



# Flamborough Quarry Haul Route Study

Natural Environment Report



# **FLAMBOROUGH QUARRY HAUL ROUTE STUDY – NATURAL ENVIRONMENT REPORT**

## **Report Prepared For:**

St. Marys Cement (Canada) Incorporated

## **Report Prepared By:**

Savanta Inc.  
58 Welstead Drive  
St. Catharines, Ontario  
L2S 4B2 Canada

## **Date:**

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## **Savanta File:**

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## **1 Introduction**

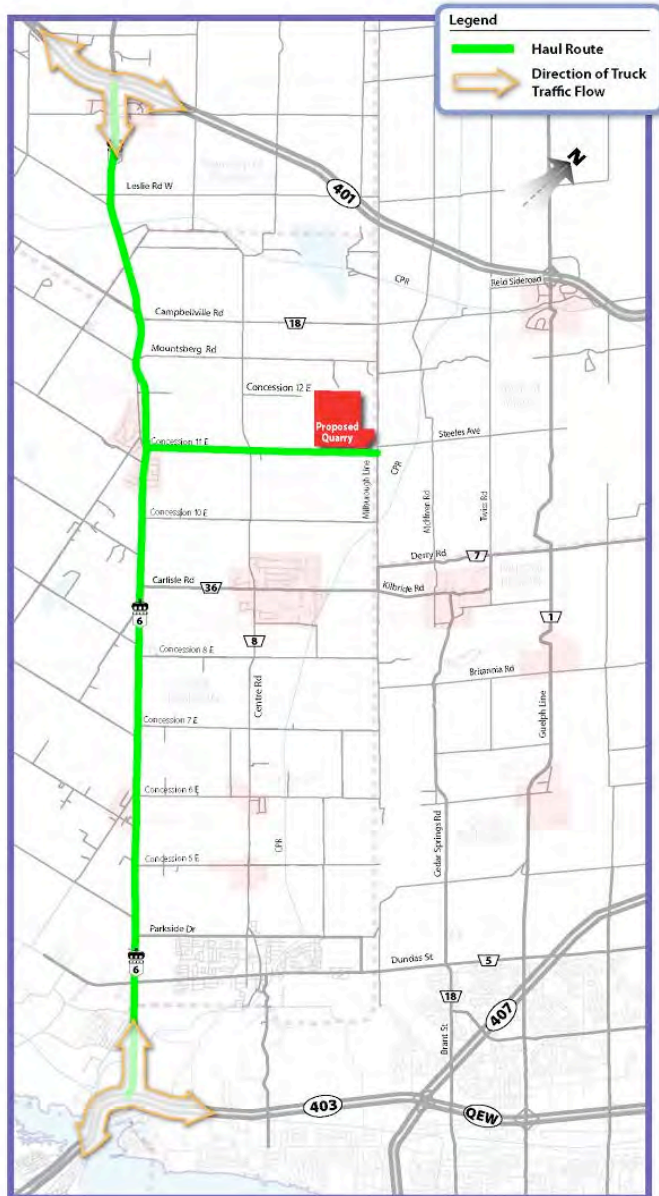
St. Marys Cement (Canada) Inc. has proposed to develop a Dolostone Quarry on Part of Lots 1, 2 and 3, Concession 11, Geographic Township of East Flamborough, in the City of Hamilton. The property is located on the north side of 11th Concession, just west of Milborough Line.

In April 2006 Dillon Consulting Limited prepared Terms of Reference for the Quarry Haul Route Evaluation on behalf of the City of Hamilton. Components of the Terms of Reference require that Alternative Haul Routes are identified, the existing baseline conditions of each alternative route are described, and a comparative analysis and evaluation is carried out. iTRANS Consulting Inc. have identified five Alternative Haul Routes, that are described and analyzed in the following report in the context of the aquatic and terrestrial natural heritage features.

This report documents the consultant team, describes the environment, defines the analysis criteria and indicators, reports the analysis and results, and offers recommendations and mitigating measures.

## 1.1 Description of Alternative Haul Routes

### Alternative Haul Route 1



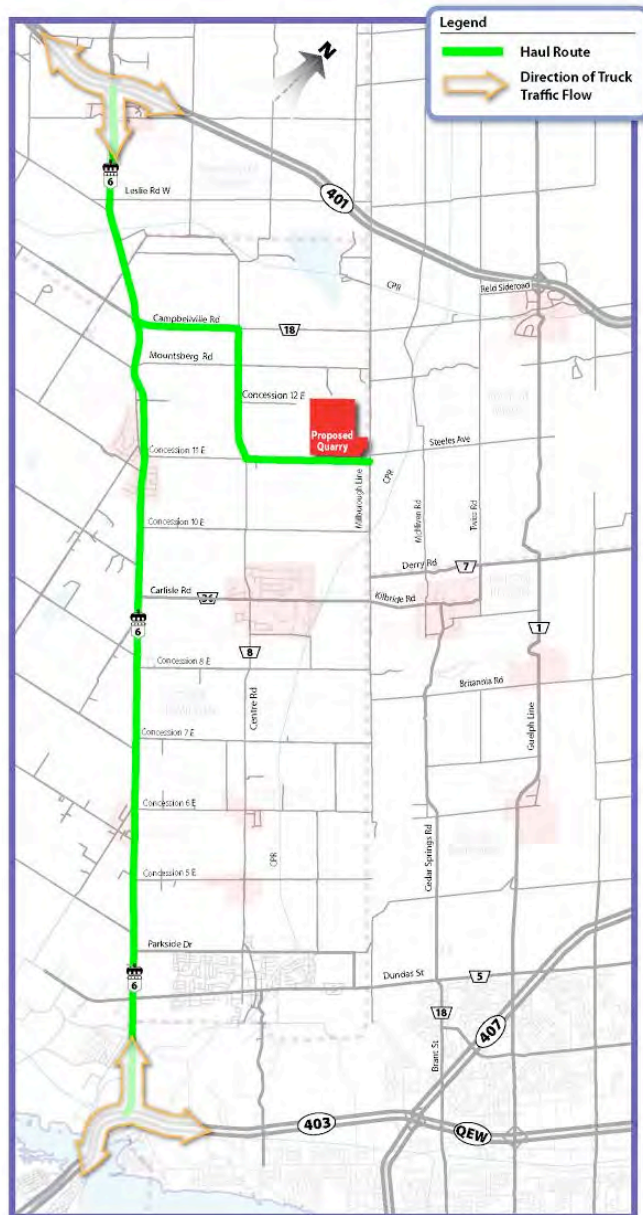
In the case of Alternative Haul Route 1, truck traffic destined for Highway 401 east would travel west on Concession 11 E, and then north on Highway 6 to the Highway 401 eastbound on-ramp.

Truck traffic destined for Highway 401 west would travel west on Concession 11 E, and then north on Highway 6 to the Highway 401 westbound on-ramp.

Truck traffic destined for Highway 403 east would travel west on Concession 11 E, and then south on Highway 6 to the Highway 403/QEW eastbound on-ramp.

Finally, truck traffic destined for Highway 403 west would travel west on Concession 11 E, and then south on Highway 6 to the Highway 403/QEW westbound on-ramp.

## Alternative Haul Route 2



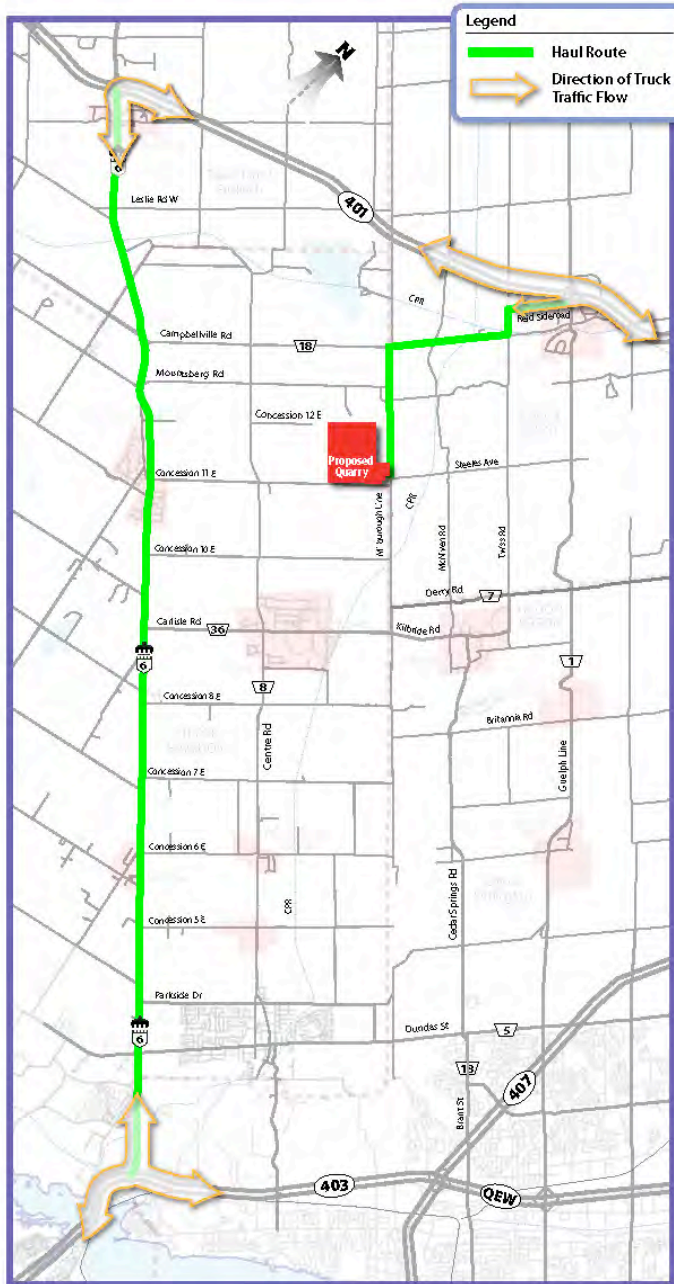
In the case of Alternative Haul Route 2 truck traffic destined for Highway 401 east would travel west on Concession 11 E, then north on Centre Road, west on Campbellville, and north on Highway 6 to the Highway 401 eastbound on-ramp.

Truck traffic destined for Highway 401 west would travel west on Concession 11 E, then north on Centre Road, west on Campbellville, and north on Highway 6 to the Highway 401 westbound on-ramp.

Truck traffic destined for Highway 403 east would travel west on Concession 11 E, then north on Centre Road, west on Campbellville, and south on Highway 6 to the Highway 403/QEW eastbound on-ramp.

Finally, truck traffic destined for Highway 403 west would travel west on Concession 11 E, north on Centre Road, west on Campbellville, and south on Highway 6 to the Highway 403 /QEW westbound on-ramp.

### Alternative Haul Route 3



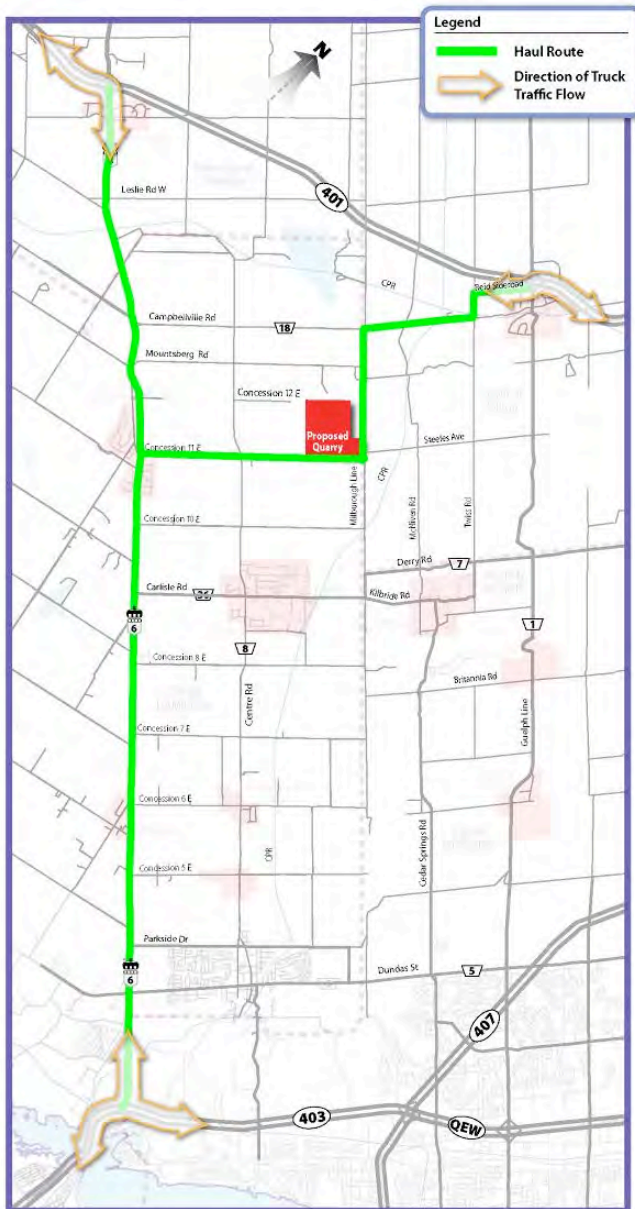
In the case of Alternative Haul Route 3, truck traffic destined for Highway 401 east would travel north on Milburgh Line, then east on Campbellville Road, north on Twiss Road, and east on Reid Sideroad to the Highway 401 eastbound on-ramp.

