milder winters, changing land use practices and reduced predation over the last two decades in southern Ontario and southern Quebec has led to an explosion of the deer population. Exceptionally high deer populations have blurred the geographic distinction of most deer yards. White-tailed Deer are now commonly associated with virtually any large woodland area with at least some coniferous cover in southeastern Ontario (Broadfoot and Voigt 2000; personal observation). The presently unnaturally high deer population has reached nuisance and public hazard proportions in parts of eastern Ontario (Broadfoot and Voigt 2000, Tighman 1989). It now constitutes a significant threat to native biodiversity and vegetation quality. The Braeside Quarry property is located within a recognized "*significant white tailed deer winter concentration area or core deer yard*" (J. Gaweda, OMNR, in lit, 2007). Consideration of deer yard implications is provided the Natural Environment Level I & II report (Skelton Brumwell 2007).

Only common amphibian and reptile species were noted in the study area. These include Leopard Frog, Eastern Garter Snake, Blue-spotted Salamander and Gray Tree Frog (see Appendix 3).

4. Significant Features and Functions

Elements of the natural landscape of the study area were found to be significant at various levels, including both provincially and globally rare values. Consideration was paid during the natural environment field investigation to assessing wildlife movement considerations and for detecting the potential presence of Species At Risk (SAR). The potential presence of Butternut (*Juglans cinerea*), a federally and provincially designated Endangered Species, received particular attention. This tree occurs commonly in southeastern Ontario and is known from the vicinity of the Braeside Quarry expansion area. No species which would require consideration under the federal or provincial Species At Risk Acts (Canada 2003; Ontario 2007), be they regulated SARA taxa (Schedule 1 - Endangered or Threatened) or COSEWIC-designated candidates for SARA protection (Schedules 2 and 3), however, are known from the study area.

4.1 SIGNIFICANT VEGETATION

The alvar vegetation (Habitats 3 and 4) constitutes Provincially Significant vegetation. Indeed, this exceptional, fire dependent vegetation found elsewhere in Canada only on limestone bedrock plains in the Ottawa Valley and along the shores of the lower Great Lakes (Catling and Brownell 1995), is also designated as Globally Rare (Bakowsky 1996). The Burnt Lands Provincial Nature Reserve Park ca. 15 kms southeast of the study area in western Ottawa was established to protect a portion of the largest example this habitat in the Ottawa Valley. A tiny alvar 5 km east of the study area along the shore of Ottawa River at Sandy Hook (Brunton 2001) is the closest such habitat to the study area, followed by the extensive Clay Bank alvar pavement site 10 kms southward along the Renfrew/ Lanark County boundary (Brunton 1988).

No other vegetation types are intrinsically significant, all constituting woodland types known to be widespread in southern Renfrew County.

4.2 SIGNIFICANT FLORA

No designated SAR vascular plants are known from the Braeside Quarry expansion area although Butternut is found close to it along Golf Club Road (M. J. Oldham, personal communication). Four Provincially Rare vascular plant species are known from the property, however, as are a number of species that are significant (rare) at at least a Regional (southern Renfrew County) scale of consideration. A fifth Provincially Rare species, Pinedrops (*Pterospora andromeda*) is

known from adjacent properties and would not be unexpected within the Alvar Coniferous Forest habitat in the study area.

A number of the significant vascular plant species along with others not sufficiently uncommon to be designated regionally rare, are considered ecologically significant by virtue of their strong association with Globally (Provincially) Rare alvar habitat. Those alvar related taxa are identified by notation in the Regional Status column of the list of native species (Appendix 1).

4.2.1 Provincially Significant flora

The four Provincially Rare species (Oldham and Brinker 2009) known from the study area are described below. None represent a federally or provincially designated Species At Risk.

Ram's-head Ladyslipper (*Cypripedium arietinum*) (Conservation Code: G3S3)

This orchid is an endemic of the Great Lakes Region of North America, typically found in small numbers in thin soil over limestone bedrock across southern Ontario and in adjacent western Quebec and the northern United States (Whiting and Catling 1986). It is closely associated with

Figure 12: Ram's-head Ladyslipper in bloom, Braeside Quarry Property)

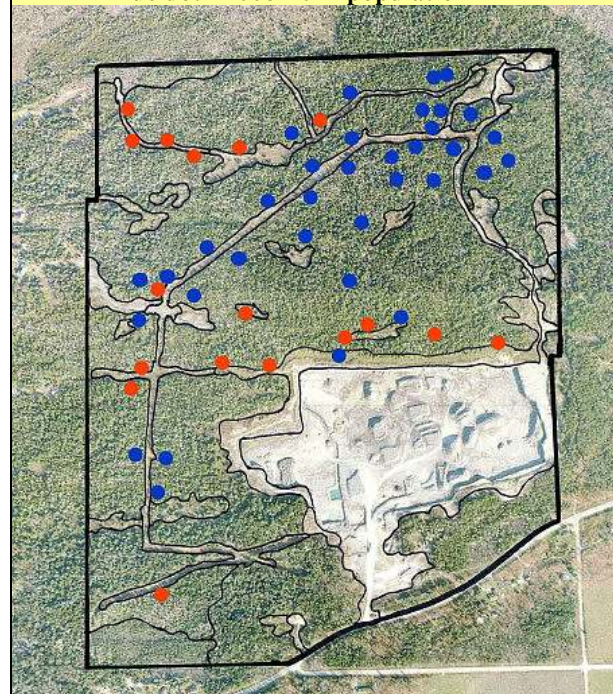


alvar habitat (Catling et al. 1975) and is not considered to be common anywhere within its range. It is listed as Provincially Rare (G4S3) - Sensitive in Ontario (Oldham and Brinker 2009; NHIC web page) (Figure 12; report cover).

Figure 13: Populations of Ram's-head Ladyslipper in Braeside Quarry expansion area

Red dot - 2006 population

Blue dot - 2008-2011 population



The size of the population in the Braeside Quarry expansion study area far exceeds that of any other documented site in Canada. It occurs more or less evenly across the Alvar Coniferous Forest habitat, usually near the edges of glades, in stands of 5 to about 200-plus plants (Figure 13).

The 17 populations observed during 2006 field studies were considered to represent only a fraction of the plants actually present in the study area. A visual sampling suggested a density of 1.0 to 1.5 plants/ m², with a study area population of between 9,000 to 14,000 plants. A subjective assessment of these populations in 2008, however, suggested that the density of flowering plants in most populations was double that of 2006 and that many more individual populations were in evidence (personal observation) (Figure 13).

The Braeside Quarry expansion area likely supports the largest known global population of Ram's-head Ladyslipper. A single small population in saturated organic substrate in mature coniferous swamp was also noted beyond the alvar habitat in the southern portion of the study area.

Hooker's Rein-orchid (*Platanthera hookeri*) (Conservation Code: G4S3)

This widespread species (Figure 14) has declined dramatically across Ontario in recent years and fewer than 100 contemporary populations are presently known in the province (Oldham & Brinker 2009). It is typically a species of dry upland mixed forest, typically in sandy soil in areas of thinly buried bedrock. It does not appear to be a calcicolous species, occurring widely across the southern Canadian Shield in Ontario on predominantly acidic substrates.

Two small populations, as is typical of the species (Reddoch & Reddoch 1997), are known from the subject area. Both occur in Alvar Coniferous Forest habitat. One is half way along the northwestern side of extraction perimeter road and the other is near the perimeter road within the proposed extraction area in the eastern portion of the property (Figure 15).

Figure 14: Hooker's Rein-orchid in Braeside Quarry expansion area (photo: K. Fleming)



Cooper's Milkvetch (*Astragalus neglectus*)

(Conservation Code: G4S3)

The Cooper's (or, Neglected) Milkvetch (Figure 16) is a species of disturbed woodland edges in dry, rocky, calcareous landscapes across and somewhat beyond the Great Lakes region of North America; it is uncommon to rare throughout this range and is listed as Provincially Rare (G4S3) - Sensitive in Ontario (Oldham and Brinker 2009; NHIC web page).

The species is strongly associated with alvar habitats in Ontario (Catling and Brownell 1995), typically appearing as scattered plants or clumps of plants. In the Braeside Quarry expansion area it expresses a very similar distribution to that of Ram's-head Ladyslipper (above), often occurring

Figure 16: Cooper's Milkvetch in flower, Braeside Quarry expansion area



within a few metres of that orchid. The Cooper's Milkvetch plants occur in more open sites. however, typically in fully open glades or along the open edges of alvar pavements and against the edge of coniferous alvar forest. It regenerates particularly dramatically following natural fire, with large population increases noted within a few years of such natural disturbances (Catling

Figure 15: Location of Hooker's Rein-orchid populations in Braeside Quarry expansion area

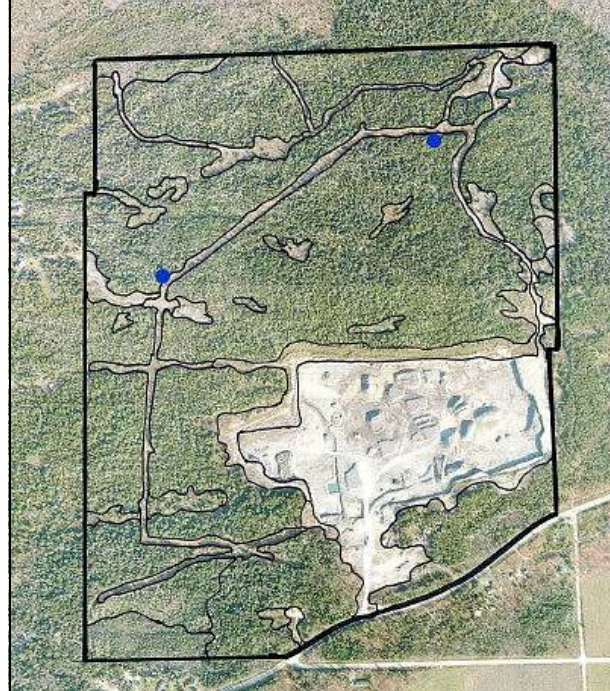
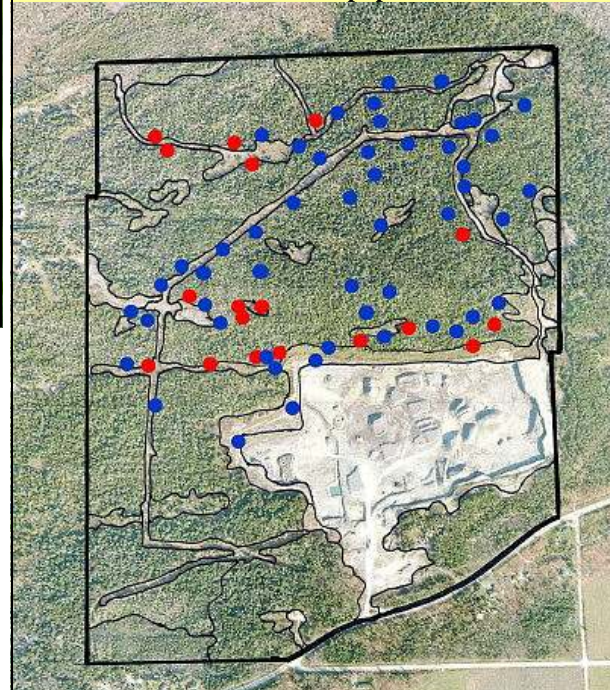


Figure 17: Cooper's Milkvetch populations in Braeside Quarry expansion area

Red dot - 2006 population

Blue dot - 2008-2011 population



and Sinclair 2002).

As with the Ram's-head Ladyslipper, the populations of Cooper's Milkvetch observed during 2006 field studies are considered to represent only a fraction of the plants actually present in the study area. A visual sampling suggested a density of 0.25 to 0.5 plants/ m² of the overall alvarhabitats area, with a study area population of between 2,500 and 4,000 plants. Subsequent site investigations suggest that the Cooper's Milk-vetch population is at least double that of the 2006 estimate (personal observation), consisting of many small, fertile populations along woodland edges (Figure 18). This may well represent the largest known Canadian population of Cooper's Milk-vetch known to occur in Canada .

White Ground-cherry (*Leucophysalis grandiflora*) (Conservation Code: G4S3)

This species is widespread across northern and central Ontario, typically appearing and flowering profusely (Figure 18) in sandy, very dry typically calcareous sites following major landscape disturbance (e.g. natural forest fire). Although rare throughout, when White Ground-cherry appears at a particular site, it typically does so in large numbers. Although not previously known from this part of the Ottawa Valley, a substantial population (dozens of plants) appeared in 2009 along the two-year old, regenerating edge of the excavation area perimeter track in the western

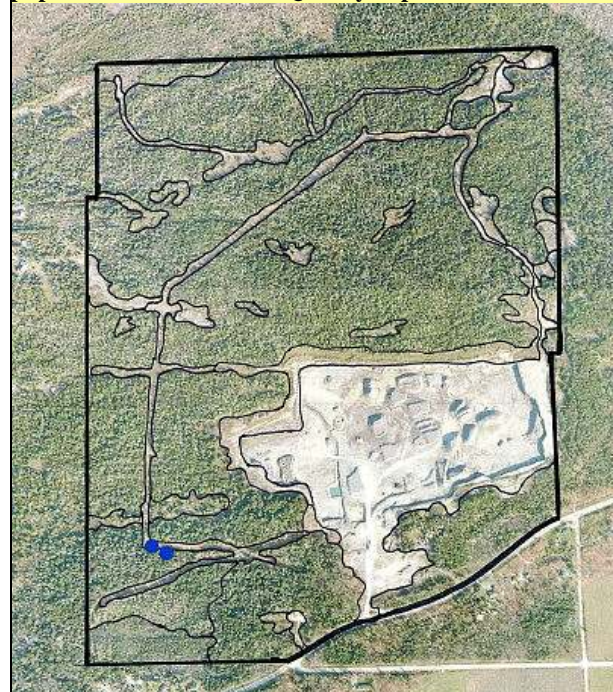
Figure 18: White Ground-cherry in bloom, Braeside Quarry expansion area



portion of the Braeside Quarry expansion area (Figure 19).

The sudden and unexpected appearance of this species along the disturbed edges of the

Figure 19: location of White Ground-cherry populations in Braeside Quarry expansion area



excavation area perimeter track (along with Regionally rare or uncommon species such as *Carex houghtoniana*, *Adlumia fungosa*, *Corydalis aurea*, *Eleocharis intermedia*, *Cardamine parviflora* and *Astragalus canadensis*) underscores the ecological importance of maintaining self-sustaining habitat areas. Many or all of these species were likely already present in the study area but were invisible in the soil seed bank, opportunistically awaiting conditions for development to be initiated by site disturbance (forest fire, canopy destruction by insect infestation, etc.).

4. 2.2 Regionally significant flora

In addition to the provincially rare plants note above, 16 species found in the study area are considered to be Regionally rare³. These are listed below.

Regionally significant species		Status within study area	Habitat Type
Northern Ground-cedar	<i>Diphasiastrum complanatum</i>	single population northwest of existing quarry	4
Ground-cedar	<i>Diphasiastrum tristachyum</i>	single population northwest of existing quarry	4
hybrid Ground-cedar	<i>Diphasiastrum</i> × <i>zeilleri</i>	single population northwest of existing quarry	4
Kalm's Brome Grass	<i>Bromus kalmii</i>	scattered in small populations (one to 5 plants) throughout	3, 4
Slender Wedge Grass	<i>Sphenopholis intermedia</i>	large patch along northern edge of existing quarry; scattered northward	3, 4
Richardson's Sedge	<i>Carex richardsonii</i>	common in glades and woodland edges throughout	3, 4
Umbrella Sedge	<i>Carex umbellata</i>	Single population in dry sandy clearing	3

² There is no list of designated Regionally Rare vascular plants for Renfrew County; the position of the study area within 10 km of the boundaries of the City of Ottawa and of Lanark County, however, suggests that a consolidation of significant species designations for those areas (Brunton2005, White 2006) should provide a reasonably reliable reference for adjacent Renfrew sites.

Intermediate Spike-rush	<i>Eleocharis intermedia</i>	One population along perimeter track	2 (disturbed)
Jointed Rush	<i>Juncus articulatus</i>	artificial opening northwest of existing quarry	1
Allegheny-vine	<i>Adlumia fungosa</i>	One population along open edges of perimeter track	2 (disturbed)
Golden Corydalis	<i>Corydalis aurea</i>	Scattered populations along open edges of perimeter track	2 (disturbed)
Bitter-cress	<i>Cardamine parviflora</i>	One population along open edges of perimeter track	2 (disturbed)
Dwarf Saskatoon	<i>Amelanchier alnifolia</i> var. <i>compacta</i>	One population on bedrock pavement in eastern corner of property	3 (disturbed)
Canada Milkvetch	<i>Astragalus canadensis</i>	One population along open edges of perimeter track	2 (disturbed)
Water Speedwell	<i>Veronica anagallis-aquatica</i>	numerous plants in seepage at south end of property	9
Purslane Speedwell	<i>Veronica peregrina</i> ssp. <i>xalapensis</i>	numerous plants throughout	3

4.3 SIGNIFICANT FAUNA

No Provincially or Regionally significant fauna are known from the Braeside Quarry expansion area. As noted previously, faunal investigations were largely undertaken opportunistically in the course of vegetation, ecological function and floristic investigations. While the data base is subsequently less complete than that for vascular plants, a number of usual observations have been made, including those relating to the locally significant species addressed below.

4.3.1 Amphibians and Reptiles

Two provincially designated SAR reptile species have been reported from the local area, Milk

Snake and Ribbon Snake (J. Gaweda, OMNR, in lit, 2007; Woods and Cook 1976; Oldham 1988). Both are listed as being of Special Concern, meaning their Ontario populations have declined from previously recorded levels but not to such a degree as to receive the protection afforded designated Endangered or Threatened taxa. Searches were conducted in suitable habitat (the alvar areas) in the early summer over several years but no animals were observed,

As noted in 3.3. *Fauna*, above, some birds requiring larger woodland habitat in which to breed successfully (Area Dependent species) were noted in the Alvar Coniferous Forest habitat. In addition, some ephemeral pools within the alvar habitat resulting from accumulated snow melt and spring-early summer rain, support substantial amphibian breeding activity.

The large, shallow, artificial pool along the excavation perimeter road ca. 330 m northwest of the northwest corner of the existing quarry was found to contain dozens if not hundreds of Gray Tree Frog tadpoles in 2006 (Figure 20) and again in 2011. The same pool supported larvae of Blue-spotted Salamander (Figure 21). Kyle Fleming noted adult Red-spotted Newts in a similar but permanent woodland pools in the western portion of the study area in 2009.

Figure 20: Gray Treefrog tadpole from ephemeral pond by excavation perimeter track



Figure 21: larval Blue-spotted Salamander from ephemeral pool



These observations suggests that the many such natural wetlettes scattered across Alvar Coniferous Forest habitat offer locally important habitat for breeding amphibians.

4.3.2 Breeding Birds

A pair of Evening Grosbeak was observed (8 June 2006) flying over the conifer-dominated northern portion of the study area. Thesed represent potentially breeding birds. No further

sightings of the species in breeding season have been made here, however. This is a predominately northern and western species that favours coniferous forest for breeding habitat. Its numbers have declined dramatically in southern Ontario over the last 30 years (Brunton 1994). Breeding records in southeastern Ontario are few and widely scattered but it is noted as a possible breeder in the Arnprior - Braeside area (Hoar 2007).

A Willow Flycatcher was recorded in June 2009 by Kyle Fleming, presumably in the scrubby upland forest and scrub west of the existing quarry. This is an uncommon species of dry upland thickets in the Ottawa Valley (Sandilands 2007b). It is not clear if a resident population exists in or adjacent to the Braeside Quarry expansion area.

Although the larger alvar glades and associated dry meadows constitute potential breeding sites for federally designated Threatened SAR Common Nighthawk, none of these conspicuous birds were recorded in or near the study area during breeding season, nor are recent breeding records known from the general area (Sandilands 2007a).

The same can be said for the recently provincially designated Threatened SAR Whip-poor-will which might be expected in any extensive upland forest areas with intervening glades and opening. None of these animals were recorded in or near the study area during breeding season, nor are recent breeding records known from the general area (Mills 2007).

4.4 SIGNIFICANT ECOLOGICAL FUNCTIONS

As noted in the various discussions of flora and fauna above, the Braeside Quarry expansion study area provides good biodiversity representation. In particular, a wide range of representative and rare native species of coniferous upland forest are present. The continuity of the forested habitat and relatively low level of non-native and invasive species indicates that this biodiversity is sustained at a relative high level of ecological integrity ('naturalness'). The study area serves both as an unusually rich reservoir of native biodiversity and as a potential source for regeneration of adjacent/ related natural areas following disturbances.

The location of the study area near the Ottawa River - a well-recognized passageway for the full range of Ottawa Valley natural features - places it strategically to perform a wildlife corridor function. The relative lack of natural habits to the south across Usborne Street, however, means that wildlife corridor functions - be they supporting the movement of plant, animal or vegetation - are primarily restricted to the length of the Braeside Plateau. In other words, this function is probably best expressed in an southeast-northwest direction.

Although no substantial permanent water bodies are represented, there is a small, beaver-controlled, permanently flooded pond along the northern boundary of the Braeside Quarry property, abundance of ephemeral wetlettes within the alvar habitats and both semi-permanent drains, and seepages along the southern (and presumably, northern) slopes of the plateau. The study area upland forests thus contribute towards maintenance of the volume and quality of surface water required by a variety of flora and fauna.

Interior Habitat - that portion of a natural woodland unaffected by potentially negative 'edge' influences such as wind-blown weed seeds, predatory birds and mammals, microclimatic alterations, etc. - can be an important component in the overall forest ecological integrity. The previous removal of almost all forest cover in the property adjacent to Braeside Quarry expansion area on the northeast (towards to the river) and the advanced fragmentation of natural forest to the northwest by the Golf Club Road and to the southwest along Usborne Street, however, has reduced the extent of Interior Forest in the study area. Interior Habitat in the study area is best represented in the predominantly Alvar Coniferous Forest area north of the existing quarry.

5. Impact Assessment and Conclusions

5.1 SIGNIFICANCE CONCLUSIONS

The overall significance of the Braeside Quarry expansion study area is summarized in the following table.

Summary of Significant Ecological values			
Vegetation	Community/ association	Representation at study site	Significance
	alvar coniferous upland forest	Extensive	Global
	alvar coniferous swamp forest	Moderate	Global
	alvar rock pavement	Low	Global
	herbaceous/ graminoid alvar glades	Moderate	Global
Flora/ fauna	Species/ feature	Representation at study site	Significance
	Ram's-head Ladyslipper (<i>Cypripedium arietinum</i>)	Exceptional (Globally unique?)	Global
	Hooker's Rein-orchid (<i>Platanthera hookeri</i>)	Minor	Provincial
	Cooper's Milk-vetch (<i>Astragalus neglectus</i>)	Exceptional (Provincially/ Nationally unique?)	Provincial
	White Ground-cherry (<i>Leucophysalis grandiflora</i>)	Low to moderate	Provincial
	herptile breeding pools	Low to Moderate	Regional
	alvar indicator species	Extensive	Regional

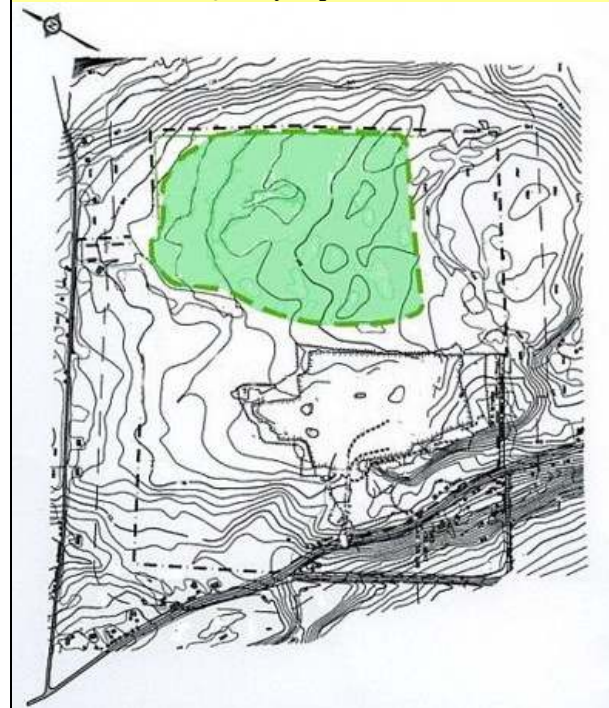
Ecological integrity and natural functions	Community/ association	Representation at study site	Significance
	representation of native biodiversity of habitat types	Extensive	Regional
	continuous forest habitat and wildlife habitat	Extensive	Regional
	watershed headwater contribution	Moderate	Regional
	reservoir for natural regeneration of native habitats	Extensive	Regional

5.1 SIGNIFICANCE WILDLIFE AREA

It is clearly evident from the results of this natural environment assessment that the most important natural values of the study area are found within the alvar habitats. The Significant Wildlife Area identified in Figure 22 includes complete representation of all significant natural values known in the study area, with the exception of one probably regionally significant plant population (Water Speedwell) and the disturbance-dependent White Ground-cherry populations in the south.

Determined through on-site and aerial photographic investigations, it includes a) the most intact (undisturbed) portions of rare Alvar Coniferous Forest and Alvar Glade habitats, b) the highest concentration of populations of Provincially Significant plant species, c) the largest area of continuous forest habitat in the Braeside Quarry expansion area, and d) virtually all Regionally significant natural values known from the study area. The remainder of the study area supports landscape and features that are of natural environment significance at a local (neighbourhood) level.

Figure 22: Significant Wildlife Area (within dashed line) in Braeside Quarry expansion area



5.2 MITIGATION OPPORTUNITIES

Mitigation aims to identify means by which negative impacts on significant natural values can be minimized or eliminated. While there are particular requirements set by provincial regulations, the higher standard of “No Net Loss” of significant natural environment values guides the mitigation considerations of this study. That is not always achievable, for various technical and economic reasons, but it remains the ecologically most appropriate standard to work towards.

The most likely opportunities for mitigation of impacts by the proposed quarry expansion on significant natural environment values include 1) the salvage of significant wildlife populations, 2) the avoidance of habitat impact, and 3) habitat compensation.

The salvage of individual organisms may well be successful for populations of a number of disturbance-tolerant plant species here (such as the Cooper’s Milkvetch), but it would be much more difficult and less certain of success for others. Species such as Ram’s-head Ladyslipper and Hooker’s Rein-orchid, for example, are dependent both on subtle micro-climatic and site conditions, and on complex relationships with soil materials and organisms. The White Ground-cherry, on the other hand, requires site disturbance and has apparently benefitted from forest habitat alterations.

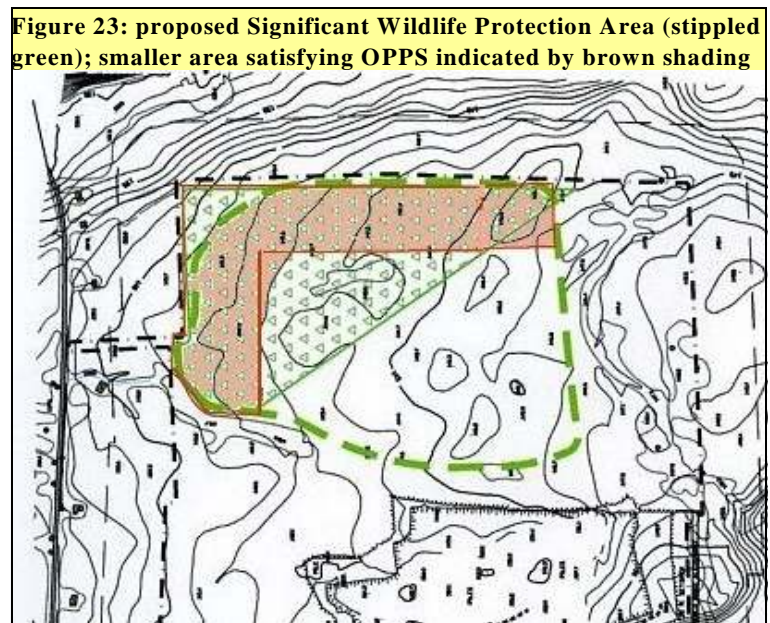
An additional constraint to plant salvage as a mitigation option is the potential unavailability of ‘vacant’ suitable habitat into which to transplant such populations. Salvage may be a useful mitigation tool in selective situations, transferring whole plants in intact plugs of sod and/ or through the gathering and spreading of seeds. It will not provide a suitable answer for protection of all significant species, however, nor will it address protective needs for the underlying habitat or ecological functions.

Protection from non-natural site change for an area of similar size and natural environment quality to that lost to development or landscape alteration, can most effectively provide a substantial measure of impact mitigation. Such a compensation action in this case would significantly increase the amount of protected alvar landscape in the Ottawa Valley.

Avoidance of impact is the ecologically preferred mitigation for protecting the natural values of unusual landscapes such as that identified within the Significant Wildlife Area (SWA). Protecting a sufficiently large proportion of this area to ensure the continued, self-sustainable representation of the full range of significant alvar natural features and functions present would mostly or entirely satisfy the ‘no net loss’ mitigation goal of this study.

The 2005 Ontario Provincial Policy Statement (OPPS) requires aggregate resource extraction to ‘minimize ... environmental impacts. The OPPS defines Negative Impacts as “degradation that threatens the health and integrity of the natural features or ecological functions for which an area is identified (Ontario 2005). Establishment of a band of protected habitat extending inward 150 to 200 m into the Significant Wildlife

Area from property boundaries (Figure 23) would likely be sufficient to satisfy the OPPS requirements for protection of the features and functions for which the Significant Area was identified. Such a protection zone would satisfy OPPS protection requirements for more stringently controlled Development or Site Alterations impacts as well (Ontario 2005). The exceptional nature of the ecological assets of the Braeside Quarry expansion study area, however, argues strongly for a more robust conservation response.



Accordingly, in recognition of the exceptional nature of this habitat and landscape, it is proposed that a large portion of the SWA be set aside from development through the establishment of a Significant Wildlife Protection Area. The green stippled area in Figure 23 contains all of the significant natural features and functions known from the Braeside Quarry expansion area. The protection from impact of this area of natural habitat would provide for the continued, self-sustaining representation of all of these features and functions.

As noted throughout this report, the alvar habitats of the Braeside Quarry expansion study area are tolerant of natural disturbance and resistant to non-native, outside influences. The plateau location of the landscape also indicates that it is not directly subject to negative influences of ‘upstream’ areas. High quality treed and open alvar habitats in the study area presently maintain important natural features and functions immediately adjacent to development activities. It is evident, therefore, that protective buffer areas typically critical to the maintenance of less disturbance tolerant and more geographically integrated natural forest habitats elsewhere in eastern Ontario, are not necessary here.

5.3 MONITORING OF MITIGATION MEASURES

Monitoring of impact mitigation measures are useful for determining if a site's remaining natural environment resources satisfactorily maintain the significant features and functions that were identified for protection. In the case of the Braeside Quarry expansion study area the proposed mitigation, including that for ensuring the continuity of rare species, consists largely of the prevention of habitat destruction within a large, self-sustaining Significant Wildlife Protection Area (Figure 23).

The self-sustainability of alvar habitat is well established (e.g. Brunton 1986, Catling and Brownell 1998, Catling et al., 2002) and thus monitoring of the performance of this mitigation is less complicated than that of habitat restoration or rehabilitation efforts. It would essentially consist of determining if the geographic extent of the area of protected natural habitat remains as it was initially established. In addition, monitoring of the condition of the boundary between the protected alvar lands and the active development area would detect if invasive weed conditions were becoming established and/ or were expanding within the open alvar.

Monitoring of the area of alvar habitat in the Significant Wildlife Protection Area can be achieved by annual ground level photographic documentation from from pre-determined, GPS-located points along the margin of the protected area. Review of these photographic images after a five year period would determine if degradation was occurring as a result of adjacent quarry activity. Such photographic documentation would also provide evidence of any significant invasive plant development along the edge. In this regard, it would be useful to have a pre-monitoring baseline survey of potentially invasive weeds along the Significant Wildlife Protection Area boundary.

In the event that the monitoring program indicates the ecological integrity of the periphery of the Significant Wildlife Protection Area to have declined over the five year period, planting of drought tolerant native conifers of species already found on site (e.g. White Spruce, White Cedar, White Pine) would provide a protective screen against further losses. Similarly, should significant populations of invasive plants have become established during the monitoring period, these can be physically removed.

In response to questions raised during the County peer review process concerning monitoring of significant features within the Significant Wildlife Protection Area, the originally described set of monitoring recommendations has been expanded. It is proposed that population counts of the two key Provincially rare species (*Cypripedium arietinum* and *Astragalus neglectus*) be undertaken biannually. As noted above, particular species population in this habitat can vary hugely from year by year, however, so interpreting a major population decline in a given year (33% was the figure suggested by Golder peer review team) can be problematic.

Should two consecutive declines exceeding 33% be noted, however, this would trigger contact with the Ontario Ministry of Natural Resources or its equivalent to initiate the development of population mitigation measures. It is proposed that the monitoring program continue for a ten year period (5 biannual sessions). Should populations remain stable over that period, monitoring can then cease. One final population monitoring should also be conducted three years after the final land clearing operation (again, to conform to concerns raised in the peer review).

5.4 ECOLOGICAL RESEARCH OPPORTUNITIES

The Significant Wildlife Protection Area provides an exceptional opportunity for academic or research institutions in eastern Ontario / western Quebec to conduct ecological investigations of rare and characteristic alvar plant species and their environment. Some scientific work has been conducted locally (Catling and Sinclair 2002, Catling Sinclair and Cuddy 2002, etc.) but not of the scale or extent possible in the Significant Wildlife Protection Area.

The exceptionally large populations of two of provincially rare vascular plant species also offer significant opportunities for scientific research, particularly in regards to the possibility of comparing ecological characteristics of populations in both disturbed and undisturbed alvar habitats over relatively long periods of time. Potential conservation biology applications are considerable. Miller Group Inc. has encouraged such academic investigation on other Ontario aggregate properties and are open to consideration of proposals for such scientific undertakings at the Braeside Quarry property (T. Jones, personal communication).

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Appendix 1: native vascular plant species observed in the Braeside Quarry expansion study area

The scientific names of the native vascular plant species, subspecies and hybrids observed in the study area are listed below in alphabetical order within plant families arranged in natural (checklist) order. This is followed by a common English name and the southern Ontario Coefficient of Conservatism (CC) value for this taxon. For taxa not provided with a southern Ontario CC value in Oldham et al. (1995), such as hybrids involving native species, an estimated value has been assigned here. These taxa are marked with an asterisk [*]. Species considered to be Regionally significant in the present study are also noted by their listing in **bold** type.

Species known to be strongly associated with alvar habitats in eastern Ontario (alvar ‘specialists’ or taxa found in particular abundance in alvar landscapes) are designated by [***] in the Regional Status column. The accession reference number for vascular plant collections is also noted in that column of the table. Location and habitat details of the voucher specimens cited in the following table are documented in Appendix 2.

SPECIES/ TAXON	COMMON NAME	REGIONAL STATUS (inferred from Brunton 2005)	CC
LYCOPODIACEAE (Clubmoss Family)			
<i>Diphasiastrum complanatum</i> (L.) Holub <i>(Lycopodium complanatum L.)</i>	Northern Ground-cedar	Regionally Significant	8
<i>Diphasiastrum tristachyum</i> (Pursh) Holub <i>(Lycopodium tristachyum Pursh)</i>	Ground-cedar	Regionally Significant DFB 16,760	8
<i>Diphasiastrum</i> ×zeileri (Rouy) Holub <i>(D. complanatum (L.) Holub x tristachyum (Pursh) Holub)</i>	hybrid Ground-cedar	Regionally Significant DFB 16,760B	8*
EQUISETACEAE (Horsetail Family)			
<i>Equisetum arvense</i> L.	Field Horsetail		0
<i>Equisetum scirpoides</i> Michx.	Dwarf Scouring-rush		7
<i>Equisetum sylvaticum</i> L.	Woodland Horsetail		7
<i>Equisetum variegatum</i> Schleich.	Variegated Scouring-rush		5
OPHIOGLOSSACEAE (Grapefern Family)			
<i>Botrychium virginianum</i> (L.) Sw.	Rattlesnake Fern		6

OSMUNDACEAE (Flowering-fern Family)			
<i>Osmunda regalis</i> L. var. <i>spectabilis</i> (Willd.) Gray	Royal Fern		7
DENNSTAEDTIACEAE (Bracken Fern Family)			
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>latiusculum</i> (Desv.) Underw.	Bracken		2
THELYPTERIDACEAE (Marsh Fern Family)			
<i>Thelypteris palustris</i> (Salisb.) Schott	Marsh Fern		5
DRYOPTERIDACEAE (Woodfern Family)			
<i>Athyrium filix-femina</i> (L.) Roth var. <i>angustum</i> (Willd.) Lawson	Lady Fern		4
<i>Dryopteris carthusiana</i> (Vill.) Fuchs (<i>D. spinulosa</i> (Muell.) Watt)	Spinulose Woodfern		5
<i>Dryopteris cristata</i> (L.) A. Gray	Crested Woodfern		7
<i>Dryopteris intermedia</i> (Muhl.) A. Gray	Evergreen Woodfern		5
<i>Dryopteris marginalis</i> (L.) A. Gray	Marginal Shieldfern		5
<i>Gymnocarpium dryopteris</i> (L.) Newm.	Oak Fern		7
<i>Onoclea sensibilis</i> L.	Sensitive Fern		4
PINACEAE (Pine Family)			
<i>Abies balsamea</i> (L.) Mill.	Balsam Fir		5
<i>Picea glauca</i> (Moench) Voss	White Spruce		6
<i>Pinus strobus</i> L.	White Pine		4
<i>Tsuga canadensis</i> L.	Eastern Hemlock		7
<i>Juniperus communis</i> L.	Common Juniper		4
<i>Thuja occidentalis</i> L.	White Cedar		4
TYPHACEAE (Cat-tail Family)			
<i>Typha latifolia</i> L.	Common Cat-tail		3
ALISMATACEAE (Water-plantain Family)			
<i>Alisma triviale</i> Pursh	Water-plantain		3
POACEAE (Grass Family)			

<i>Agrostis scabra</i> Willd.	Tickle Grass		6
<i>Bromus ciliatus</i> L.	Fringed Brome Grass		6
<i>Bromus kalmii</i> A. Gray	Kalm's Brome Grass	Regionally Significant *** DFB 16,756	8
<i>Danthonia spicata</i> (L.) Beauv. ex R. & S.	Poverty Grass		7
<i>Dichanthelium acuminatum</i> (Sw.) Gould & Clarke ssp. <i>implicatum</i> (Scrib.) Freckmann & LeLong (<i>Panicum implicatum</i> Scribn.)	Small Panic Grass		2
<i>Glyceria striata</i> (Lam.) A. Hitchc.	Fowl Manna Grass		3
<i>Muhlenbergia glomerata</i> (Willd.) Trin.	Wild Timothy	DFB 16,764	
<i>Muhlenbergia mexicana</i> (L.) Trin.	Mexican Muhlenbergia	DFB 17,769	1
<i>Oryzopsis asperifolia</i> Michx.	Mountain Rice Grass		6
<i>Panicum capillare</i> L.	Witch Grass		0
<i>Panicum flexile</i> (Gatt.) Scribn.	Wiry Panic Grass	Regionally Significant DFB 16,762	8
<i>Panicum philadelphicum</i> Bernh. ex Trin.	Philadelphia Panic Grass	Uncommon (locally abundant) ***	8
<i>Schizachne purpurascens</i> (Torr.) Swallen	False Melic Grass		6
<i>Sphenopholis intermedia</i> (Rydb.) Rydb.	Slender Wedge Grass	Regionally Significant DFB 16,765	6
<i>Sporobolus vaginiflorus</i> (Torr. ex A. Gray) Wood (<i>s.l.</i>)	Ensheathed Dropseed		1
CYPERACEAE (Sedge Family)			
<i>Carex aurea</i> Nutt.	Golden Sedge	DFB 16,771	4
<i>Carex castanea</i> Wahl.	Chestnut Sedge		7
<i>Carex communis</i> Bailey	Common Sedge		6
<i>Carex deweyana</i> Schw.	Dewey's Sedge	DFB 17,416	6
<i>Carex disperma</i> Dew.	Two-seeded Sedge	DFB 16,628; DFB 17,419	8
<i>Carex eburnea</i> Boott	Ivory Sedge	***	6
<i>Carex foenea</i> Willd. (<i>C. aenea</i> Fern.)	Copper Sedge		8

<i>Carex gracillima</i> Schw.	Filiform Sedge	DFB 16,771	4
<i>Carex granularis</i> Willd.	Granular Sedge		3
<i>Carex houghtoniana</i> Torr. ex Dew.	Houghton's Sedge	DFB 17,405	6
<i>Carex hystericina</i> Willd.	Porcupine Sedge		4
<i>Carex interior</i> Bailey	Inland Sedge		6
<i>Carex intumescens</i> Rudge	Bladder Sedge		6
<i>Carex leptalea</i> Wahl.	Bristle-stalked Sedge		8
<i>Carex pedunculata</i> Willd.	Peduncled Sedge	DFB 17,408	5
<i>Carex retrorsa</i> Schw.	Back-turned Sedge		5
<i>Carex richardsonii</i> R. Br.	Richardson's Sedge	Regionally Significant *** DFB 16,625; DFB 17,401; DFB 17,411	9
<i>Carex rosea</i> Schkuhr ex Willd. (<i>C. convoluta</i> Mack.)	Rolled-up Sedge	DFB 17,407	5
<i>Carex scoparia</i> Willd.	Broom Sedge	DFB 17,776	5
<i>Carex tenera</i> Dew.	Slender Sedge		4
<i>Carex tonsa</i> (Fern.) Bickn. var. <i>rugosperma</i> (Mack.) Crins (<i>C. rugosperma</i> Mack.)	Rough-seeded Sedge	DFB 17,404; DFB 17,417 ***	8
<i>Carex trisperma</i> Dew. var. <i>trisperma</i>	Three-seeded Sedge		9
<i>Carex umbellata</i> Schkuhr	Umbrella Sedge	Regionally Significant *** DFB 16,662	7
<i>Carex vulpinoidea</i> Michx.	Fox Sedge	DFB 17,413	5
<i>Cyperus squarrosus</i> L. (<i>C. aristatus</i> Rottb.)	Awed Bulrush	DFB 17,344	10
<i>Eleocharis erythropoda</i> Steudel (<i>E. calva</i> Torr.)	Red-stemmed Spike-rush		5
<i>Eleocharis intermedia</i> Schultes	Intermediate Spike-rush	Regionally Significant DFB 17,343	6
<i>Eleocharis obtusa</i> (Willd.) Schultes	Blunt Spike-rush		5

<i>Schoenoplectus tabernaemontani</i> (Gmel.) Palla (<i>Scirpus validus</i> Vahl)	Strong Bulrush		5
<i>Scirpus cyperinus</i> (L.) Kunth	Wool-grass		4
<i>Scirpus hattorianus</i> Fern. (<i>S. atrovirens</i> Willd., p. pt.)	Mosquito Bulrush		6
<i>Scirpus microcarpus</i> Presl (<i>S. rubrotinctus</i> Fern.)	Red-stem Bulrush		4
<i>Scirpus pendulus</i> Muhl. (<i>S. lineatus</i> auct., non Michx.)	Drooping Bulrush	DFB 16,761	3
ARACEAE (Arum Family)			
<i>Arisaema triphyllum</i> (L.) Schott	Jack-in-the-pulpit		5
JUNCACEAE (Rush Family)			
<i>Juncus alpinoarticulatus</i> Chaix. (<i>J. alpinus</i> Vill., p. pt.)	Alpine Rush	DFB 17,458	5
<i>Juncus articulatus</i> L.	Jointed Rush	Regionally Significant DFB 16,759	5
<i>Juncus tenuis</i> Willd.	Path Rush		0
LILIACEAE (Lily Family)			
<i>Lilium philadelphicum</i> L.	Wood Lily		8
<i>Maianthemum canadense</i> Desf. var. <i>canadense</i>	Canada Mayflower		5
<i>Maianthemum racemosum</i> (L.) Link (<i>Smilacina racemosa</i> (L.) Desf.)	False Solomon's-seal		4
<i>Maianthemum stellatum</i> (L.) Link (<i>Smilacina stellata</i> (L.) Desf.)	Starry False Solomon's-seal		6
AMARYLLIDACEAE (Amaryllis Family)			
<i>Iris versicolor</i> L.	Blue Flag		5
<i>Sisyrinchium montanum</i> Greene	Blue-eyed Grass		4
ORCHIDACEAE (Orchid Family)			

<i>Cypripedium arietinum</i> R. Br.	Rams-head Lady's-slipper	PROVINCIAL CONSERVATION CONCERN (S3) *** DFB 16,623; DFB16,627; DFB 16,758; DFB17,402; DFB 17,402	10
<i>Cypripedium parviflorum</i> Salisb. (s.l.) (<i>C. calceolus</i> L.)	Yellow Lady's-slipper	***	7
<i>Liparis loeselii</i> (L.) Rich.	Bog Twayblade		5
<i>Malaxis unifolia</i> Michx.	Green Adder's-mouth		7
<i>Platanthera aquilonis</i> Sheviak (<i>P. hyperborea</i> (L.) Lindl.)	Northern Green Orchid		5
<i>Platanthera hookeri</i> (Torr.) Lindl.	Hooker's Orchid	PROVINCIAL CONSERVATION CONCERN (S3)	8
<i>Spiranthes lacera</i> (Raf.) Raf.	Slender Ladies-tresses		7
SALICACEAE (Willow Family)			
<i>Populus balsamifera</i> L.	Balsam Poplar		4
<i>Populus tremuloides</i> Michx.	Trembling Aspen		2
<i>Salix discolor</i> L.	Pussy Willow		3
<i>Salix humilis</i> Marsh.	Upland Willow		7
<i>Salix petiolaris</i> Sm.	Meadow Willow		3
BETULACEAE (Birch Family)			
<i>Alnus incana</i> (L.) Moench ssp. <i>rugosa</i> (Du Roi) Clausen (<i>A. rugosa</i> (Du Roi) Spreng.)	Speckled Alder		6
<i>Betula papyrifera</i> Marsh.	White Birch		2
<i>Ostrya virginiana</i> (Mill.) K. Koch	Ironwood		4
FAGACEAE (Oak Family)			
<i>Quercus macrocarpa</i> Michx.	Bur Oak		5
<i>Quercus rubra</i> L.	Red Oak		6
ULMACEAE (Elm Family)			

<i>Ulmus americana</i> L.	White Elm		3
CHENOPODIACEAE (Goosefoot Family)			
<i>Chenopodium capitatum</i> (L.) Aschers	Strawberry-blight	DFB17,340	4
<i>Chenopodium simplex</i> (Torr.) Raf. (<i>C. gigantospermum</i> Aellen; <i>C. hybridum</i> auct., non L.)	Maple-leaved Goosefoot		0
CARYOPHYLLACEAE (Pink Family)			
<i>Silene antirrhina</i> L.	Sleepy Catch-fly		3
RANUNCULACEAE (Crowfoot Family)			
<i>Anemone cylindrica</i> A. Gray	Thimbleweed	DFB16,770	7
<i>Anemone virginiana</i> L. (s.l.) (incl. <i>A. riparia</i> auct., non Fern.; <i>A. virginica</i> L. var. <i>cylindroidea</i> Boivin)	Tall Anemone		4
<i>Coptis trifolia</i> (L.) Salisb.	Goldthread		7
<i>Adlumia fungosa</i> (Ait.) Greene	Alleghany-vine	Regionally Significant DFB17,415	8
<i>Corydalis aurea</i> Willd.	Golden Corydalis	Regionally Significant *** DFB16,759 DFB17,400	8
BRASSICACEAE (Mustard Family)			
<i>Arabis glabra</i> (L.) Bernh.	Smooth Rock-cress		4
<i>Cardamine parviflora</i> L. var. <i>arenicola</i> (Britt.) Schulz	Bitter-cress	Regionally Significant DFB17,426	7
<i>Cardamine pensylvanica</i> Muhl.	Pennsylvania Bitter-cress	DFB16,772	6
SAXIFRAGACEAE (Saxifrage Family)			
<i>Mitella nuda</i> L.	Naked Mitrewort		6
<i>Saxifraga virginensis</i> Michx.	Early Saxifrage		6
GROSSULARIACEAE (Currant Family)			
<i>Ribes glandulosum</i> Grauer	Skunk Currant		6
<i>Ribes hirtellum</i> Michx.	Hairy Gooseberry	DFB17,410	6
<i>Ribes lacustre</i> (Pers.) Poir.	Swamp Currant		7
ROSACEAE (Rose Family)			

<i>Amelanchier alnifolia</i> Nutt. var. <i>compacta</i> (Neilson) McKay (<i>A. canadensis</i> , auct., in part; <i>A. humilis</i> Wieg., in part)	Saskatoon	Regionally Significant ***	8
<i>Amelanchier sanguinea</i> (Pursh) DC.	Round-leaf Serviceberry		7
<i>Amelanchier spicata</i> K. Koch var. <i>stolonifera</i> (Wieg.) Cinq-Mars (<i>A. stolonifera</i> Wieg.)	Shadbush	DFB 17,409; DFB 17,414	7
<i>Crataegus chrysoarpa</i> Ashe (incl. <i>C. aboriginum</i> Sarg)	Hawthorn		4
<i>Fragaria virginiana</i> Duchesne	Common Strawberry		2
<i>Prunus virginiana</i> L.	Choke Cherry		2
<i>Rosa acicularis</i> Lindl.	Bristly Rose		7
<i>Rubus strigosus</i> Michx. (<i>R. idaeus</i> L. var. <i>strigosus</i> (Michx.) Max.)	Common Raspberry		0
<i>Waldsteinia fragarioides</i> (Michx.) Tratt.	Barren-ground Strawberry		5
FABACEAE (Bean Family)			
<i>Astragalus canadensis</i> L.	Canada Milk-vetch	Regionally Significant	8
<i>Astragalus neglectus</i> (T. & G.) Sheld. (<i>A. cooperi</i> A. Gray)	Cooper's Milk-vetch	PROVINCIAL CONSERVATION CONCERN (S3) *** DFB 16,624; DFB 16,757	9
GERANIACEAE (Geranium Family)			
<i>Geranium bicknellii</i> Britt.	Bicknell's Geranium		5
POLYGALACEAE (Milkwort Family)			
<i>Polygala paucifolia</i> Willd.	Fringed Milkwort		6
<i>Polygala senega</i> L.	Senega Snakeroot		7
ANACARDIACEAE (Cashew Family)			
<i>Rhus hirta</i> (L.) Sudworth (<i>R. typhina</i> L.)	Staghorn Sumac		1
<i>Toxicodendron rydbergii</i> (Rydb.) Greene (<i>Rhus radicans</i> L. var. <i>rydbergii</i> (Sm.) McNeill)	Poison-ivy		0

ACERACEAE (Maple Family)			
<i>Acer rubrum</i> L.	Red Maple		4
BALSAMINACEAE (Touch-me-not Family)			
<i>Impatiens capensis</i> Meerb.	Spotted Touch-me-not		4
RHAMNACEAE (Buckthorn Family)			
<i>Rhamnus alnifolia</i> L'Her	Alder-leaved Buckthorn		7
VITACEAE (Grape Family)			
<i>Parthenocissus vitacea</i> (Knerr) Hitchc.	Virginia Creeper		3
TILIACEAE (Linden Family)			
<i>Tilia americana</i> L.	Basswood		4
VIOLACEAE (Violet Family)			
<i>Viola cucullata</i> Ait.	Marsh Blue Violet		5
<i>Viola nephrophylla</i> Greene	Northern Bog Violet	DFB 17,878	7
ELAEAGNACEAE (Oleaster Family)			
<i>Shepherdia canadensis</i> (L.) Nutt.	Buffaloberry	***	7
ONAGRACEAE (Evening-primrose Family)			
<i>Circaea alpina</i> L.	Lesser Enchanter's-nightshade		6
<i>Epilobium angustifolium</i> L.	Fireweed		3
<i>Epilobium ciliatum</i> Raf. (<i>E. adenocaulon</i> Haussk.; <i>E. glandulosum</i> , auct., non Lehm.)	Willow-herb		3
<i>Epilobium leptophyllum</i> Raf.	Narrow-leaved Willow-herb	DFB 17,334; DFB 17,406	7
ARALIACEAE (Ginseng Family)			
<i>Aralia nudicaulis</i> L.	Wild Sarsaparilla		4
<i>Aralia racemosa</i> L.	Spikenard		7
APIACEAE (Carrot Family)			
<i>Sanicula marilandica</i> L.	Black Snakeroot		5
<i>Sium suave</i> Walt.	Water-parsnip		4

CORNACEAE (Dogwood Family)			
<i>Cornus canadensis</i> L. var. <i>canadensis</i>	Bunchberry		7
<i>Cornus rugosa</i> Lam.	Round-leaved Dogwood		6
<i>Cornus sericea</i> L. (<i>C. stolonifera</i> Michx.)	Red-osier Dogwood		2
PYROLACEAE (Wintergreen Family)			
<i>Pyrola asarifolia</i> Michx.	Pink Pyrola		7
<i>Pyrola chlorantha</i> Sw. (<i>P. virens</i> Schweig.)	Greenish-flowered Pyrola		6
MONOTROPACEAE (Indian-pipe Family)			
<i>Monotropa uniflora</i> L.	Indian-pipe		6
ERICACEAE (Heath Family)			
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	Bearberry	DFB 16,767	8
<i>Gaultheria procumbens</i> L.	Wintergreen		6
PRIMULACEAE (Primrose Family)			
<i>Trientalis borealis</i> Raf.	Starflower		6
OLEACEAE (Olive Family)			
<i>Fraxinus americana</i> L.	White Ash		4
<i>Fraxinus nigra</i> Marsh.	Black Ash		7
GENTIANACEAE (Gentian Family)			
<i>Gentianopsis crinita</i> (Froel.) Ma	Fringed Gentian		8
APOCYNACEAE (Dogbane Family)			
<i>Apocynum androsaemifolium</i> L.	Spreading Dogbane		3
ASCLEPIADACEAE (Milkweed Family)			
<i>Asclepias syriaca</i> L.	Common Milkweed		0
LAMIACEAE (Mint Family)			
<i>Dracocephalum parviflorum</i> Nutt.	Dragonhead	DFB 17,424	7
<i>Lycopus uniflorus</i> Michx.	Northern Bugleweed		5

<i>Mentha canadensis</i> L. (<i>M. arvensis</i> auct., non L.)	Wild Mint		3
<i>Scutellaria lateriflora</i> L.	Mad-dog Skullcap		5
<i>Trichostema brachiatum</i> L. (<i>Isanthus brachiatus</i> (L.) Britt.)	False Pennyroyal	***	9
SOLANACEAE (Nightshade Family)			
<i>Leucophysalis grandiflora</i> (Hook.) Rydb. (<i>Physalis grandiflora</i> Hook.)	White Ground-cherry	PROVINCIAL CONSERVATION CONCERN (S3) DFB 17,403.	8
SCROPHULARIACEAE (Figwort Family)			
<i>Mimulus ringens</i> L.	Monkey-flower		6
<i>Penstemon hirsutus</i> (L.) Willd.	Hairy Beard-tongue	***	7
<i>Veronica anagallis-aquatica</i> L. (<i>V. catenata</i> Penn; <i>V. comosa</i> Richter)	Water Speedwell	Regionally Significant DFB 16,773	7
<i>Veronica peregrina</i> L. ssp. <i>xalapensis</i> (Kunth) Penn.	Purslane Speedwell	Regionally Significant *** DFB 16,625	7
RUBIACEAE (Bedstraw Family)			
<i>Galium palustre</i> L.	Marsh Bedstraw	DFB 16,774	5
<i>Galium trifidum</i> L.	Small Bedstraw		5
CAPRIFOLIACEAE (Honeysuckle Family)			
<i>Linnaea borealis</i> L.	Twinflower		7
<i>Lonicera dioica</i> L.	Red Honeysuckle		5
<i>Lonicera hirsuta</i> L.	Hairy Honeysuckle		7
<i>Symphoricarpos albus</i> (L.) Blake	Snowberry		7
ASTERACEAE (Aster Family)			
<i>Achillea millefolium</i> L.	Yarrow		0
<i>Ambrosia artemisiifolia</i> L.	Ragweed		0
<i>Anaphalis margaritacea</i> (L.) Benth. & Hook.	Pearly-everlasting		3

<i>Antennaria howellii</i> E. Greene (s. l.) (incl. <i>A. h.</i> ssp. <i>canadensis</i> (E. Greene) Bayer, ssp. <i>petaloidea</i> (Fern.) Bayer, and ssp. <i>neodioica</i> (E. Greene) Bayer)	Canada Pussy-toes		2
<i>Bidens cernuus</i> L.	Nodding Beggar-ticks		2
<i>Bidens frondosa</i> L.	Large-leaved Beggar-ticks		3
<i>Conyza canadensis</i> (L.) Cronq.	Horseweed		0
<i>Doellingeria umbellata</i> (Mill) Nees (<i>Aster umbellatus</i> Mill.)	Flat-topped Aster		6
<i>Erechtites hieraciifolius</i> (L.) Raf.	Pilewort		2
<i>Erigeron annuus</i> (L.) Pers.	Daisy Fleabane		0
<i>Erigeron philadelphicus</i> L.	Philadelphia Fleabane		1
<i>Eupatorium perfoliatum</i> L.	Boneset		2
<i>Eurybia macrophylla</i> (L.) Cass. (<i>Aster macrophyllus</i> L.)	Large-leaved Aster		5
<i>Euthamia graminifolia</i> (L.) Nutt. (<i>Solidago graminifolia</i> (L.) Salisb.)	Narrow-leaved Goldenrod		2
<i>Eutrochium maculatum</i> (L.) E.E. Lamont (<i>Eupatorium maculatum</i> L.)	Joe-Pye-weed		3
<i>Hieracium umbellatum</i> L. (incl. <i>H. canadense</i> Michx. (s.l.); <i>H. kalmii</i> L. (s.l.); <i>H. laevigatum</i> L.)	Hawkweed	DFB 16,768	7
<i>Lactuca biennis</i> (Moench) Fern.	Blue-lettuce		6
<i>Packera pauperculus</i> (L.) A. & D. Love (<i>Senecio pauperculus</i> Muhl.)	Balsam Ragwort		7
<i>Petasites frigidus</i> (L.) Fries var. <i>palmatus</i> (Ait.) Cronq. (<i>P. palmatus</i> (Ait.) A. Gray)	Sweet Coltsfoot		8
<i>Prenanthes altissima</i> L.	Tall White-lettuce		5
<i>Solidago canadensis</i> L. ssp. <i>canadensis</i>	Canada Goldenrod		1
<i>Solidago juncea</i> Ait.	Early Goldenrod		3

<i>Solidago ptarmicoides</i> (Torr. & Gray) Boivin (<i>Aster ptarmicoides</i> Torr. & Gray; <i>Solidago asteroides</i> Semple)	Upland Goldenrod		9
<i>Solidago squarrosa</i> Muhl.	Stout Goldenrod		10
<i>Symphotrichum ciliolatum</i> (Lindl.) A. & D. Love (<i>Aster ciliolatus</i> Lindl.)	Fringed Blue Aster		6
<i>Symphotrichum cordifolium</i> (L.) Nesom (<i>Aster cordifolius</i> L.)	Heart-leaved Aster		5
<i>Symphotrichum lanceolatum</i> (Willd.) Nesom ssp. <i>lanceolatum</i> (<i>Aster lanceolatus</i> Willd.; <i>A. simplex</i> Willd.)	Panicled Aster		3
<i>Symphotrichum puniceum</i> (L.) A. & D. Love var. <i>puniceum</i> (<i>Aster puniceus</i> L.)	Purple-stemmed Aster		6
Total: 204 taxa	Average CC value: 5.19	CC Aggregate	1067

Appendix 2: native vascular plant collections and observations

The following provides detailed location and habitat data for each native and non-native vascular plant voucher specimen obtained in the Braeside Quarry expansion area between 2006 and 2011. Each data set begins with a unique accession number for that collection. The collection data are arranged sequentially in chronological order. The acronym following the habitat description indicates the herbarium (or herbaria) in which the voucher is permanently deposited.

Location and habitat data are also provided for sight records of significant plant populations not supported by a voucher. These do not have an accession number but are indicated by ** before the taxon name.

8 June 2006

45° 28.763' N 76° 26.496' W ^[NAD 84]

300 m southeast of Golf Course Road from south end of Sand Point golf course, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

thin, turfy soil in open, saturated alvar glade dominated by *Senecio pauperculus*, *Poa compressa*, *P. pratensis*, *Carex umbellata* with *Carex aurea*, *Penstemon hirsutus*, *Cypripedium parviflorum*, *Polygala senega*.

16,622 - *Carex umbellata* Schkuhr

VERY COMMON

Dfb

** - *Veronica peregrina* L. ssp. *xalapensis* (Kunth) Penn.

COMMON

** *Trichostema brachiatum* L.

(*Isanthus brachiatus* (L.) Britt.)

COMMON

45° 28.7' N 76° 26.4' W ^[NAD 84]

400 m southeast of Golf Course Road from south end of Sand Point golf course along northeastern edge of Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

at glade edges in sparse to scattered *Thuja occidentalis*, *Abies balsamea* alvar forest in thin, dry soil over limestone bedrock with *Arctostaphylos uva-ursi*, *Cypripedium parviflorum*, *Polygala senega*.

16,623 - *Cypripedium arietinum* R. Br.

COMMON - several hundred plants in vicinity

Dfb

- in dry, open alvar glade amongst *Thuja occidentalis*, *Abies balsamea* forest in *Cladina* lichen beds with *Arctostaphylos uva-ursi*, *Carex rugosperma*.

16,624 - *Astragalus neglectus* (T.& G.) Sheld.

(*A. cooperi* A. Gray)

SCATTERED PLANTS

Dfb

16,625 - *Carex richardsonii* R. Br.

SCATTERED COMMONLY

Dfb

16,625 - *Veronica peregrina* L. ssp. *xalapensis* (Kunth) Penn.

UNCOMMON

Dfb

45° 28.547' N 76° 26.131' W ^[NAD 84]

865 m southeast of Golf Course Road from south end of Sand Point golf course by ATV trail northeastern edge of Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

at glade edges in sparse to scattered *Thuja occidentalis*, *Abies balsamea* alvar forest in thin, dry soil over limestone

bedrock with *Arctostaphylos uva-ursi*, *Cypripedium parviflorum*, *Polygala senega*, *Rosa acicularis*.

16,627 - *Cypripedium arietinum* R. Br.

COMMON - 500+ plants in vicinity (clusters scattered throughout 1 km of this habitat)

Dfb, WIN

45° 28.562' N 76° 26.246' W ^[NAD 84]

750 m southeast of Golf Course Road from south end of Sand Point golf course by ATV trail northeastern edge of Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

at edge of large glade in *Thuja occidentalis*, *Abies balsamea* alvar forest in thin, dry soil over limestone bedrock with *Arctostaphylos uva-ursi*, *Cypripedium parviflorum*, *Polygala senega*, *Rosa acicularis*.

**** *Cypripedium arietinum* R. Br.**

COMMON - hundreds of plants

**** *Astragalus neglectus* (T.& G.) Sheld.**

(*A. cooperi* A. Gray)

SCATTERED PLANTS

45° 28.631' N 76° 26.356' W ^[NAD 84]

540 m southeast of Golf Course Road from south end of Sand Point golf course by ATV trail northeastern edge of Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

along trail in in *Thuja occidentalis*, *Abies balsamea* alvar forest in thin, dry soil over limestone bedrock with *Arctostaphylos uva-ursi*, *Cypripedium parviflorum*, *Polygala senega*, *Rosa acicularis*.

**** *Astragalus neglectus* (T.& G.) Sheld.**

(*A. cooperi* A. Gray)

10+ SCATTERED PLANTS

45° 25.181' N 76° 26.969' W ^[NAD 84]

70 m north of Campbell - CR3 (Usborne Street) intersection at southern end of Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

in dense, saturated moss in flooded *Thuja occidentalis*, *Abies balsamea*, *Fraxinus nigra* swamp forest with *Aralia racemosa*, *Carex trisperma*, *Bidens frondosa*.

16,628 - ***Carex disperma* Dew.**

COMMON

Dfb

31 July 2006

45° 28.409' N 76° 26.576' W ^[NAD 84]

71 m northwest from northwest corner of existing pit, 1.25 km eastnortheast of Campbell/ Usborne Streets intersection, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

edge of *Thuja occidentalis*, *Populus tremuloides*, *Picea glauca*, *Pinus strobus* alvar forest in very thin, dry substrate over limestone bedrock with *Arctostaphylos uva-ursi*, *Cornus canadensis* in moss and lichen mat.

16,756 - ***Bromus kalmii* A. Gray**

UNCOMMON

3: Dfb, Philippe Rabaute (FR), WIN

- common in this habitat elsewhere on property

** ***Astragalus neglectus* (T.& G.) Sheld.**

(*A. cooperi* A. Gray)

UNCOMMON

** - ***Pyrola chlorantha* Sw.**

(*P. virens* Schweig.)

UNCOMMON

** ***Cypripedium arietinum* R. Br.**

COMMON

45° 28.524' N 76° 26.724' W ^[NAD 84]

360 m northwest from northwest corner of existing pit, 1km northeast of Campbell/ Usborne Streets intersection, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

in mature *Thuja occidentalis*, *Populus tremuloides*, *Picea glauca*, *Pinus strobus* alvar forest in thin, peaty substrate over limestone bedrock with *Rhamnus alnifolia*, *Eurybia macrophylla*, *Toxicodendron rydbergii*, *Abies balsamea* seedlings.