Truck traffic destined for Highway 401 west would travel north on Milburgh Line, then east on Campbellville Road, north on Twiss Road, east on Reid Sideroad and north on Guelph Line to the Highway 401 westbound on-ramp

Truck traffic destined for Highway 403/QEW east would travel north on Milburgh Line, then east on Campbellville Road, north on Twiss Road, and east on Reid Sideroad to the Highway 401 eastbound on-ramp. From here, there are several alternatives to reach the destination including taking the 407 ETR south to Highway 403.

Finally, truck traffic destined for Highway 403 west would travel north on Milburgh Line, east on Campbellville Road, north on Twiss Road, and east on Reid Sideroad to the Highway 401. From here, there are several alternatives to reach the destination including taking the 407 ETR southwest or Highway 6 south to the 403/QEW.

### Alternative Haul Route 4



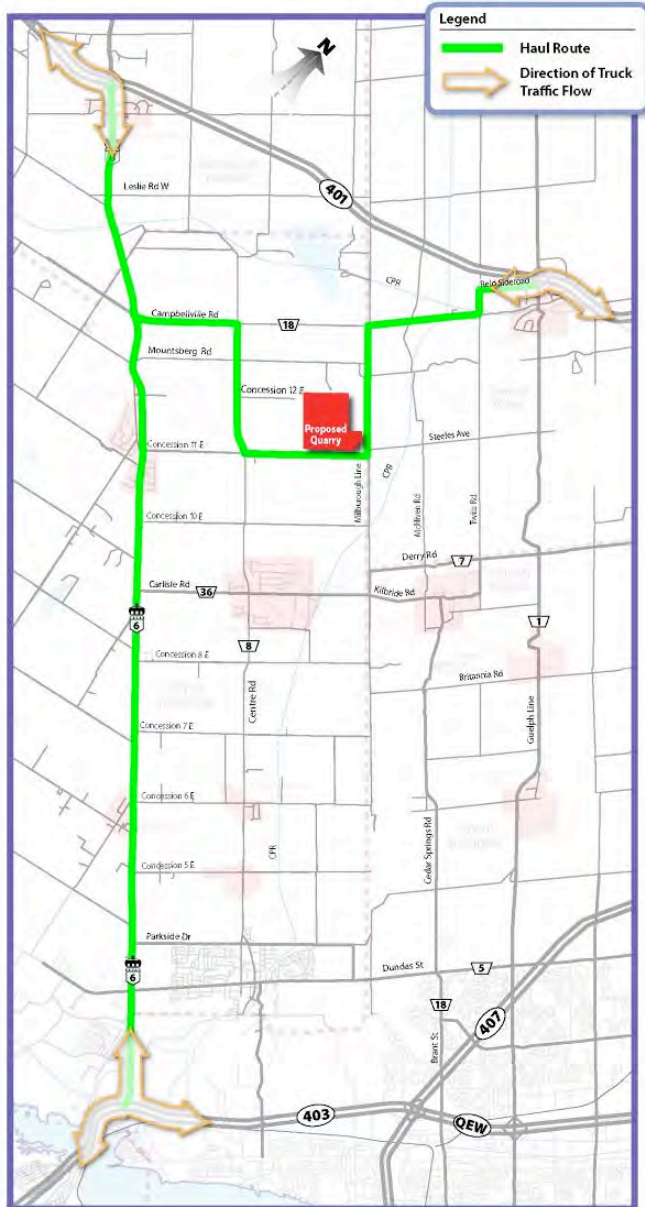
In the case of Alternative Haul Route 4, truck traffic destined for Highway 401 east would travel north on Milborough Line, then east on Campbellville Road, north on Twiss Road, and east on Reid Sideroad to the Highway 401 eastbound on-ramp.

Truck traffic destined for Highway 401 west would travel west on Concession 11 E, and then north on Highway 6 to the Highway 401 westbound on-ramp.

Truck traffic destined for Highway 403 east would travel west on Concession 11 E, and then south on Highway 6 to the Highway 403 eastbound on-ramp.

Finally, truck traffic destined for Highway 403 west would travel west on Concession 11 E, and then south on Highway 6 to the Highway 403 westbound on-ramp.

### Alternative Haul Route 5



In the case of Alternative Haul Route 5, truck traffic destined for Highway 401 east would travel north on Milborough Line, then east on Campbellville Road, north on Twiss Road, and east on Reid Sideroad to the Highway 401 eastbound on-ramp.

Truck traffic destined for Highway 401 west would travel west on Concession 11 E, then north on Centre Road, then west on Campbellville, and then north on Highway 6 to the Highway 401 westbound on-ramp.

Truck traffic destined for Highway 403 east would travel west on Concession 11 E, then north on Centre Road, west on Campbellville, and south on Highway 6 to the Highway 403/QEW eastbound on-ramp.

Finally, truck traffic destined for Highway 403 west would travel west on Concession 11 E, then north on Centre Road, west on Campbellville, and south on Highway 6 to the Highway 403 /QEW westbound on-ramp.

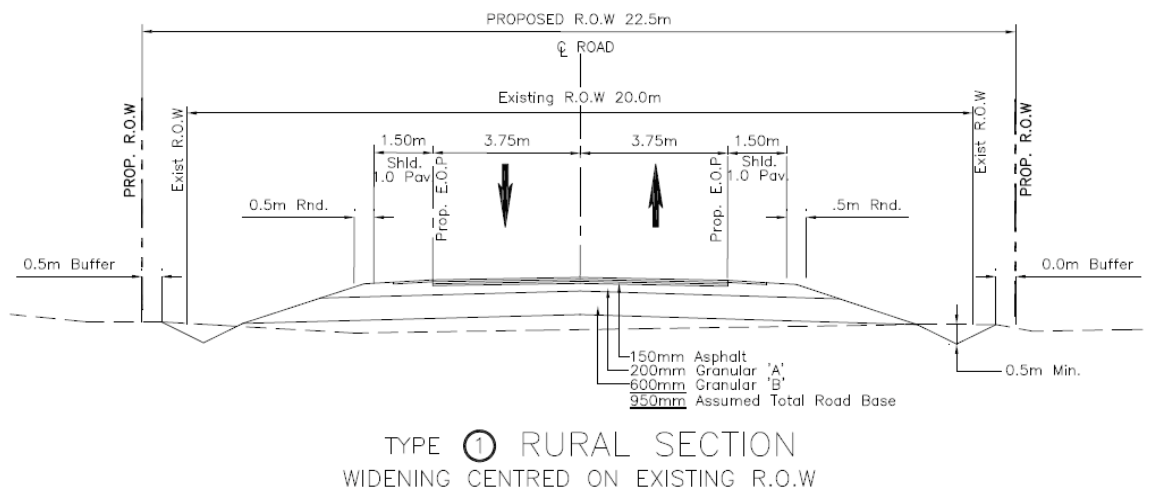
## 1.2 Cross-section Design and Analysis

For this study two types of cross-sections are proposed: rural (requires property acquisition) and urban (within the existing right-of-way). For the purpose of the analysis the rural cross-section was applied as it has the most significant impacts due to property acquisition and was therefore deemed more conservative. However, given the challenges that can be associated with land acquisition, the urban design that fits the existing right-of-way was also given consideration. It was concluded that this design would not require land acquisition however it would have a more significant impact on the existing character of the road and has a higher associated cost of construction.

Figure 1, Figure 2, Figure 3, and Figure 4 illustrate the proposed road bed design and shows rural and urban alternative cross-sections for both Type 1 and Type 3 sections.

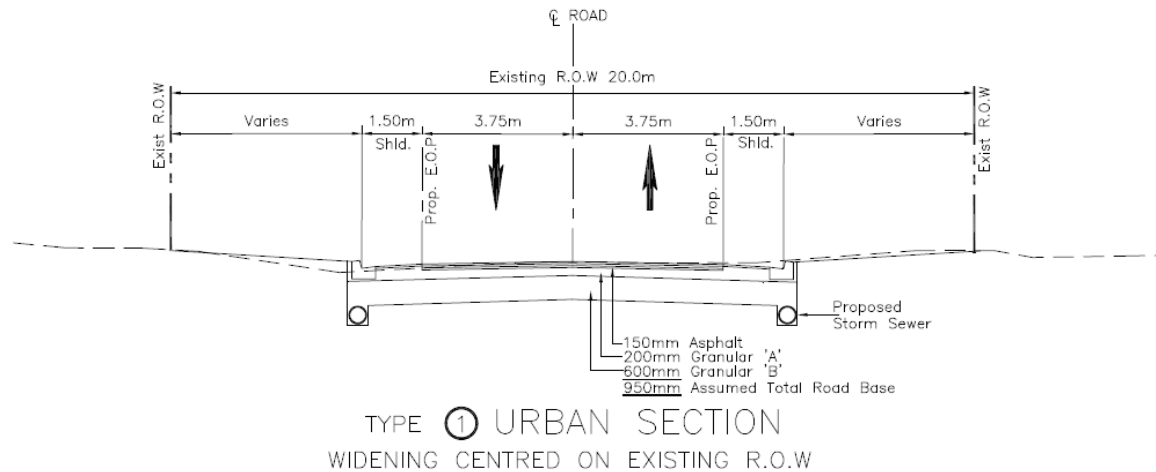
### Type 1

With the rural cross-section the proposed right-of-way is 2.5m greater than the existing 20m right of way. This cross-section allows for 3.75m travel lanes, 1.0m paved shoulder, 0.5m gravel shoulder, 0.5m rounding, and a drainage ditch.



**Figure 1: Type 1 Rural Cross-Section**

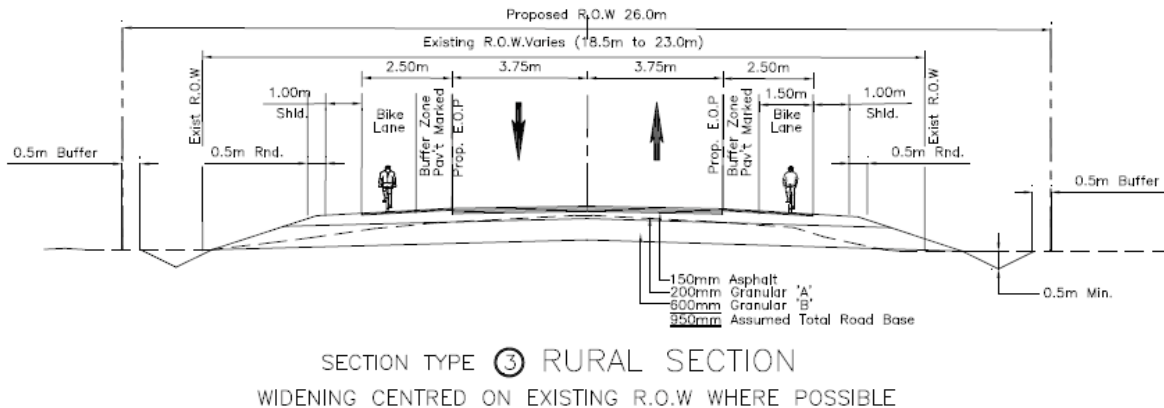
With the urban cross-section the proposed right-of-way fits into the existing 20m right-of-way. The cross-section allows for 3.75m travel lanes, and a 1.5m paved shoulder with curb and gutter.



**Figure 2: Type 1 Urban Cross-Section**

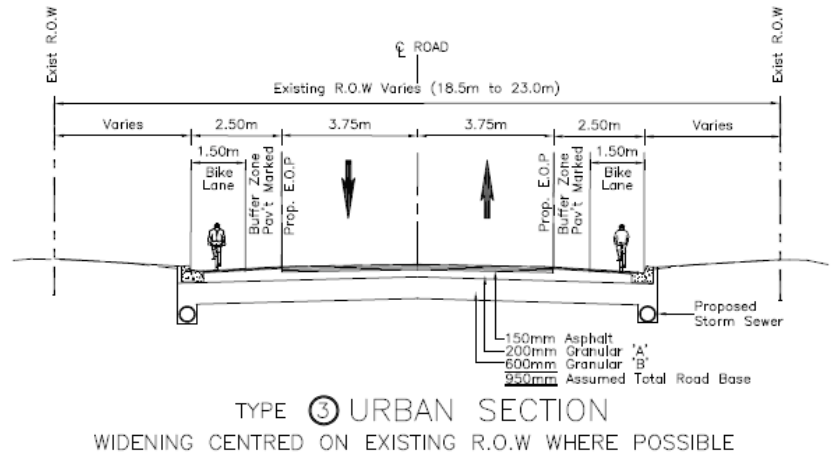
**Type 3**

With the rural cross-section the proposed right-of-way is 3m to 7.5m greater than the existing right-of-way depending on the varying existing cross-section. This cross-section allows for 3.75m travel lanes, 1.0m paved buffer, 1.5m paved bike lane, 1.0m gravel shoulder, 0.5m rounding, a drainage ditch and a 0.5m buffer.



**Figure 3: Type 3 Rural Cross-Section**

With the urban cross-section the proposed right-of-way can be fit into the existing right-of-way that varies from 18.5m to 23m. The cross-section allows for 3.75m travel lanes, a 1.0m paved buffer, a 1.5m paved bike lake, and curb and gutter with a minimum boulevard of 3m.



**Figure 4: Type 3 Urban Cross-Section**

It is important to note that both Type 1 and Type 3 section designs do not account for any changes in the existing profile and assume that widening is at existing profile grade.

While the urban cross-section fits into the existing right-of-ways, the storm sewer infrastructure and appurtenances increase the construction costs approximately 50 percent over the rural design. It is a trade off between the cost (and challenge) of purchasing land and constructing a more expensive infrastructure.

Applying the rural cross-section that would require land acquisition is a conservative approach for haul route comparative evaluation purposes. The decision on which cross-section to move forward with would be decided at the detailed design stage of an Environmental Assessment when pavement recommendations are finalized. Typically, resolution of the design details would occur during the subsequent Municipal Class EA process.

## 2 Description of the Consultant Team

### ***Tom Hilditch, President, Savanta Inc.***

Tom is an environmental professional, communicator and businessperson. After 25 years, in senior roles with three leading North American consulting firms, he launched Savanta Inc., with an eye towards advancing the implementation of practical and productive sustainable development projects and programs.

For 26 years, Tom has led a variety of environmental approvals, compliance, restoration, communications and sustainability projects and initiatives. Through his work and research in Canada, the U.S.A., China, Hong Kong, Japan, Equatorial Guinea, Venezuela, Thailand, Malaysia, Singapore, Turkey, Qatar and the U.A.E., he has developed a broad appreciation for a full range of environmental business challenges and solutions. He has investigated hundreds of natural areas ranging across wetlands, forests, grasslands, coastal and marine systems, many covering thousands of square kilometers. Tom has worked collaboratively amongst all

manner of stakeholders in an effort to optimize sustainable outcomes on specific projects and on more broad regulatory initiatives.

***Heather Davis, Ecologist***

Ms. Davis has experience conducting and writing environmental impact statements, tree preservation plans and baseline studies. Heather has completed professional botanist training and has performed plant community classification, taxonomic identification of terrestrial vascular plants and species at risk surveys as a part of various projects. Heather has conducted a variety of assignments related to species at risk including rare flora and fauna surveys and statistical analyses. She has completed field investigations and population estimates for Lake Erie Water Snake and Eastern Fox Snake in the Lake Erie Archipelago. She has also participated in surveys for Green Dragon, Pitcher's Thistle, Queensnake and species at risk turtles in southern Ontario. She has completed assignments regarding riparian habitat restoration, invasive vegetation management, erosion control and related public education initiatives. She is proficient in technical report writing and primary literature research and compilation.

***Heather Whitehouse, Ecologist***

Ms. Whitehouse directs and manages ecological reporting projects (Environmental Impact Studies/Assessments) for small (i.e. lot) and large-scale (i.e. Block Plan) projects across the Greater Toronto Area. Heather is involved in all aspects of the project from conducting ecological investigative studies to working with agencies to meet regulatory requirements to report writing. Heather has worked in both terrestrial and aquatic environments, with expertise in wetland plant ecology. Ms. Whitehouse has developed long-term ecological monitoring and annual field study programs, and also conducts numerous programs as she is certified by the Ministry of Natural Resources to conduct Ecological Land Classification and wetland evaluations. Clients cross a broad spectrum of industry sectors including urban development, sand and gravel quarries, mining, and municipal governments. Project work has taken her to central and northern Alberta, throughout Ontario, inland New Brunswick and rural Idaho.

***Valerie Wyatt, M.Sc., Senior Project Manager***

Ms. Wyatt is a knowledgeable field ecologist and project manager with twelve years of professional experience. Valerie has successfully managed or directed dozens of projects including impact assessments, community plans and biological inventories. These projects involved the implementation of natural heritage policy of the Ontario Provincial Policy Statement, Greenbelt Plan, Oak Ridges Moraine Act and municipal policy documents for numerous municipal draft plan applications throughout southern Ontario. Valerie's expertise includes field inventories of vegetation communities, breeding birds and other wildlife; analysis of community significance, terrestrial linkages, habitat assessment and ecological land classification; integration of engineering, hydrogeological, planning and geomorphological studies; and review agency liaison. Valerie has served on the Technical Committee for Guelph's Natural Heritage Strategy, the Steering Committee for Environment Canada's and the Canadian Wild Association's Bird Monitoring Database Project and has appeared as an expert witness before the Ontario Municipal Board.

***Andrew Taylor, B.Sc., Terrestrial Ecologist***

Andrew has successfully managed both small and large projects, including environmental impact statements, constraint analyses and environmental implementation reports. In addition, he has coordinated natural heritage components of Environmental Assessments. These projects involve the implementation of natural heritage policies of the Ontario Provincial Policy Statement, Greenbelt Plan and municipal policy documents. Andrew also has experience with policies pertaining to Threatened and Endangered Species including Butternut. Andrew has strong field skills including identification of vascular plants, breeding amphibians (calling frogs and toads), breeding salamanders (adult and egg studies), reptiles and bats, with a particular emphasis on birds, butterflies and dragonflies. He is skilled at assessing wildlife habitat, applying Ecological Land Classification (ELC) and delineating wetland boundaries. Andrew is experienced at analyzing natural heritage features for the presence of Significant Woodlands or Significant Wildlife Habitat using guidance documents such as the 'Natural Heritage Reference Manual, How Much Habitat is Enough?' and the 'Significant Wildlife Habitat Technical Guide'.

***Ryan Park, B.Sc., Aquatic Ecologist***

Ryan has experience in industry and development sector projects. He has conducted field investigations, liaised with government agencies and regulators, synthesized data and produced reports. His specific areas of expertise include Environmental Impact Studies and Environmental Effects Monitoring. Ryan has assessed potential impacts to aquatic and terrestrial habitats at a number of development-related sites such as subdivisions, sewage treatment plants and aggregate expansions. Ryan is also responsible for managing and maintaining the field equipment for the Guelph office. Ryan's technical experience includes both terrestrial and aquatic habitats. He has conducted fisheries habitat assessments based on provincial protocols, benthic macroinvertebrate surveys and fisheries inventories.

### **3 Description of the Environment**

#### **3.1 Aquatic Environment**

There are four subwatersheds of Bronte Creek found within the study area including: Bronte Creek tributaries; Mountsberg Creek; Flamboro Creek; and, Kilbride Creek. Within the study area, there are a total of 19 potential watercourse crossings with the following flow regimes: permanent (6); intermittent (9); and, ephemeral (4). Most of the intermittent and ephemeral watercourses are dominated by herbaceous vegetation within the channels, thereby limiting their potential as direct habitat for fish. A more detailed discussion about the aquatic habitat features within the study area is found in Appendix B - Stantec (2008); however, Table 1 and Figure 5 summarize this information.

Redside Dace which is designated as threatened under Ontario's Endangered Species Act and special concern under Schedule 3 of the federal Species at Risk Act (SARA) is found in close proximity to a number of the potential crossing locations associated with Bronte Creek. It is also important to note that Redside Dace was recently reevaluated by the Committee on the Status of Endangered Wildlife in Canada and upgraded to federally endangered. Consultations are currently underway to have redside dace added to Schedule 1 of the SARA.

The fieldwork completed by Stantec in 2006 was further supplemented through reconnaissance surveys by Savanta Inc. on June 18, 2008. Photographs from this additional work are provided at the end of this report (Appendix A).

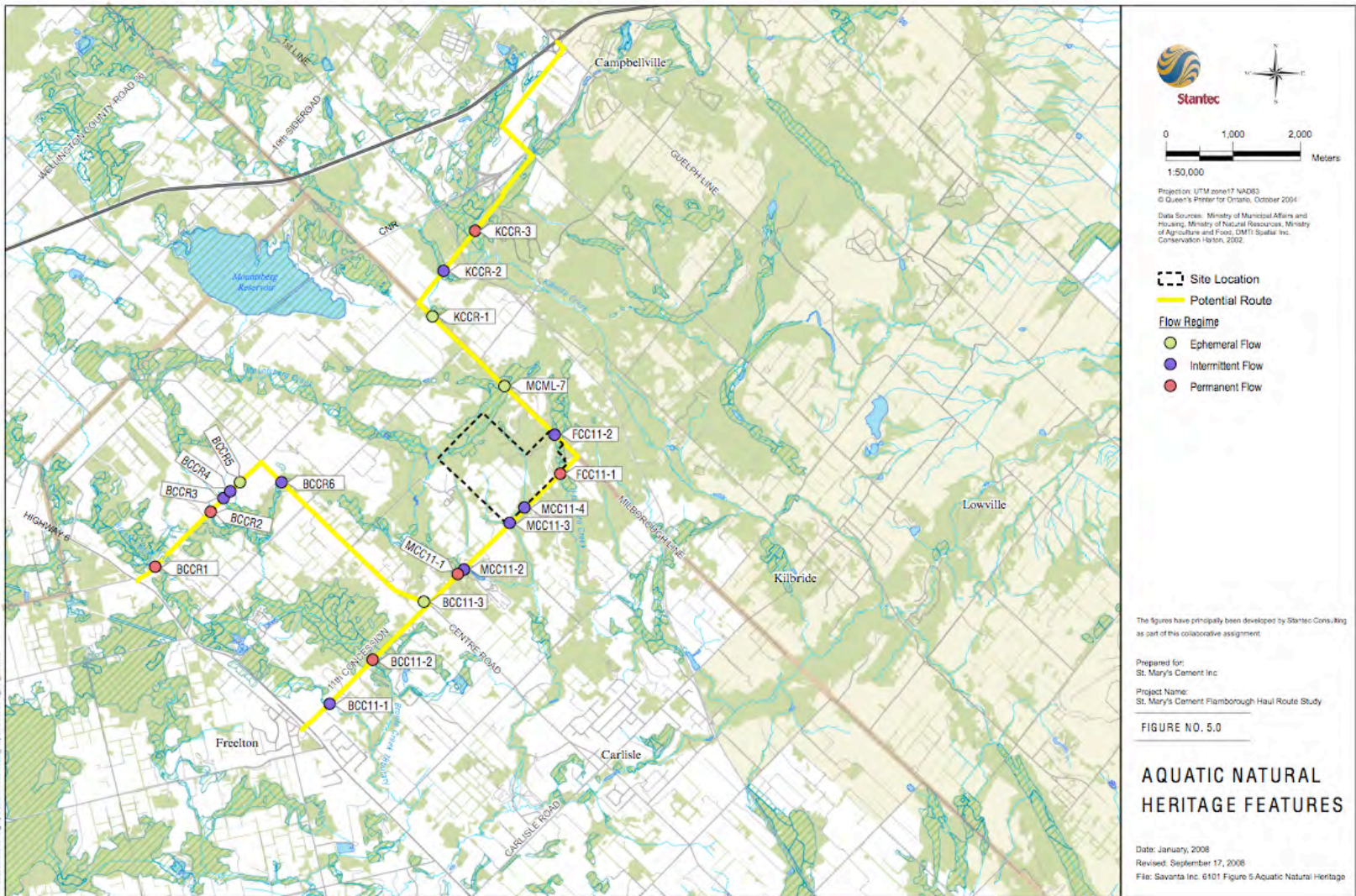


Table 1. Aquatic Natural Heritage Features													
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features						Crossing Structure <sup>1</sup>
		1	2	3	4	5	Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>	
							Cool (18°C) or Cold (14°C)	Warm (23°C)					
Bronte Creek (BCCR1)	Campbellville Rd (east of Highway 6)		√			√		√	permanent	Brook trout (near crossing)  Redside Dace <sup>4</sup> (downstream)	Gravel/sand /cobble	Low- upstream  Excellent - downstream	Open Box Culvert
Bronte Creek	Campbellville Rd (east of		√			√			dry	Brook trout  RSD	Grassy	Moderate	CSP