16,757 - ***Astragalus neglectus* (T.& G.) Sheld.**

(*A. cooperi* A. Gray)

COMMON

Dfb, Philippe Rabaute (FR), WIN, CAN

16,758 - ***Cypripedium arietinum* R. Br.**

UNCOMMON

Dfb

45° 28.528' N 76° 26.574' W ^[NAD 84]

north side of long artificial clearing 300 m east- northwest from northwest corner of existing pit, 1.1km northeast of Campbell/ Usborne Streets intersection, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

in thin mud over limestone bedrock and gravel in shallow water of open, ephemeral pool with *Equisetum variegatum*, *Euthamia graminifolia*, *Scirpus microcarpus*. *Eleocharis obtusa*.

16,759 - ***Juncus articulatus* L.**

COMMON

Dfb, CAN

45° 28.437' N 76° 26.535' W ^[NAD 84]

105 m northwest from northwest corner of existing pit, 1.25 km east-northeast of Campbell/ Usborne Streets intersection, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

edge of *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* alvar forest in very thin, dry substrate over limestone bedrock with *Arctostaphylos uva-ursi*, *Cornus canadensis* in moss and lichen mat.

16,760 - *Diphasiastrum tristachyum* (Pursh) Holub

(*Lycopodium tristachyum* Pursh)

RARE (5 of 8 plants from small patch)

Dfb, OAC

17,760B - *Diphasiastrum* ×*zeilleri* (Rouy) Holub

(*D. complanatum* (L.) Holub x *tristachyum* (Pursh) Holub)

RARE (3 of 8 plants from small patch)

Dfb

- growing with *D. tristachyum*; *D. complanatum* known from ca. 1km to west (Dfb 15,510)

** *Diphasiastrum complanatum* (L.) Holub

(*Lycopodium complanatum* L.)

RARE

45° 28.280' N 76° 26.135' W ^[NAD 84]

250 m northeast of eastern corner of existing pit, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

edge of disturbed *Thuja occidentalis*, *Picea glauca*, *Abies balsamea* alvar forest in thin, sandy substrate over limestone bedrock.

** *Solidago squarrosa* Muhl.

UNCOMMON

45° 28.348' N 76° 26.139' W ^[NAD 84]

275 m northeast of eastern corner of existing pit along rough track, Braeside Quarry property, McNab - Braeside Tp.,

Renfrew Co.

disturbed, scraped edge of roadway through disturbed *Thuja occidentalis*, *Picea glauca*, *Abies balsamea* alvar forest in thin, sandy substrate over limestone bedrock.

16,761 - *Scirpus pendulus* **Muhl.**

(*S. lineatus* auct., non Michx.)

UNCOMMON

Dfb

16,762 - *Panicum flexile* (Gatt.) Scribn.

ABUNDANT

Dfb, Philippe Rabaute (FR)

16,763 - *Dichanthelium acuminatum* (Sw.) Gould & Clarke ssp. *implicatum* (Scribn.) Freckmann & LeLong

(*Panicum implicatum* Scribn.)

COMMON

3: Dfb, WIN, Philippe Rabaute (Montpazier, FR)

45° 28.370' N 76° 26.129' W ^[NAD 84]

250 m northeast of eastern corner of existing pit along rough track, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

disturbed limestone bedrock and gravel in thin soil by *Thuja occidentalis*, *Picea glauca*, *Populus tremuloides* alvar forest with *Trichostema brachiatum*, *Panicum flexilie*.

16,764 - *Muhlenbergia glomerata* (Willd.) Trin.

UNCOMMON

Dfb

16,765 - *Sphenopholis intermedia* (Rydb.) Rydb.

UNCOMMON

Dfb

45° 28.261' N 76° 26.291' W ^[NAD 84]

75 m north of mid-point of existing pit along rough track, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

in glade dominated by *Arctostaphylos uva-ursi* in *Thuja occidentalis*, *Abies balsamea* alvar forest in thin, dry substrate over limestone bedrock in moss and lichen mat.

16,766 - *Cypripedium arietinum* R. Br.

COMMON

Dfb

16,767 - *Arctostaphylos uva-ursi* (L.) Spreng.

ABUNDANT

Dfb, Philippe Rabaute (FR)

16,768 - *Hieracium umbellatum* L. ['kalmii' type]

(incl. *H. canadense* Michx. (s.l.); *H. kalmii* L. (s.l.); *H. laevigatum* L.)

RARE

Dfb

** *Astragalus neglectus* (T.& G.) Sheld.

(*A. cooperi* A. Gray)

COMMON

45° 28.321' N 76° 26.739' W ^[NAD 84]

northwest side of mid-point of existing pit, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

open limestone bedrock and gravel in disturbed roadside with *Panicum flexile*, *Potentilla recta*, *Juniperus communis* seedlings, *Euphorbia cyparissias*.

16,769 - *Muhlenbergia mexicana* (L.) Trin.

RARE

Dfb, Philippe Rabaute (Montpellier, FR)

45° 28.399' N 76° 26.933' W ^[NAD 84]

200 m northwest of mid-point of existing pit, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

disturbed, regenerating meadow in thin sandy soil over limestone bedrock with scattered *Thuja occidentalis*, *Picea glauca* groves and dense *Juniperus communis* thickets, with *Spiranthes lacera*, *Toxicodendron rydbergii*, *Elymus repens*.

16,770 - *Anemone cylindrica* A. Gray

COMMON

Dfb, WIN

45° 28.398' N 76° 27.010' W ^[NAD 84]

433 m northwest (336°) from Campbell/ Usborne Streets intersection west of existing pit, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

in peaty, spring-flooded ground below mature *Thuja occidentalis*, *Abies balsamea* swamp forest with sparse undergrowth of *Aralia nudicaulis*, *Onoclea sensibilis*, *Toxicodendron rydbergii*, *Petasites frigidus*.

16,771 - *Carex granularis* Willd.

SCATTERED UNCOMMONLY

Dfb, WIN

** *Cypripedium arietinum* R. Br.

UNCOMMON

45° 28.275' N 76° 26.939' W ^[NAD 84]

295 m northwest (341°) from Campbell/ Usborne Streets intersection west of existing pit, Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

cold, flowing water in seepage area in *Thuja occidentalis*, *Abies balsamea* swamp forest in peat and moss substrate with *Platanthera aquilonis*, *Bidens* spp., *Maianthemum stellatum*, *Mitella nuda*.

16,772 - *Cardamine pensylvanica* Muhl.

UNCOMMON

Dfb

16,773 - *Veronica anagallis-aquatica* L. var. *glandulosa* Farw.

(*V. catenata* Penn; *V. comosa* Richter)

LARGE PATCH (few [white] flowering)

Dfb, WIN

16,774 - *Galium palustre* L.

COMMON

3: Dfb, Philippe Rabaute (FR), WIN

27 August 2008

45. 47148° N 76. 44743° W ^[NAD 84]

150 m west of existing pit, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

regenerating sand bank along one year old road through mature *Picea glauca*, *Thuja occidentalis* forest with *Pteridium aquilinum*, *Aster macrophyllum*.

17,340 - *Chenopodium capitatum* (L.) Aschers

RARE (single clump)

Dfb

** *Chenopodium simplex* (Torr.) Raf.

(*C. gigantospermum* Aellen; *C. hybridum* auct., non L.)

UNCOMMON

45. 47585° N 76. 44347° W ^[NAD 84]

300 m north of existing pit, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

regenerating scrape in severely disturbed, spring-flooded alvar barren with *Arctostaphylos uva-ursi*, *Trichostemum brachiatum*, *Solidago ptarmicoides*.

17,341 - *Carex richardsonii* R. Br.

COMMON

Dfb

**** *Liparis loeselii* (L.) Rich.**

SCATTERED PLANTS

45. 47630° N 76. 43999° W ^[NAD 84]

500 m north of existing pit, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

spring-flooded wetlette in mature *Thuja occidentalis*, *Abies balsamea*, *Picea glauca* forest.

17,342 - *Epilobium leptophyllum* Raf.

UNCOMMON

Dfb

dry glade in *Thuja occidentalis*, *Picea glauca* alvar forest with *Cypripedium arietinum*, *Astragalus neglectus*, *Arctostaphylos uva-ursi*.

**** *Malaxis unifolia* Michx.**

ONE PLANT

45. 47571° N 76. 44130° W ^[NAD 84]

475 m north of existing pit, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

wet mud over limestone bedrock on one year old track through mature *Thuja occidentalis*, *Abies balsamea*, *Picea glauca* alvar forest.

17,343 - *Eleocharis intermedia* Schultes

UNCOMMON

Dfb, WIN

17,344 - *Cyperus squarrosus* L.

(*C. aristatus* Rottb.)

UNCOMMON

Dfb,

22 May 2009

45.47068° N 76.44578° W ^[NAD 84]

200 m northwest of scale house along excavation perimeter road, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

17,400 - *Corydalis aurea* Willd.

SEVERAL CLUMPS

Dfb, Marcel Blondeau, St. Foy - QFA

45.47594° N 76.44342° W ^[NAD 84]

800 m north of scale house along excavation perimeter road, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Dry alvar glade in *Arctostaphylos uva-ursi* health in *Thuja occidentalis*, *Picea glauca* forest with *Cornus canadensis*, *Amelanchier spicata stolonifera*, *Carex eburnea*.

17,401 - *Carex richardsonii* R. Br.

COMMON

Dfb,

45. 47376° N 76.44731° W ^[NAD 84]

560 m north northwest of scale house along excavation perimeter road, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Edges of glade in mature *Thuja occidentalis*, *Picea glauca* alvar forest with *Polygala pauciflora*, *Carex eburnea*.

17,402 - *Cypripedium arietinum* R. Br.

COMMON (several dozen plants) at peak of bloom

4: Dfb,

- site to be destroyed by quarry expansion

45. 47213° N 76.44819° W ^[NAD 84]

420 m west northwest of scale house along excavation perimeter road, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Sandy edge of new (three year old) road cut through dry *Abies balsamea*, *Thuja occidentalis*, *Populus tremuloides* forest with *Carex tonsa*, *Symphoricarpos albus*, *Aquilegia canadensis*, *Dichanthelium acuminatum*.

17,403 - *Leucophysalis grandiflora* (Hook.) Rydb.

(*Physalis grandiflora* Hook.)

5 CLUMPS (several with remnant mature stalks from previous year)

Dfb, WIN, CAN

17,404 - *Carex tonsa* (Fern.) Bickn. var. *rugosperma* (Mack.) Crins

(*C. rugosperma* Mack.)

COMMON - dozens of clumps

Dfb, WIN, Philippe Rabaute (Montpilier, FR)

17,405 - *Carex houghtoniana* Torr. ex Dew.

LARGE PATCH

Dfb, WIN, Philippe Rabaute (Montpilier, FR), CAN

2 June 2009

45.46788° N 76.43839° W [NAD 84]

180 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Disturbed edge of *Thuja occidentalis*, *Populus tremuloides*, *Ulmus americana* forest in thin soil over limestone bedrock with *Carex eburnea*, *Symphoricarpos albus*, *Toxicodendron rydbergii*.

17,407 - *Carex rosea* Willd. (Section: Acrocystis)

UNCOMMON

Dfb, WIN

17,408 - *Carex pedunculata* Willd.

UNCOMMON

Dfb, Philippe Rabaute (Montpilier, FR)

45.46971° N 76.43573° W [NAD 84]

300 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Open, disturbed limestone bedrock flats with *Sedum* spp., *Toxicodendron rydbergii*, *Rudbeckia hirta*.

**** *Sedum spurium* Bieb.**

UNCOMMON

**** *Sedum hispanicum* L.**

COMMON

17,409 - *Amelanchier spicata* K. Koch var. *stolonifera* (Wieg.) Cinq-Mars

(*A. stolonifera* Wieg.)

UNCOMMON

Dfb, WIN

45.47057° N 76.43533° W ^[NAD 84]

600 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Disturbed edge of limestone bedrock flats with *Maianthemum racemosum*, *Euphorbia cyparissias*, *Vitis riparia*.

17,410 - *Ribes hirtellum* Michx.

UNCOMMON

Dfb, WIN

45.47064° N 76.43501° W ^[NAD 84]

590 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Edge of *Thuja occidentalis*, *Abies balsamea* forest in thin, dry soil over limestone bedrock with *Polgala pauciflora*, *Waldsteinia fragarioides*, *Linnaea borealis*, *Maianthemum canadense*.

**** ** *Cypripedium arietinum* R. Br.**

UNCOMMON (20+ plants in full flower)

17,411 - *Carex richardsonii* R. Br.

COMMON

Dfb, WIN,

45.47194° N 76.43373° W ^[NAD 84]

760 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

In glade in *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* forest in thin, dry soil over limestone bedrock with *Polgala pauciflora*, *Linnaea borealis*, *Maianthemum canadense*.

**** *Cypripedium arietinum* R. Br.**

RARE (8 plants in full flower)

45.47269° N 76.43310° W [NAD 84]

860 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

In glade in *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* forest in thin, mossy soil over limestone bedrock with *Polgala pauciflora*, *Linnaea borealis*, *Maianthemum canadense*.

**** *Cypripedium arietinum* R. Br.**

COMMON (70+ plants in full flower)

45.47367° N 76.43166° W [NAD 84]

860 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Disturbed edge of limestone bedrock flats by *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* forest with *Thuja* saplings.

17,412 - *Salix humilis* Marsh.

UNCOMMON

Dfb, CAN

45.47380° N 76.42954° W [NAD 84]

1.1 km north of Usborne Street 2 km west of Braeside, McNab-Braeside Tp., Renfrew Co.

On saturated, mossy log in old, shallowly-flooded beaver pond.

17,413 - *Carex vulpinoidea* Michx. (Section: Multiflorae)

UNCOMMON

Dfb, WIN, Philippe Rabaute (Montpilier, FR)

- caespitose

45.47356° N 76.43002° W ^[NAD 84]

1100 m northeast of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

In *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* forest in thin moss over limestone bedrock by open pond with *Polgala pauciflora*, *Carex eburnea*, *Toxicodendron rydbergii*, *Maianthemum canadense*.

**** *Cypripedium arietinum* R. Br.**

COMMON (50+ plants in full flower)

45.47448° N 76.43309° W ^[NAD 84]

1100 m north of Usborne Street along east side of Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

In *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* forest in thin moss over limestone bedrock with *Polgala pauciflora*, *Carex eburnea*, *Toxicodendron rydbergii*, *Maianthemum canadense*.

**** *Cypripedium arietinum* R. Br.**

COMMON (50+ plants in full flower)

- continuous in glades westward for ca. 300 m

45.47566° N 76.43515° W ^[NAD 84]

1200 m northeast of Usborne Street across Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

In glade in *Thuja occidentalis*, *Picea glauca*, *Pinus strobus* forest in thin moss over limestone bedrock with *Polgala*

pauciflora, *Carex eburnea*, *Toxicodendron rydbergii*, *Cypripedium parviflorum*, *Maianthemum canadense*.

**** *Cypripedium arietinum* R. Br.**

COMMON (200+ plants in full flower)

45.47035° N 76.43700° W [NAD 84]

480 m northeast of Usborne Street by northeast corner of existing Miller Group Braeside Quarry, McNab - Braeside Tp., Renfrew Co.

Disturbed limestone bedrock flats with *Juniperus communis*, *Populus balsamifera*, *Rudbeckia hirta*.

17,414 - *Amelanchier spicata* K. Koch var. *stolonifera* (Wieg.) Cinq-Mars

(*A. stolonifera* Wieg.)

COMMON

Dfb, WIN

45.47109° N 76.43652° W [NAD 84]

550 m northeast of Usborne Street by northeast corner of existing Miller Group Braeside Quarry, McNab - Braeside Tp., Renfrew Co.

Glade in *Abies balsamea*, *Thuja occidentalis*, *Pinus strobus* alvar forest in thin soil over limestone bedrock with *Toxicodendron rydbergii*, *Arctostaphylos uva-ursi*, *Carex eburnea*, *Cypripedium parviflorum*.

**** *Cypripedium arietinum* R. Br.**

UNCOMMON (7 plants in full flower)

45.47112° N 76.43841° W [NAD 84]

525 m northeast of Usborne Street by north side of existing Miller Group Braeside Quarry, McNab - Braeside Tp., Renfrew Co.

Open edge of track through dry *Thuja occidentalis*, *Abies balsamea*, *Pinus strobus* alvar forest in thin soil over

limestone bedrock with *Toxicodendron rydbergii*, *Arctostaphylos uva-ursi*, *Carex eburnea*, *Cypripedium parviflorum*.

** *Astragalus neglectus* (T.& G.) Sheld.

(*A. cooperi* A. Gray)

SCATTERED PLANTS

45.47168° N 76.44743° W ^[NAD 84]

355 m northwest of Miller Group Braeside Quarry scale house along extraction area perimeter road north of Usborne Street, McNab - Braeside Tp., Renfrew Co.

In thin sand over limestone bedrock at edge of recently cut (Oct 2006) open track through mature *Thuja occidentalis*, *Picea glauca*, *Populus tremuloides* forest with *Pteridium aquilinum*, *Carex tonsa*, *Geranium bicknellii*.

17,415 - *Adlumia fungosa* (Ait.) Greene

ONE PLANT

Dfb

17,416 - *Carex deweyana* Schw.

COMMON

Dfb, Philippe Rabaute (Montpilier, FR)

17,417 - *Carex tonsa* (Fern.) Bickn. var. *rugosperma* (Mack.) Crins

(*C. rugosperma* Mack.)

COMMON

Dfb, Win, Marcel Blondeau, St. Foy - QFA

45.47590° N 76.44608° W ^[NAD 84]

255 m southeast of Golf Course Road along Miller Group Braeside Quarry perimeter road north, McNab - Braeside Tp., Renfrew Co.

Saturated moss mat by two year old pool in clearing in *Thuja occidentalis*, *Abies balsamea* alvar forest with *Carex*

brunnescens.

17,418 - *Petasites frigidus* (L.) Fries var. *palmatus* (Ait.) Cronq.

(*P. palmatus* (Ait.) A. Gray)

COMMON

Dfb, WIN

45.47548° N 76.44557° W [NAD 84]

265 m southeast of Golf Course Road along Miller Group Braeside Quarry perimeter road north, McNab - Braeside Tp., Renfrew Co.

Open gravel of in two-year wet bedrock scrape in *Thuja occidentalis*, *Abies balsamea* alvar forest with *Carex granularis*, *C. aurea*.

17,419 - *Carex disperma* Dew.

COMMON

Dfb, Philippe Rabaute (Montpilier, FR)

45.47660° N 76.44380° W [NAD 84]

250 m southeast of Golf Course Road by large clearing along Miller Group Braeside Quarry perimeter road north, McNab - Braeside Tp., Renfrew Co.

Dry glade in *Thuja occidentalis*, *Abies balsamea* alvar forest with *Arctostaphylos uva-ursi*, *Waldsteinia fragarioides*, *Rosa acicularis*.

**** *Astragalus neglectus* (T.& G.) Sheld.**

(*A. cooperi* A. Gray)

SCATTERED PLANTS

45.47660° N 76.44344° W [NAD 84]

255 m southeast of Golf Course Road by large clearing along Miller Group Braeside Quarry perimeter road north,

McNab - Braeside Tp., Renfrew Co.

Dry glade in *Thuja occidentalis*, *Abies balsamea* alvar forest with *Arctostaphylos uva-ursi*, *Waldsteinia fragarioides*, *Rosa acicularis*, *Polygala pauciflora*.

**** *Cypripedium arietinum* R. Br.**

COMMON (50+ plants in full flower)

45.47264° N 76.44851° W [NAD 84]

260 m southeast of Golf Course Road by large clearing along Miller Group Braeside Quarry perimeter road north, McNab - Braeside Tp., Renfrew Co.

Sandy heap at edge of two year old roadway through *Thuja occidentalis*, *Abies balsamea* alvar forest with *Euphorbia cyparissias*, *Aquilegia canadensis*.

**** *Corydalis aurea* Willd.**

SMALL CLUSTER of robust plants

3 June 2009

45.47573° N 76.44159° W [NAD 84]

520 m southeast of Golf Course Road northeast of large clearing along Miller Group Braeside Quarry perimeter road north, McNab - Braeside Tp., Renfrew Co.

Sandy heap at edge of two year old roadway through *Thuja occidentalis*, *Abies balsamea* alvar forest with *Euphorbia cyparissias*, *Aquilegia canadensis*.

**** *Corydalis aurea* Willd.**

SMALL CLUSTER of robust plants

45.47569° N 76.44049° W [NAD 84]

550 m southeast of Golf Course Road, 950 m northeast of Usborne Street on northwest side of Miller Group Braeside

Quarry perimeter road north 150 m northeast of big clearing, McNab - Braeside Tp., Renfrew Co.

Edge of *Thuja occidentalis*, *Abies balsamea* alvar forest with *Arctostaphylos uva-ursi*, *Waldsteinia fragarioides*, *Polygala pauciflora*.

**** *Platanthera hookeri* (Torr.) Lindl.**

ONE (non-flowering) PLANT

45.47289° N 76.43552° W ^[NAD 84]

840 m northeast of Osborne Street across Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Edge of *Thuja occidentalis*, *Abies balsamea* alvar forest with *Arctostaphylos uva-ursi*, *Waldsteinia fragarioides*, *Polygala pauciflora*.

**** *Carex richardsonii* R. Br.**

COMMON

**** *Astragalus neglectus* (T. & G.) Sheld.**

(*A. cooperi* A. Gray)

SCATTERED PLANTS

4 June 2009

45.474280° N 76.44951° W ^[NAD 84]

430 m west northwest of scale house along excavation perimeter road, Miller Group Braeside Quarry property, McNab - Braeside Tp., Renfrew Co.

Sandy edge of new (October 2006) road cut through dry *Abies balsamea*, *Thuja occidentalis*, *Populus tremuloides* forest with *Carex rugosperma*, *Symphoricarpos albus*, *Aquilegia canadensis*, *Dichanthelium acuminatum*.

17,424 - *Dracocephalum parviflorum* Nutt.

UNCOMMON

Dfb, WIN, CAN, Philippe Rabaute (Montpellier, FR)

17,425 - *Luzula pallidula* Kirsch.

(*L. pallescens* (Wahl.) Bess.)

COMMON

4: Dfb, CAN, Philippe Rabaute (Montpellier, FR), DAO

- confined to 2½ year old road bank

45.47404° N 76.44651° W ^[NAD 84]

270 m southeast of Golf Course Road northeast of large clearing along Miller Group Braeside Quarry perimeter road, McNab - Braeside Tp., Renfrew Co.

Sandy edge of new (Oct 2006) road cut through dry *Abies balsamea*, *Thuja occidentalis* alvar forest with *Carex rugosperma*, *Toxicodendron rydbergii*, *Corydalis aureus*, *Aquilegia canadensis*.

17,426 - *Cardamine parviflora* L. var. *arenicola* (Britt.) Schulz

SEVERAL LARGE PATCHES

3: Dfb, WIN, Philippe Rabaute (Montpellier, FR)

- confined to 2½ year old road bank

** *Astragalus neglectus* (T.& G.) Sheld.

(*A. cooperi* A. Gray)

SCATTERED PLANTS

** *Astragalus canadensis* L.

ONE LARGE CLUMP

45.47367° N 76.43166° W ^[NAD 84]

870 m northeast of Osborne Street along south side of Miller Group Braeside Quarry perimeter road near east side of property, McNab - Braeside Tp., Renfrew Co.

In *Thuja occidentalis*, *Abies balsamea* alvar forest with *Arctostaphylos uva-ursi*, *Waldsteinia fragarioides*.

Toxicodendron rydbergii, *Polygala pauciflora*.

** *Platanthera hookeri* (Torr.) Lindl.

20+ PLANTS (8-10 approaching flowering)

17 June 2009

45.47234° N 76.44298° W ^[NAD 84]

150 m north of scale house in Miller Group Braeside Quarry, McNab - Braeside Tp., Renfrew Co.

Flooded, regenerating scrape in open limestone quarry with *Lythrum salicaria*.

17,458 - *Juncus alpinoarticulatus* Chaix.

(*J. alpinus* Vill., p. pt.)

COMMON

Dfb

9 September 2009

45.46953° N 76.43618° W

110 m east of Braeside Quarry pit immediately east of quarry property boundary, McNab-Braeside Tp., Renfrew County.

Arid, bare limestone pavement in scrubby *Thuja occidentalis* forest.

17,518 - *Sedum sarmentosum* Bunge

LARGE (sterile) PATCH

Dfb, WIN

- previously unknown in Renfrew Co.

17,519 - *Sedum spurium* Bieb.

UNCOMMON

Dfb

- previously unknown in Renfrew Co.

45.47176° N 76.44024° W

355 m west and 20 m north along north edge of Braeside Quarry pit , McNab-Braeside Tp., Renfrew County.

In thin duff over limestone bedrock in mature *Thuja occidentalis* alvar forest with *Arctostaphylos uva-ursi*, *Maianthemum stellatum*.

**** *Cypripedium arietinum* R. Br.**

UNCOMMON (20+ plants in full flower)

**** *Astragalus neglectus* (T.& G.) Sheld.**

(*A. cooperi* A. Gray)

SCATTERED PLANTS

6 August 2010

45.474452° N 76.447252° W ^[NAD 84]

north side of Miller Group Braeside Quarry Property 250 m south of Golf Course Road, McNab - Braeside Tp., Renfrew Co.

open limestone bedrock flat along regenerating three-year old road right-of-way with *Sporobolus vaginiflorus*, *Panicum philadelphicum*, *Astragalus neglectus*.

17,776 - *Carex scoparia* Willd.

UNCOMMON

Dfb, WIN

1 June 2011

45.474408° N 76.4675° W ^[NAD 84]

northeast of Miller Group Braeside Quarry Property along excavation perimeter track, McNab - Braeside Tp.,

Renfrew Co.

Moist, mossy glade in *Thuja occidentalis*, *Abies balsamea* alvar forest with *Cypripedium pubescens*, *Carex castanea*, *Arctostaphylos uva-ursi*.

17,878 - *Viola nephrophylla* Greene

COMMON

Dfb, Philippe Rabaute (Montpilier, FR)

45.47569° N 76.44049° W ^[NAD 84]

550 m southeast of Golf Course Road, 950 m northeast of Osborne Street on northwest side of Miller Group Braeside Quarry perimeter road north 150 m northeast of big clearing, McNab - Braeside Tp., Renfrew Co.

Edge of *Thuja occidentalis*, *Abies balsamea* alvar forest with *Arctostaphylos uva-ursi*, *Waldsteinia fragarioides*., *Polygala pauciflora*.

**** *Platanthera hookeri* (Torr.) Lindl.**

11 plants; 3 in flower

One sterile plant here in 2009

Appendix 3: Faunal observations

The following lists the vertebrate fauna observed in the Braeside Quarry expansion area between 2006 and 2011. Skelton Brumwell biologist Kyle Fleming contributed significant data towards this listings based on his on-site investigations in 2009 and 2011.

Breeding Bird Species

Species noted flying over the Braeside Quarry expansion area but apparently not having any contact with features or habitats within it, are listed at the end of the table and noted with **.

Ruffed Grouse	
Turkey Vulture	
Sharp-shinned Hawk	
Broad-winged Hawk	
Red-tailed Hawk	
Rock Pigeon	
Mourning Dove	
Great Horned Owl	
Ruby-throated Hummingbird	
Belted Kingfisher	
Hairy Woodpecker	
Downy Woodpecker	
Northern Flicker	
Pileated Woodpecker	
Eastern Wood Pewee	

Alder Flycatcher	
Willow Flycatcher	
Eastern Phoebe	
Great Crested Flycatcher	
Red-eyed Vireo	
Blue Jay	
American Crow	
Common Raven	
Barn Swallow	
Black-capped Chickadee	
Red-breasted Nuthatch	
White-breasted Nuthatch	
Brown Creeper	
Winter Wren	
Veery	

Wood Thrush	
American Robin	
Gray Catbird	
Brown Thrasher	
<i>European Starling</i>	
Cedar Waxwing	
Nashville Warbler	
Yellow Warbler	
Black-throated Blue Warbler	
Black-throated Green Warbler	
Blackburnian Warbler	
Black and White Warbler	
American Redstart	
Northern Waterthrush	
Ovenbird	

Common Yellowthroat	
Scarlet Tanager	
Chipping Sparrow	
Song Sparrow	
Swamp Sparrow	
White-throated Sparrow	
Northern Cardinal	
Rose-breasted Grosbeak	

Indigo Bunting	
Red-winged Blackbird	
Common Grackle	
Brown-headed Cowbird	
Purple Finch	
American Goldfinch	
Evening Grosbeak	
Fly over Species	

Canada Goose	**
Mallard	**
Great Blue Heron	**
American Kestrel	**
Killdeer	**
Ring-billed Gull	**
Herring Gull	**

Amphibians and Reptiles

Painted Turtle
 Eastern Garter Snake
 Green Frog
 Wood Frog
 Gray Treefrog
 Northern Leopard frog
 Red-spotted Newt
 Blue-spotted Salamander (larvae in breeding pool)

Mammals

Meadow Vole	Woodchuck
American Beaver	White-tailed Deer
Eastern Chipmunk	Raccoon
Red Squirrel	Striped Skunk
Eastern Cottontail	
Snowshoe Hare	

Appendix 4: *Résumé*: DANIEL F. BRUNTON

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Natural environment assessment experience developed since the early 1970s is anchored by years of field investigation in many parts of North America, with a strong emphasis on southern Ontario and southwestern Quebec. Over 400 individual projects have been undertaken since 1979. These include such diverse issues as highway corridor up-grades, municipal natural areas assessment, the evaluation of ecological values of wilderness parks (Ontario, Nunavut and Manitoba), and participation in the national-wide Office of the Auditor-General performance audit of Parks Canada. These studies have provided the authoritative and appropriate natural environment data for a wide variety of successful development and planning programs.



Although largely involving private sector interests, project clients include municipal, provincial and federal government agencies, NGOs and research institutions. These activities have included presentation and discussion of findings to a variety of bodies including individual clients, municipal councils and committees, Ontario Municipal Board hearings, print and electronic media, federal and provincial review agencies and a Parliamentary Committee. Accreditations include certification as an Ontario Butternut Health Assessor (No. 113).

A representative selection of professional undertakings follows.

1) ***INVENTORY, ENVIRONMENTAL ASSESSMENT AND ECOLOGICAL RESTORATION***

These involves inventories and assessment of the natural environment resources of a wide variety of

landscapes, varying in size from <1 to almost 500,000 ha. More than 150 such

investigations have been undertaken to date, including habitat rehabilitation and significant species rehabilitation/ preservation projects. Examples include:

- Ottawa River Interprovincial Crossing study Phases 1 and 2 (Roche-NCE/ NCC et al., 2006-)
natural environment inventory and significance assessment of numerous alternatives; participation in route selection process and input into preliminary design of technically preferred inter-provincial crossing route and structures.

- \$ South March Highlands existing conditions and Management Planning study (Douglas Associates/ City of Ottawa, 2007-2009).
- review and up-date of natural environment conditions, significant species and ecological functions as Phase One of management planning for provincially significant natural area adjacent to urban lands; contributions throughout Phase Two for preparation of the Management Plan by Douglas Associates.

- City of Ottawa Urban Natural Areas study (Muncaster Environmental Planning/ City of Ottawa, 2003 B 2006).
- comprehensive evaluation and ranking of over 190 candidate natural areas within the City of Ottawa for master planning, development implications and official plan applications.

- \$ Highway 7 up-grade (Peterborough) (National Capital Engineering/ Ministry of Transportation, 2004-2005).
- inventory and assessment of natural environment conditions, features and functions and identification of mitigation options along significant highway corridor.

- \$ Significant Woodlands and sand pit expansions (Levac Robichaud Leclerc/ UCPR, 2005 – on-going).
- review of significance and mitigation requirements regarding potential impact on designated Significant Woodlands by the proposed expansion of sand pits in Prescott-Russell [several stand-alone studies since 2005].

- \$ Mud Lake Pathway system plan, Britannia, Ottawa (Douglas Associates/ National Capital Commission, 2002 - 2004).
- comprehensive natural environment review of pathway network within Provincially Significant urban natural area, including route selection, planning of 'birder park' function, interpretive

opportunities and construction audit.

\$ Vegetation remediation and habitat reconstruction at West Hunt Club Road/ Moodie Drive intersection realignment, Nepean (Robinson Consultants/ Region of Ottawa-Carleton, 1998 - 2000).

- inventory, assessment and reconstruction of significant natural habitats, with post-reconstruction ecological monitoring [Transportation Association of Canada's 1999 *Environmental Achievement Award* recipient].

\$ CFB Petawawa floristics and wetland inventory, Renfrew County (Delcan Corp./ Dept. of National Defense, 1998/ 1999).

- comprehensive review of floristic and ecologically values of 30,000 ha military training area, including development of significant features management strategies.