<sup>1</sup> CSP – corrugated steel pipe  
 CP – corrugated pipe  
 CPP – corrugated plastic pipe

<sup>2</sup> Conservation Halton. 2002. Bronte Creek Watershed Study: Aquatic Habitat Inventory and Assessment

<sup>3</sup> Riparian vegetation cover qualification based on Stantec (2008) report (Appendix B) and Savanta Inc reconnaissance survey on June 18th, 2008

<sup>4</sup> RSD is designated as threatened under the Endangered Species Act (website last accessed September 17, 2008:

<http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/246809.html>). RSD is designated as Special Concern under Schedule 3 of the federal Species at Risk Act (website last accessed September 17, 2008: [www.sararegistry.gc.ca](http://www.sararegistry.gc.ca))

Table 1. Aquatic Natural Heritage Features													
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features						Crossing Structure <sup>1</sup>
		1	2	3	4	5	Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>	
							Cool (18°C) or Cold (14°C)	Warm (23°C)					
(BCCR2)	Highway 6)									(downstream)			
Bronte Creek (BCCR3)	Campbellville Rd (east of Highway 6)		√			√			intermittent		Graminoid	Graminoid swale - upstream Graminoid swale into swamp >100 m - downstream	CSP (1.2 ft diameter)
Bronte Creek (BCCR4)	Campbellville Rd (east of Highway 6)		√			√			intermittent		Graminoid	Graminoid swale - upstream Graminoid swale into swamp >100 m - downstream	CSP (1.2 ft diameter)
Bronte Creek (BCCR5)	Campbellville Rd (east of Highway 6)		√			√			ephemeral		Stream buried under horse track to south,	Graminoid swale - upstream Buried underground -	CSP (1.2 ft diameter)

Table 1. Aquatic Natural Heritage Features														
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features							Crossing Structure <sup>1</sup>
							Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>		
		1	2	3	4	5	Cool (18°C) or Cold (14°C)	Warm (23°C)						
												opens in pond in centre of track	downstream	
Bronte Creek (BCCR6)	Centre Rd		√			√			intermittent			Narrow-leaved Cattail – Typha angustifolia - vegetation	Cattail in-stream – upstream and downstream	Black plastic CP (1.1 ft diameter)
Bronte Creek (BCC11-1)	Concession 11 (west of Centre Rd)	√			√				intermittent			Dry on both sides	Graminoid – excellent - upstream Graminoid – good -	CSP (2.1 ft diameter)

Table 1. Aquatic Natural Heritage Features													
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features						Crossing Structure <sup>1</sup>
		1	2	3	4	5	Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>	
							Cool (18°C) or Cold (14°C)	Warm (23°C)					
												downstream	
Bronte Creek (BCC11-2)	Concession 11 (west of Centre Rd)	√			√		√		permanent	Brook trout (near crossing) RSD (near crossing)	Sand/cobble/gravel	Moderate	Open Box Culvert
Bronte Creek (BCC11-3)	Concession 11 (at Centre Rd)	√	√		√		√		ephemeral		Dry on both sides	Low	CSP (1.1 ft diameter)
Mountsberg Creek (MCC11-1)	Concession 11 (east of Centre Rd)	√	√		√	√		√	permanent	No recent records of either brook trout or reddsie dace	Boulders/cobble/gravel	Moderate	Open Box Culvert

Table 1. Aquatic Natural Heritage Features													
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features						Crossing Structure <sup>1</sup>
		1	2	3	4	5	Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>	
							Cool (18°C) or Cold (14°C)	Warm (23°C)					
Mountsberg Creek (MCC11-2)	Concession 11 (east of Centre Rd)	√	√		√	√			intermittent			Meadow marsh then riparian forest <20 m – excellent - upstream  No culvert found, may join underground at creek junction - downstream	CSP (1.1 ft diameter)
Mountsberg Creek (MCC11-3)	Concession 11 (east of Centre Rd)	√	√		√	√			intermittent		Dry on both sides	<50 m of riparian forest then open meadow - upstream  Continuous riparian forest cover -	CSP (1.1 ft diameter)

Table 1. Aquatic Natural Heritage Features													
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features						Crossing Structure <sup>1</sup>
							Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>	
		1	2	3	4	5	Cool (18°C) or Cold (14°C)	Warm (23°C)					
												downstream	
Mountsberg Creek (MCC11-4)	Concession 11 (east of Centre Rd)	√	√		√	√			intermittent		Graminoid	Graminoid swale than agr. to north – upstream  Riparian lowland with defined bed and bank channel - downstream	CSP (1.1 ft diameter)
Mountsberg Creek (MCML-7)	Milborough Line			√	√	√			ephemeral		Standing water on both sides		CSP (2.1 ft diameter)
Flamboro Creek (FCC11-1)	Concession 11	√	√		√	√			permanent	Brook trout (downstream)	Musk upstream and sand/grave	Excellent	CPP

Table 1. Aquatic Natural Heritage Features														
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features							Crossing Structure <sup>1</sup>
							Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>		
		1	2	3	4	5	Cool (18°C) or Cold (14°C)	Warm (23°C)						
												l downstream		
Flamboro Creek (FCC11-2)	Milborough Line			√	√	√			intermittent			Dry on both sides	Riparian forest – excellent – upstream and downstream	Culvert not found
Kilbride Creek (KCML-1)	Milborough Line			√	√	√			ephemeral			Dry on both sides	Riparian lowland – upstream and downstream	CSP (1.5 ft diameter)
Kilbride Creek (KCCR-2)	Campbellville Road			√	√	√			intermittent			No water	Graminoid meadow marsh - upstream  Graminoid meadow marsh that continues	CSP (1.10 ft diameter)

Table 1. Aquatic Natural Heritage Features														
Feature	Location	Alternative Haul Routes (√ - denotes potential crossing)					Broad Functions of Aquatic Natural Heritage Features							Crossing Structure <sup>1</sup>
							Thermal Regime <sup>2</sup>		Flow	Rare or Sensitive Species	Substrate	Riparian Vegetation Cover <sup>3</sup>		
		1	2	3	4	5	Cool (18°C) or Cold (14°C)	Warm (23°C)						
												into riparian forest – excellent - downstream		
Kilbride Creek (KCCR-3)	Campbellville Road			√	√	√	√		permanent	Brook trout (near crossing)	Gravel/Sand/ Cobble	Excellent	3 x CSPs	
	Total	8	12	5	13	17								

Adapted from Table 4.3 – Stantec (2008 – Appendix B) report with supplemented reconnaissance fieldwork completed by Savanta Inc. on June 18, 2008

### 3.2 Terrestrial Environment

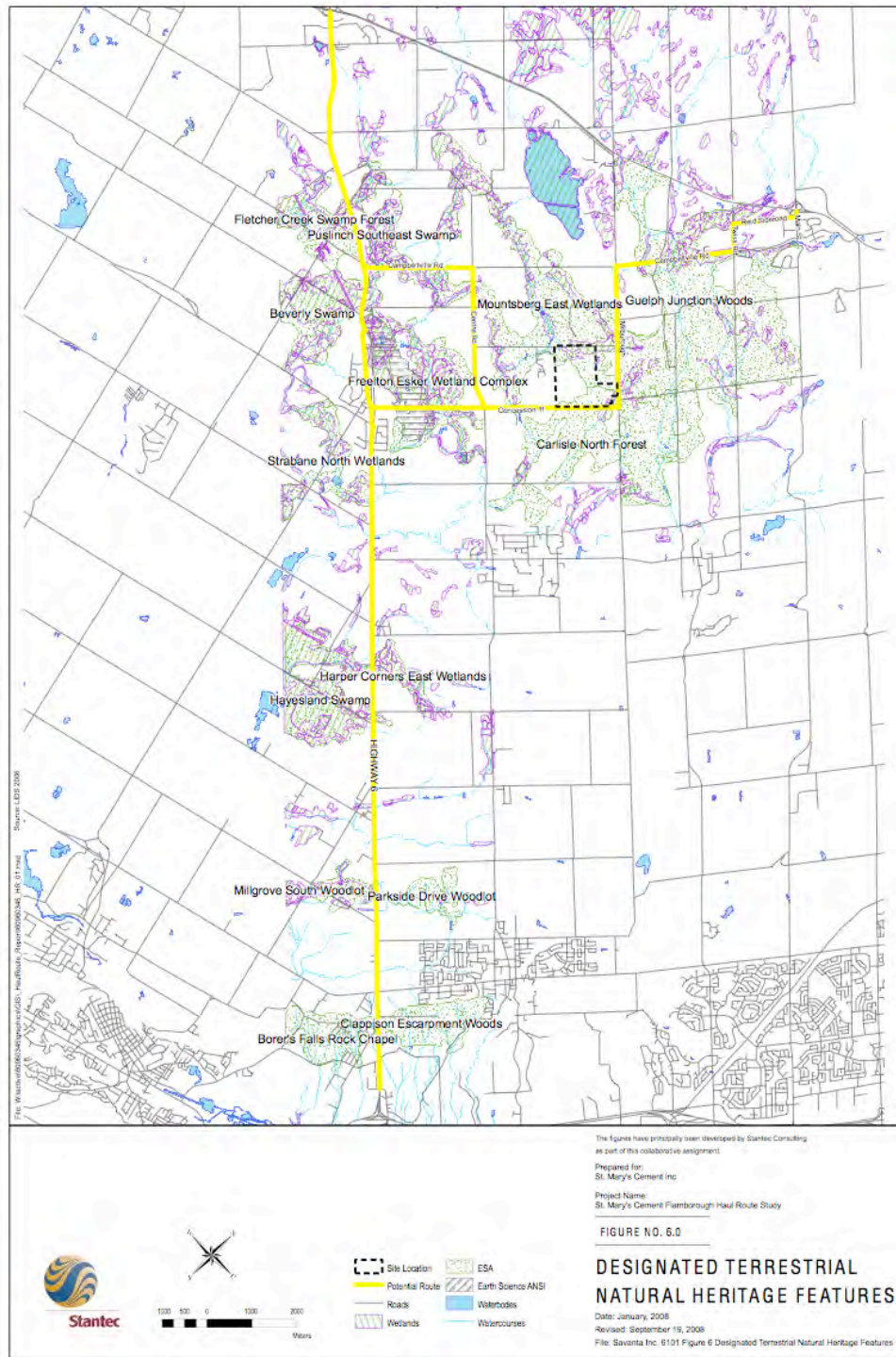
Five alternative haul routes have been identified between the proposed St. Marys Cement Flamborough Quarry and 400-series highways. A more detailed outline of the alternative haul routes is provided in Section 1.1 and in the Transportation Report (iTrans, 2008) report, with the latter including a discussion of the projected increases in truck traffic for each haul route and associated links.

Several Environmentally Significant Areas (ESAs), Areas of Natural and Scientific Interest (ANSIs), and provincially significant wetlands (PSWs) lie within 100-metres of one or more of the alternate haul routes. There are 7 identified core deer wintering areas found on the Subject Lands and along the alternative haul routes identified. Many of these natural areas are known to contain rare or sensitive vegetation communities, in addition to rare or at risk species such as West Virginia White (*Pieris virginiensis*) and Jefferson salamander (*Ambystoma jeffersonianum*). As well, many contribute to a generally well-linked landscape in terms of wildlife movement functions. Stantec (2008 – Appendix B) provides a more detailed analysis of the features and functions of the individual habitats, including vegetation communities based on the Ecological Land Classification (ELC) system, found within the study area. Figure 6 summarizes the distribution of these features.

As outlined in Section 1.1, all haul route alternatives include the use of Highway 6 for some of the quarry truck traffic; however, only Haul Route Alternatives 1 and 2 result in any discernible increase over baseline truck traffic. More specifically, for Haul Route Alternatives 1 and 2, the baseline range in truck traffic is 9-15% and with the addition of quarry truck traffic it increases to 9-18% for Highway 6 north of Concession 11. This contrasts with Haul Route Alternatives 3-5 that result in only a 1% increase in total truck traffic with the addition of the quarry truck traffic and this is limited to the link between Campbellville Road north to Badenoch Street. As such, emphasis is placed on the discussion of this link specific to Haul Route Alternatives 1 and 2.

With all haul route alternatives the total truck traffic percentage increase over baseline conditions is negligible for the Highway 6 link south of Concession 11 being a maximum 1% increase and in most instances there is no detectable change in truck traffic. As such, this link is not carried forward as part of the detailed natural heritage features comparative impact analysis. Notwithstanding, a brief overview of the characteristics of the significant terrestrial natural features identified within the boundaries of the entire study area, including Highway 6 south of Concession 11, are summarized in Section 3.2.1.

Table 2 summarizes each haul route and associated terrestrial natural heritage feature:



Feature	Designation <sup>6</sup>	Location	Alternative Haul Route (√ - denotes potential effects)					Broad Functions of Significant Features			
			1	2	3	4	5	Linkage Function	Wintering Deer Yard	Rare or Sensitive Species and/or Vegetation Community	Maintenance of Water Quality
Freelton Esker Wetland Complex	Provincially significant earth science ANSI  Part of Beverly Swamp wetland complex (PSW)  ESA	Highway 6 (north)  Concession 11	√	√		√	√	√		√	√
Beverly Swamp	PSW  ESA	Highway 6 (north)	√	√			√	√	√	√	√

<sup>5</sup> With all haul route options the total truck traffic percentage increase over baseline conditions is negligible for the Highway 6 link south of Concession 11 being a maximum 1% increase and in most instances there is no detectable change in truck traffic. As such, this link is not carried forward as part of the detailed natural heritage features comparative impact analysis. Detailed discussion in the Transportation Report (iTrans, 2008) report.

<sup>6</sup> ESA – Environmentally Significant Area  
 PSW – Provincially Significant Wetland  
 ANSI – Area of Natural and Scientific Interest

Feature	Designation <sup>6</sup>	Location	Alternative Haul Route (√ - denotes potential effects)					Broad Functions of Significant Features			
			1	2	3	4	5	Linkage Function	Wintering Deer Yard	Rare or Sensitive Species and/or Vegetation Community	Maintenance of Water Quality
Puslinch Southeast Swamp	ESA PSW	Highway 6 (north)	√	√			√	√			√
Fletcher Creek Swamp Forest	ESA PSW	Highway 6 (north)	√	√			√	√	√	√	√
Mountsberg East Wetlands	Life Science ANSI ESA PSW	Concession 11; Milborough Line; Mountsberg Rd	√	√	√	√	√	√		√	√
Carlisle North Forest	ESA	Concession 11; Milborough Line	√	√	√	√	√	√			√
Guelph Junction Woods and Extensions	Life Science ANSI	Milborough Line; Campbellville			√	√	√	√		√	√

**Table 2. Terrestrial Natural Heritage Features<sup>5</sup>**

Feature	Designation <sup>6</sup>	Location	Alternative Haul Route (√ - denotes potential effects)					Broad Functions of Significant Features			
			1	2	3	4	5	Linkage Function	Wintering Deer Yard	Rare or Sensitive Species and/or Vegetation Community	Maintenance of Water Quality
		Rd; Reid SR									
		Total	6	6	3	4	7				

Adapted from Table 4.1, Stantec (2008)

### **3.2.1 Overview of Terrestrial Natural Heritage Features**

The following terrestrial natural heritage features have been identified within the boundaries of the study area (Figure 6):

#### **3.2.1.1 Highway 6 – south of Concession 11**

From south near the QEW to the north near Highway 401, designated features along Highway 6 include:

##### *Borer's Falls Rock Chapel*

This feature has been designated as an ESA and includes a forested southeast-facing segment of the Niagara Escarpment, with the talus slope woods supporting a number of significant species and a regionally significant vegetation community. This feature provides an important linkage to Cootes Paradise.

##### *Clappison Escarpment Woods*

This feature is designated as an ESA and the forested talus slope provides habitat for a number of rare and uncommon plant species, and the vegetation communities are considered regionally significant (with potential for provincial significance).

##### *Parkside Drive Woodlot*

Portions of this feature adjacent to Borer's Creek have been designated as a provincially significant wetland, and the area is a candidate ESA. This woodlot is located in the headwaters of Borer's Creek and as such reportedly provides an important role in maintaining ground and surface quality and quantity. The feature contains interior forest habitat, and provides a linkage between Millgrove South Woodlot and Waterdown North wetlands. It also supports rare species, including the regionally rare Sedge Wren (*Cistothorus platensis*), and vegetation communities.

##### *Millgrove South Woodlot*

This woodlot feature has been designated as an ESA and is generally isolated, with only weak linkages to Hayesland swamp to the northwest. The area provides headwater functions for both Borer's and Logie's Creeks. Prior inventories determined the presence of various rare species.

##### *Hayesland Swamp*

This forested wetland is designated as an ESA and occurs within the Grindstone and Spencer Creek watershed boundaries. The area serves as an important headwater area contributing to downstream coldwater habitat. The habitat supports a number of rare and at risk species, including records for Blanding's turtle (*Emydoidea blandingii*) and cerulean warbler (*Dendroica cerulea*).

##### *Harper Corners East Wetlands*

This area is designated as an ESA; however, most of the marsh and swamp wetland communities at this site are disturbed and there are minimal if any natural or hydrological linkages to adjacent sites.

#### *Strabane North Wetlands* (part of Beverly Swamp wetland complex)

This feature is part of the Beverly Swamp wetland complex that is designated as a provincially significant wetland and an ESA. The riparian wetlands at this site help to maintain water quality associated with Strabane Creek, a tributary of Bronte Creek and this section of the creek is reported to possess important fish habitat.

#### **3.2.1.2 Highway 6 – north of Concession 11**

##### *Freelton Esker Wetland Complex* (part of Beverly Swamp wetland complex)

This feature is designated as a provincially significant Earth Science ANSI and is a part of the Beverly Swamp wetland complex that is designated as provincially significant and an ESA. The wetlands at this site contribute to maintaining a coldwater thermal regime in this part of Bronte Creek, and include both natural and hydrological linkages to a number of other sites. There are records of rare species at this site including West Virginia White – *Special Concern* (*Pieris virginiensis*).

##### *Beverly Swamp*

This feature is designated both as a provincially significant and as an ESA; it is reportedly the largest and most pristine wetland complex remaining in southern Ontario and serves as a headwater for three watersheds – Bronte, Spencer, and Fairchild Creeks. It is possible that this area possesses some national significance in terms of the presence of a number of northern species that are at their southern limit here (e.g. black spruce, snowshoe hare, northern flying squirrel). There are records for a number of rare and at risk species, including Blanding's turtle (*Emydoidea blandingii*), eastern fox snake (*Elaphe gloydi*), and green violet (*Hybanthus concolor*).

##### *Puslinch Southeast Swamp*

This feature is designated as an ESA and as a provincially significant wetland with the riparian wetlands in this complex help to maintain the water quality of Bronte Creek and an associated significant coldwater fish community. The feature is connected to other natural areas, including the Beverly Swamp and the Fletcher Creek Swamp, and rare species have been recorded.

##### *Fletcher Creek Swamp Forest*

This site has been designated as an ESA and portions of it as a provincially significant wetland, and includes large swamps, wet meadow, and thicket habitats and well-drained upland moraine ridges, and supports habitat for a number of rare and at risk species including eastern ribbonsnake (*Thamnophis sauritis*).

#### **3.2.1.3 Campbellville Road**

From west at Highway 6 to the eastern portion of the study area at Guelph Line, features found along Campbellville Road associated with the alternative haul routes include:

##### *Puslinch Southeast Swamp*

This feature is designated as an ESA and as provincially significant wetlands with the riparian wetlands in this complex helping to maintain the water quality of Bronte Creek and an

associated significant coldwater fish community. The feature is connected to other natural areas, including the Beverly Swamp and the Fletcher Creek Swamp, and rare species have been recorded.

#### *Guelph Junction Woods*

This feature is designated as a life science ANSI and consists of extensive and largely undisturbed mixed forest habitat and provides both a linkage function for wildlife and also contributes to the maintenance of water quality. The area is part of an extensive headwater region of the Twelve Mile Creek and significant recharge (and also discharge) is reportedly evident. In the northeastern part of the system, there is a large cedar bog, a rare community, and the area also supports a number of rare species such as: Walking Fern (*Camptosorus rhizophyllus*).

#### **3.2.1.4 Centre Road**

From north to the south end at Concession 11, features found along Centre Road include:

##### *Mountsberg East Wetlands*

This feature is designated as an ESA, life science ANSI, with portions being a provincially significant wetland and is noted by NHIC as being “highly susceptible to groundwater contamination”, due to a combination of steeply rolling topography and shallow, coarse soils, with groundwater recharge occurring in the vicinity. This wetland includes range of aquatic, terrestrial, and wetland vegetation communities and provides a linkage function for wildlife and is continuous upstream with Mountsberg Wildlife Area and downstream with the Carlisle North Forests, in addition to contributing to enhanced water quality in the upper Bronte Creek system, and includes deer wintering habitat. This area provides habitat for a number of provincially and nationally rare and at risk species including West Virginia White (provincially designated as a butterfly species of *Special Concern*).

#### **3.2.1.5 Concession 11**

From the west end at Highway 6, features found along Concession 11 associated with the alternative haul routes include:

##### *Freelton Esker Wetland Complex (part of Beverly Swamp wetland complex)*

This feature is designated as a provincially significant Earth Science ANSI and is a part of the Beverly Swamp wetland complex that is designated as provincially significant and an ESA. The wetlands at this site contribute to maintaining a coldwater thermal regime in this part of Bronte Creek, and include both natural and hydrological linkages to a number of other sites. There are records of rare species at this site including West Virginia White– *Special Concern* (*Pieris virginiensis*).

##### *Mountsberg East Wetlands*

This feature is designated as an ESA, life science ANSI, with portions being a provincially significant wetland and is noted by NHIC as being “highly susceptible to groundwater contamination” due to a combination of steeply rolling topography and shallow, coarse soils, with groundwater recharge occurring in the vicinity. This wetland includes range of aquatic, terrestrial, and wetland vegetation communities and provides a linkage function for wildlife and

is continuous upstream with Mountsberg Wildlife Area and downstream with the Carlisle North Forests, in addition to contributing to enhanced water quality in the upper Bronte Creek system, and includes deer wintering habitat. This area provides habitat for a number of provincially and nationally rare and at risk species including West Virginia white (provincially designated as species of *Special Concern*).

#### *Carlisle North Forest*

This forest is designated as an ESA and incorporates the headwaters of three tributaries: Mountsberg Creek; and two of Flamboro Creek. The area has records for a number of rare species, including West Virginia White (*Pieris virginiensis*) and supports part of the deer wintering area associated with Guelph Junction. This area is connected to a number of other natural areas.

#### **3.2.1.6 Millborough Line**

From south at Concession 11 to north at Campbellville Road, features found along Millborough Line include:

#### *Carlisle North Forest*

This forest is designated as an ESA and incorporates the headwaters of three tributaries: Mountsberg Creek; and two of Flamboro Creek. The area has records for a number of rare species, including West Virginia White (*Pieris virginiensis*) and supports part of the deer wintering area associated with Guelph Junction. This area is connected to a number of other natural areas.