2) **NATURAL ENVIRONMENT POLICY, MANAGEMENT AND PLANNING**

These are primarily planning or management oriented studies with minimized inventory elements. Professional review of the suitability of pre-existing or draft natural environment analysis on behalf of provincial, federal or municipal authorities have also been undertaken. Examples include:

C Deloro Mine Clean-up Value Engineering Assessment (Genivar/ Ministry of the Environment, 2009).

- natural environment input into Value Engineering assessment of comprehensive cleanup program for toxic/ radioactive material at long-abandoned mine site.

C RMOC Natural Environment Systems Strategy (NESS) [Phase 1 & 3] (Regional Municipality of Ottawa-Carleton, 1993/ 1994; 1996/ 1997)

- identification, weighting and analysis of natural environment attributes for GIS-based ecological system planning strategy and on-site inventory and rating of natural area candidates within a large portion (ca. 25%) of Ottawa-Carleton for Regional government Official Plan revision.

C Selection and evaluation of Life Science Areas of Natural and Scientific Interest (ANSIs) in southeastern and southcentral Ontario [Site District 6-12, 5-7, 5-8, 5-9 5-10 and 5-11] (Ministry of Natural Resources, 1990-1995)

- assessment of representational life science values in large ecological site districts in southern Ontario, including identification of the ecological framework and a system of candidate ANSIs for each site district.

3) ***SIGNIFICANT SPECIES INVESTIGATION AND MANAGEMENT***

A variety of investigations involving on-site investigation as well as laboratory and archival research, have been undertaken on significant species in Canada and elsewhere, including:

- Species At Risk at Niagara on the Lake Rifle Range property, Ontario (Franz Environmental/ Public Works Canada, 2011).

- background research and on-site review of candidate Species At Risk and potential significant habitats in decommissioned military property/ national historic site.

- Endangered Species status reports (COSEWIC, 1982 - 2003).

- field investigation, off-site research and documentation of status and conservation management situation (plus up-dates) for Endangered or Threatened Southern Maidenhair Fern (*Adiantum capillus-veneris*), Giant Helleborine Orchid (*Epipactis gigantea*); Mosquito-fern (*Azolla mexicana*); Bolander's Quillwort (*Isoetes bolanderi*), and Engelmann's Quillwort (*Isoetes engelmannii*).

- Recovery Plan strategy for Engelmann's Quillwort (*Isoetes engelmannii*) (Parks Canada/ Ontario Ministry of Natural Resources, 2003-2006; 2009)

- in-field inventory (Ontario) and investigation of distribution and status of nationally Endangered vascular plant and preparation of draft recovery strategy.

- Recovery Plan strategy for Bolander's Quillwort (*Isoetes bolanderi*) (Parks Canada/ Ontario Ministry of Natural Resources, 2009-2011)

- in-field inventory (Alberta) and investigation of distribution and status of nationally Threatened vascular plant and preparation of draft recovery strategy.

4) ***OTHER PROFESSIONAL ACTIVITIES***

A variety of additional ecologically-based initiative and professional undertakings have been initiated since the early 1970s, involving media activity, interpretive writing and public presentation/ testimony. These include:

expert witness testimony before Ontario Municipal Board hearings, including those concerning Albion [Leitrim] Wetland, Ottawa, Alfred Bog (Alfred), Stittsville High School wetland, Ottawa, Fernbank wetland, Ottawa, Comfort Marsh (Gananoque), Julian Lake Quarry (Peterborough Co.), and South March Highlands (Ottawa);

authorship of ca. 100 refereed natural sciences papers in Canadian and international journals including *The Canadian Field-Naturalist*, *Taxon*, *British Fern Gazette*, *Canadian Journal of Botany*, *Rhodora*, *American Fern Journal*, *Castanea*, *Michigan Botanist*.

5) AWARDS, CITATIONS

Acknowledgment of local, national or international level professional and personal achievements in conservation, scientific research and/ or ecological management include:

Canada 125 Medal (Government of Canada, 1992) - contributions to natural areas and ecological features protection and conservation in the National Capital Region;

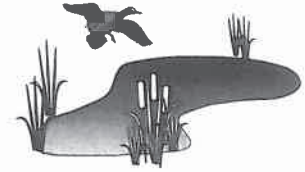
COSEWIC Service Award (Committee on the Status of Endangered Wildlife In Canada, 1998) - acknowledgement of multiple contributions to Endangered and Threatened Species research in eastern and western Canada.

1999 Environmental Achievement Award (Transportation Association of Canada, 2000) - co-recipient, re: habitat salvage and relocation at West Hunt Club Road/ Moodie Drive intersection project in Ottawa;

OFNC Honorary Membership (Ottawa Field-Naturalists, 2010) -life-time achievement award for contribution to Canadian natural sciences, conservation and organizational development.

APPENDIX C

Fisheries Assessment- Muncaster Environmental Planning



September 22, 2009

Mr. Jay Clark, P. Eng.
Senior Project Engineer,
Skelton, Brumwell & Associates Inc.
93 Bell Farm Road, Suite 107
Barrie, Ontario
L4M 5G1

Dear Mr. Clark:

RE: Miller Braeside Quarry Expansion
Summary of Ryan Creek 2008 and 2009 Observations

This letter summarizes our 2008 and 2009 observations of the fish habitat and community in Ryan Creek in proximity to Carmichael Side Road and Campbell Drive. The observations are in support of the proposed Miller Braeside Quarry Expansion, and specifically with regard to the appropriate thermal requirements associated with the discharge outlet of dewatering from the quarry. The discharge outlet to Ryan Creek will be on the north side of Carmichael Side Road.

Memorandums dated November 28th and December 9th, 2008 and September 16th, 2009 detail our methodology and findings. The autumn 2008 work focused on a fish habitat assessment of Ryan Creek, with sampling of the fish community completed between Carmichael Side Road and Campbell Drive in the spring of 2008 and a water temperature survey was done in the summer of 2009.

In general, the fish habitat consisted of a slow moving glide with fully vegetated banks. The banks were failing in many locations. Fallen trees provided large woody debris cover as the result of the erosion and abundant beaver activity. The substrate was dominated by fines with an area of clumping clay located immediately downstream of Carmichael Side Road that may act as gravel in terms of substrate. The presence of juvenile white suckers and creek chub would support that spawning within the gravel size clay occurs. No upwellings or watercress were observed where there was the gravel sized clay substrate. No trout or redds were observed during the autumn field review or captured during the early spring sampling. Furthermore the width-to-depth ratios were generally greater than those found in watercourses supporting trout and fines dominated by clay represented the vast majority of exposed substrate, providing little potential trout spawning habitat.

Based on the absence of riffles, very limited amount of cobble, rubble and small boulder material and dominance of fine substrate, the aquatic ecosystem objectives for supporting trout are greatly lacking in the study area. In addition, the large amount of erosion throughout the area observed would result in infilling of the redds and impede the successful hatching of any salmonid eggs. As summarized below the observed summer water temperatures are too warm to support a viable brook trout population.

The fish community sampling with a backpack electrofisher indicate Ryan Creek in the vicinity of Carmichael Side Road and Campbell Drive supports a diverse assemblage of common cool water fish species, with nine species observed (creek chub, white sucker, blacknose dace, common shiner, northern redbelly dace, brook stickleback, bluntnose minnow, mottled sculpin and central mudminnow). No fish species of special concern were netted. Mottled sculpin, which was netted at all five sites, has a preference for cold water but is frequently observed in cool water systems. No external evidence of disease or other stressors were observed on the fish netted.

A water temperature of 24.5°C was recorded at 16:00 on August 17th, below the surface in a water depth of 41cm downstream of the small riffle upstream of the culvert on the north side of Carmichael Side Road, with a water temperature of 25.0°C recorded below the surface in a water depth of 23cm upstream of the small riffle upstream of the culvert. The corresponding air temperature was 32°C. Using the graph in the Fisheries and Oceans Canada protocol to determine the thermal condition of the watercourse, the combination of maximum air temperature and water temperature at 16:00 would place Ryan Creek in this location just above the threshold for coolwater conditions. 25°C is the upper limited for coolwater status.

CONCLUSION

Applying the aquatic performance standards in Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives, in Appendix F of MOE's Stormwater Management Planning and Design Manual, the appropriate aquatic ecosystem objective among the four options (brook trout, brook trout/rainbow trout, pike/darters/sunfish and longnose dace/brown bullhead/brook stickleback) appears to be pike/darters/sunfish given the potential pike habitat observed, cool/warm water temperatures and the lack of suitable trout habitat.

The water temperature survey suggests the reach of Ryan Creek in proximity to the proposed discharge location borders between cool and warmwater fish habitat. No evidence of potential trout utilization or suitable trout habitat was observed during the field surveys. However, sculpins are widely distributed through this reach of Ryan Creek. Mottled sculpins prefer cold water but are frequently observed in coolwater systems. Thus a water temperature target of 22°C, representing the middle of the temperature range for coolwater systems, is recommended.

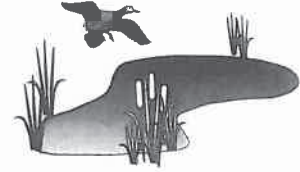
Please call if you have any questions on the above summary.

Yours Sincerely,
MUNCASTER ENVIRONMENTAL PLANNING INC.



Bernie Muncaster, M.Sc.
Principal

jcbraesumlet



INTEROFFICE MEMORANDUM

To:	Jay Clark, P. Eng., Senior Project Engineer, Skelton, Brumwell & Associates Inc. – 9 pages
From:	Bernie Muncaster, Muncaster Environmental Planning Inc.
Date:	November 28 th , 2008
Subject:	Miller Braeside Quarry Expansion Ryan Creek Autumn, 2008 Observations

Hello Jay,

The following is a summary of our field review of Ryan Creek.

Methodology

The field review was completed outside of the growing season, on November 18, 2008. Recent rain events preceded the site review. Ryan Creek was reviewed from upstream of Carmichael Side Road to downstream of Campbell Drive. The purpose of the site review was to complete a reconnaissance of the aquatic habitat taking note of potential barriers, available spawning habitat and the general morphology, with an emphasis on potential trout utilization. Transects were completed where possible (wadeable, accessible) and not at any predetermined interval. The data collected from transects provide an indication of the site's characteristics and should not be used to determine abundance of available habitat.

General Observations on Potential Pike and/or Trout Spawning in Ryan Creek

In general the project area contained moderate to good potential pike spawning along the floodplain (see Figure 4) and within the flooded area (flooded by beaver activity) and little potential trout spawning habitat. The banks were fully vegetated. The vegetation included reed canary grass, goldenrod, fern and bulrush. These potential spawning sites were of varying lengths and widths ranging from 20 – 200 m long and 5 – 30 m wide. No gravel, pebbles or sufficient cobbles were observed for trout spawning however it may be possible that the hard packed clay in gravel form could meet the spawning requirements for trout (see Figure 2). No trout or redds were observed at the time of the visit.

Potential Barriers to Fish Movement

There were seven beaver dams present within the reaches of Ryan Creek reviewed, four of which were active (see Figure 3). The first and second active beaver dams were 341 m and 281 m downstream of Campbell Drive. The third was in the upstream portion of the culvert on Campbell Drive. The last active beaver dam was in the upstream portion of the culvert on Carmichael Side Road. All four active dams were in excellent condition and considered a potential non-permanent barrier to fish movement. The three abandoned beaver dams were located between Campbell Drive and Carmichael Side Road. These abandoned beaver dams were in poor condition and did not create a barrier to fish movement.

An additional barrier during periods of low flow is present 342 m downstream of Campbell Drive, where there is an abrupt fall of 50 – 100 cm in the elevation of the channel bed. Immediately downstream of the barrier were two plunge pools which had an average maximum depth of 40 cm.

Descriptions of Each Reach

The reviewed portion of Ryan Creek is broken down into five sites (see Figure 1), with the following descriptions for individual reaches

Site 1. Downstream of Campbell Drive, Downstream of Falls (18T 387930 5034965)

The water temperature was 2°C at 13:15 (Appendix A). The average wetted width was 100 cm. The average water depth was 13 cm. The habitat type consisted of run morphological units with two plunge pools. The average drop was 75 cm and the average maximum plunge pool depth was 40 cm. The substrate was composed of hard packed clay in gravel/pebble form (10 – 50 mm). No in-stream cover was recorded. There was no in-stream vegetation at the time of the visit. Note that the visit occurred outside of the growing season. There were no visible signs of erosion.

The stream banks were fully vegetated. Riparian vegetation included reed canary grass, goldenrod. There was no canopy cover throughout the site.

This site contained moderate pike spawning habitat and possibly potential trout spawning sites depending on their readiness to use clay “gravel/pebble” (see Figure 2).

Site 2. Downstream of Campbell Drive, Upstream of Falls (18T 387906 5034996 to 18T 387631 5035067)

The reach length was 341 m. The water temperature was 2°C at 14:00 and the air temperature was -2°C (Appendix A). The average channel and wetted widths were 4000 cm and 4000 cm. The average water depth was 48 cm (range 19 - >100 cm). The habitat consisted of a beaver pond upstream of a well maintained beaver dam. The substrate was composed of fines.

Occasional large woody debris represents in-stream structure. There was no in-stream vegetation at the time of the visit. Note that the visit occurred outside of the growing season. There were no visible signs of erosion.

Watercress was present along the bank edge at one location (see Figure 2). The presence of watercress could signify ground water discharge. While no change in water temperature was noted, this could have been the result of flooding.

The stream banks were fully vegetated. Riparian vegetation included reed canary grass, goldenrod and watercress (as discussed above). There was no canopy cover.

This site contained good pike spawning habitat and no potential trout spawning sites.

**Site 3. Upstream of Campbell Drive, Flooded Portion
(18T 387603 5035061 to 18T 387364 5035191)**

The site length was 345 m. The water temperature was 2°C at 10:56, TDS was 323 ppm, conductivity was 636 µs and the air temperature was -1°C (Appendix A). The average channel and wetted widths were 1700 cm and 450 cm. The average water depth was 60 cm (range 41 - >100 cm). The habitat consisted of a beaver pond as result of recent beaver activity at the upstream end of the Campbell Drive culvert. The substrate was composed of fines. Large woody debris in the form of two fallen trees in the creek represents in-stream structure. No in-stream vegetation was present at the time of the visit. Note that the visit occurred outside of the growing season. There were no visible signs of erosion.

Watercress was present along the bank edge at one location (see Figure 2). The presence of watercress could signify ground water discharge. While a slight change in water temperature was noted (5°C), this could have been the result of flooding.

The stream banks were fully vegetated. Riparian vegetation included white spruce, Manitoba maple, reed canary grass, goldenrods, ferns, bulrushes and watercress. There was no canopy cover.

This site contained moderate pike spawning habitat and no potential trout spawning sites.

**Site 4. Upstream of Campbell Drive, Non-flooded Portion
(18T 387364 5035191 to 18T 386959 503527)**

The site length was 555 m. The water temperature was 2°C at 12:24 (Appendix A). The average channel and wetted widths were 1283 cm and 262 cm. The average bankfull depth was approximately 50 cm and the average water depth was 28 cm (range 4 – 70 cm). The habitat type consisted of glide and run morphological units with one pool. The maximum pool depth was 60 cm. The substrate was composed of fines dominated by clay with occasional sand and very little cobble. The clay was hard packed some of which formed gravels/pebbles (1 -30 mm). Cobble provided in-stream cover at 6 % of the points. Large woody debris was also available as

cover but not present along any transects. There was no in-stream vegetation at the time of the visit. Note that the visit occurred outside of the growing season. Occasional undercutting was observed along the banks. The undercut banks would only provide cover to fish during extreme high flows. An exposed gravel outcrop was present downstream from the culvert at Carmichael Side Road. Three previously mentioned abandoned beaver dams were in this reach.

The stream banks were fully vegetated. Riparian vegetation included white spruce, Manitoba maple, reed canary grass, goldenrod, ferns and bulrush. There was no canopy cover.

This site contained moderate pike spawning habitat and maybe potential trout spawning sites depending on their readiness to use clay "gravel/pebble".

Site 5. Upstream of Carmichael Side Road. (18T 386934 5035354)

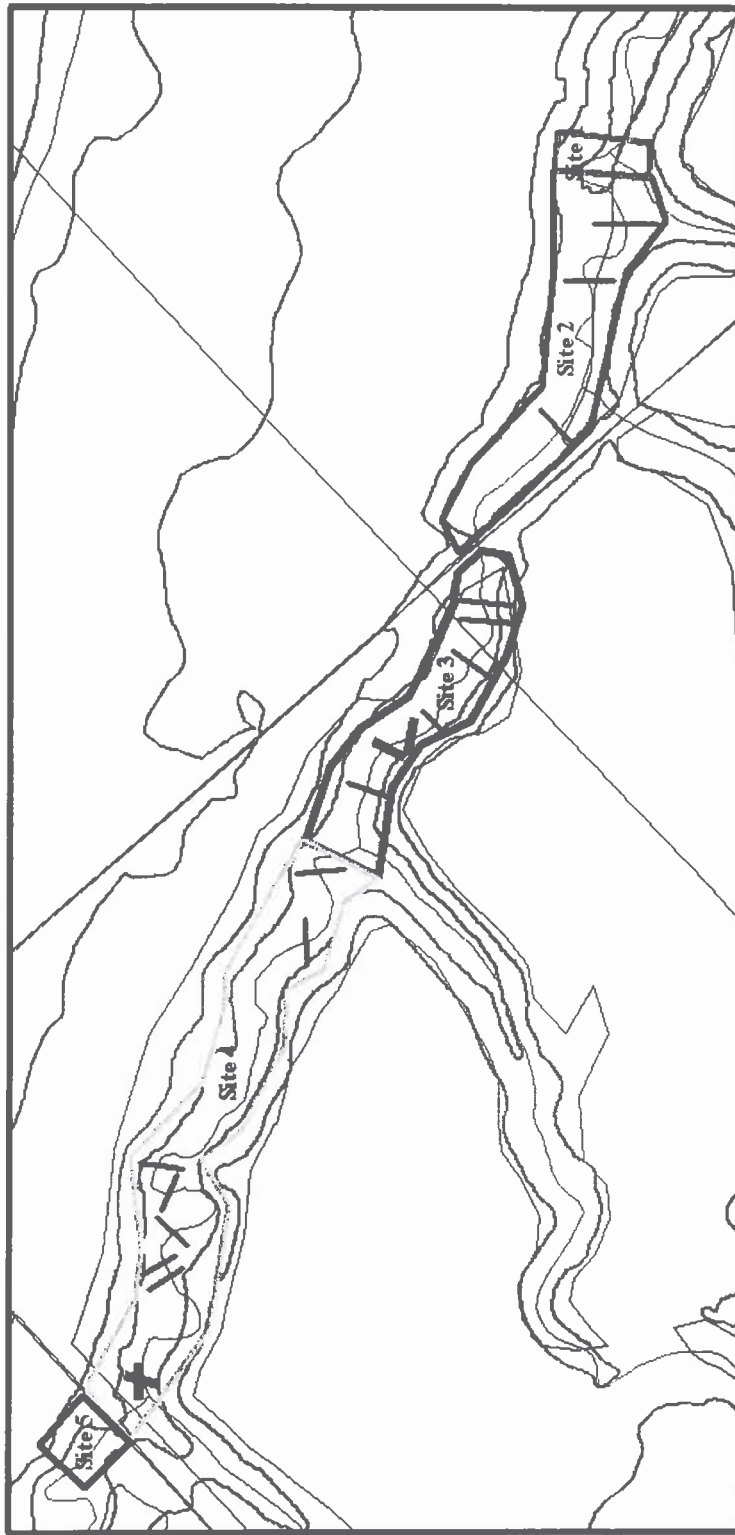
Access to this site was limited due to electrical fencing crossing the creek near the culvert. Cattle were present and grazing in the enclosure and had access to the creek. An active beaver dam was in the upstream portion of the culvert under Carmichael Side Road. The stream banks were vegetated but grazed.

Please call if you have any questions on the above observations.

Bernie Muncaster
Muncaster Environmental Planning Inc.
bmuncaster@rogers.com

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Location of Sites and LWD



Legend

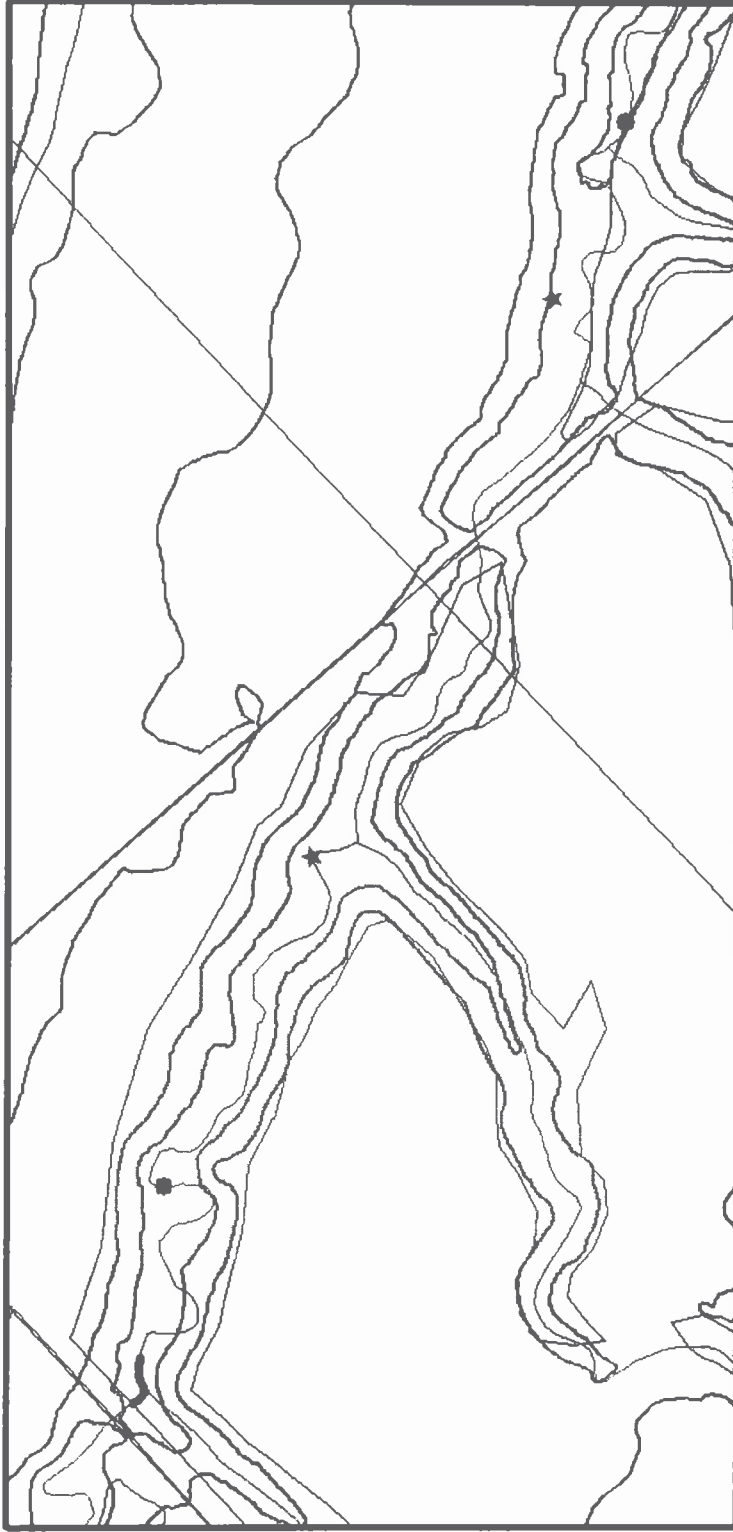
- LWD
- ⊕ Multiple LWD



Bowfn Environmental Consulting Inc.

November 27, 2008

Location of "Gravel/Pebble" Clay



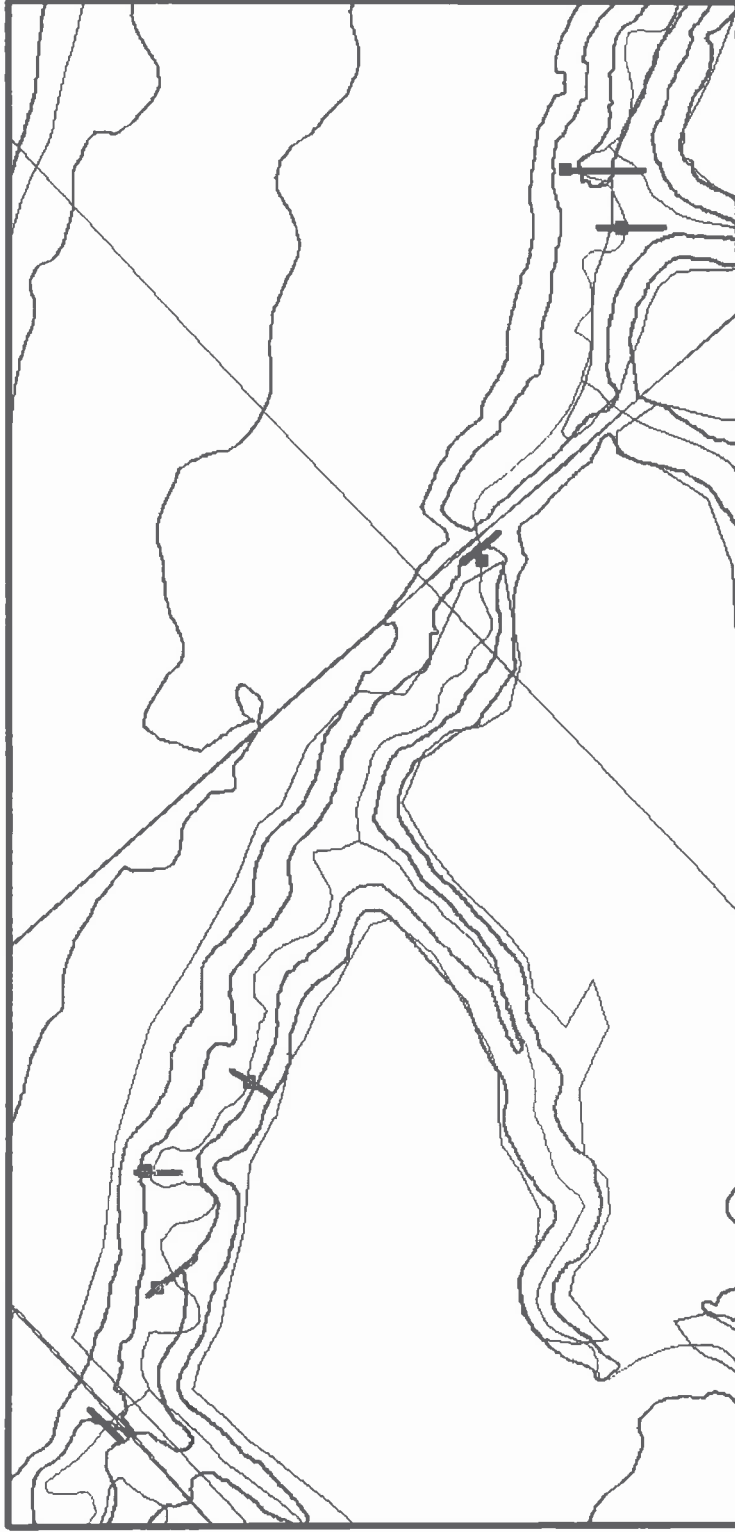
(Basemap from OBM)



Legend

- ★ Location of Watercross
- Location of "gravel/pebble" Clay

Location of Beaver Dams

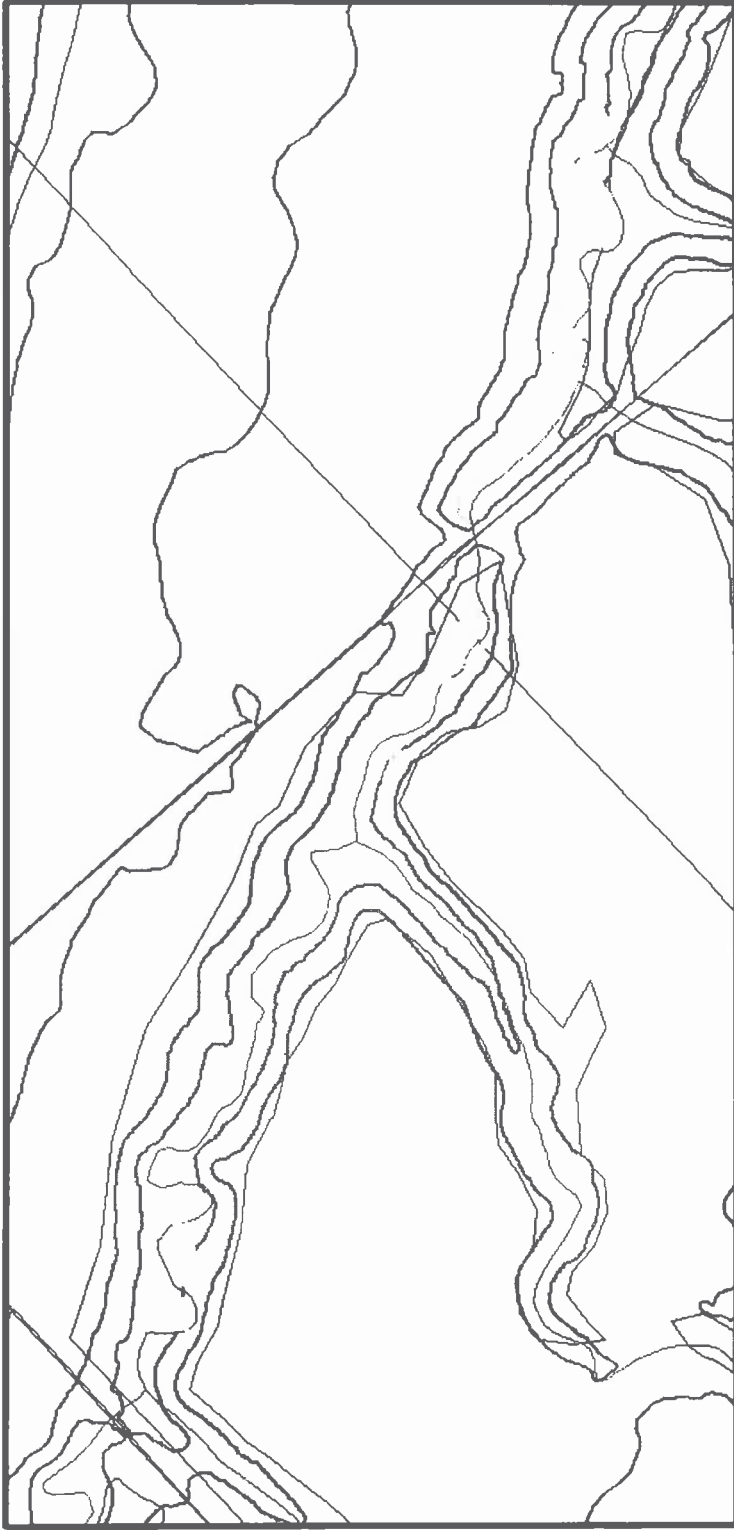


- Legend**
- Active Beaver Dam
 - Abandoned Beaver Dam

Bowfin Environmental Consulting Inc.

November 27, 2008

Location of Potential Pike Spawning Habitat



Legend



Bowfin Environmental Consulting Inc.

November 27, 2008

APPENDIX A

Table 1 Summary of Water Quality Results

Date	Time	Location	Air Temp (°C)	Water Temp (°C)	TDS (ppm)	Cond. (µs/cm)
November 18, 2008	10:56	Ryan Creek Mark 001	-1	2	323	636
November 18, 2008	11:26	Ryan Creek Mark 007		2		
November 18, 2008	11:32	Ryan Creek Mark 010		5		
November 18, 2008	11:39	Ryan Creek Mark 011		2		
November 18, 2008	11:40	Ryan Creek Mark 012		2		
November 18, 2008	12:00	Ryan Creek Mark 015		2		
November 18, 2008	12:17	Ryan Creek Mark 019		2		
November 18, 2008	12:24	Ryan Creek Mark 020		2		
November 18, 2008	13:15	Ryan Creek Mark 024		2		
November 18, 2008	14:00	Ryan Creek Mark 031	-2	2		



INTEROFFICE MEMORANDUM

To:	Jay Clark, P. Eng., Senior Project Engineer, Skelton, Brumwell & Associates Inc. – 3 pages
From:	Bernie Muncaster, Muncaster Environmental Planning Inc.
Date:	December 9 th , 2008
Subject:	Miller Braeside Quarry Expansion Ryan Creek – Application of MOE Aquatic Ecosystem Objectives Criteria

Hello Jay,

Further to our memorandum of November 28th summarizing our autumn field observations, I have reviewed the field observations in relation to Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives, in Appendix F of MOE's Stormwater Management Planning and Design Manual.