#### *Mountsberg East Wetlands*

This feature is designated as an ESA, life science ANSI, with portions being a provincially significant wetland and is noted by NHIC as being “highly susceptible to groundwater contamination” due to a combination of steeply rolling topography and shallow, coarse soils, with groundwater recharge occurring in the vicinity. This wetland includes range of aquatic, terrestrial, and wetland vegetation communities and provides a linkage function for wildlife and is continuous upstream with Mountsberg Wildlife Area and downstream with the Carlisle North Forests, in addition to contributing to enhanced water quality in the upper Bronte Creek system, and includes deer wintering habitat. This area provides habitat for a number of provincially and nationally rare and at risk species including West Virginia white (provincially designated as species of *Special Concern* (MNR, 2008).

## **4 Analysis Criteria and Indicators**

The following section discusses each alternative haul route alternative with the associated information and the following criteria and associated indicators summarized in Table 3:

- 1) Potential for disturbance to aquatic habitat
  - a. Number, character and sensitivity of watercourses crossed where road works are expected, exclusive of crossings of Highway 6
  - b. Likelihood of increased runoff effects on these watercourses.
  - c. Potential for increased erosion and sediment loading to receiving streams during construction.

- d. Likelihood of water quality impacts to watercourses from runoff as a result of road improvements
- 2) Potential for removal of aquatic habitat from road improvements (e.g. bridge or culvert extensions or replacements).
  - a. Number of watercourse culverts/structures that could require extension to accommodate road improvements.
  - b. Magnitude of removal effects.
  - c. Sensitivity of habitat affected.
  - d. Type of structure (bridge or culvert) being widened to accommodate road improvements
- 3) Potential for disturbance to natural habitat
  - a. Number and identification of sensitive features that the haul routes pass by.
  - b. Distance of designated significant features traversed through (rural road segments where alterations/effects may occur)
  - c. Effects on vegetation from increased run-off from new road works, dust, emissions, etc.
- 4) Potential for removal of natural habitat from road improvements.
  - a. Area, character and sensitivity of vegetation to be removed due to required road improvements.
  - b. Potential effects on wildlife as a result of habitat removal.
- 5) Potential for increased wildlife kills.
  - a. Presence of wildlife corridors that the routes pass through.
  - b. Likelihood of increased vehicle wildlife conflicts as a result of increased truck traffic volumes.
  - c. Likelihood of increased vehicle wildlife conflicts as a result of the reluctance of wildlife to use longer/wider bridge or culvert structures.

#### 4.1 Alternative Haul Route 1

The proposed route for Haul Route 1 passes by the following designated features:

- 1) Fletcher Creek Swamp Forest;
- 2) Puslinch Southeast Swamp;
- 3) Beverly Swamp;
- 4) Freelon Esker Wetland Complex;
- 5) Mountsberg East Wetlands; and,
- 6) Carlisle North Forest.

A total of 8 watercourse crossings - 3 permanent; 4 intermittent; 1 ephemeral - are associated with Haul Route 1.

The total potential maximum intrusion into ELC vegetation communities (not including agricultural, residential, or industrial) under the rural cross-section (most conservative) for Haul Route 1 is 3.1 hectares.

There are no direct impacts associated with Haul Route 1 along Highway 6 as it relates to Fletcher Creek Swamp, Puslinch Southeast Swamp, or Beverly Swamp. Haul Route 1 will result in a maximum 18 % increase over existing truck traffic along Highway 6 north of Concession 11

(iTrans, 2008). As such, indirect impacts as it relates to increases in truck traffic may include increases in:

- air pollution
- light
- noise
- wildlife related collisions

The existing ROW for Concession 11 west of Centre Road ranges from 18.5-23 m and the proposed ROW for Haul Route 1 is 26 m. This would translate to a potential intrusion of up to 8 m into the Freelon Esker Wetland Complex. Direct impacts may include:

- increased sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 1 will result in a maximum 78 % increase in total truck traffic along Concession 11 west of Centre Road (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Concession 11 west of Centre Road:

- BCC11-1
- BCC11-2
- BCC11-3

Particularly with BCC11-1 and BCC11-3, proposed extensions to the existing CSPs could translate to a HADD under the Federal Fisheries Act (FFA), if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions and using appropriate sediment and erosion control measures.

The extension of BCC11-2 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the amount of riparian vegetation that is required for removal. There are records for both reddsides dace and brook trout near this crossing.

The existing ROW for Concession 11 east of Centre Road ranges from 18.5-23 m and the proposed ROW for Haul Route 1 is 22 m. This would translate to a potential intrusion of up to 4 m into the Mountsberg East Wetlands and Carlisle North Forest. Mountsberg East Wetlands narrows at the intersection with Concession 11, so the greatest impacts are anticipated to be associated with Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 1 will result in a maximum 72 % in total truck traffic along Concession 11 east of Centre Road (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m for Concession 11 east of Centre Road:

- MCC11-1
- MCC11-2
- MCC11-3
- MCC11-4
- FCC11-1

Particularly with MCC11-2, MCC11-3, and MCC11-4 proposed extensions to the existing CSPs could translate to a HADD under the FFA, if it is deemed that these reaches provide fish habitat, either directly or indirectly. The extensions of MCC11-1 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the amount of riparian vegetation that is required for removal. The extension of FCC11-1 where there is a corrugated plastic pipe and where the reach provides habitat for brook trout and is high quality would likely constitute a HADD under the FFA.

#### **4.2 Alternative Haul Route 2**

The proposed route for Haul Route 2 passes by the following designated features:

- 1) Fletcher Creek Swamp Forest;
- 2) Puslinch Southeast Swamp;
- 3) Beverly Swamp;
- 4) Freelon Esker Wetland Complex;
- 5) Mountsberg East Wetlands; and,
- 6) Carlisle North Forest.

A total of 12 watercourse crossings - 4 permanent; 6 intermittent; 2 ephemeral - are associated with Haul Route 2.

The total potential maximum intrusion into ELC vegetation communities (not including agricultural, residential, or industrial) under the rural cross-section (most conservative) for Haul Route 2 is 2.5 hectares.

There are no direct impacts associated with Haul Route 2 along Highway 6 as it relates to: Fletcher Creek Swamp Forest, Puslinch Southeast Swamp, or Beverly Swamp. However, indirect impacts may include increases in:

- light
- noise
- dust
- wildlife related collisions

Haul Route 2 will result in a maximum increase in total truck traffic along Highway 6 of 18 % (iTrans, 2008).

The existing ROW for Campbellville Road, east of Highway 6, ranges from 18.5-23 m and the proposed ROW for Haul Route 2 is 22 m. This would translate to a potential intrusion of up to 4 m into the Puslinch Southeast Swamp. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 2 will result in a maximum increase in total truck traffic along Campbellville Road east of Highway 6 of 25 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m along Campbellville Road east of Highway 6:

- BCCR1
- BCCR2
- BCCR3
- BCCR4
- BCCR5

The extension of BCCR1 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the amount of riparian vegetation that is required for removal. This reach provides habitat for brook trout and potentially Redside Dace, although it is unlikely that the two co-occur. This reach is considered to be of high quality.

At the extension of BCCR2 where there is a corrugated steel pipe and where the reach provides habitat for brook trout downstream, the works may constitute a HADD under the FFA if this reach is deemed to provide direct habitat and if maintenance and/or improvements to fish passage are desired at this location.

Particularly with BCCR3, BCCR4, and BCCR5 proposed extensions to the existing CSPs would translate to a HADD under the FFA if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions.

The existing ROW for Centre Road ranges from 18.5-23 m and the proposed ROW for Haul Route 2 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 2 will result in a maximum increase in total truck traffic along Centre Road of 57 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m along Centre Road: BCCR6. The extension of the existing corrugated plastic pipe at BCCR6 would likely be acceptable since the channel is well vegetated with cattails and does not likely provide direct fish habitat; however, this would need to be confirmed with the agencies (i.e. MNR, Conservation Halton, and Fisheries and Oceans Canada).

The existing ROW for Concession 11, east of Centre Road, ranges from 18.5-23 m and the proposed ROW for Haul Route 2 is 22 m. This would translate to a potential intrusion of up to 4 m into the Mountsberg East Wetlands and Carlisle North Forest. Mountsberg East Wetlands narrows at the intersection with Concession 11, so the greatest impacts are anticipated to be associated with Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 2 will result in a maximum increase in total truck traffic along Concession 11 of 72 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m for Concession 11 east of Centre Road:

- MCC11-1
- MCC11-2
- MCC11-3
- MCC11-4
- FCC11-1

Particularly with MCC11-2, MCC11-3, and MCC11-4 proposed extensions to the existing CSPs could translate to a HADD under the FFA, if it is deemed that these reaches provide fish habitat, either directly or indirectly. The extensions of MCC11-1 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the amount of riparian vegetation that is required for removal. At FCC11-1 where there is a corrugated plastic pipe and where the reach provides habitat for brook trout and is high quality, a comparable extension may constitute a HADD under the FFA.

### **4.3 Alternative Haul Route 3**

The proposed route for Haul Route 3 passes by the following designated features:

- 1) Mountsberg East Wetlands;
- 2) Carlisle North Forest; and,
- 3) Guelph Junction Woods and Extensions.

A total of 5 watercourse crossings - 1 permanent; 2 intermittent; 2 ephemeral - are associated with Haul Route 3.

The total potential maximum intrusion into ELC vegetation communities (not including agricultural, residential, or industrial) under the rural cross-section (most conservative) for Haul Route 3 is 6.2 hectares.

The existing ROW for Milborough Line ranges from 18.5-23 m and the proposed ROW for Haul Route 3 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands and Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 3 will result in a maximum increase in total truck traffic along Milborough Line of 79 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Milborough Rd:

- MCML-7
- FCC11-2
- KCML-1

Particularly with MCML-7, FCC11-1, and KCML-1 proposed extensions to the existing CSPs could translate to a HADD under the FFA but only if it is deemed that these reaches provide fish habitat, either directly or indirectly.

The existing ROW for Campbellville Road, east of Milborough Line, ranges from 18.5-23 m and the proposed ROW for Haul Route 3 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands, Carlisle North Forest, and Guelph Junction Woods. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 3 will result in a maximum increase in total truck traffic along Campbellville Road, east of Milborough Line of 46 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Campbellville Road, east of Milborough Rd:

- KCCR-2
- KCCR-3

For KCCR-2 proposed extensions to the existing CSP could translate to a HADD under the FFA but only if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions.

For KCCR-3, the existing crossing structure is 3 corrugated steel pipes and because brook trout are known to occur in the area and the overall habitat is considered to be high quality, an extension of a comparable nature to the existing structure would likely constitute a HADD under the FFA.

The existing ROW for Twiss Road and Reid Sideroad ranges from 18.5-23 m and the proposed ROW for Haul Route 3 is 22 m. This would translate to a potential intrusion of up to 4 m into North Junction Woods. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 3 will result in a maximum increase in total truck traffic along Twiss Road and Reid Sideroad of 72% and 52 %, respectively (iTrans, 2008).

#### **4.4 Alternative Haul Route 4**

The proposed route for Haul Route 4 passes by the following designated features:

- 1) Freelton Esker Wetland Complex;
- 2) Mountsberg East Wetlands;
- 3) Carlisle North Forest; and,
- 4) Guelph Junction Woods.

A total of 13 watercourse crossings - 4 permanent; 6 intermittent; 3 ephemeral - are associated with Haul Route 3.

The total potential maximum intrusion into ELC vegetation communities (not including agricultural, residential, or industrial) under the rural cross-section (most conservative) for Haul Route 4 is 10.3 hectares.

The existing ROW for Concession 11 west of Centre Road ranges from 18.5-23 m and the proposed ROW for Haul Route 4 is 22.5 m. This would translate to a potential intrusion of up to 4 m into the Freelton Esker Wetland Complex. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 4 will result in a maximum increase in total truck traffic along Concession 11 west of Centre Road of 43 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m for Concession 11 west of Centre Road:

- BCC11-1
- BCC11-2

- BCC11-3

Particularly with BCC11-1 and BCC11-3, proposed extensions to the existing CSPs could translate to a HADD under the FFA if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions. The extension of BCC11-2 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD although this may depend on the amount of riparian vegetation that is required for removal.