There are seven aquatic performance standards in Table F.1 used to determine the appropriate aquatic ecosystem objective among brook trout, brook trout/rainbow trout, pike/darters/sunfish and longnose dace/brown bullhead/brook stickleback. Field information was collected on five of the performance standards; channel morphology, in-stream cover, substrate, riparian habitat and barriers, and they are discussed individually below:

Channel Morphology

This standard evaluates the characteristics of pools, riffles and bankfull width-to-depth ratio. Riffles were lacking throughout the review area from Carmichael Side Road to downstream of Campbell Drive. Three pools were observed downstream of culverts and elevation drops. The width-to-depth ratios are influenced by beaver dams and associated ponding and are generally appear greater than 10:1. As aquatic ecosystem objectives to support trout stipulate bankfull width-to-depth ratios less than 10, and representation of riffles and pools greater than 10 and 4 percent, respectively, the current channel morphology conditions appear greatly lacking in meeting the objectives for supporting trout populations.

In-Stream Cover

On the positive side, large woody debris (lwd) is present throughout the study area (see Figure 1 of the November 28th memorandum), however overhead cover is almost nil. Total in-stream cover also appears lacking due to the absence of boulders and very limited undercut banks and other forms of potential in-stream structure. Note that the late time of the field review (November 18th) precluded observations on the extent of aquatic vegetation. The targets for brook trout with respect to overhead and in-stream cover are not currently achieved in the study area

Substrate

No gravel, pebbles or sufficient cobbles were observed for trout spawning however it may be possible that the hard packed clay in gravel form could meet the spawning requirements for trout (see Figure 2 of the November 28th memorandum). No trout or redds were observed during the November 18th field review. Based on the absence of riffles, very limited amount of cobble, rubble and small boulder material and dominance of fine substrate, the aquatic ecosystem objectives for supporting trout are greatly lacking in the study area based on substrate requirements.

Riparian Habitat

Two components, shading and woody debris, are represented for this criterion. As indicated above, woody debris is generally well represented and overhead cover to provide shading is lacking.

Barriers

Along with substrate and channel morphology factors, a series of barriers in the study area is a primary deficiency in meeting the trout aquatic ecosystem objectives. Seven beaver dams are present within the reaches of Ryan Creek reviewed, four of which were active (see Figure 3 of the November 28th memorandum). Although the beaver dams are not permanent structures, their large number indicates beaver dams in some form are a well-established component of the ecosystem. In addition, another barrier during periods of low flow is present downstream of Campbell Drive, where there is an abrupt fall of 50 – 100 cm in the elevation of the channel bed.

Summary

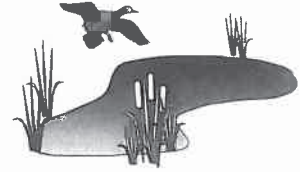
The aquatic ecosystem objectives for supporting trout are greatly lacking in the study area due to a dominance of run morphological units, with no riffles and very few pools. A very limited amount of coarse substrate is present, along with almost nil canopy cover. The characteristics of the study area appear more consistent with the aquatic performance standards to support the pike/darters/sunfish assemblage. Potential northern pike spawning habitat appears relatively common through the study area.

Table F.1 is designed to assist in defining aquatic objectives for target species and defining required standards to meet aquatic objectives. A comparison to the actual physical and biological conditions has identified several performance standards which appear limiting, including channel morphology, substrate, riparian habitat and barriers.

Please call if you have any questions on the above observations.

Bernie Muncaster
Muncaster Environmental Planning Inc.
bmuncaster@rogers.com

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INTEROFFICE MEMORANDUM

To:	Jay Clark, P. Eng., Senior Project Engineer, Skelton, Brumwell & Associates Inc. – 12 pages
From:	Bernie Muncaster, Muncaster Environmental Planning Inc.
Date:	September 16 th , 2009
Subject:	Miller Braeside Quarry Expansion Ryan Creek Spring and Summer, 2009 Observations

Hello Jay,

The following is a summary of our field reviews and analysis of Ryan Creek undertaken in 2009.

METHODOLOGY

The 2009 field reviews consisted of two components, a spring fish sampling survey and an August water temperature survey. The spring fish sampling survey was completed on May 12th, 2009. Ryan Creek was sampled with a backpack electrofishing unit at five locations from Carmichael Side Road to upstream of Campbell Drive. The station lengths varied between 40 and 50 metres, with sampling beginning at the downstream end and continuing upstream in a zigzag fashion through the channel. All fish netted were identified in the field, measured and released downstream. In addition to the fish sampling, fish habitat observations were made, including potential barriers to fish movement and features of the channel morphology.

The purpose of the spring fish sampling was to identify the fish community utilizing Ryan Creek and the associated thermal and other sensitivities of the fish species comprising the fish community.

The summer water temperature was taken on August 17th, 2009, following Department of Fisheries and Oceans protocol (Stoneman and Jones, 1996). The maximum air temperatures on August 14th and 15th were 30°C, with a maximum air temperature of 31°C on August 16th. The maximum air temperature on August 17th was 32°C. This provided consistent previous air temperatures as required in the protocol. The water temperatures were taken between 16:00 and 16:06 in well mixed sections of the main flow upstream of the Carmichael Road culvert.

FISH SAMPLING RESULTS

The following site summaries begin at the downstream end of the sampling, upstream of Campbell Drive and continue upstream to Carmichael Side Road. The water depths were too deep for backpack electrofishing downstream of Site 1.

**Site 1. 175 metres Upstream of Campbell Drive
(18T 387453 5035151 to 18 T 387431 5035136)**

The site length was 40 metres. At 11:34 on May 12th, 2009 the following water quality results were recorded: water temperature 11.0°C, air temperature 14.0°C, pH 7.04, conductivity 240 µs, and total dissolved solids 179 ppm. The average channel and wetted widths were 538 cm and 458 cm, respectively. The average bankfull depth was 63 cm and the average water depth was 35 cm (range 13 – 72 cm). The habitat type consisted of glide morphological units. The substrate was composed of fines. In-stream cover was provided at 100% of the points. The in-stream cover consisted of large woody debris (67%), and aquatic vegetation (67%). There were signs of erosion on the left bank.

The stream banks were moderately vegetated. Herbaceous vegetation was dominated by grasses followed by marsh marigold and sedges. The little canopy cover was provided by white spruce.

The area fished was 183 m² and the shock time was 599 seconds. A total of 71 fish representing five species were captured: white sucker, common shiner, creek chub, brook stickleback and mottled sculpin (Table 1).

Table 1 Site 1 – 175 metres Upstream of Campbell Drive, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	6	41-57
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	34	25-37
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	19	27-103
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	6	41-48
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	6	37-43
Total				71	

**Site 2. 350 metres Upstream of Campbell Drive
(18 T 387313 5035205 to 18 T 387277 5035248)**

The site length was 50 metres. At 12:48 on May 12th, 2009 the following water quality results were recorded: water temperature 12.0°C, air temperature 15.0°C, pH 7.08, conductivity 485 µs, and total dissolved solids 243 ppm. The average channel and wetted widths were 410 cm and 358 cm, respectively. The average bankfull depth was approximately 51 cm and the average water depth was 26 cm (range 6 – 58 cm). The habitat type consisted of glide morphological units. The substrate was composed of fines. There was no in-stream cover observed, although aquatic vegetation may have been underestimated due to the early timing of the survey. There were no signs of erosion.

The stream banks were moderately vegetated. The riparian vegetation consisted primarily of herbaceous vegetation such as grasses, sedges and aster with occasional woody vegetation (hawthorn, white spruce and bur oak). The little canopy cover was provided by white spruce, and bur oak.

The area fished was 179 m² and the shock time was 815 seconds. A total of 123 fish were captured representing seven species: central mudminnow, white sucker, common shiner, bluntnose minnow, creek chub, brook stickleback and mottled sculpin (Table 2).

Table 2 Site 2 – 350 metres Upstream of Campbell Drive, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	7	50-91
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	10	45-135
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	61	21-36
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	2	50-57
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	10	30-82
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	21	41-60
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	12	40-55
Total				123	

**Site 3. 200 metres Downstream of Campbell Drive, Flooded Portion
(18 T 387128 5035324 to 18 T 387096 5035274)**

The site length was 41 metres. At 13:41 on May 12th, 2009 the following water quality results were recorded: water temperature 13.0°C, air temperature 16.0°C, pH 7.06, conductivity 469 µs, and total dissolved solids 235 ppm. The average channel and wetted widths were 360 cm and 337 cm, respectively. The average bankfull depth was approximately 40 cm and the average water depth was 17 cm (range 4 – 32 cm). The habitat type consisted of glide morphological units. The substrate was composed of fines. In-stream cover was provided at 33% of the points. The in-stream cover consisted of large woody debris. Both banks were eroding and failing.

The stream banks were moderately vegetated by herbaceous vegetation consisting primarily of grasses. The little canopy cover was provided by white spruce and Manitoba maple.

The area fished was 138 m² and the shock time was 596 seconds. A total of 68 fish were captured representing eight species: central mudminnow, white sucker, northern redbelly dace, common shiner, bluntnose minnow, creek chub, brook stickleback and mottled sculpin (Table 3).

Table 3 Site 3 – Downstream of Carmichael Side Road, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	2	57-83
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	11	42-103
northern redbelly dace	<i>Phoxinus eos</i>	herbivore	cool / warm	1	55
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	13	28-67
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	7	50-68
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	15	33-103
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	5	47-52
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	14	44-93
Total				68	

**Site 4. 60 metres Downstream of Carmichael Side Road
(18 T 387028 5035306 to 18 T 386979 5035329)**

The site length was 45 metres. At 14:29 on May 12th, 2009 the following water quality results were recorded: water temperature 14.0°C, air temperature 17.0°C, pH 7.06, conductivity 479 µs, and total dissolved solids 236 ppm. The average channel and wetted widths were 400 cm and 277 cm, respectively. The average bankfull depth was approximately 41 cm and the average water depth was 14 cm (range 3 – 32 cm). The habitat type consisted of glide morphological unit. The substrate was composed of fines. There was no in-stream cover observed, however the quantity and diversity of the aquatic vegetation may have been underestimated due to the timing of the survey. There were no signs of erosion.

The stream banks were moderately vegetated. The riparian vegetation consisted primarily of herbaceous species such as grasses and aster with occasional woody vegetation (wild red raspberry and hawthorns). There was no canopy cover.

The area fished was 125 m² and the shock time was 524 seconds. A total of 84 fish representing 6 species were captured: central mudminnow, white sucker, common shiner, creek chub, brook stickleback and mottled sculpin (Table 4).

Table 4 Site 4 – 60 metres Downstream of Carmichael Side Road, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	3	45-55
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	1	58
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	52	27-130
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	19	33-80
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	5	40-50
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	4	50-93
Total				84	

Site 5. Carmichael Side Road

The pool located immediately downstream of the culvert at Carmichael Side Road was sampled briefly. The catch consisted of 14 fish representing six species: white sucker, common shiner, blacknose dace, creek chub, brook stickleback and mottled sculpin (Table 5).

Table 5 Site 5 - Carmichael Side Road, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	1	
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	1	
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore / generalist	cool	1	62
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	1	
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	6	
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	4	
Total				14	

RYAN CREEK
2009 SPRING SAMPLING and SUMMER WATER TEMPERAURE OBSERVATIONS

Total Catch (May 12, 2009)

A total of 360 fish representing nine species were captured (Table 6).

**Table 6 Total Catch May 12th, 2009 Ryan Creek –
Campbell Drive to Carmichael Side Road**

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	12	45-91
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	29	41-135
northern redbelly dace	<i>Phoxinus eos</i>	herbivore	cool / warm	1	55
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	161	21-130
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	9	50-68
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore / generalist	cool	1	62
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	64	27-103
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	43	40-60
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	40	37-93
Total				360	

Table 7 List of Fish Species Netted and their Habitat Requirements

Species Name	Latin Names	General Habitat (Adult)	Reproductive guild	Spawning Period/ Habitat	Spawning Temp (°C)
white sucker	<i>Catostomus commersoni</i>	Slow moving water, pools.	A.1.3 Non-guarder. Open substrate spawner. Rock and gravel spawners with benthic larvae.	Spring (April-May)	near 10°C
northern redbelly dace	<i>Phoxinus eos</i>	Quiet waters in ponds, lakes or streams. Can be found in bog lakes.	A.1.5 Non-guarder. Open substrate spawner. Obligate plant spawners. Scatter adhesive eggs onto submerged live or dead aquatic plants or recently flooded live terrestrial plants.	Spring - early summer	
central mudminnow	<i>Umbra limi</i>	ponds and pools with dense aquatic vegetation.	A.1.5 Non-guarders. Open substrate spawners. Scatter or deposit adhesive eggs onto submerged live or dead aquatic plants or recently flooded live terrestrial plants. Occasionally on wood.	Spring	13-16°C
common shiner	<i>Notropis cornutus</i>	Streams dweller, prefers pools located below faster water. bottom velocities of 0.1-0.5 m/s.	B.2.3 Nest builder with high parental care. Eggs deposited on cleaned rocks or in dug gravel pits.	Spring	15-18.3°C
bluntnose minnow	<i>Pimephales notatus</i>	Variety of habitats.	B.2.7 Nest spawner. High parental care. Deposits eggs underneath flat stones (occasionally uses logs)	Late spring - summer	19-26°C

Species Name	Latin Names	General Habitat (Adult)	Reproductive guild	Spawning Period/ Habitat	Spawning Temp (°C)
blacknose dace	<i>Rhinichthys atratulus</i>	Inhabitats runs and pools with clear water. Typically in fast flowing water with gravel.	A.1.3 Non guarder, open substratum spawner. Spawns within gravelly bottoms.	Spring	15-22°C
creek chub	<i>Semotilus atromaculatus</i>	Variable habitats, typically found in small streams <12m wide. prefer velocities lower than 0.3 m/s but have been found in velocities up to 0.6 m/s.	A.2.3 Non-guarders. Burry eggs in gravel nests. Clean rocks with fast flowing water or springs required.	Spring	≥12.8°C
brook stickleback	<i>Culaea inconstans</i>	Clear, cold water with dense vegetation.	B.2.4 Guarders, creates a nest using kidney secretion to bind together vegetation or algae.	Spring	15-19°C
mottled sculpin	<i>Cottus bairdi</i>	Cool streams and lakes often associated with sandy substrate in streams.	B.2.7 Nest builder with high parental care. Deposits eggs underneath rock or ledge.	Spring	5-16°C

(Balon 1981, Coker *et al.* 2001, McMahon 1982 and Scott and Crossman 1973)

FISH COMMUNITY SUMMARY

Ryan Creek in the vicinity of Carmichael Side Road and Campbell Drive supports a diverse assemblage of common cool water fish species, with nine species observed. No fish species of special concern were netted. Mottled sculpin, which was netted at all five sites, has a preference for cold water but is frequently observed in cool water systems. No external evidence of disease or other stressors were observed on the fish netted.

The habitat requirements of the fish species observed are provided in Table 7. The aquatic vegetation in the channel is important spawning habitat for many of the fish species, including central mudminnow, brook stickleback and northern redbelly dace. Other species will utilize the coarser substrate material found elsewhere in the Ryan and Dochart Creek systems.

The fish species observed have a range of sensitivity to sediment and turbidity. MTO (2006) classify the sensitivity of each species to sediment and turbidity for feeding, reproduction and respiration functions. Most of the fish species observed have a low or moderate sensitivity to sediment and turbidity for the three functions. However, creek chub is highly sensitive to sediment and turbidity for the feeding and respiration functions, with white sucker and blacknose dace highly sensitive for the respiration function. Common shiner has a moderate sensitivity to sediment and turbidity, while northern redbelly dace, brook stickleback, bluntnose minnow, mottled sculpin and central mudminnow have mixture of low and moderate sensitivity depending on the function.

SUMMER WATER TEMPERATURE RESULTS

Water temperatures were taken between 16:00 and 16:06 immediately upstream, north, of Carmichael Side Road. A water temperature of 24.5°C was recorded below the surface in a water depth of 41cm downstream of the small riffle upstream of the culvert on the north side of the road, with a water temperature of 25.0°C recorded below the surface in a water depth of 23cm upstream of the small riffle upstream of the culvert.

Using the graph in Stoneman and Jones (1996), the combination of maximum air temperature and water temperature at 16:00 would place Ryan Creek in this location just above the threshold for coolwater conditions. 25.0°C is the upper limited for cool water status in Coker et al. (2001).

However, we still recommend a target of 22°C given the wide spread presence of sculpins in the Creek during the spring sampling.

REFERENCES

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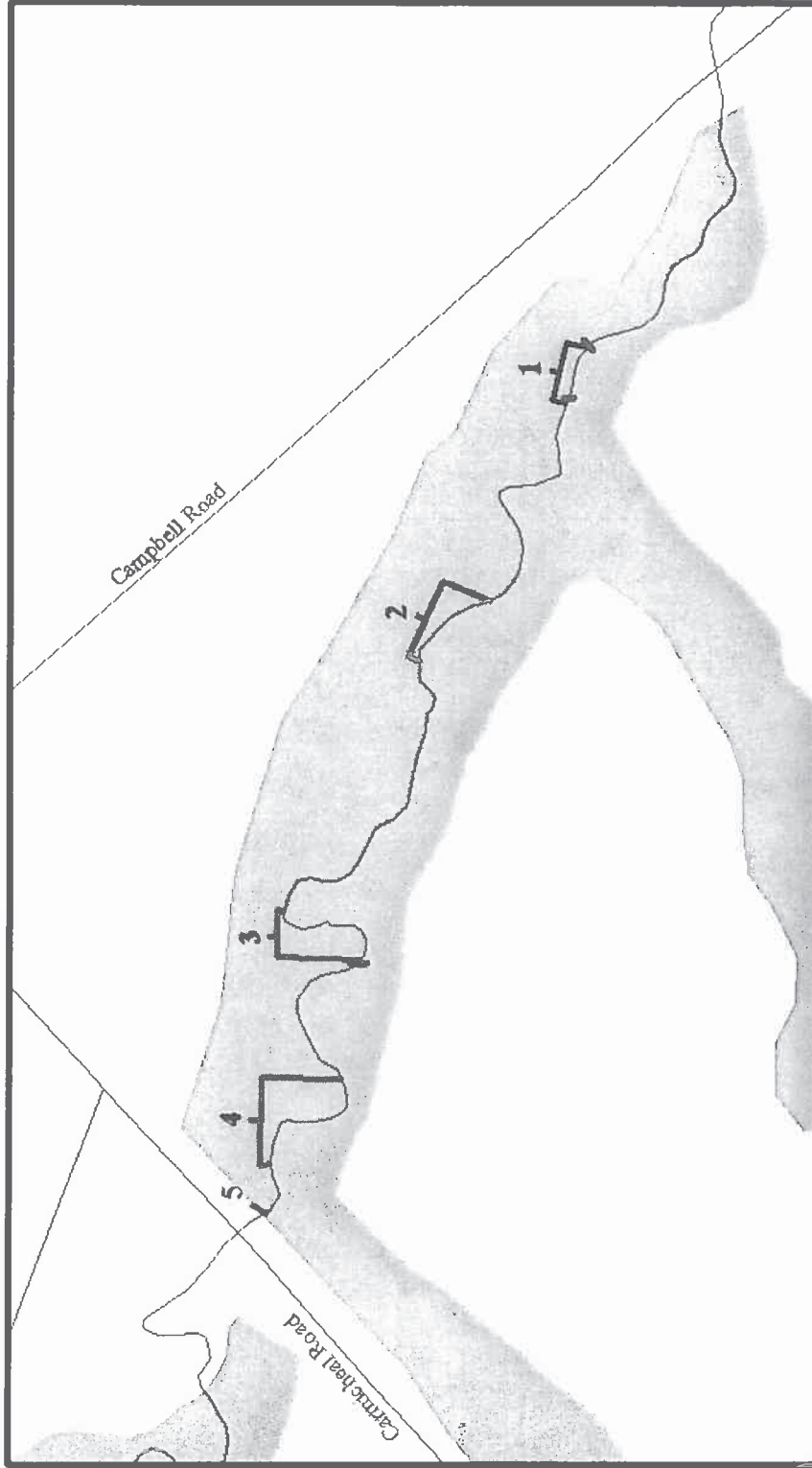
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Stoneman, C.L. and M. L. Jones. 1996. A simple method to evaluate the thermal stability of trout streams. 4 pp.

Please call if you have any questions on the above observations.

Bernie Muncaster. M.Sc.
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braeside2009memo



(Basemap created from OBM)



Legend

- 1 [Symbol] Fish Sampling Site
- [Symbol] Large Woody Debris

*Bowfin Environmental Consulting Inc.
September 18, 2009*

APPENDIX D

Summary- Peer Review Response

Peer Review Comments- Golder Associates

(March 2, 2009; August 16, 2011)

Responses to Peer Review- Skelton Brumwell & Associates/Brunton Consulting

(December 8, 2009; March 21, 2011)

SUMMARY- PEER REVIEW RESPONSE

Miller Braeside Quarry Expansion

Natural Environment Report Level I & II

The following table identifies where in the revised Natural Environment Report Level I & II December 2011 peer review comments made by Golder Associates are addressed.

Golder Peer Review Comment	Addressed in SBA/Brunton Correspondence (dated)	Where addressed in revised NER Level I & II
March 2, 2009		
1) Biological Resources- Plant Communities (Pg. 5): Plant Community mapping not completed for cultural areas (roadways) and woodlands within the existing licensed area.	December 8, 2009	NER- S4.1.2, Page 10; Figure 5 Appendix B- Brunton (2011)- S3.1; Page 9-12, 16
2) Biological Resources- Plant Communities (Pg. 5): No calculation of areas for plant community polygons.	December 8, 2009	NER- S4.1.2, Page 10, Table 1 Appendix B- Brunton (2011)- S3.1, Pg.9
3) Biological Resources- Plant Communities (Pg. 5): Characterization of alvar conifer forest poorly substantiated.	December 8, 2009	NER Appendix B- Brunton (2011)- S3.1, Pg.'s 12-16
4) Biological Resources- Local Flora (Pg.6): Status of local flora not justified.	December 8, 2009	NER Appendix B- Brunton (2011)
5) Biological Resources- Wildlife (Pg. 6): No breeding bird survey completed.	December 8, 2009	NER- S4.2.1, Pg.14-15 Appendix B- Brunton (2011)- S3.3.1; 4.3.2, Appendix C
6) Summary of Conclusions & General Comments (Pg. 7): Exact boundary of southeast wetland not mapped and impacts on wetland as a result of potential drawdown in quarry and reduction of surface water not addressed.	December 8, 2009; March 21, 2011	NER- Figure 7; S4.3, Pg.16; S6.1, Pg.21 Gorrell Investigations (2011)
7) General Comments (Pg. 8): Better mapping useful for forest cover on the plateau to allow comparison of total resource, area of forest in study area, and area of forest to be eliminated by expansion.	December 8, 2009	NER- S4.1.1, Pg.10; Figure 4

8) General Comments (Pg. 9): Not identified in report who or how the “significant wildlife area” was identified. Significant Wildlife Area (Protection Area) does not include most rare specimens. No discussion on impacts to designated deer yard.	December 8, 2009; March 21, 2011	Significant Wildlife Protection Area: NER- S7.1, Pg.26-29 Appendix B- Brunton (2011)- S5.2, Pg. 34-35 Deer Yard: NER- S7.1, Pg. 29 Appendix B- Brunton (2011)- S3.3.2, Pg. 21
9) General Comments (Pg. 9): Exact area of plant community losses relative to total area of the affected plant communities not quantified.	December 8, 2009	Addressed in December 8, 2009 for further clarification only.
10) General Comments (Pg. 9): Negative Impact on ecological functions of adjacent areas not discussed.	December 8, 2009	Addressed in December 8, 2009 for further clarification only.
11) General Comments (Pg. 9): Increase in volume of discharge to Ryan Creek and groundwater drawdown not clearly identified and discussed.	December 8, 2009	NER- S7.3, Pg. 30-31

March 02, 2009

08-1122-0216/6000

County of Renfrew
9 International Drive
Pembroke, Ontario
K8A 6W5

Attention: Mr. Bruce Howarth, MCIP, RPP, Senior Planner

RE: REVIEW OF REPORT TITLED "NATURAL ENVIRONMENT REPORT LEVEL I & II: BRAESIDE QUARRY EXPANSION, TOWNSHIP OF MCNAB/BRAESIDE, COUNTY OF RENFREW," PREPARED BY SKELTON BRUMWELL & ASSOCIATES, DATED NOVEMBER 21, 2007

Dear Sir:

The County of Renfrew has retained Golder Associated Ltd. (Golder Associates) to conduct a technical review of various reports related to a proposed quarry expansion. These reports were prepared in support of an application for a Zoning By-Law Amendment under the Township of McNab/Braeside Official Plan (Section 9.3(3)) to permit the expansion of a quarry operated by Miller Paving Limited, as well as an application to the Ontario Ministry of Natural Resources (MNR) for a quarry license with extraction below the water table. This submission comprises Golder Associates' technical review of the Natural Environment investigation and evaluation report referenced above, prepared by Skelton Brumwell & Associates (Skelton Brumwell) for the Miller Group Inc, including a Natural Environment Assessment Report prepared by Brunton Consulting Services, appearing as Appendix B to the report by Skelton Brumwell. As requested, this letter has also been provided in PDF format.

The Natural Environment Level 1 & 2 report was authored by Kyle Fleming, B.Sc., Environmental Planner/Biologist, for Skelton Brumwell. The Natural Environment assessment (Appendix B of the Skelton Brumwell report) was prepared by Daniel F. Brunton, an independent consulting biologist with an extensive background in natural environment studies in eastern Ontario and particularly in the Ottawa area. On January 29, 2009, Golder Associates contacted Skelton Brumwell to advise them that Golder Associates had been retained by the County of Renfrew to conduct a technical review of the natural environment investigation report.

In addition to the above referenced report, Golder Associates also examined the following documents specifically for the purpose of gaining additional understanding of the natural environment features on, and in the vicinity of, the Braeside Quarry:

Braeside Quarry Expansion, Hydrological Investigation, Township of McNab/Braeside, County of Renfrew, prepared by Skelton, Brumwell & Associates Inc., dated October, 2007.

In addition, this natural environment report review by Golder Associates has been informed by earlier technical reviews that were prepared by Golder Associates, including a review of the hydrological studies (Golder, in litt., September 18, 2008) and a review of the hydrogeological studies (Golder, in litt., September 11, 2008).

To assist with the review of the natural environment studies, Golder Associates was also provided with a copy of the Site Plans, prepared by Skelton Brumwell and dated November 2007. The Site Plans consisted of the following sheets: Site Environs, Existing Features & Cross Sections, Operational Plan, Progressive & Final Rehabilitation Plan, Monitoring & Mitigation. These Site Plans are referenced herein, where appropriate.

SCOPE AND FORMAT OF TECHNICAL REVIEW

Within designated parts of the Province of Ontario, the licensing requirements for quarries are outlined under the Bill 52 amendment to the *Aggregate Resources Act* (ARA). The Township of McNab/Braeside has been designated under the ARA (refer to Section 9.1 of the Official Plan). The proposed quarry expansion is a Category 2, Class "A" licence application which would permit the extraction of more than 20,000 tonnes of aggregate material per year.

The technical aspects for a natural environment assessment associated with a proposed quarry are outlined in the document titled **Aggregate Resources Act of Ontario, Provincial Standards, Version 1.0** (hereafter referred to as the "Provincial Standards"). In the context of the Provincial Standards, the natural environment assessments of a proposed quarry are referred to as a Natural Environment Level 1 study and, in those cases where significant features are identified within 120 m of the proposed quarry, a Natural Environment Level 2 study. Excerpts from the Provincial Standards that describe the information to be addressed in a Natural Environment Level 1 study (Section 2.2.3) and Natural Environment Level 2 study (Section 2.2.4) are summarized in Attachment A. This review focuses on a determination as to whether or not the Natural Environment report addresses the requirements of the McNab/Braeside Official Plan (OP) and Provincial Standards for a quarry below the established water table.

Golder Associates has reviewed the natural environment investigation report (referred to herein as “the Natural Environment Report”) from the following perspectives:

1. Have the study area physical features, including geology, physiography, soils, surface water and climate, been identified and adequately characterized with respect to their influences upon the biological resources of the area and the roles they may play in shaping or circumscribing the plant and wildlife communities and the local ecosystems?
2. Have the local biological features been identified and adequately characterized?
3. Has a reasonable assessment been made of the values attached to the biological resources of the study area and have those elements with special conservation status designations been singled out for a discussion of their significance and potential response to the proposed quarry expansion?
4. Have the on-site features been screened against the significance criteria and prescriptions that are set out in the Township OP and the Provincial Policy Statement (PPS), issued under *The Planning Act*?
5. Have the potential effects of the proposed quarry expansion upon the natural environment features been identified and assessed with respect to the local resources, and particularly those with special conservation status designations (impact assessment)?
6. If the potential exists for development-related effects upon natural features, has the magnitude of the impact been identified and is it acceptable? Have appropriate, site-specific mitigation measures been proposed to minimize impacts, so far as is possible?
7. Have appropriate monitoring programs been developed to measure and evaluate the actual effects of quarry development upon the natural environment features, and to allow a comparison between the effects measured during the operational monitoring programs with those predicted as part of the impact assessment (Item #5 above)?

These questions are answered in this review. The results of our review are presented in the following sections of this submission:

- Site Description
- Stated Objectives of the Natural Environment Report
- Scope of the Natural Environment Report Investigation
- Summary of Conclusions from the Natural Environment Report
- General Comments on the Natural Environment Report
- Compliance with Provincial Standards, Official Plan and Overall Summary of Peer Review

SITE DESCRIPTION

Site Location, Proposed Quarry Development Plan and Topographic Setting

The proposed quarry expansion site is located adjacent to the existing, operational Miller Braeside Quarry (MNR License #16173) and is located on Part of Lots 16 and 17, Concession A, Municipality of McNab/Braeside, Renfrew County. The existing licensed area comprises 29.7 hectares (ha) with a disturbed area of 17.1 ha. The additional area to be licensed as per the expansion application, is 103.0 ha which would result in a total licensed area of 132.7 ha. Within this 132.7 ha licensed parcel, the proposed extraction area would be 68.4 ha. The remaining 64.3 ha of the licensed area would be maintained in its current undeveloped state (based upon the 'Operational Plan,' Drawing No. 3 of the Site Plan). The base elevation of the proposed licensed extraction area will be 125 metres above sea level (m ASL) and annual extraction will not exceed 1,000,000 tonnes. According to the rehabilitation plan, it is expected that the rehabilitated quarry will flood to a final lake level of approximately 132 m ASL ('Progressive & Final Rehabilitation Plan,' Drawing No. 4 of the Site Plan).

The Miller property is located approximately 3 kilometres northwest of the Village of Braeside and is situated on a bedrock plateau or mesa that has its principal axis oriented parallel to the channel of the Ottawa River. The majority of the mesa is undeveloped and forested. The mesa is characterized by elevations on the order of 30 to 40 metres above the surrounding clay plain with relatively steep faces to the south and southwest onto a clay plain and to the north and northeast into the Ottawa River. The highest elevations on the bedrock mesa occur just south of the existing Miller Quarry, at approximately 153 m ASL. The visible base of the bedrock formation occurs at approximately 125 m ASL. At the base on the southwest side, the gradient drops to less than 10% and the ground surface slopes gently towards Ryan Creek which, at this location, has an approximate elevation of 113 m ASL. The surface of the mesa, though relatively flat, is irregular. On the study area, the maximum elevation occurs near the center of the south edge and slopes gradually to approximately 140 m ASL at the north boundary of the site. However, along the west edge of the site, the edge of the bedrock mesa is present and steeper slopes are present, dropping from approximately 150 m ASL at the quarry rim to 138 m ASL at Osborne Street and to 133 m ASL in the northwest corner of the site.

Geology, Physiography, Soils and Climate

The occurrence of limestone outliers extending north into Renfrew County, along the Ottawa River, has important consequences to the soils and vegetation in the southern townships of the County. These formations are likely the main source of the calcareous components of the local soils, enhancing their productivity. On the other hand, the relatively small area occupied by these outliers, their elevation above the clay plains of the Ottawa Valley and their relatively shallow

overburdens have limited their use for agriculture. Those same attributes, small area, elevated position and shallow overburden, generally preclude the development of permanent surface drainage features and tend to make soils droughty, since there are no up-gradient inputs of surface water and there is little soil moisture reserve.

Well removed from the influences of the Great Lakes and occupying a broad trough between heights of land to the east and west, the climate of Renfrew County is somewhat cooler and drier than many other southern Ontario locations. Its climatic regime is more closely aligned with the Algonquin Park and Haliburton Highlands regions than it is with the Ottawa and Eastern Counties region. None of the above considerations are discussed in the Natural Environment Report.

The Biological Resources

Plant communities

Plant community mapping was done by Brunton for the great majority of the study area, but not for its entirety. If there are corridors of cultural vegetation that follow the roadways through the study area, these should have been classified and discussed. There are also two blocks of woodlands on the west side of the present licence area that have not been classified. Even if access was restricted, these communities should be classified and made part of the considerations given to the natural features in the study area.

With the many tools available to calculate polygon areas, the absence of a tabulation of the areas occupied by each community type in the study area is a serious omission. Particularly when considering the potential impacts of the proposed development, a knowledge of the area of each vegetation type affected by the expansion, and the proportion that will be directly affected, is a useful indicator of the magnitude of the impact of the development, at least within the local area.