The existing ROW for Concession 11 east of Centre Road ranges from 18.5-23 m and the proposed ROW for Haul Route 4 is 22 m. This would translate to a potential intrusion of up to 4 m into the Mountsberg East Wetlands and Carlisle North Forest. Mountsberg East Wetlands narrows at the intersection with Concession 11, so the greater impacts are anticipated to be associated with Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 4 will result in a maximum increase in total truck traffic along Concession 11 east of Centre Road of 35 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m for Concession 11 east of Centre Road:

- MCC11-1
- MCC11-2
- MCC11-3
- MCC11-4
- FCC11-1

Particularly with MCC11-2, MCC11-3, and MCC11-4 proposed extensions to the existing CSPs could translate to a HADD under the FFA if it is deemed that these reaches provide fish habitat, either directly or indirectly. The extensions of MCC11-1 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the amount of riparian vegetation required for removal. The extension of FCC11-1 where there is a corrugated plastic pipe and where the reach provides habitat for brook trout and is high quality may constitute a HADD under the FFA.

The existing ROW for Milborough Line ranges from 18.5-23 m and the proposed ROW for Haul Route 4 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands and Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 4 will result in a maximum increase in total truck traffic along Milborough Line of 75 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Milborough Rd:

- MCML-7
- FCC11-2
- KCML-1

Particularly with MCML-7, FCC11-2, and KCML-1 proposed extensions to the existing CSPs could translate to a HADD under the FFA but only if it is deemed that these reaches provide fish habitat, either directly or indirectly.

The existing ROW for Campbellville Road, east of Milborough Line, ranges from 18.5-23 m and the proposed ROW for Haul Route 4 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands, Carlisle North Forest, and Guelph Junction Woods. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 4 will result in a maximum increase in total truck traffic along Campbellville Road east of Milborough Line of 41 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Campbellville Road, east of Milborough Rd:

- KCCR-2
- KCCR-3

For KCCR-2 proposed extensions to the existing CSP could translate to a HADD under the FFA but only if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions.

For KCCR-3, the existing crossing structure is 3 corrugated steel pipes and because brook trout are known to occur in the area and the overall habitat is considered high quality and sensitive, extensions of a comparable nature will likely constitute a HADD under the FFA.

The existing ROW for Twiss Road and Reid Sideroad ranges from 18.5-23 m and the proposed ROW for Haul Route 4 is 22 m. This would translate to a potential intrusion of up to 4 m into North Junction Woods. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 4 will result in a maximum increase in total truck traffic along Twiss Road and Reid Sideroad of 68% and 47%, respectively (iTrans, 2008).

#### **4.5 Alternative Haul Route 5**

The proposed route for Haul Route 5 passes by the following designated features:

- (1) Fletcher Creek Swamp Forest;
- (2) Puslinch Southeast Swamp;
- (3) Mountsberg East Wetlands;
- (4) Carlisle North Forest; and,
- (5) Guelph Junction Woods and Extensions.

A total of 17 watercourse crossings - 5 permanent; 8 intermittent; 4 ephemeral - are associated with Haul Route 5.

The total potential maximum intrusion into ELC vegetation communities (not including agricultural, residential, or industrial) under the rural cross-section (most conservative) for Haul Route 5 is 10.9 hectares.

There are no direct impacts associated with Haul Route 5 along Highway 6 as it relates to Fletcher Creek Swamp or Puslinch Southeast Swamp. However, indirect impacts may include increases in:

- light
- noise
- wildlife related collisions

Haul Route 5 will result in a maximum increase in total truck traffic along Highway 6 of 16 %.

Haul Route 5 will result in a maximum increase in total truck traffic along Campbellville Road, east of Highway 6 of 7 % (iTrans, 2008).

The existing ROW for Campbellville Road, east of Highway 6, ranges from 18.5-23 m and the proposed ROW for Haul Route 5 is 22 m. This would translate to a potential intrusion of up to 4 m into the Puslinch Southeast Swamp. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Extensions would also be required for the following crossings of up to 4 m along Campbellville Road east of Highway 6:

- BCCR1
- BCCR2
- BCCR3
- BCCR4
- BCCR5

The extension of BCCR1 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the amount of riparian vegetation required for removal. This reach provides habitat for brook trout and potentially Redside Dace, although it is unlikely that the two co-occur, and is considered very high quality.

The extension of BCCR2 where there is a corrugated steel pipe and where the reach provides habitat for brook trout downstream may constitute a HADD under the FFA.

Particularly with BCCR3, BCCR4, and BCCR5 proposed extensions to the existing CSPs could translate to a HADD under the FFA if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions.

The existing ROW for Centre Road ranges from 18.5-23 m and the proposed ROW for Haul Route 5 is 22.5 m. This would translate to a potential intrusion of up to 4 m into the Mountsberg East Wetlands. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 5 will result in a maximum increase in total truck traffic along Centre Road of 10 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m along Centre Road: BCCR6. The extension of the existing corrugated plastic pipe at BCCR6 would likely be acceptable since the channel is well vegetated with cattails and does not likely provide direct fish habitat; however, this would require confirmation by the agencies.

The existing ROW for Concession 11, east of Centre Road, ranges from 18.5-23 m and the proposed ROW for Haul Route 5 is 22 m. This would translate to a potential intrusion of up to 4 m into the Mountsberg East Wetlands and Carlisle North Forest. Mountsberg East Wetlands narrows at the intersection with Concession 11, so the greater impacts are anticipated to be associated with Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 5 will result in a maximum increase in total truck traffic along Concession 11 east of Centre Road of 35 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 4 m for Concession 11 east of Centre Road:

- MCC11-1

- MCC11-2
- MCC11-3
- MCC11-4
- FCC11-1

Particularly with MCC11-2, MCC11-3, and MCC11-4 proposed extensions to the existing CSPs could translate to a HADD under the FFA if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions. The extensions of MCC11-1 would mimic the existing Open Box Culvert and maintain a natural substrate and would not likely constitute a HADD, although this may depend on the extent of removal of riparian vegetation. At the extension of FCC11-1 where there is a corrugated plastic pipe and where the reach provides habitat for brook trout and is high quality, the works may constitute a HADD under the FFA.

The existing ROW for Milborough Line ranges from 18.5-23 m and the proposed ROW for Haul Route 5 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands and Carlisle North Forest. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 5 will result in a maximum increase in total truck traffic along Milborough Line of 75 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Milborough Rd:

- MCML-7
- FCC11-2
- KCML-1

Particularly with MCML-7, FCC11-2, and KCML-1 proposed extensions to the existing CSPs would translate to a HADD under the FFA but only if it is deemed that these reaches provide fish habitat, either directly or indirectly. However, it may be possible to largely mitigate the effects by conducting the work under dry conditions.

The existing ROW for Campbellville Road, east of Milborough Line, ranges from 18.5-23 m and the proposed ROW for Haul Route 5 is 26 m. This would translate to a potential intrusion of up to 8 m into the Mountsberg East Wetlands, Carlisle North Forest, and Guelph Junction Woods. Direct impacts may include increases in:

- sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 5 will result in a maximum increase in total truck traffic along Campbellville Road, east of Milborough Line of 36 % (iTrans, 2008).

Extensions would also be required for the following crossings of up to 8 m for Campbellville Road, east of Milborough Rd:

- KCCR-2
- KCCR-3

For KCCR-2 proposed extensions to the existing CSP could translate to a HADD under the FFA but only if it is deemed that these reaches provide fish habitat, either directly or indirectly.

For KCCR-3, the existing crossing structure is 3 corrugated steel pipes and because brook trout are known to occur in the area and the overall habitat is considered very high quality habitat, the works will likely constitute a HADD under the FFA.

The existing ROW for Twiss Road and Reid Sideroad ranges from 18.5-23 m and the proposed ROW for Haul Route 5 is 22 m. This would translate to a potential intrusion of up to 4 m into North Junction Woods. Direct impacts may include:

- increased sunscald, dessication, windthrow, invasive species at new edges
- light
- noise
- dust
- wildlife related collisions

Haul Route 5 will result in a maximum increase in truck traffic along Twiss Road and Reid Sideroad of 68% and 47%, respectively (iTrans, 2008).

## 5 Analysis

### 5.1 Data sources

- 1) Stantec. 2008. Natural Heritage Existing Conditions Report for Flamborough Quarry Haul Route Study. Prepared for: St. Marys Cement (Canada) Inc. April.
- 2) iTrans 2008. Peak Average Daily Traffic and Truck Percentages. March
- 3) iTrans. 2008. Representative Cross Section Alternatives – Flamborough Quarry. April
- 4) iTrans. 2008. Transportation Report. September
- 5) Stantec. 2008. Haul Route Alternatives – SMC Flamborough Quarry. March.
- 6) Stantec. 2008. Fig 2 – Designated Natural Features – SMC Flamborough Quarry. March
- 7) Stantec. 2008. Figures 3-1 and 3-2. ELC Vegetation Communities. SMC Flamborough Quarry. March
- 8) Stantec 2008. Figure 4. Potential Watercourse Crossings. SMC Flamborough Quarry. January
- 9) Stantec 2008. EIS and Level 2 Natural Environment Report: Proposed Flamborough Quarry. March.
- 10) Stantec 2008. Fig 1 – Key Findings Summary. SMC Flamborough Quarry. February
- 11) Natural Heritage Information Centre
- 12) Municipality of Hamilton-Wentworth. 2005. Hamilton-Wentworth Official Plan. (NB – new OP for amalgamated city is currently under development)

## 5.2 Assumptions

The daily operating times of the trucks along the various haul routes are anticipated to be limited to 0600 to 1800 (weekdays) and 0600 to 1200 (Saturdays). Peak total daily traffic times are: 0700 to 0830 and 1615 to 1830 (iTrans, 2008).

Peak times of year for wildlife collisions are May-June and October-December, and times of the day are 0500 to 0700 and 1700 to 2300 (MTO, 2008). Peak times for amphibian roadkills tend to be in spring and to a lesser extent summer, and for reptiles in the fall and spring (Hels and Buchwald, 2001; Coleman et al, 2008). Peak times for mammal roadkills tend to be in the fall (Caro et al, 2000).

Four key factors are considered relevant to determining species' vulnerability to road mortality: (1) velocity of the species; (2) diurnal movement patterns with those species that are most active during the day being most vulnerable; (3) vehicle characteristics; and, (4) frequency of road crossings (Hels and Buchwald, 2001). Other related considerations tie in with avoidance behaviour that can be generally divided into three categories: (1) road surface avoidance; (2) general traffic avoidance; and, (3) car avoidance, but vary according to species (McGregor et al, 2008).

## 5.3 Methodology

All of the alternative haul route options were qualitatively evaluated from an aquatic and terrestrial habitat perspective to determine the route that would translate to the lowest overall impact. Some quantitative analyses as far as the relative numbers of aquatic and terrestrial natural heritage features directly or indirectly affected by the various haul route alternatives was also undertaken. Tables 1, 2, and 3 summarize these data; while Section 3 provides a related discussion in addition to highlighting the relative increases in truck traffic anticipated with each haul route alternative broken down by individual roads

## 5.4 Results

In reviewing the five alternative haul route options, the preferred alternative from both an aquatic and terrestrial point of view in terms of the fewest number of affected features is: Haul Route 3. This alternative necessitates the least number of crossings of watercourses and affects the least number of designated terrestrial significant natural heritage features, with a detailed discussion in Section 4 and a summary presented in Table 3.

The high, medium and low criteria were assigned to each haul route alternative relative to each other and with consideration given to typical mitigation measures. For example, with the first criterion under the Aquatic Environment – “Potential for disturbance to aquatic habitat” – Alternative Haul Routes 1 and 3 have a requirement for relatively fewer crossing watercourse structures; however, because there are still quite a few, they were assigned a “medium”. Similarly, in terms of the “likelihood of increased runoff effects on these watercourses”, the use of standard sediment and erosion control measures should help to minimize the impacts of any construction activities; however, they will not be entirely eliminated so all Haul Route alternatives are assigned a “low-medium”.