The characterization of the largest plant community on the site, the conifer/mixedwoods forest identified as Unit 1 in Figure 4 of the Natural Environment Report, as an alvar community is poorly substantiated. An alvar community is characterized by a mix of physical and biological features that do not appear in the description provided for this community type in the Natural Environment Report. A white cedar-balsam fir conifer forest type is a characteristic forest-type for large areas of southern and central Ontario, on poorly or imperfectly drained lands. Bedrock-controlled drainage is not a defining characteristic of alvar communities, though shallow soils over calcareous bedrock is one necessary characteristic. Based upon the species distribution mapping that is provided in Figure 5 of the Natural Environment Report, the area occupied by Units 1 and 2 appears to be a mosaic of alvar glades and shrublands in a conifer/mixedwoods forest. That is the picture provided by the plant community descriptions in Brunton's natural environment assessment (Appendix B of the Natural Environment Report).

Other forest communities identified in the study area are characteristic of coarse, relatively infertile soils, including mixedwoods stands of trembling aspen, white cedar and white spruce, open conifer woodlands with groves of trembling aspen, and swamp communities of conifers, dominated by white cedar and balsam fir, and of mixedwoods, including white cedar, balsam fir, black ash and trembling aspen.

The Local Flora

The inventory of vascular plants appears relatively thorough, although the assignment of status based upon the status of plants in the flora of the City of Ottawa does not appear to be justified. There are significant distinctions to be made between the environmental and ecological conditions at the site study area and the lands in and around the City of Ottawa that suggest that the Ottawa designations should not be applied or should be considered highly tentative. Furthermore, conservation status is generally not assigned to hybrids, as they do not represent breeding populations of individuals that contribute to the survival of a particular species. The value of comparing the Coefficient of Conservatism (not 'Conservation,' as appears in the Natural Environment Report) for the study area flora with that of values obtained from natural areas in the City of Ottawa is also questionable. Unlike the flora of Renfrew, the flora of the Ottawa area has been much affected by long-standing anthropogenic impacts, in addition to a different suite of environmental conditions. However, the local flora does support large populations of two species of conservation concern and these populations are considered a highly significant aspect of the local flora.

Wildlife

Observations of wildlife were made on an incidental and opportunistic basis. The species of wildlife reported appear to be representative of the habitats that are present in the study area and do not include any particularly rare species. Without sufficient explanatory context, the reference to a declining Evening Grosbeak population appears somewhat misplaced in a summary treatment of wildlife observations. A breeding bird survey was not conducted for the study.

STATED OBJECTIVES OF THE NATURAL ENVIRONMENT INVESTIGATION

Section 2 of the Natural Environment Report states that the purpose of the investigation was to meet the requirements of the Provincial Standards under the *Aggregate Resources Act* "for pit and quarry planning." The Level I component of the report screens the natural heritage resources on the study area for those features identified in the PPS as warranting consideration for conservation and assessment of potential negative impacts from adjacent development. The Level II component of the report identifies the potential impacts and recommends mitigation measures to eliminate or reduce those impacts to a level where the identified features and their

ecological functions are not so affected that the qualities on which they were deemed significant are lost or no longer function as they do without the adjacent development.

SCOPE OF THE NATURAL FEATURE INVESTIGATION

The Natural Environment Report investigation included the following components:

- Review of existing data and published information for the site including the databases maintained by the Natural Heritage Information Centre;
- Review of planning/zoning designations provided by the Official Plans for the County of Renfrew and the Township of McNab/Braeside;
- Acquisition and analysis of aerial imagery for the study area;
- Conduct of a Natural Environment Assessment by Brunton Consulting;
- Conduct of a hydrogeological investigation by Gorrell Resource Investigations;
- Conduct of a hydrological investigation by staff of Skelton Brumwell;
- Contour mapping of the study area by Base Mapping Company Ltd.; and
- Consultation with the Pembroke District office of OMNR.

SUMMARY OF CONCLUSIONS FROM THE NATURAL ENVIRONMENT REPORT

The Natural Environment Report provides the following key conclusions based on the reviews and field studies conducted in the study area:

- A locally significant wetland (identified as a 'Sensitive Area of Concern' on Schedule 2.1 of the County of Renfrew Official Plan) occurs southeast of the proposed licence boundary, just at the limit of extent of 'adjacent lands' (i.e., 120 m from the licence boundary) and just over 1% of its catchment basin is present within the proposed expansion area;
- Significant woodlands are present in the study area, on the basis of the size of the forested area, the presence of a rare plant community (alvar) and linkage to wetlands;
- Significant wildlife habitat is present in the study area, on the basis of the presence of seasonal wildlife concentration areas (a deer yard), a rare plant community (alvar), and a possible animal movement corridor; and
- As a consequence of water discharge from the quarry to a water course, Ryan Creek, identified as 'cold water habitat,' potential impacts to fish habitat need to be considered.

The Natural Environment Report argues for dismissal of the wetland (item #1, above) from further consideration in its assessment of quarry impacts (p. 18), based upon the assertion that the distance between the licence boundary and the wetland is above the critical threshold of 120 m and that the forest vegetation between the licensed property and the wetland is sufficient to buffer the wetland from direct effects. However, as there may be some effect upon the water regime of

the wetland and because the exact boundary of the wetland has not been mapped and the line showing the 120 m zone around the licence area ('Site Environs,' Figure 1 of the Site Plans) appears to 'capture' the proximate edge of the wetland feature, and since the hydrogeologic peer review suggests that the predicted drawdown has not been fully characterized, Golder Associates believes that this matter should be further addressed in the Level II component of the evaluation of potential development impacts.

GENERAL COMMENTS ON THE NATURAL ENVIRONMENT ASSESSMENT

The stated objective of the Natural Environment Report was to provide support for quarry planning and expansion by identifying significant natural features, as enumerated by the Township OP and the PPS, that might be affected by the proposed expansion and proposing measures to ensure that development impacts would not negatively affect those features or their ecological functions. In our opinion, the objectives of the Level I report component have been satisfied, but those of the Level II component were not satisfied.

The consideration of the wetland feature to the southeast of the proposed expansion has been relatively off-hand and has not addressed the combination of groundwater drawdown and reduced surface inputs. It is unclear just what area is being considered when the report refers to an area representing 1% of the catchment that "is located on the subject property" (p. 15 of the Natural Environment Report). In the hydrological report (p. 32), it is reported that this "1% would be utilized for the proposed quarry expansion" and this appears to be confirmed on Figure 4 of the Hydrological Report, meaning that another 4 or 5 ha of the wetland catchment basin are also on the licensed parcel. The distinction between the surface catchment area and groundwater divide has not been clarified. Thus, some additional area will be affected by the setback from the quarry rim and the construction of the surrounding berm. Although a loss of even 2% of the catchment area may not be significant, groundwater drawdown may also effect the water regime in the wetland and some consideration needs to be given to the combination of these two impacts.

An area of 'significant woodlands' is identified based upon the presence of an alvar community, the overall size of the woodland area, and the linkage to wetlands. However, except for some extended discussion of the alvar community, the other aspects of these attributes are not clearly presented. A very poor-quality image, referred to as the LANDSAT image of the County, is presented as Figure 3 of the Natural Environment Report to provide some overview of the forest cover in the vicinity of the study area. An incomplete legend further limits the utility of this figure. A clean topographic map with some outline or approximation of the forest cover on all of the Braeside limestone outlier would have been more useful as a demonstration of the extent of and existing disturbances to the forest cover on this feature. As well, numbers for the total area of the forest community and that on the proposed licence property would have permitted useful comparisons between the total resource, the area of forest on the study area and the area of forest

that would be directly eliminated by the proposed quarry expansion. None of this information is provided in the Natural Environment Report.

Neither is it clear how the 'significant wildlife area' on the lands proposed for the licence expansion was identified or by whom (Figure 7 of the Natural Environment Report). Indeed, it is quite peculiar that this area would only be confined to the proposed licence expansion lands. While some rationale for "significant wildlife habitat" is provided, there is no indication in the discussion that appears in the Natural Environment Report that particular community attributes, such as forest stand composition, tree age or other identifiable characteristics, such as wildlife distribution or usage, have been applied to identify the specific polygon of 'significant wildlife area' that is shown in Figure 7 of the report. The Brunton report does not cite the deer yard in delineating the significant area or protection area, but the Skelton Brumwell report suggests that the deer yard is addressed by these delineations with no ecological rationale. In addition, the 'significant wildlife area' polygon (Figure 7) does not capture most of the rare specimens as suggested, based upon the rare plant mapping that appears in Figure 5 of the report. The Skelton Brumwell report suggests (page 24) that "*virtually all of the significant features and functions of the study area*" are present in the 'significant wildlife area,' when neither the 'significant area' nor the protection area actually include many rare mapped specimens nor discuss the removal of a portion of the designated deer yard (a Significant Wildlife Habitat under the PPS). Without that information, it is impossible to determine if the proposed 'wildlife protection area' will achieve the functions that are attributed to it.

It is clear from the proposed expansion that losses will occur in several plant communities. The exact area of these losses and their relation to the total area of the affected plant communities has not been quantified, making it difficult to assess the magnitude of the potential impacts of the proposed quarry expansion. Without knowing the magnitude of the impacts, it is equally difficult to evaluate the likelihood that the proposed mitigation will accomplish what it is intended to do. The Natural Environment Report has not demonstrated that there will be no negative impacts on the significant natural features on and adjacent to the proposed quarry expansion and the discussion of ecological functions is insufficient to provide any reasonable assurances that these will not be negatively impacted by the proposed development.

The effects of the proposed development upon the cold water fishery in Ryan Creek are given an incomplete discussion. The issues here are not simply the fate of the drainage from lands that presently drain to Ryan Creek, but also the effect of groundwater drawdown on the wetlands and seepage dependent plant communities that occur in proximity to the quarry, as well as the impact of the increased discharge to Ryan Creek as a result of quarry dewatering. The proposed quarry expansion will significantly increase the volume of water that is discharged to Ryan Creek and neither this, nor the potential impacts from groundwater drawdown are clearly identified and discussed in the Natural Environment Report.

COMPLIANCE WITH PROVINCIAL STANDARDS, OFFICIAL PLAN AND OVERALL SUMMARY OF PEER REVIEW

The Natural Environment Report does not adequately address the direct impacts to natural environment features in the area of the proposed quarry expansion; therefore, in our opinion it does not meet the requirements associated with a Natural Environment Level 2 study as per Section 2.2.4 of the Provincial Standards (Attachment A). Based on Golder Associates' review of the Natural Environment Report, there are several key issues which have yet to be addressed. These issues relate to the assessment of potential impacts to the wetland feature southeast of the proposed quarry expansion, the identification of the area of 'significant woodlands' and 'significant wildlife habitat' on and around the study area and the absolute and proportional area of these features that will be affected by the proposed expansion. As well, the effectiveness of the proposed mitigation measures to maintain the features and ecological functions for which these significant areas have been identified has not been adequately addressed or demonstrated.

Regarding the Township of McNab/Braeside Official Plan, no particular environmental designations have been placed on the lands of the proposed licence expansion and thus no special requirement, other than those applied to pit and quarry development and operations need to be applied to this proposed expansion. However, the wetland southeast of the site has been identified as a 'sensitive area of concern' by the County of Renfrew OP and, in our opinion, the Natural Environment Report does not adequately demonstrate that there will be no impacts to this feature as a result of the proposed quarry expansion. It is also our opinion that insufficient analysis is provided to permit any conclusions about the effectiveness of the proposed mitigation on maintaining the features and ecological functions of the significant areas that have been identified on and around the proposed quarry expansion.

As was stated above, it is our opinion that the treatment in the Natural Environment Report did not meet the overall objective: that being to provide support for a proposed quarry expansion by evaluating the natural environment features on-site and proposing mitigation that would meet the requirements of the Township OP and of the PPS, issued under *The Planning Act*. We believe the Report satisfies the Level 1 study requirements but not the Level 2 requirements, thus failing to satisfy the requirements of the PPS. That said, with additional desktop analysis of the updated hydrogeologic information, interpretation of the predicted affects on wetland levels and stream flows, rationale for the significant and protection area boundaries (including relative proportions of communities to be affected), the objectives can be met without further field assessment.

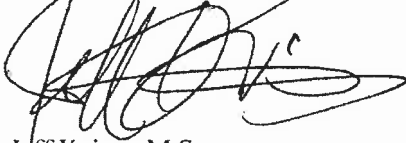
LIMITATIONS

This technical review was conducted by Golder Associates on behalf of the Renfrew County. The objective of the review was to assess the Skelton Brumwell Report in terms of compliance with the requirements of the Provincial Standards and Official Plan and to derive an opinion as to whether the Skelton Brumwell Report has adequately characterized the natural environment in the area of the proposed Braeside Quarry in terms of assessing the potential for adverse effects of the quarry operation on these resources. The scope of the review was based on the review of documentation as referenced herein. The review was based on the information provided in the Skelton Brumwell Report; Golder Associates did not conduct any independent field investigations, analysis, or testing.

Any use of which a third party makes of this report, any reliance on the report, or decisions based on the report, are the responsibility of those third parties unless authorized by Golder Associates in writing. Golder Associates accepts no responsibility for damages suffered by any unauthorized third parties as a result of decisions made or actions taken based on this report.

Yours truly,

GOLDER ASSOCIATES LTD.



Jeff Kaiser, M.Sc.
Senior Biologist/Ecologist



Kevin Trimble, M.Sc.
Associate/Senior Ecologist

JK/KT/am

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Attachment:

Attachment A: Excerpt from Provincial Standards

ATTACHMENT A
EXCERPT FROM PROVINCIAL STANDARDS

Application Standards for

Category 2: Class "A" licence for a quarry operation which intends to extract aggregate material from below the established groundwater table.

- ◆ Application Standards
 - ◇ Site Plan Standards
 - ◇ Report Standards
- ◆ Prescribed Conditions
- ◆ Notification and Consultation Standards

Category 2

1.0 Site Plan Standards for Below Groundwater Extraction of Quarry Operations

The site plan accompanying an application for a Class A quarry licence which intends to extract aggregate material from below the established groundwater table must show the following information on at least three separate drawings using a combination of the headings identified. Two (2) copies of the site plan and reports must be submitted with the application:

1.1 Existing Features

- 1.1.1 each drawing must be numbered and indicate the total number of drawings submitted (e.g. 1 of 4);
- 1.1.2 a key map showing the location of the quarry site;
- 1.1.3 a general description of the site by lot and concession, if any, and the municipality, county or the region where the quarry is located;
- 1.1.4 a scale reference using both ratio and graphic methods between a scale of 1:1000 and 1:5000;
- 1.1.5 applicant's name and address;
- 1.1.6 a statement that "this site plan is prepared under the Aggregate Resources Act for a Class A licence, Category 2";
- 1.1.7 a stamp and signature of a Professional Engineer, Ontario Land Surveyor, Landscape Architect or signature of other qualified person as approved under subsection 8(4) of the Aggregate Resources Act under whose direction this plan was prepared and certified;
- 1.1.8 north arrow, normally pointing towards the top of the page;
- 1.1.9 a section for recording site plan amendments, including approval dates;
- 1.1.10 a list of references which apply specifically to the preparation of the site plan;
- 1.1.11 a legend;
- 1.1.12 the boundary of the area to be licensed, including the dimensions and hectarage of the site;
- 1.1.13 demarcation of lot and concession lines;

- 1.1.14 the use and existing zoning of land on and within 120 metres of the site;
- 1.1.15 the topography of the site illustrated by a one or two metre contour interval, expressed as metres above mean sea level;
- 1.1.16 the location and use of all buildings and other structures existing on and within 120 metres of the site;
- 1.1.17 the location of every existing entrance to and exit from the site;
- 1.1.18 main internal haul roads on the site;
- 1.1.19 the elevation of the established groundwater table on site;
- 1.1.20 existing surface water drainage and drainage facilities on and within 120 metres of the site;
- 1.1.21 the location and type of existing fences on the site;
- 1.1.22 the location of existing tree cover (i.e. wood lots and hedgerows) on the site and within 120 metres of the site;
- 1.1.23 the location of existing stockpiles of topsoil and overburden on the site;
- 1.1.24 the location of existing aggregate stockpiles, including any recyclable materials on the site;
- 1.1.25 existing scrap location(s) on the site;
- 1.1.26 existing fuel storage area(s) on the site;
- 1.1.27 significant natural features on and within 120 metres of the site;
- 1.1.28 significant man-made features on and within 120 metres of the site;
- 1.1.29 all existing excavation faces and rehabilitated areas;
- 1.1.30 the location of existing processing area(s) and whether or not the equipment is stationary and/or portable;
- 1.1.31 the location of existing berms and their height; and
- 1.1.32 location of cross-section(s).

1.2 Operations

- 1.2.1 the sequence and direction of the proposed quarry development;
- 1.2.2 details of how the stripping and stockpiling of the topsoil and overburden will be dealt with;
- 1.2.3 the maximum number of lifts and the maximum height of the lifts;
- 1.2.4 main internal haul roads on the site;
- 1.2.5 the location of every proposed entrance to and exit from the site;
- 1.2.6 the elevation of the established groundwater table on the site;
- 1.2.7 any proposed water diversion and points of discharge to surface water;
- 1.2.8 the location, type and installation schedule or phasing for any proposed fencing around the licensed boundary of the site;
- 1.2.9 the location of any proposed buildings and other structures to be erected on the site;
- 1.2.10 the location of any proposed stockpiles of topsoil and overburden on the site;
- 1.2.11 the location of any proposed aggregate stockpile area(s), including any recyclable materials on the site;
- 1.2.12 any proposed scrap location(s) on the site;
- 1.2.13 the location of any proposed fuel storage area(s) on the site;
- 1.2.14 the area in hectares to be extracted;
- 1.2.15 the location and labelling of all excavation setbacks from the licensed boundary;
- 1.2.16 the final extraction elevation of the site using spot elevations;
- 1.2.17 the location of any proposed permanent and/or temporary processing area(s) on the site;
- 1.2.18 the location of any proposed berms and the minimum height;
- 1.2.19 details on how berms will be vegetated and maintained;
- 1.2.20 the general types of equipment that will normally be used on site;
- 1.2.21 the location, design and phasing of any proposed tree screens and identify whether deciduous, coniferous or both;

- 1.2.22 details on the hours of operation of the site taking into account all facets of the operation which involves the actual physical movement of aggregate;
- 1.2.23 details of how trees and stumps shall be disposed of or utilized;
- 1.2.24 location of cross-section(s);
- 1.2.25 a section to record any variations from the operational standards that relate to the site;
- 1.2.26 details of frequency and timing of blasts; and
- 1.2.27 a statement to indicate the maximum number of tonnes of aggregate to be removed from the site in any calendar year. This may be expressed as unlimited, and;
- 1.2.28 any recommendations and/or monitoring program(s) identified in the technical reports.

1.3 Progressive Rehabilitation

- 1.3.1 the sequence and direction of progressive rehabilitation;
- 1.3.2 details on how the overburden and topsoil will be used to facilitate progressive rehabilitation;
- 1.3.3 the location, design and type of vegetation (e.g. grasses, legumes, shrubs and trees, etc.) that will be established on the site during progressive rehabilitation;
- 1.3.4 how the slope will be established on the excavation faces and the quarry floor;
- 1.3.5 details on how progressive rehabilitation will be conducted in relation to the operational sequences; and
- 1.3.6 if proposed, details on the importation of topsoil or inert material to facilitate rehabilitation of the site.

1.4 Final Rehabilitation

- 1.4.1 if proposed, details on the importation of topsoil or inert material to facilitate rehabilitation of the site;
- 1.4.2 how the final slopes will be established on all excavation faces and the quarry floor;
- 1.4.3 the location, design and type of vegetation (e.g. grasses, legumes, shrubs, and trees, etc.) that will be established on the site during final rehabilitation;
- 1.4.4 any building(s) or structure(s) to remain on the site;
- 1.4.5 anticipated elevation of the groundwater table;

- 1.4.6 any internal haul roads that will remain on the site;
- 1.4.7 final surface water drainage and drainage facilities on the site;
- 1.4.8 the final elevations of the rehabilitated areas of the site illustrated by a one or two meter contour interval, expressed as metres above mean sea level, and;
- 1.4.9 location of cross-section(s).

1.5 Cross-Sections

- 1.5.1 one or more cross-sections of existing conditions, rehabilitation and the anticipated final elevation of the groundwater table, within the licensed boundary;
- 1.5.2 the final slope gradient that will be established
- 1.5.3 the cross-section of a typical berm design that will be constructed on the site; and
- 1.5.4 appropriate horizontal and vertical scales.

2.0 Report Standards for Category 2 Applications

2.1 Summary Statement

A summary statement accompanying an application for a licence must be signed by the author and provide information on the following:

- 2.1.1 any planning and land use considerations;
- 2.1.2 the agricultural classification of the proposed site, using the Canada Land Inventory classes. For the land being returned to agriculture, the proposed rehabilitation techniques must be identified.
- 2.1.3 the quality and quantity of aggregate on site;
- 2.1.4 the main haulage routes and proposed truck traffic to and from the site, and necessary entrance permits; and
- 2.1.5 the progressive and final rehabilitation and the suitability of the proposed rehabilitation having regard to the adjacent lands.

The summary statement may be prepared by the applicant.

2.2 Technical Reports

Technical reports accompanying an application for a licence must provide information on the following:

- 2.2.1 Hydrogeological Level 1: Preliminary hydrogeologic evaluation to determine the final extraction elevation relative to the established groundwater table(s) in both unconsolidated surficial materials (if present) and the consolidated bedrock strata, and the potential for adverse effects to groundwater and surface water resources and their uses (e.g. waterwells, groundwater aquifers, surface water courses and bodies, discharge areas, etc.);

NB: A Permit to Take Water may be required if any part of the operation utilizes, ponds by flow restriction, or diverts ground and/or surface water on, or from the site.

- 2.2.2 Hydrogeological Level 2: Where the results of Level 1 have identified a potential for adverse effects of the operation on ground water and surface water resources and their uses, an impact assessment is required to determine the significance of the effect and feasibility of mitigation. The assessment should address the potential effects of the operation on the following features if located within the zone of influence for extraction below the established groundwater table, where applicable;

A technical report must be prepared by a person with appropriate training and/or experience in hydrogeology to include the following items;

- (a) water wells;
- (b) springs;
- (c) groundwater aquifers;
- (d) surface water courses and bodies;
- (e) discharge to surface water;
- (f) proposed water diversion, storage and drainage facilities on site;
- (g) methodology;
- (h) description of the physical setting including local geology, hydrogeology, and surface water systems;
- (i) water budget;
- (j) impact assessment;
- (k) mitigation measures including trigger mechanisms;
- (l) contingency plan;
- (m) monitoring plan; and
- (n) technical support data in the form of tables, graphs and figures, usually appended to the report.

- 2.2.3 Natural Environment Level 1: determine whether any of the following features exist on and within 120 metres of the site: significant wetland, significant portions of the habitat of endangered or threatened species, fish habitat, significant woodlands (south and east of the Canadian Shield), significant valley lands (south and east of the Canadian Shield), significant wildlife habitat and significant areas of natural and scientific interest;
- 2.2.4 Natural Environment Level 2: impact assessment where the level 1 identified any features on and within 120 metres of the site in order to determine any negative impacts on the natural features or ecological functions for which the area is identified and any proposed preventative, mitigative or remedial measures;
- 2.2.5 Cultural Heritage Resource Stage 1: determine if there are any known significant archaeological resources on the subject property and the potential of the site to have heritage resources;
- 2.2.6 Cultural Heritage Resource Stage 2: property survey by a licenced archaeologist if stage 1 identifies known resources or a medium to high potential for heritage resources on the site and mitigation, if recommended;
- 2.2.7 Cultural Heritage Resource Stage 3 and 4: detailed site investigation by a licensed archaeologist (e.g. test pits, plowing fields and survey) when recommended by stage 2 and mitigation through excavation, documentation or avoidance, if recommended;
- 2.2.8 If extraction and/or processing facilities are within 500 metres of a sensitive receptor, a noise assessment report is required to determine whether or not provincial guidelines can be satisfied;

- 2.2.9 A Blast Design report is required if a sensitive receptor is within 500 metres of the limit(s) of extraction to demonstrate that provincial guidelines can be satisfied; and
- 2.2.10 Each report shall state the qualifications and experience of the individual(s) that have prepared the report(s).

The technical report(s) must be prepared by a person with appropriate training and/or experience.

Skelton Brumwell

& ASSOCIATES INC.

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**CONSULTING
ENGINEERS
AND
PLANNERS**

December 8, 2009

Miller Paving Ltd.
505 Miller Ave.
P.O. Box 4080
Markham, ON L3R 9R8

Attention: Tom Jones
Property Manager

Dear Tom:

Re: Response to Golder Peer Review
Natural Environment Report Level I & II
Miller Braeside Quarry Expansion
Township of McNab-Braeside
County of Renfrew
Our File: P/N 2033

This letter responds to the peer review comments by Golder Associates in their letter March 2, 2009 in review of the Natural Environment Report Level I & II prepared by Skelton, Brumwell and Natural Environment Assessment by Brunton Consulting for the Miller Braeside Quarry Expansion.

This correspondence draws from several reports, subsequent responses to peer reviews and knowledge of the team of consultants. Following each response, a square bracket [SBA] will be used to illustrate which document or consultant(s) provided the response.

As a numbering system was not used in the peer review, we have numbered comments in the order they appear. This will allow for a more complete response to issues raised. Beside each point, we have shown the section and page number from the Golder Peer Review, and summarized each comment.

- 1) **Biological Resources- Plant Communities (Pg. 5):** *Plant community mapping not completed for cultural areas (roadways) and woodlands within the existing licensed area.*

The habitat mapping has been revised to accommodate this concern subsequent to several additional field inspections. It employs current (late 2008) aerial photography and include considerations such as the roadway along the proposed operational limit (attached as Figure 1).

[Brunton Consulting (Brunton)]



2) **Biological Resources- Plant Communities (Pg. 5):** *No calculation of areas for plant community polygons.*

The areas of all natural and non-natural habitats in the Braeside Quarry property are as follows:

Habitat type	Area (hectares)
1 - Developed (Transformed)	28.1
2 - Cultural Meadow and Thicket	9.5
3 - Alvar Glade and Pavement	2.4
4 - Alvar Coniferous forest	56.7
5 - Young Upland Mixed Forest	15.5
6 - Mature Upland Mixed Forest	4.7
7 - Upland Coniferous Forest and Scrub	10.0
8 - Coniferous Swamp Forest	3.5
9 - Mixed Swamp Forest	2.3

[Brunton]

3) **Biological Resources- Plant Communities (Pg. 5):** *Characterization of alvar conifer forest poorly substantiated.*

Treed Alvar (ALT1 vegetation of Lee et al. (1998)) in the study area, as it in other major alvar complexes in the Ottawa Valley such as the Burnt Lands (Ottawa - Lanark County) and Clay Bank (Lanark-Renfrew Counties), is closest in composition to the White Cedar - White Spruce - Philadelphia Panic Grass Tree Alvar vegetation of Bakowsky (1996). Elements of Jack Pine - White Cedar - Common Juniper Treed Alvar vegetation are represented as well. This forest vegetation, characterized by a semi-open canopy (50 - 75% cover), typically overtops a dense growth of low, dryland, often calciphylic shrubs and herbs such as Bearberry (*Arctostaphylos uva-ursi*) and Ebony Sedge (*Carex eburnea*) growing in moss and Reindeer (*Cladina*) lichen mats in gaps and small glades scattered abundantly between canopy trees. Canopy saplings often form dense stands along such edges as well, making the undergrowth nearly impenetrable in places. Ground vegetation beneath the areas of continuous canopy is typically sparse, consisting of sedges (*Carex eburnea*, *C. castanea*, *C. gracillima*), Canada Mayflower (*Maianthemum canadense*), Fringed Polygala (*Polygala pauciflora*), Ram's-head orchid (*Cypripedium arietinum*) and Poison-ivy (*Toxicodendron rydbergii*).

The occurrence of natural fire in this unusually dry habitat is indicated by the abundance of ancient burned stumps. This natural disturbance has historically been important in maintaining the semi-open canopy of Treed Alvar (Catling et al, 1975, Brunton 1986, Catling and Brownell 1995, Catling and



Sinclair 2002). The high density of Common Juniper shrubbery and of canopy seedlings in some areas may reflect the unnatural exclusion of natural fire from many such alvars areas in recent decades (Brunton 1986, Catling and Sinclair 2002).

Alvar conifer forest occurs on level to gently sloping limestone bedrock with only a thin covering of dry, sandy soil. Slight depressions within this vegetation are periodically and seasonally flooded, creating an abundance of tiny 'wetlettes'. These miniature wetlands are often dominated by moss (including *Sphagnum*) and support a variety of typical wetland herbaceous and shrub species. They are contained, however, within what is predominately an upland habitat.

This vegetation is both Globally and Provincially Rare (Bakowsky 1996; Reschke et al. 1999).

[Brunton]

4) Biological Resources- Local Flora (Pg. 6): *Status of local flora not justified.*

Although not always included in evaluations of natural landscape, Regionally Significant features can provide valuable additional indications of the ecological importance of particular areas. This is especially useful with native floristic data. No listing of Regionally Significant (e.g. rare within Renfrew County) plants exists. The study area, however, is on the southernmost edge of Canadian Shield-dominated Renfrew County and is biophysically much more like the adjacent, sedimentary lowlands-dominated City of Ottawa landscape. Accordingly, assessing Regional floristic rarity of the Braeside Property can be realistically evaluated against Ottawa data. A recent, comprehensive evaluation of floristic biodiversity and Regional Significance exists for Ottawa (Brunton 2005) and constitutes both an appropriate and accurate reflection of the regional importance of the Braeside Quarry property native flora.

[Brunton]

5) Biological Resources- Wildlife (Pg. 6): *No breeding bird survey completed.*

A breeding bird survey was completed by Skelton Brumwell on June 2, 2009 to compliment observations made by Dan Brunton during surveys from 2005-2009. Incidental observations were also made for other fauna (reptiles, amphibians, mammals) during the survey.

A total of 28 bird species and 5 other faunal species were detected. A list of the species is attached. None of the species detected are listed in the Ontario Endangered Species Act (2007).

[Skelton, Brumwell & Associates (SBA)]



- 6) **Summary of Conclusions & General Comments (Pg. 7):** *Exact boundary of southeast wetland not mapped and impacts on wetland as a result of potential drawdown in quarry and reduction of surface water not addressed.*

The boundary and closest limit to extraction for the southeast wetland is shown on Figure 2. The limit of this wetland is approximately 259 metres from the edge of proposed extraction. The wetland is on private land and is beyond the extent of the detailed natural environment inventory conducted for this assessment.

[SBA]

Two identified wetlands have developed on the upper competent bedrock on or near the Miller property. The weathered bedrock contributes to these wetlands through recharge to the upper springs at approximately 135 to 137 m ASL.

On the north-west corner there is a wetland feature that is partially on the Miller property. A drainage divide within this wetland outlets about 40 percent of its drainage area to Golf Club Road (Unnamed Drain) and 60 percent to Osborne Street (Ryan Creek).

A 17 percent reduction in drainage area would result in a low to moderate impact on the wetland springs and pools. However this impact is acceptable and does not require mitigation, as the natural feature does not constitute a significant habitat at a provincial or regional level, nor does it constitute a portion of a Provincially Significant Wetland.

A second small wetland area is found off site to the south-east of the Miller property. The wetland developed because of the presence of a topographically suitable bedrock depression on the competent bedrock step, at and slightly below the elevation that the upper springs emerge. This wetland has an outlet which flows seasonally. The water level is also controlled extensively by beaver activity.

The springs that contribute to the wetland are indirect surface water flow within the same drainage area identified in the hydrology report. The recharge source for the springs coincides with the competent bed rock within the drainage area. A 1 percent reduction in the drainage area and spring flow would result in a negligible impact to the wetland. The south-east wetland shows no indication of significant natural features, functions or strong indication of the potential for such value to occur.

Neither wetland has been identified as a significant natural feature and thus do not require protection.

[Gorrell Investigations (Gorrell)]

- 7) **General Comments (Pg. 8):** *Better mapping useful for forest cover on the plateau to allow comparison of total resource, area of forest in study area, and area of forest to be eliminated by expansion.*



Attached as Figure 3 is the best available mapping of forest cover within the plateau and connecting woodlands. Total forest cover for the plateau is 924.06 ha. This area calculation does not take into account significant fragmentation (residences, roadways, etc.) found within the plateau.

The total forest cover area to be extracted by expansion of the quarry is 50.41 ha. This results in a 5.5% loss of forest cover within the plateau.

This loss of forest cover will not be significant.

[SBA]

- 8) **General Comments (Pg. 9):** *Not identified in report who or how the "significant wildlife area" was identified. Significant Wildlife Area (Protection Area) does not include most rare specimens. No discussion on impacts to designated deer yard.*

The Significant Wildlife Area (SWA) delineates the area determined through on-site and aerial photographic investigations to include a) the most intact (undisturbed) portions of rare Coniferous Alvar Forest and Alvar Glade habitats, b) the highest concentration of populations of Provincially Significant plant species, c) the largest area of continuous forest habitat in the Braeside Quarry expansion area, and d) virtually all Regionally Significant natural values known from the Braeside Quarry Expansion area. Identification of the SWA thus permits us to focus conservation management efforts on the area of greatest ecological importance.

The extent of Deer Yard within the Braeside Property was not considered in the definition of the SWA. White-tailed Deer are now commonly associated with virtually any large woodland area with at least some coniferous cover in southeastern Ontario (Broadfoot and Voigt 2000; pers. obs.). The presently unnaturally high deer population has reached nuisance and public hazard proportions in much of eastern Ontario (Broadfoot and Voigt 2000, Tighman 1989) and also constitutes a significant threat to native vegetation quality. Consideration of deer yard significance is addressed separately, however, in the Natural Environment Level I & II report (Skelton Brumwell 2007).

[Brunton]

- 9) **General Comments (Pg. 9):** *Exact area of plant community losses relative to total area of the affected plant communities not quantified.*

The proportion of each habitat type that would be eliminated by the proposed extraction of the Braeside Quarry Expansion Area is calculated below. This represents the total area of each habitat in the Braeside Quarry Expansion Area minus those portions contained within the Significant Wildlife Protection Area and other development exclusion areas.



Habitat type	Total Area for Each Habitat (ha)	Total Area Disturbed (ha)
1 - Developed (Transformed)	28.1	n/a - not of ecological significance
2 - Cultural Meadow and Thicket	9.5	n/a - not of ecological significance
3 - Alvar Glade and Pavement	2.4	0.7
4 - Alvar Coniferous forest	56.7	30.7
5 - Young Upland Mixed Forest	15.5	8.8
6 - Mature Upland Mixed Forest	4.7	2.9
7 - Upland Coniferous Forest and Scrub	10.0	5.9
8 - Coniferous Swamp Forest	3.5	0
9 - Mixed Swamp Forest	2.3	0

The only significant habitats impacted by the proposed Braeside Quarry expansion are Treed Alvar and associated Alvar Glade vegetation, with 54% and 29%, respectively, of these habitats eventually being eliminated. All documented features and functions of these two habitats, however, are known to occur within the Significant Wildlife Protection Area. Populations of significant species are large enough and areas within which ecological functions operate are large enough to ensure all of these features and functions are self-sustainable within the SWPA.

[Brunton]

- 10) **General Comments (Pg. 9):** *Negative impact on ecological functions of adjacent areas not discussed.*

Field investigations were limited to the subject property, as adjacent lands are privately owned. A review of previously identified natural heritage features was completed for adjacent lands within 120 metres. Only one feature was identified bordering on the limit of adjacent lands, being the southeast wetland. This wetland is addressed in Comment #6.

Direct impacts to habitat will be limited to the expansion area only. Mitigation measures have been recommended to ensure no negative impacts as defined by the PPS to features and functions within the expansion area. As such, no negative impacts are anticipated on natural features and functions within adjacent lands.

[SBA]

- 11) **General Comments (Pg. 9):** *Increase in volume of discharge to Ryan Creek and groundwater drawdown not clearly identified and discussed.*



The Hydrology Report identifies the de-watering pumps and capacities, monthly pumped volumes, calculates mean and median monthly flow, mean annual flow and baseflow for Ryan Creek, estimates discharge to Ryan Creek associated with de-watering operations, calculates de-watering thermal impact on Ryan Creek, includes fish and aquatic habitat surveys completed by Muncaster Environmental (see attached) and outlines surface water monitoring and contingency plans to safeguard Ryan Creeks aquatic ecosystem.

Ryan Creek appears to best fit the MOE pike/darters/sunfish category given the observed potential pike habitat, cool/warm water temperatures and lack of trout habitat. This category has a maximum annual water temperature range of 31 C to 35 C. However sculpins are widely distributed throughout Ryan Creek. Thus a water temperature target of 22 C was recommended.

De-watering is primarily conducted in wet weather seasons (60.9% spring/18.7% fall) with 20.4 % occurring in the summer when thermal impacts are critical. Mass balance calculations show the creek temperature increasing from 19.5 C to 20.6 C for August during ultimate quarry de-watering operation. This maximum daily temperature is 1.4 C below the maximum annual water temperature threshold of 22 C which is typical for brook trout (cold water fish), as per the MOE biophysical performance standards for aquatic ecosystems.

The Hydrology Report concludes that the ultimate quarry de-watering operation will not result in harmful alteration or destruction of fish habitat. As a result of Golder comments, a sensitivity analysis was completed assuming 50, 75 and 100% of the dewatering discharge reaching Ryan Creek. This analysis determined that all thermal impacts will be below the maximum annual water temperature of 22 C.

[SBA]

The issue of the contribution of the groundwater at the quarry to base flow at Ryan Creek was evaluated. The site setting, hydrogeology, geology and hydrology between the site and Ryan Creek have been regularly observed by GRI since monitoring for the discharge permit began in 2007.

There is an interconnected surface water – shallow groundwater flow system on the plateau and surrounding area that includes runoff, surface water accumulations on competent bedrock and two levels of springs on the escarpment face on both the east and west side of the upland. The mapping of flow consistently shows that it emerges finally at the base of the escarpment in the lower springs (GRI, 2009). Just down-slope on the plain below the escarpment, clay on the order of 7 m thick was deposited. This clay has a very low primary and secondary hydraulic conductivity, and correspondingly very low transmissivity. Any groundwater originating from the escarpment emerges as springs to the surface at the base of the escarpment or continues downward through the bedrock flow system.

Due to the low hydraulic conductivity/ transmissivity of the clay, any well or other discharge point such as the creek would be capturing groundwater from no further than 200 to 300 m. Therefore, no groundwater from the escarpment, either from the quarry site or the plateau itself is providing base flow to Ryan Creek.

Similarly, runoff from the quarry only intermittently reaches Ryan Creek. Flows from the discharge point on the quarry site through to Ryan Creek were regularly documented by GRI staff starting in April 2009 through to present to evaluate the existing condition. Groundwater that emerges as springs at the base of the escarpment drains overland through the roadside drainage network. During



periods of peak flow, such as spring runoff or in significant precipitation events (such as the 1:100-year or more- severity storm that occurred on July 24, 2009), runoff from the base of the escarpment combined with runoff through the drainage network from Osborne Street, down Campbell Road and then along Carmichael Road does reach Ryan Creek, but this period is brief – 4 to 6 weeks annually, predominantly in the spring runoff period. During these peak events there is now and will continue to be some contribution from present and future operations to the creek flow. In periods other than these peak or anomalous events, or for 85 to 90% of the year, the flow in the drainage system was observed to end consistently at a point on Campbell Drive, approximately 375 m down flow from Osborne Street.

This pattern will continue through the life of the operations. Based on the observations, it is predicted that the contributions to Ryan Creek will not change from the existing condition.

[Gorrell]

We believe that the supplemental information provided satisfies the peer review concerns relative to potential impacts on natural heritage features and functions.

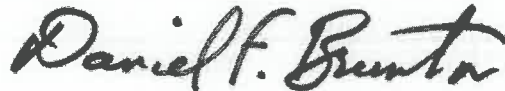
Upon acceptance of the additional information included in this response, both the Natural Environment Report Level I & II and the Natural Environment Assessment will be revised and provided to the Township and Golders.

If you or Golders have any questions, please contact us.

Yours truly
Per



Kyle Fleming, BSc (Wildlife)
Environmental Planner/Biologist
Skelton, Brumwell & Associates



Daniel Brunton
Brunton Consulting Services

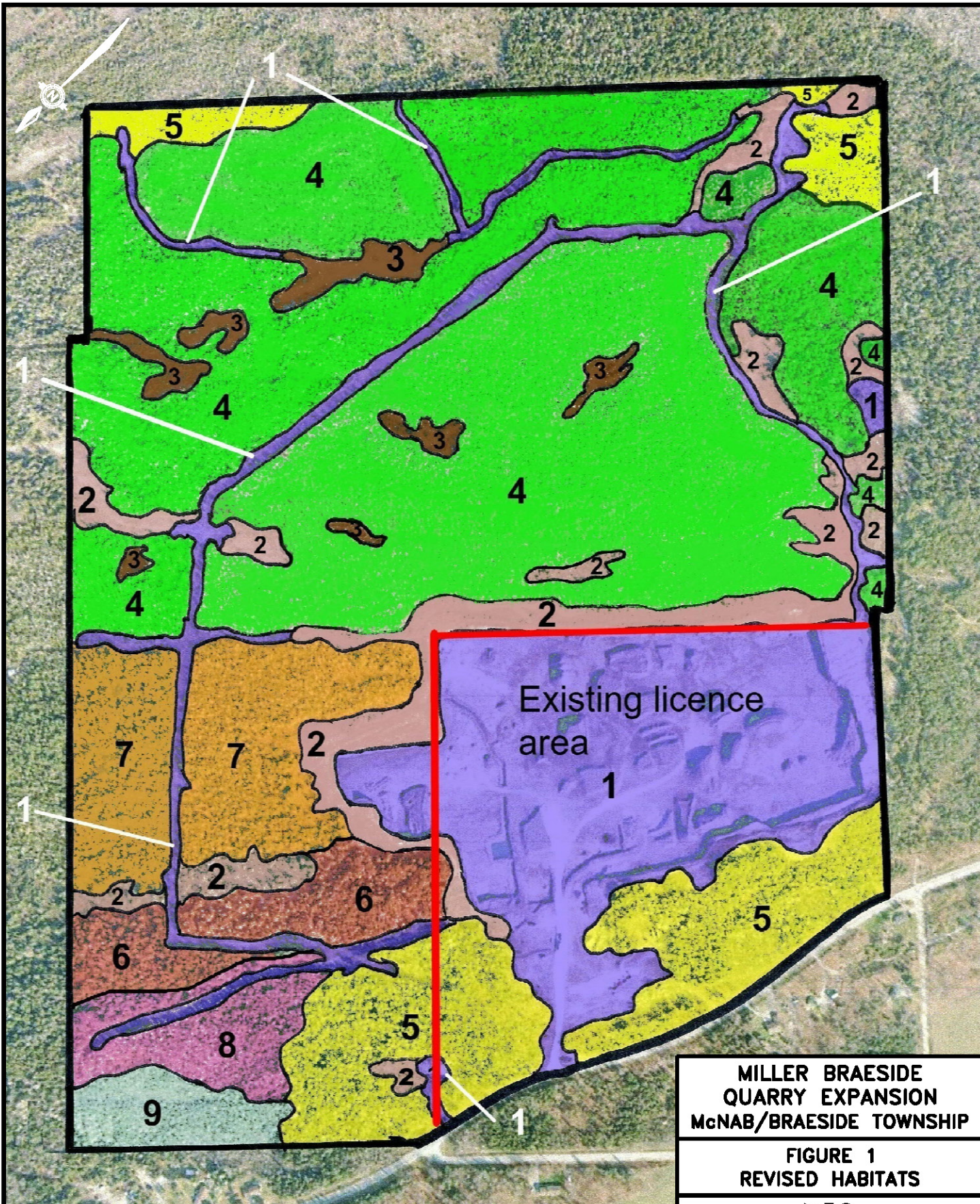
Attach.

cc: Gorrell Investigations Inc.

JKF/DB/gkb/bal

C-09-340





**MILLER BRAESIDE
 QUARRY EXPANSION
 McNAB/BRAESIDE TOWNSHIP**

**FIGURE 1
 REVISED HABITATS**

N.T.S.

P/N 2033 | DEC. 2009

**Skelton Brumwell
 & ASSOCIATES INC.**

CONSULTING ENGINEERS & PLANNERS
 83 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
 TELEPHONE (705) 726-1141 FAX (705) 726-0331

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LEGEND

- - - - - PROPOSED EXPANSION AREA
- - - - - EXISTING QUARRY
- - - - - LIMIT OF FOREST COVER

**MILLER BRAESIDE
 QUARRY EXPANSION
 McNAB/BRAESIDE TOWNSHIP**

**FIGURE 2
 FOREST COVER**

Scale 1: 40,000

P/N 2033 DEC. 2009

	Skelton Brumwell & ASSOCIATES INC
---	--

CONSULTING ENGINEERS & PLANNERS
 93 BELL FARM ROAD, SUITE 107 BARRIE, ONTARIO L4M 5G1
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Source: Google Maps

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**MILLER BRAESIDE
QUARRY EXPANSION
McNAB/BRAESIDE TOWNSHIP**

**FIGURE 3
DISTANCE TO SE WETLAND**

Scale 1:5000

P/N 2033 | DEC. 2009

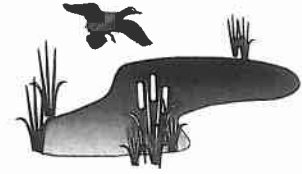
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& ASSOCIATES INC.**

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Miller Braeside Quarry Expansion

Breeding Birds & Incidental Wildlife Observations- June 2-2009

Common Name	Scientific Name	Status (SRANK)
BREEDING BIRDS		
Ruffed Grouse	<i>Bonasa umbellus</i>	S5
Broad-winged hawk	<i>Buteo platypterus</i>	S5B
Veery	<i>Catharus fuscescens</i>	S4B
Brown Creeper	<i>Certhia americana</i>	S4B
Belted Kingfisher	<i>Ceryle alcyon</i>	S4B
Northern Flicker	<i>Colaptes auratus</i>	S4B
American Crow	<i>Corvus brachyrhynchos</i>	S5B
Common Raven	<i>Corvus corax</i>	S5
Blue Jay	<i>Cyanocitta cristata</i>	S5
Blackburnian Warbler	<i>Dendroica fusca</i>	S5B
Yellow warbler	<i>Dendroica petechia</i>	S5B
Black-throated Green Warbler	<i>Dendroica virens</i>	S5B
Grey Catbird	<i>Dumetella carolinensis</i>	S4B
Willow Flycatcher	<i>Empidonax traillii</i>	S5B
Wood Thrush	<i>Hylocichla mustelina</i>	S4B
Song Sparrow	<i>Melospiza melodia</i>	S5B
Black and White Warbler	<i>Mniotilta varia</i>	S5B
Indigo Bunting	<i>Passerina cyanea</i>	S4B
Downy Woodpecker	<i>Picoides pubescens</i>	S5
Black –Capped Chickadee	<i>Poecile atricapilla</i>	S5
Ovenbird	<i>Seiurus aurocapilla</i>	S4B
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	S5B
Chipping Sparrow	<i>Spizella passerina</i>	S5B
Brown Thrasher	<i>Toxostoma rufum</i>	S4B
American Robin	<i>Turdus migratorius</i>	S5B
Nashville Warbler	<i>Vermivora ruficapilla</i>	S5B
Red-eyed Vireo	<i>Vireo olivaceus</i>	S5B
White-throated sparrow	<i>Zonotrichia albicollis</i>	S5B
AMPHIBIANS		
Green Frog	<i>Rana clamitans</i>	S5
Wood frog	<i>Rana sylvatica</i>	S5
Eastern Newt	<i>Notophthalmus viridescens viridescens</i>	S5
MAMMALS		
White-tailed Deer	<i>Odocoileus virginianus</i>	S5
Eastern Cottontail	<i>Sylvilagus floridanus</i>	S5



September 22, 2009

Mr. Jay Clark, P. Eng.
Senior Project Engineer,
Skelton, Brumwell & Associates Inc.
93 Bell Farm Road, Suite 107
Barrie, Ontario
L4M 5G1

Dear Mr. Clark:

RE: Miller Braeside Quarry Expansion
Summary of Ryan Creek 2008 and 2009 Observations

This letter summarizes our 2008 and 2009 observations of the fish habitat and community in Ryan Creek in proximity to Carmichael Side Road and Campbell Drive. The observations are in support of the proposed Miller Braeside Quarry Expansion, and specifically with regard to the appropriate thermal requirements associated with the discharge outlet of dewatering from the quarry. The discharge outlet to Ryan Creek will be on the north side of Carmichael Side Road.

Memorandums dated November 28th and December 9th, 2008 and September 16th, 2009 detail our methodology and findings. The autumn 2008 work focused on a fish habitat assessment of Ryan Creek, with sampling of the fish community completed between Carmichael Side Road and Campbell Drive in the spring of 2008 and a water temperature survey was done in the summer of 2009.

In general, the fish habitat consisted of a slow moving glide with fully vegetated banks. The banks were failing in many locations. Fallen trees provided large woody debris cover as the result of the erosion and abundant beaver activity. The substrate was dominated by fines with an area of clumping clay located immediately downstream of Carmichael Side Road that may act as gravel in terms of substrate. The presence of juvenile white suckers and creek chub would support that spawning within the gravel size clay occurs. No upwellings or watercress were observed where there was the gravel sized clay substrate. No trout or redds were observed during the autumn field review or captured during the early spring sampling. Furthermore the width-to-depth ratios were generally greater than those found in watercourses supporting trout and fines dominated by clay represented the vast majority of exposed substrate, providing little potential trout spawning habitat.

Based on the absence of riffles, very limited amount of cobble, rubble and small boulder material and dominance of fine substrate, the aquatic ecosystem objectives for supporting trout are greatly lacking in the study area. In addition, the large amount of erosion throughout the area observed would result in infilling of the redds and impede the successful hatching of any salmonid eggs. As summarized below the observed summer water temperatures are too warm to support a viable brook trout population.

The fish community sampling with a backpack electrofisher indicate Ryan Creek in the vicinity of Carmichael Side Road and Campbell Drive supports a diverse assemblage of common cool water fish species, with nine species observed (creek chub, white sucker, blacknose dace, common shiner, northern redbelly dace, brook stickleback, bluntnose minnow, mottled sculpin and central mudminnow). No fish species of special concern were netted. Mottled sculpin, which was netted at all five sites, has a preference for cold water but is frequently observed in cool water systems. No external evidence of disease or other stressors were observed on the fish netted.

A water temperature of 24.5°C was recorded at 16:00 on August 17th, below the surface in a water depth of 41cm downstream of the small riffle upstream of the culvert on the north side of Carmichael Side Road, with a water temperature of 25.0°C recorded below the surface in a water depth of 23cm upstream of the small riffle upstream of the culvert. The corresponding air temperature was 32°C. Using the graph in the Fisheries and Oceans Canada protocol to determine the thermal condition of the watercourse, the combination of maximum air temperature and water temperature at 16:00 would place Ryan Creek in this location just above the threshold for coolwater conditions. 25°C is the upper limited for coolwater status.

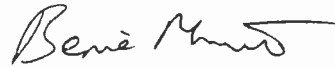
CONCLUSION

Applying the aquatic performance standards in Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives, in Appendix F of MOE's Stormwater Management Planning and Design Manual, the appropriate aquatic ecosystem objective among the four options (brook trout, brook trout/rainbow trout, pike/darters/sunfish and longnose dace/brown bullhead/brook stickleback) appears to be pike/darters/sunfish given the potential pike habitat observed, cool/warm water temperatures and the lack of suitable trout habitat.

The water temperature survey suggests the reach of Ryan Creek in proximity to the proposed discharge location borders between cool and warmwater fish habitat. No evidence of potential trout utilization or suitable trout habitat was observed during the field surveys. However, sculpins are widely distributed through this reach of Ryan Creek. Mottled sculpins prefer cold water but are frequently observed in coolwater systems. Thus a water temperature target of 22°C, representing the middle of the temperature range for coolwater systems, is recommended.

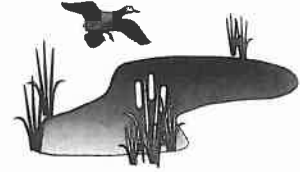
Please call if you have any questions on the above summary.

Yours Sincerely,
MUNCASTER ENVIRONMENTAL PLANNING INC.



Bernie Muncaster, M.Sc.
Principal

jcbraesumlet



INTEROFFICE MEMORANDUM

To:	Jay Clark, P. Eng., Senior Project Engineer, Skelton, Brumwell & Associates Inc. – 9 pages
From:	Bernie Muncaster, Muncaster Environmental Planning Inc.
Date:	November 28 th , 2008
Subject:	Miller Braeside Quarry Expansion Ryan Creek Autumn, 2008 Observations

Hello Jay,

The following is a summary of our field review of Ryan Creek.

Methodology

The field review was completed outside of the growing season, on November 18, 2008. Recent rain events preceded the site review. Ryan Creek was reviewed from upstream of Carmichael Side Road to downstream of Campbell Drive. The purpose of the site review was to complete a reconnaissance of the aquatic habitat taking note of potential barriers, available spawning habitat and the general morphology, with an emphasis on potential trout utilization. Transects were completed where possible (wadeable, accessible) and not at any predetermined interval. The data collected from transects provide an indication of the site's characteristics and should not be used to determine abundance of available habitat.

General Observations on Potential Pike and/or Trout Spawning in Ryan Creek

In general the project area contained moderate to good potential pike spawning along the floodplain (see Figure 4) and within the flooded area (flooded by beaver activity) and little potential trout spawning habitat. The banks were fully vegetated. The vegetation included reed canary grass, goldenrod, fern and bulrush. These potential spawning sites were of varying lengths and widths ranging from 20 – 200 m long and 5 – 30 m wide. No gravel, pebbles or sufficient cobbles were observed for trout spawning however it may be possible that the hard packed clay in gravel form could meet the spawning requirements for trout (see Figure 2). No trout or redds were observed at the time of the visit.

Potential Barriers to Fish Movement

There were seven beaver dams present within the reaches of Ryan Creek reviewed, four of which were active (see Figure 3). The first and second active beaver dams were 341 m and 281 m downstream of Campbell Drive. The third was in the upstream portion of the culvert on Campbell Drive. The last active beaver dam was in the upstream portion of the culvert on Carmichael Side Road. All four active dams were in excellent condition and considered a potential non-permanent barrier to fish movement. The three abandoned beaver dams were located between Campbell Drive and Carmichael Side Road. These abandoned beaver dams were in poor condition and did not create a barrier to fish movement.

An additional barrier during periods of low flow is present 342 m downstream of Campbell Drive, where there is an abrupt fall of 50 – 100 cm in the elevation of the channel bed. Immediately downstream of the barrier were two plunge pools which had an average maximum depth of 40 cm.

Descriptions of Each Reach

The reviewed portion of Ryan Creek is broken down into five sites (see Figure 1), with the following descriptions for individual reaches

Site 1. Downstream of Campbell Drive, Downstream of Falls (18T 387930 5034965)

The water temperature was 2°C at 13:15 (Appendix A). The average wetted width was 100 cm. The average water depth was 13 cm. The habitat type consisted of run morphological units with two plunge pools. The average drop was 75 cm and the average maximum plunge pool depth was 40 cm. The substrate was composed of hard packed clay in gravel/pebble form (10 – 50 mm). No in-stream cover was recorded. There was no in-stream vegetation at the time of the visit. Note that the visit occurred outside of the growing season. There were no visible signs of erosion.

The stream banks were fully vegetated. Riparian vegetation included reed canary grass, goldenrod. There was no canopy cover throughout the site.

This site contained moderate pike spawning habitat and possibly potential trout spawning sites depending on their readiness to use clay “gravel/pebble” (see Figure 2).

Site 2. Downstream of Campbell Drive, Upstream of Falls (18T 387906 5034996 to 18T 387631 5035067)

The reach length was 341 m. The water temperature was 2°C at 14:00 and the air temperature was -2°C (Appendix A). The average channel and wetted widths were 4000 cm and 4000 cm. The average water depth was 48 cm (range 19 - >100 cm). The habitat consisted of a beaver pond upstream of a well maintained beaver dam. The substrate was composed of fines.

Occasional large woody debris represents in-stream structure. There was no in-stream vegetation at the time of the visit. Note that the visit occurred outside of the growing season. There were no visible signs of erosion.

Watercress was present along the bank edge at one location (see Figure 2). The presence of watercress could signify ground water discharge. While no change in water temperature was noted, this could have been the result of flooding.

The stream banks were fully vegetated. Riparian vegetation included reed canary grass, goldenrod and watercress (as discussed above). There was no canopy cover.

This site contained good pike spawning habitat and no potential trout spawning sites.

**Site 3. Upstream of Campbell Drive, Flooded Portion
(18T 387603 5035061 to 18T 387364 5035191)**

The site length was 345 m. The water temperature was 2°C at 10:56, TDS was 323 ppm, conductivity was 636 µs and the air temperature was -1°C (Appendix A). The average channel and wetted widths were 1700 cm and 450 cm. The average water depth was 60 cm (range 41 - >100 cm). The habitat consisted of a beaver pond as result of recent beaver activity at the upstream end of the Campbell Drive culvert. The substrate was composed of fines. Large woody debris in the form of two fallen trees in the creek represents in-stream structure. No in-stream vegetation was present at the time of the visit. Note that the visit occurred outside of the growing season. There were no visible signs of erosion.

Watercress was present along the bank edge at one location (see Figure 2). The presence of watercress could signify ground water discharge. While a slight change in water temperature was noted (5°C), this could have been the result of flooding.

The stream banks were fully vegetated. Riparian vegetation included white spruce, Manitoba maple, reed canary grass, goldenrods, ferns, bulrushes and watercress. There was no canopy cover.

This site contained moderate pike spawning habitat and no potential trout spawning sites.

**Site 4. Upstream of Campbell Drive, Non-flooded Portion
(18T 387364 5035191 to 18T 386959 503527)**

The site length was 555 m. The water temperature was 2°C at 12:24 (Appendix A). The average channel and wetted widths were 1283 cm and 262 cm. The average bankfull depth was approximately 50 cm and the average water depth was 28 cm (range 4 – 70 cm). The habitat type consisted of glide and run morphological units with one pool. The maximum pool depth was 60 cm. The substrate was composed of fines dominated by clay with occasional sand and very little cobble. The clay was hard packed some of which formed gravels/pebbles (1 -30 mm). Cobble provided in-stream cover at 6 % of the points. Large woody debris was also available as

cover but not present along any transects. There was no in-stream vegetation at the time of the visit. Note that the visit occurred outside of the growing season. Occasional undercutting was observed along the banks. The undercut banks would only provide cover to fish during extreme high flows. An exposed gravel outcrop was present downstream from the culvert at Carmichael Side Road. Three previously mentioned abandoned beaver dams were in this reach.

The stream banks were fully vegetated. Riparian vegetation included white spruce, Manitoba maple, reed canary grass, goldenrod, ferns and bulrush. There was no canopy cover.

This site contained moderate pike spawning habitat and maybe potential trout spawning sites depending on their readiness to use clay "gravel/pebble".

Site 5. Upstream of Carmichael Side Road. (18T 386934 5035354)

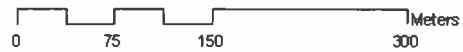
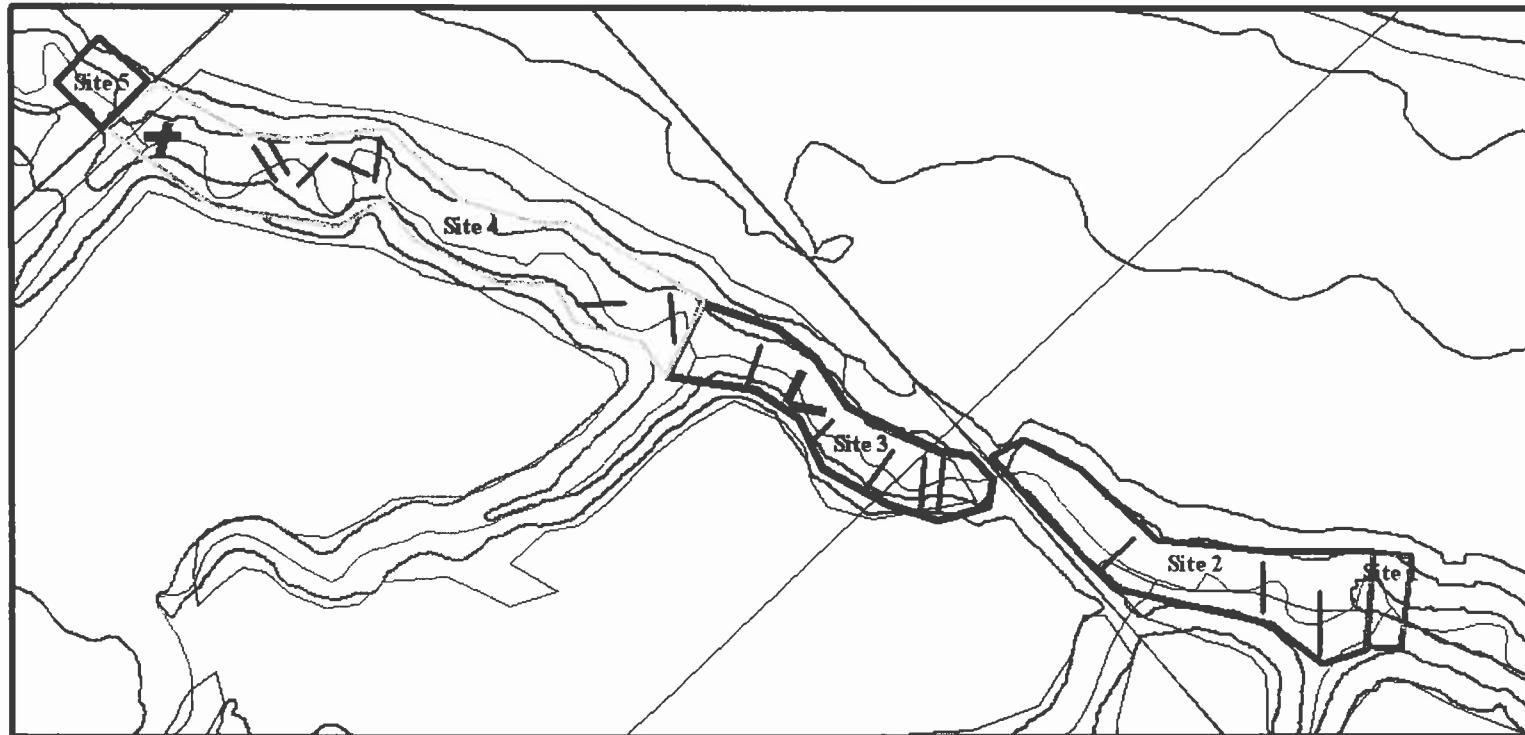
Access to this site was limited due to electrical fencing crossing the creek near the culvert. Cattle were present and grazing in the enclosure and had access to the creek. An active beaver dam was in the upstream portion of the culvert under Carmichael Side Road. The stream banks were vegetated but grazed.

Please call if you have any questions on the above observations.

Bernie Muncaster
Muncaster Environmental Planning Inc.
bmuncaster@rogers.com

braesidenovfieldmemo

Location of Sites and LWD



Legend

- LWD
- ⊕ Multiple LWD

Bowfin Environmental Consulting Inc.

November 27, 2008

Location of "Gravel/Pebble" Clay



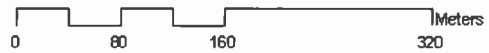
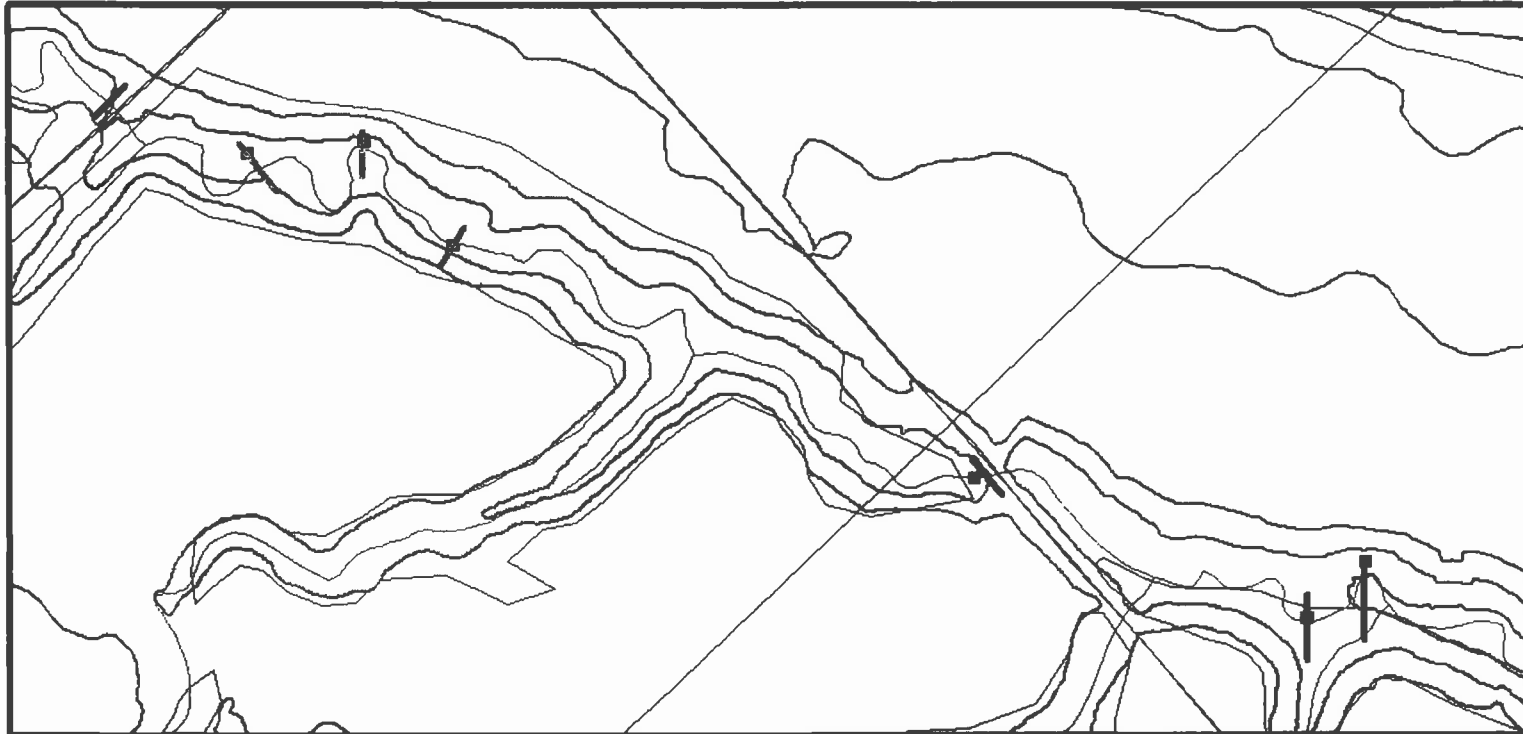
(Basemap from OBM)





Legend

- ★ Location of Watercress
- Location of "gravel/pebble" Clay

Location of Beaver Dams



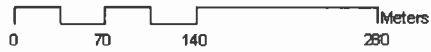
Legend

-  Active Beaver Dam
-  Abandoned Beaver Dam

Bowfin Environmental Consulting Inc.

November 27, 2008

Location of Potential Pike Spawning Habitat



Legend



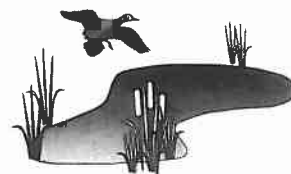
Bowfin Environmental Consulting Inc.

November 27, 2008

APPENDIX A

Table 1 Summary of Water Quality Results

Date	Time	Location	Air Temp (°C)	Water Temp (°C)	TDS (ppm)	Cond. (µs/cm)
November 18, 2008	10:56	Ryan Creek Mark 001	-1	2	323	636
November 18, 2008	11:26	Ryan Creek Mark 007		2		
November 18, 2008	11:32	Ryan Creek Mark 010		5		
November 18, 2008	11:39	Ryan Creek Mark 011		2		
November 18, 2008	11:40	Ryan Creek Mark 012		2		
November 18, 2008	12:00	Ryan Creek Mark 015		2		
November 18, 2008	12:17	Ryan Creek Mark 019		2		
November 18, 2008	12:24	Ryan Creek Mark 020		2		
November 18, 2008	13:15	Ryan Creek Mark 024		2		
November 18, 2008	14:00	Ryan Creek Mark 031	-2	2		



INTEROFFICE MEMORANDUM

To:	Jay Clark, P. Eng., Senior Project Engineer, Skelton, Brumwell & Associates Inc. – 3 pages
From:	Bernie Muncaster, Muncaster Environmental Planning Inc.
Date:	December 9 th , 2008
Subject:	Miller Braeside Quarry Expansion Ryan Creek – Application of MOE Aquatic Ecosystem Objectives Criteria

Hello Jay,

Further to our memorandum of November 28th summarizing our autumn field observations, I have reviewed the field observations in relation to Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives, in Appendix F of MOE's Stormwater Management Planning and Design Manual.

There are seven aquatic performance standards in Table F.1 used to determine the appropriate aquatic ecosystem objective among brook trout, brook trout/rainbow trout, pike/darters/sunfish and longnose dace/brown bullhead/brook stickleback. Field information was collected on five of the performance standards; channel morphology, in-stream cover, substrate, riparian habitat and barriers, and they are discussed individually below:

Channel Morphology

This standard evaluates the characteristics of pools, riffles and bankfull width-to-depth ratio. Riffles were lacking throughout the review area from Carmichael Side Road to downstream of Campbell Drive. Three pools were observed downstream of culverts and elevation drops. The width-to-depth ratios are influenced by beaver dams and associated ponding and are generally appear greater than 10:1. As aquatic ecosystem objectives to support trout stipulate bankfull width-to-depth ratios less than 10, and representation of riffles and pools greater than 10 and 4 percent, respectively, the current channel morphology conditions appear greatly lacking in meeting the objectives for supporting trout populations.

In-Stream Cover

On the positive side, large woody debris (lwd) is present throughout the study area (see Figure 1 of the November 28th memorandum), however overhead cover is almost nil. Total in-stream cover also appears lacking due to the absence of boulders and very limited undercut banks and other forms of potential in-stream structure. Note that the late time of the field review (November 18th) precluded observations on the extent of aquatic vegetation. The targets for brook trout with respect to overhead and in-stream cover are not currently achieved in the study area

Substrate

No gravel, pebbles or sufficient cobbles were observed for trout spawning however it may be possible that the hard packed clay in gravel form could meet the spawning requirements for trout (see Figure 2 of the November 28th memorandum). No trout or redds were observed during the November 18th field review. Based on the absence of riffles, very limited amount of cobble, rubble and small boulder material and dominance of fine substrate, the aquatic ecosystem objectives for supporting trout are greatly lacking in the study area based on substrate requirements.

Riparian Habitat

Two components, shading and woody debris, are represented for this criterion. As indicated above, woody debris is generally well represented and overhead cover to provide shading is lacking.

Barriers

Along with substrate and channel morphology factors, a series of barriers in the study area is a primary deficiency in meeting the trout aquatic ecosystem objectives. Seven beaver dams are present within the reaches of Ryan Creek reviewed, four of which were active (see Figure 3 of the November 28th memorandum). Although the beaver dams are not permanent structures, their large number indicates beaver dams in some form are a well-established component of the ecosystem. In addition, another barrier during periods of low flow is present downstream of Campbell Drive, where there is an abrupt fall of 50 – 100 cm in the elevation of the channel bed.

Summary

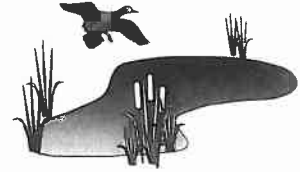
The aquatic ecosystem objectives for supporting trout are greatly lacking in the study area due to a dominance of run morphological units, with no riffles and very few pools. A very limited amount of coarse substrate is present, along with almost nil canopy cover. The characteristics of the study area appear more consistent with the aquatic performance standards to support the pike/darters/sunfish assemblage. Potential northern pike spawning habitat appears relatively common through the study area.

Table F.1 is designed to assist in defining aquatic objectives for target species and defining required standards to meet aquatic objectives. A comparison to the actual physical and biological conditions has identified several performance standards which appear limiting, including channel morphology, substrate, riparian habitat and barriers.

Please call if you have any questions on the above observations.

Bernie Muncaster
Muncaster Environmental Planning Inc.
bmuncaster@rogers.com

braesidetableF1memo



INTEROFFICE MEMORANDUM

To:	Jay Clark, P. Eng., Senior Project Engineer, Skelton, Brumwell & Associates Inc. – 12 pages
From:	Bernie Muncaster, Muncaster Environmental Planning Inc.
Date:	September 16 th , 2009
Subject:	Miller Braeside Quarry Expansion Ryan Creek Spring and Summer, 2009 Observations

Hello Jay,

The following is a summary of our field reviews and analysis of Ryan Creek undertaken in 2009.

METHODOLOGY

The 2009 field reviews consisted of two components, a spring fish sampling survey and an August water temperature survey. The spring fish sampling survey was completed on May 12th, 2009. Ryan Creek was sampled with a backpack electrofishing unit at five locations from Carmichael Side Road to upstream of Campbell Drive. The station lengths varied between 40 and 50 metres, with sampling beginning at the downstream end and continuing upstream in a zigzag fashion through the channel. All fish netted were identified in the field, measured and released downstream. In addition to the fish sampling, fish habitat observations were made, including potential barriers to fish movement and features of the channel morphology.

The purpose of the spring fish sampling was to identify the fish community utilizing Ryan Creek and the associated thermal and other sensitivities of the fish species comprising the fish community.

The summer water temperature was taken on August 17th, 2009, following Department of Fisheries and Oceans protocol (Stoneman and Jones, 1996). The maximum air temperatures on August 14th and 15th were 30°C, with a maximum air temperature of 31°C on August 16th. The maximum air temperature on August 17th was 32°C. This provided consistent previous air temperatures as required in the protocol. The water temperatures were taken between 16:00 and 16:06 in well mixed sections of the main flow upstream of the Carmichael Road culvert.

FISH SAMPLING RESULTS

The following site summaries begin at the downstream end of the sampling, upstream of Campbell Drive and continue upstream to Carmichael Side Road. The water depths were too deep for backpack electrofishing downstream of Site 1.

**Site 1. 175 metres Upstream of Campbell Drive
(18T 387453 5035151 to 18 T 387431 5035136)**

The site length was 40 metres. At 11:34 on May 12th, 2009 the following water quality results were recorded: water temperature 11.0°C, air temperature 14.0°C, pH 7.04, conductivity 240 µs, and total dissolved solids 179 ppm. The average channel and wetted widths were 538 cm and 458 cm, respectively. The average bankfull depth was 63 cm and the average water depth was 35 cm (range 13 – 72 cm). The habitat type consisted of glide morphological units. The substrate was composed of fines. In-stream cover was provided at 100% of the points. The in-stream cover consisted of large woody debris (67%), and aquatic vegetation (67%). There were signs of erosion on the left bank.

The stream banks were moderately vegetated. Herbaceous vegetation was dominated by grasses followed by marsh marigold and sedges. The little canopy cover was provided by white spruce.

The area fished was 183 m² and the shock time was 599 seconds. A total of 71 fish representing five species were captured: white sucker, common shiner, creek chub, brook stickleback and mottled sculpin (Table 1).

Table 1 Site 1 – 175 metres Upstream of Campbell Drive, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	6	41-57
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	34	25-37
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	19	27-103
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	6	41-48
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	6	37-43
Total				71	

**Site 2. 350 metres Upstream of Campbell Drive
(18 T 387313 5035205 to 18 T 387277 5035248)**

The site length was 50 metres. At 12:48 on May 12th, 2009 the following water quality results were recorded: water temperature 12.0°C, air temperature 15.0°C, pH 7.08, conductivity 485 µs, and total dissolved solids 243 ppm. The average channel and wetted widths were 410 cm and 358 cm, respectively. The average bankfull depth was approximately 51 cm and the average water depth was 26 cm (range 6 – 58 cm). The habitat type consisted of glide morphological units. The substrate was composed of fines. There was no in-stream cover observed, although aquatic vegetation may have been underestimated due to the early timing of the survey. There were no signs of erosion.

The stream banks were moderately vegetated. The riparian vegetation consisted primarily of herbaceous vegetation such as grasses, sedges and aster with occasional woody vegetation (hawthorn, white spruce and bur oak). The little canopy cover was provided by white spruce, and bur oak.

The area fished was 179 m² and the shock time was 815 seconds. A total of 123 fish were captured representing seven species: central mudminnow, white sucker, common shiner, bluntnose minnow, creek chub, brook stickleback and mottled sculpin (Table 2).

Table 2 Site 2 – 350 metres Upstream of Campbell Drive, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	7	50-91
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	10	45-135
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	61	21-36
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	2	50-57
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	10	30-82
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	21	41-60
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	12	40-55
Total				123	

**Site 3. 200 metres Downstream of Campbell Drive, Flooded Portion
(18 T 387128 5035324 to 18 T 387096 5035274)**

The site length was 41 metres. At 13:41 on May 12th, 2009 the following water quality results were recorded: water temperature 13.0°C, air temperature 16.0°C, pH 7.06, conductivity 469 µs, and total dissolved solids 235 ppm. The average channel and wetted widths were 360 cm and 337 cm, respectively. The average bankfull depth was approximately 40 cm and the average water depth was 17 cm (range 4 – 32 cm). The habitat type consisted of glide morphological units. The substrate was composed of fines. In-stream cover was provided at 33% of the points. The in-stream cover consisted of large woody debris. Both banks were eroding and failing.

The stream banks were moderately vegetated by herbaceous vegetation consisting primarily of grasses. The little canopy cover was provided by white spruce and Manitoba maple.

The area fished was 138 m² and the shock time was 596 seconds. A total of 68 fish were captured representing eight species: central mudminnow, white sucker, northern redbelly dace, common shiner, bluntnose minnow, creek chub, brook stickleback and mottled sculpin (Table 3).

Table 3 Site 3 – Downstream of Carmichael Side Road, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	2	57-83
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	11	42-103
northern redbelly dace	<i>Phoxinus eos</i>	herbivore	cool / warm	1	55
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	13	28-67
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	7	50-68
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	15	33-103
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	5	47-52
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	14	44-93
Total				68	

**Site 4. 60 metres Downstream of Carmichael Side Road
(18 T 387028 5035306 to 18 T 386979 5035329)**

The site length was 45 metres. At 14:29 on May 12th, 2009 the following water quality results were recorded: water temperature 14.0°C, air temperature 17.0°C, pH 7.06, conductivity 479 µs, and total dissolved solids 236 ppm. The average channel and wetted widths were 400 cm and 277 cm, respectively. The average bankfull depth was approximately 41 cm and the average water depth was 14 cm (range 3 – 32 cm). The habitat type consisted of glide morphological unit. The substrate was composed of fines. There was no in-stream cover observed, however the quantity and diversity of the aquatic vegetation may have been underestimated due to the timing of the survey. There were no signs of erosion.

The stream banks were moderately vegetated. The riparian vegetation consisted primarily of herbaceous species such as grasses and aster with occasional woody vegetation (wild red raspberry and hawthorns). There was no canopy cover.

The area fished was 125 m² and the shock time was 524 seconds. A total of 84 fish representing 6 species were captured: central mudminnow, white sucker, common shiner, creek chub, brook stickleback and mottled sculpin (Table 4).

Table 4 Site 4 – 60 metres Downstream of Carmichael Side Road, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	3	45-55
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	1	58
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	52	27-130
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	19	33-80
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	5	40-50
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	4	50-93
Total				84	

Site 5. Carmichael Side Road

The pool located immediately downstream of the culvert at Carmichael Side Road was sampled briefly. The catch consisted of 14 fish representing six species: white sucker, common shiner, blacknose dace, creek chub, brook stickleback and mottled sculpin (Table 5).

Table 5 Site 5 - Carmichael Side Road, May 12th, 2009

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	1	
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	1	
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore / generalist	cool	1	62
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	1	
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	6	
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	4	
Total				14	

RYAN CREEK
2009 SPRING SAMPLING and SUMMER WATER TEMPERAURE OBSERVATIONS

Total Catch (May 12, 2009)

A total of 360 fish representing nine species were captured (Table 6).

**Table 6 Total Catch May 12th, 2009 Ryan Creek –
Campbell Drive to Carmichael Side Road**

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
central mudminnow	<i>Umbra limi</i>	insectivore / omnivore	cool / warm	12	45-91
white sucker	<i>Catostomus commersoni</i>	insectivore	cool	29	41-135
northern redbelly dace	<i>Phoxinus eos</i>	herbivore	cool / warm	1	55
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	161	21-130
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	9	50-68
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore / generalist	cool	1	62
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	64	27-103
brook stickleback	<i>Culaea inconstans</i>	insectivore	cool	43	40-60
mottled sculpin	<i>Cottus bairdi</i>	insectivore	cold	40	37-93
Total				360	

Table 7 List of Fish Species Netted and their Habitat Requirements

Species Name	Latin Names	General Habitat (Adult)	Reproductive guild	Spawning Period/Habitat	Spawning Temp (°C)
white sucker	<i>Catostomus commersoni</i>	Slow moving water, pools.	A.1.3 Non-guarder. Open substrate spawner. Rock and gravel spawners with benthic larvae.	Spring (April-May)	near 10°C
northern redbelly dace	<i>Phoxinus eos</i>	Quiet waters in ponds, lakes or streams. Can be found in bog lakes.	A.1.5 Non-guarder. Open substrate spawner. Obligate plant spawners. Scatter adhesive eggs onto submerged live or dead aquatic plants or recently flooded live terrestrial plants.	Spring – early summer	
central mudminnow	<i>Umbra limi</i>	ponds and pools with dense aquatic vegetation.	A.1.5 Non-guarders. Open substrate spawners. Scatter or deposit adhesive eggs onto submerged live or dead aquatic plants or recently flooded live terrestrial plants. Occasionally on wood. Adapted to low oxygen levels.	Spring	13-16°C
common shiner	<i>Notropis cornutus</i>	Streams dweller, prefers pools located below faster water. bottom velocities of 0.1-0.5 m/s.	B.2.3 Nest builder with high parental care. Eggs deposited on cleaned rocks or in dug gravel pits.	Spring	15-.6-18.3°C
bluntnose minnow	<i>Pimephales notatus</i>	Variety of habitats.	B.2.7 Nest spawner. High parental care. Deposits eggs underneath flat stones (occasionally uses logs)	Late spring - summer	19-26°C

Species Name	Latin Names	General Habitat (Adult)	Reproductive guild	Spawning Period/Habitat	Spawning Temp (°C)
blacknose dace	<i>Rhinichthys atratulus</i>	Inhabits runs and pools with clear water. Typically in fast flowing water with gravel.	A.1.3 Non guarder, open substratum spawner. Spawns within gravelly bottoms.	Spring	15-22°C
creek chub	<i>Semotilus atromaculatus</i>	Variable habitats, typically found in small streams <12m wide. prefer velocities lower than 0.3 m/s but have been found in velocities up to 0.6 m/s.	A.2.3 Non-guarders. Burry eggs in gravel nests. Clean rocks with fast flowing water or springs required.	Spring	≥12.8°C
brook stickleback	<i>Culaea inconstans</i>	Clear, cold water with dense vegetation.	B.2.4 Guardians, creates a nest using kidney secretion to bind together vegetation or algae.	Spring	15-19°C
mottled sculpin	<i>Cottus bairdi</i>	Cool streams and lakes often associated with sandy substrate in streams.	B.2.7 Nest builder with high parental care. Deposits eggs underneath rock or ledge.	Spring	5-16°C

(Balon 1981, Coker *et al.* 2001, McMahon 1982 and Scott and Crossman 1973)

FISH COMMUNITY SUMMARY

Ryan Creek in the vicinity of Carmichael Side Road and Campbell Drive supports a diverse assemblage of common cool water fish species, with nine species observed. No fish species of special concern were netted. Mottled sculpin, which was netted at all five sites, has a preference for cold water but is frequently observed in cool water systems. No external evidence of disease or other stressors were observed on the fish netted.

The habitat requirements of the fish species observed are provided in Table 7. The aquatic vegetation in the channel is important spawning habitat for many of the fish species, including central mudminnow, brook stickleback and northern redbelly dace. Other species will utilize the coarser substrate material found elsewhere in the Ryan and Dochart Creek systems.

The fish species observed have a range of sensitivity to sediment and turbidity. MTO (2006) classify the sensitivity of each species to sediment and turbidity for feeding, reproduction and respiration functions. Most of the fish species observed have a low or moderate sensitivity to sediment and turbidity for the three functions. However, creek chub is highly sensitive to sediment and turbidity for the feeding and respiration functions, with white sucker and blacknose dace highly sensitive for the respiration function. Common shiner has a moderate sensitivity to sediment and turbidity, while northern redbelly dace, brook stickleback, bluntnose minnow, mottled sculpin and central mudminnow have mixture of low and moderate sensitivity depending on the function.

SUMMER WATER TEMPERATURE RESULTS

Water temperatures were taken between 16:00 and 16:06 immediately upstream, north, of Carmichael Side Road. A water temperature of 24.5°C was recorded below the surface in a water depth of 41cm downstream of the small riffle upstream of the culvert on the north side of the road, with a water temperature of 25.0°C recorded below the surface in a water depth of 23cm upstream of the small riffle upstream of the culvert.

Using the graph in Stoneman and Jones (1996), the combination of maximum air temperature and water temperature at 16:00 would place Ryan Creek in this location just above the threshold for coolwater conditions. 25.0°C is the upper limited for cool water status in Coker et al. (2001).

However, we still recommend a target of 22°C given the wide spread presence of sculpins in the Creek during the spring sampling.

REFERENCES

Balon, Eugene K. 1981. Additional and amendments to the classification of reproductive styles in fishes. *Env. Biol. Fish.* Vol. 6 No. ¾. Pp: 377-389.

Coker, G.A, C.B. Portt, and C.K. Minns. 2001. Morphological and Ecological Characteristics of Canadian Freshwater Fishes. *Can. MS Rpt. Fish. Aquat. Sci.* 2554: iv+89 pp.

Environmental Guide for Fish and Fish Habitat, Section 5: Sensitivity of Fish and Fish Habitat, October 2006. Ministry of Transportation of Ontario

McMahon, Thomas E. 1982. Habitat Suitability Information: Creek chub. FWS/OBS-82/10.4. Fish and Wildlife Service US Department of the Interior. 30pp.

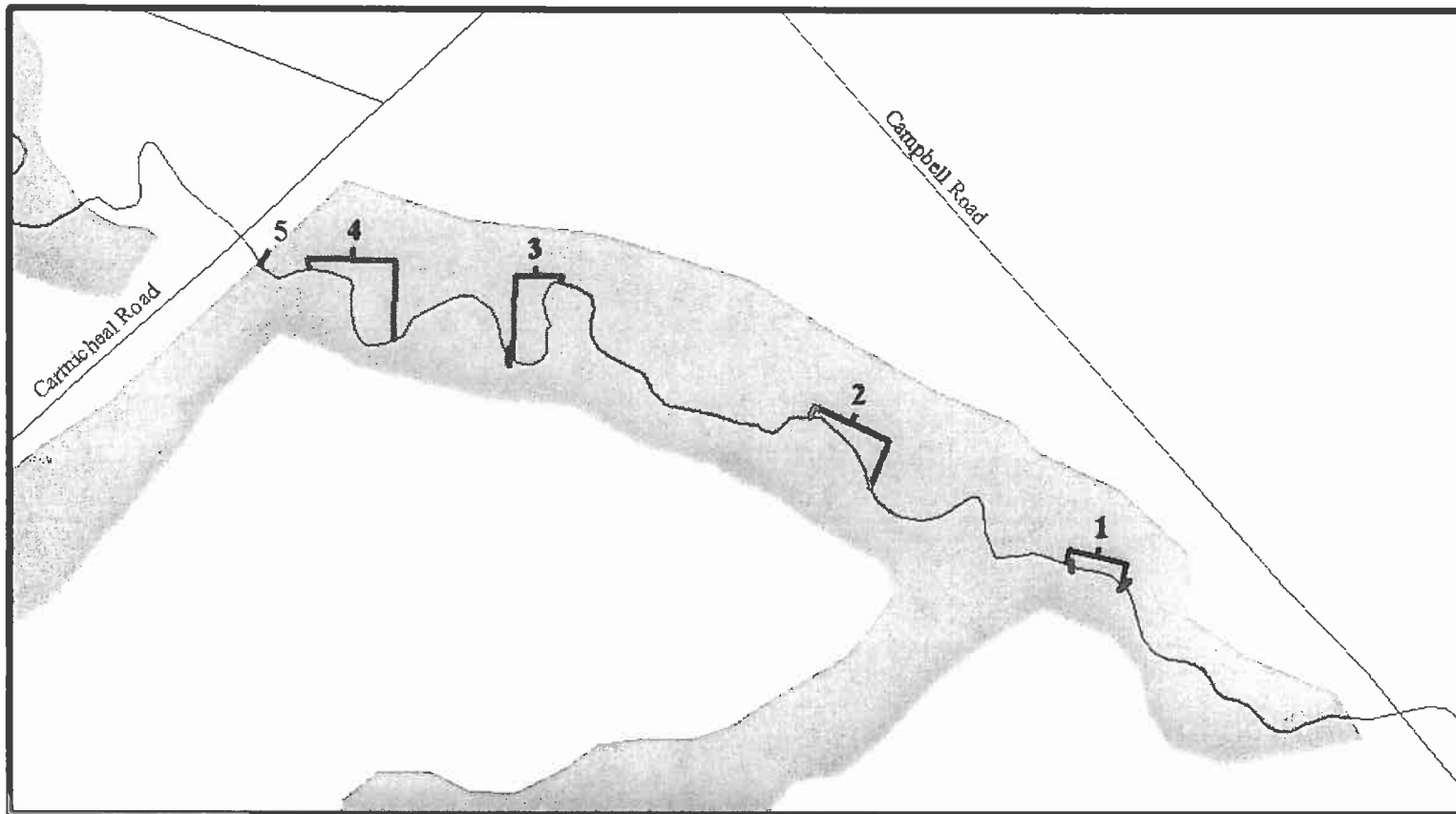
Scott and Crossman 1973. *Freshwater Fishes of Canada*. Bulletin 184. Fisheries Research Board of Canada, Ottawa 1973. 966pp.

Stoneman, C.L. and M. L. Jones. 1996. A simple method to evaluate the thermal stability of trout streams. 4 pp.

Please call if you have any questions on the above observations.

Bernie Muncaster. M.Sc.
Muncaster Environmental Planning Inc.
bmuncaster@rogers.com

braeside2009memo



(Basemap created from OBM)



Legend

-  Fish Sampling Site
-  Large Woody Debris



Skelton Brumwell

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CONSULTING
ENGINEERS
AND
PLANNERS

March 21, 2011

Golder Associates
2390 Argenta Road
Mississauga, ON L5N 5Z7

Attention: Jeff Kaiser
Senior Ecologist



Dear Jeff:

Re: Supplemental references for Natural Environment Peer Review of proposed Miller Braeside
Quarry Expansion
Our File: P/N 05-2033

Following conversations between Jeff Kaiser (Golder Associates), Gary Bell (Skelton Brumwell & Associates) and Daniel Brunton (Brunton Consulting Services) in February 2011, this correspondence provides supplemental references on two natural environment issues of remaining concern to Golder Associates.

Responses to natural heritage peer review comments were provided in the December 8, 2009 Response to Golder Peer Review. We look forward to your review of that response and this supplementary information.

The two issues which still require clarification are:

1) Southeast Wetland

The wetland is identified as a Local Wetland on Schedule B in the Township of McNab-Braeside Official Plan. This was based on mapping provided to the Township by the Ontario Ministry of Natural Resources (MNR).

Your concern was that a mitigative response regarding potential impacts of the proposed quarry expansion on the features and functions of this wetland was not stated clearly.

As noted in the December 8, 2009 response, the Southeast Wetland is located on private land some 114 metres from the Miller property boundary and thus has not been readily available for investigation. This wetland is 259 metres from the proposed limit of extraction.

No special features are known or expected to occur in this semi-permanent, frequently stagnant beaver pond. Based on this knowledge and our off-site landscape assessment, it is



evident that the natural environment significance of this wetland is measured at a broad landscape level (i.e. ecological functions).

Hydrological investigations determined (as noted in the December 8, 2009 response) that approximately only 1% of the surface water flow into the wetland originates from the extraction area. Some groundwater contribution from the Miller property via springs, observed on the adjacent property by Gorrell Resources, contributes to the wetland. Please see response letter December 8, 2009 regarding issue 6 provided by Gorrell Resources.

Natural environment conditions contributing to this local wetland will not be impacted by the proposed Braeside Quarry expansion. The assessment, analysis and documentation (noted above and in the Dec.8-09 response) support this conclusion and satisfy Official Plan Scoped Environmental Impact Statement requirements for development applications potentially affecting such values. No monitoring or mitigation is warranted.

2) Significant Wildlife Protection Area Representation

The Significant Wildlife Protection Area (SWPA) represents the protected portion of the area of most significant alvar-related natural habitats and features of the Braeside Quarry Expansion area. Golder Associates felt that the delineation of the SWPA required further clarification, including an explanation of how this protection objective can be achieved when many significant species populations appear to be located outside the SWPA.

The December 8, 2009 response memo summarizes all of the significant natural environment components of the SWPA. That documentation establishes that the SWPA includes the complete range of significant natural features and functions of the Braeside Quarry Expansion area. Approximately 50% of the total footprint of significant alvar-related habitat is included in the proposed SWPA. Most importantly, the SWPA represents a continuous natural area that will be self-sustaining during and following the Braeside Quarry expansion.

Significant species representation is essentially continuous across the alvar-related habitat of the property. The distribution maps of provincially rare plants depicted in the October 2007 Natural Environment Assessment illustrate 2006 field season observations, indicating that many (a slight majority) of significant species populations occur beyond the boundaries of the SWPA. The virtually continuous distribution of significant species population has been confirmed, however, by on-site investigations in 2007-2010. Indeed, it appears that significant species populations are slightly denser in the SWPA than in the area of alvar-related habitat to be eliminated. While populations of significant species will be lost through the elimination of alvar-related habitat in the course of the Braeside Quarry Expansion, the majority of such populations will be retained in the self-sustaining natural habitat protected within the SWPA.

It is our understanding that with this supplement, no natural environment issues remain outstanding with the Golder Associates Natural Environment Peer Review of the proposed Braeside Quarry Expansion.

Once Golder has provided written acceptance of the correspondence sent December 8, 2009 and this supplement, we will revise the Natural Environment Report Level I & II (and Brunton Natural Environment Assessment) for submission to the Township for acceptance of peer review by Golder.



If you have any questions, please contact Dan or Kyle.

Yours truly,

SKELTON, BRUMWELL & ASSOCIATES INC.

Per:



Dan Brunton
Brunton Consulting

Per:



Kyle Fleming, BSc (Wildlife)
Ecologist

JKF/DB/bal

C-11-056

Cc: Miller Paving Ltd.- Tom Jones



August 16, 2011

Project No. 08-1122-0216

Bruce Howarth, MCIP, RPP, Senior Planner
County of Renfrew
9 International Drive
Pembroke, Ontario
K8A 6W5

**NATURAL ENVIRONMENT, HYDROLOGY AND HYDROGEOLOGY REVIEW COMMENTS
PROPOSED BRAESIDE QUARRY EXPANSION
MUNICIPALITY OF MCNAB/BRAESIDE, ONTARIO**

Dear Mr. Howarth:

The County of Renfrew has retained Golder Associated Ltd. (Golder) to conduct a technical review of various reports related to a proposed quarry expansion in the municipality of McNab/Braeside. These reports were prepared in support of an application for Zoning By-Law Amendment under the Township of McNab/Braeside Official Plan (Section 9.3(3)) as well as an application to the Ministry of Natural Resources ("MNR") for a quarry license with extraction below the water table. The owner and operator of the quarry is Miller Group Inc. (Miller).

Golder has previously completed technical reviews of documents dealing with three major areas of potential impacts arising from the proposed quarry expansion: (1) hydrogeology; (2) hydrology; and, (3) biology, including ecology, referred to as natural heritage features. This submission comprises Golder's review of the Skelton Brumwell Associates Inc. letter dated July 4, 2011 which was prepared in response to the Golder letter of May 10, 2011 (dated May 10, 2010).

Based on the review of the Skelton Brumwell Associates Inc. letter dated July 4, 2011, we are generally satisfied with the responses to our questions and comments. We note, however, that despite any proposed changes to the figures indicating the predicted radius of influence of the proposed quarry expansion, under-draining of the southeast wetland could potentially occur. Regardless, the proposed groundwater monitoring program should provide the data necessary to evaluate the potential for impacts to springs and the wetland located east and southeast of the quarry. Thus, we will not recommend that monitoring of the springs or wetlands be required, unless and until the results of the groundwater monitoring program indicate that impacts to either the springs and/or the wetland may occur. We also note that Table 1 attached to the July 4, 2011 letter includes "Well Site Reference" numbers that do not correspond to any mapping that we are aware of. This should be addressed in the final reports.

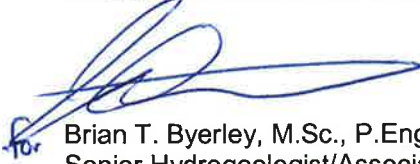
It is our understanding that revised reports will be prepared by the Miller team and submitted to the Township and the County, and that Golder will then be requested to review and comment on those reports.



We trust that this submission meets with your approval. Please contact the undersigned if you have any questions.

Yours truly,

GOLDER ASSOCIATES LTD.



for Brian T. Byerley, M.Sc., P.Eng.
Senior Hydrogeologist/Associate



Kris. A Marentette, M.Sc., P.Geo.
Senior Hydrogeologist/Principal

BTB/KAM/sg

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cc: Jennifer B. Gorrell, M.Sc., P.Eng., P.Geo, BGC Engineering Inc.
Tom Jones, Property Manager, Miller Paving Limited
Gary Bell, Skelton, Brumwell and Associates Inc.