**Table 3 – Criteria and Indicators**

Criteria	Indicators	Alternative Haul Route 1	Alternative Haul Route 2	Alternative Haul Route 3	Alternative Haul Route 4	Alternative Haul Route 5
Potential for disturbance to aquatic habitat.	<p>Number, character and sensitivity of watercourses crossed where road works are expected, exclusive of crossings of Highway 6).</p> <p><i>Ephemeral – water flows for a short period of time in response to local precipitation events.</i></p> <p><i>Intermittent – water flows for several months of the year, usually in the wetter periods.</i></p>	<p>MEDIUM</p> <p>3 Permanent, 4 Intermittent 1 ephemeral = 8 crossings</p>	<p>HIGH</p> <p>4 permanent 6 intermittent 2 ephemeral = 12 crossings</p>	<p>MEDIUM</p> <p>1 permanent 2 intermittent 2 ephemeral = 5 crossings</p>	<p>HIGH</p> <p>4 permanent 6 intermittent 3 ephemeral = 13 crossings</p>	<p>HIGH</p> <p>5 permanent 8 intermittent 4 ephemeral = 17 crossings</p>
	<p>Likelihood of increased runoff effects on these watercourses. These effects can be managed largely through proven impact mitigation measures.</p> <p>Riparian conditions of permanent water courses at proposed crossings</p>	<p>LOW - MEDIUM</p> <p>Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. In short-term, until vegetation becomes re-established, there will be a slight increase in runoff from adjacent banks disturbed during construction.</p>	<p>LOW - MEDIUM</p> <p>Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. In short-term, until vegetation becomes re-established, there will be a slight increase in runoff from adjacent banks disturbed during construction.</p>	<p>LOW - MEDIUM</p> <p>Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. In short-term, until vegetation becomes re-established, there will be a slight increase in runoff from adjacent banks disturbed during construction.</p>	<p>LOW - MEDIUM</p> <p>Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. In short-term, until vegetation becomes re-established, there will be a slight increase in runoff from adjacent banks disturbed during construction.</p>	<p>LOW - MEDIUM</p> <p>Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. In short-term, until vegetation becomes re-established, there will be a slight increase in runoff from adjacent banks disturbed during construction.</p>
	<p>Potential for increased erosion and sediment loading to receiving streams during construction. These</p>	<p>LOW - MEDIUM</p> <p>Use of appropriate</p>	<p>LOW - MEDIUM</p> <p>Use of appropriate</p>	<p>LOW - MEDIUM</p> <p>Use of appropriate</p>	<p>LOW - MEDIUM</p> <p>Use of appropriate</p>	<p>LOW - MEDIUM</p> <p>Use of appropriate</p>

Criteria	Indicators	Alternative Haul Route 1	Alternative Haul Route 2	Alternative Haul Route 3	Alternative Haul Route 4	Alternative Haul Route 5
	effects can be largely mitigated through appropriate construction sedimentation mitigation measures.	sediment and erosion control measures, work within appropriate construction timing guidelines and isolation of work area will be required.	sediment and erosion control measures, work within appropriate construction timing guidelines and isolation of work area will be required.	sediment and erosion control measures, work within appropriate construction timing guidelines and isolation of work area will be required.	sediment and erosion control measures, work within appropriate construction timing guidelines and isolation of work area will be required.	sediment and erosion control measures, work within appropriate construction timing guidelines and isolation of work area will be required.
	Likelihood of water quality impacts to watercourses from runoff as a result of road improvements.	LOW - MEDIUM Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. This may result in increased introduction of chlorides and/or sand, in addition to other pollutants such as grease/oil, etc.	LOW - MEDIUM Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. This may result in increased introduction of chlorides and/or sand, in addition to other pollutants such as grease/oil, etc.	LOW - MEDIUM Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. This may result in increased introduction of chlorides and/or sand, in addition to other pollutants such as grease/oil, etc.	LOW - MEDIUM Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. This may result in increased introduction of chlorides and/or sand, in addition to other pollutants such as grease/oil, etc.	LOW - MEDIUM Extension of existing crossings will result in slight increase in runoff from wider road/impervious surface. This may result in increased introduction of chlorides and/or sand, in addition to other pollutants such as grease/oil, etc.
Potential for removal of aquatic habitat from road improvements (e.g. bridge or culvert extensions or replacements).	Number of watercourse culverts/structures that could require extension to accommodate road improvements.	Potential for improvement in fish habitat/passage and/or groundwater upwellings by replacing corrugated plastic pipe (FCC11-1) (and possibly those associated with intermittent/ephemeral) with open foot structure. 3 permanent and 5 intermittent/ ephemeral	Potential for improvement in fish habitat/passage and/or groundwater upwellings by replacing corrugated plastic pipe (FCC11-1) and CP (BCCR6), (and possibly those associated with intermittent/ephemeral) with open foot structure.	Potential for improvement in fish habitat/passage and/or groundwater upwellings by replacing CSP (KCCR-3), (and possibly those associated with intermittent/ephemeral) with open foot structure. 1 permanent and 4	Potential for improvement in fish habitat/passage and/or groundwater upwellings by replacing corrugated plastic pipe (FCC11-1) and CSP (KCCR-3), (and possibly those associated with intermittent/ephemeral) with open foot structure. 4 permanent and 9 intermittent/ephemeral watercourses may require	Potential for improvement in fish habitat/passage and/or groundwater upwellings by replacing corrugated plastic pipe (FCC11-1) and CSP (KCCR-3), (and possibly those associated with intermittent/ephemeral) with open foot structure. 5 permanent and 12 intermittent/ephemeral

Criteria	Indicators	Alternative Haul Route 1	Alternative Haul Route 2	Alternative Haul Route 3	Alternative Haul Route 4	Alternative Haul Route 5
		watercourse crossings may require extensions.	4 permanent and 8 intermittent/ephemeral watercourses may require extensions.	intermittent/ephemeral watercourses may require extensions.	extensions.	watercourses may require extensions.
	Magnitude of removal effects.	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH
	Sensitivity of habitat affected. Brook trout and / or redbreasted dace habitat at multiple crossing locations	HIGH	HIGH	HIGH	HIGH	HIGH
	Type of structure (bridge or culvert) being widened to accommodate road improvements	HIGH Permanent watercourses: 5m wide open box culvert (BCC11-2); 7.3 m wide open box culvert (MCC11-1); 0.4 m corrugated plastic pipe (FCC11-1)	MEDIUM Permanent watercourses: 6m open box culvert (BCCR1); 5m open box culvert (BCCR11-2); 7.3 m wide open box culvert (MCC11-1); 0.4 m corrugated plastic pipe (FCC11-1).	MEDIUM Permanent watercourses: Three 1.8 m diameter corrugated steel pipes (KCCR-3).	HIGH Permanent watercourses: 5m wide open box culvert (BCC11-2); 7.3 m wide open box culvert (MCC11-1); 0.4 m corrugated plastic pipe (FCC11-1)	MEDIUM Permanent watercourses: 6m open box culvert (BCCR1); 5m open box culvert (BCCR11-2); 7.3 m wide open box culvert (MCC11-1); 0.4 m corrugated plastic pipe (FCC11-1).
Potential for disturbance to natural habitat.	Number and identification of sensitive features that the haul routes pass by.  Distance of designated significant features traversed through (rural road segments where alterations/effects may occur)	6 1) Fletcher Creek Swamp Forest; 2) Puslinch Southeast Swamp; 3) Beverly Swamp; 4) Freelon Esker Wetland Complex; 5) Mountsberg East Wetlands; and, 6) Carlisle North Forest.	6 1) Fletcher Creek Swamp Forest; 2) Puslinch Southeast Swamp; 3) Beverly Swamp; 4) Freelon Esker Wetland Complex; 5) Mountsberg East Wetlands; and, 6) Carlisle North Forest.	3 1) Mountsberg East Wetlands; 2) Carlisle North Forest; and, 3) Guelph Junction Woods and Extensions.	4 1) Freelon Esker Wetland Complex; 2) Mountsberg East Wetlands; 3) Carlisle North Forest; and, 4) Guelph Junction Woods.	5 1) Fletcher Creek Swamp Forest; 2) Puslinch Southeast Swamp; 3) Mountsberg East Wetlands; 4) Carlisle North Forest; and, 5) Guelph Junction Woods and Extensions.

Criteria	Indicators	Alternative Haul Route 1	Alternative Haul Route 2	Alternative Haul Route 3	Alternative Haul Route 4	Alternative Haul Route 5
	Effects on vegetation from increased run-off from new road works, dust, emissions, etc.	HIGH	HIGH	HIGH	HIGH	HIGH
Potential for removal of natural habitat from road improvements.	Area, character and sensitivity of vegetation to be removed due to required road improvements.	MEDIUM 1.6 ha	MEDIUM 1.4 ha	HIGH 4.5 ha	HIGH 5.6 ha	HIGH 5.8 ha
	Potential effects on wildlife as a result of habitat removal.	LOW Loss of habitat Edge Effects Windthrow Sunscald/dessication Part loss of deer wintering yard	LOW Loss of habitat Edge Effects Windthrow Sunscald/dessication Part loss of deer wintering yard	MEDIUM Loss of habitat Edge Effects Windthrow Sunscald/dessication Part loss of deer wintering yard	HIGH Loss of habitat Edge Effects Windthrow Sunscald/dessication Part loss of deer wintering yard	HIGH Loss of habitat Edge Effects Windthrow Sunscald/dessication Part loss of deer wintering yard
Potential for increased wildlife kills.	Presence of wildlife corridors that the routes pass through.	HIGH Significant connectivity between Freelton Esker Wetland on both sides of Conc 11, and between Mountsberg East Wetland and Carlisle North Forest MNR significant deer wintering yard in Lower Mountsberg Creek	HIGH Significant connectivity between Puslinch SE Swamp on both sides of Campbellville Rd, and with Mountsberg East Wetland and Carlisle North Forest MNR significant deer wintering yard in Lower Mountsberg Creek	HIGH Significant connectivity between Mountsberg East Wetland on both sides of Milborough Rd, and with Guelph Junction Woods (and Carlisle North Forest) MNR significant deer wintering yard in Lower Mountsberg Creek	HIGH Significant connectivity between Freelton Esker Wetland on both sides of Conc 11, and between Mountsberg East Wetland and Carlisle North Forest MNR significant deer wintering yard in Lower Mountsberg Creek	HIGH Significant connectivity between PSS on both sides of Campbellville Rd, with MEW on both sides of Millborough Rd and with Guelph Junction Woods (and Carlisle North Forest), and with Mountsberg East Wetland and Carlisle North Forest MNR significant deer wintering yard in Lower Mountsberg Creek
	Likelihood of increased vehicle wildlife conflicts as a result of increased truck traffic volumes.	HIGH	HIGH	HIGH	HIGH	HIGH

Criteria	Indicators	Alternative Haul Route 1	Alternative Haul Route 2	Alternative Haul Route 3	Alternative Haul Route 4	Alternative Haul Route 5
	Likelihood of increased vehicle wildlife conflicts as a result of the reluctance of wildlife to use longer/wider bridge or culvert structures.	MEDIUM	MEDIUM	HIGH	HIGH	HIGH

## 6 Conclusions and Recommendations

Specific to Alternative Haul Route 3, the edges of the following vegetation communities will likely be affected directly through removals and/or indirectly as a result of the increase in adjacent truck traffic as a result of the proposed expansion to the existing road Right-of-Way under the rural cross-section option (most conservative):

FOC4-1: Fresh – Moist White Cedar Coniferous Forest  
FOD5-8: Dry Fresh Sugar Maple Forest  
FOM7-2: Dry–Fresh White Pine–Sugar Maple Mixed Forest  
SWM4-1: White Cedar–Hardwood Organic Mixed Swamp  
SWM1-1: White Cedar–Hardwood Mineral Mixed Swamp  
FOD5-1: Dry–Fresh Sugar Maple Deciduous Forest  
FOM7-2: Fresh-Moist White Cedar– Hardwood Mixed Forest  
FODD5-8: Dry–Fresh Sugar Maple–White Ash Deciduous Forest  
FOM9-1: Dry–Fresh Sugar Maple–White Cedar Mixed Forest  
SWD3-2A: Silver Maple Mineral Deciduous Swamp  
FOD5-2: Dry–Fresh Sugar Maple–Beech Deciduous Forest  
SWD2-2: Green Ash Mineral Deciduous Swamp  
SWC1-2: White Cedar Conifer Mineral Coniferous Swamp  
FOC2-2: Dry – Fresh White Cedar Coniferous Forest  
SWD3-3A: Swamp Maple Mineral Deciduous Swamp  
SWM1-1A: White Cedar Hardwood Mineral Mixed Swamp  
FOM3-2: Dry-Fresh Sugar Maple – Hemlock Mixed Forest  
FOD4-2A: Dry-Fresh White Ash Deciduous Forest  
SWD3-2A: Silver Maple Mineral Deciduous Swamp

These effects (i.e. intrusions into these vegetation communities, increases in light, sunscald, dessication, pollution, noise, etc) will result in some localized loss in area of habitat and some residual indirect effects on newly created edges. There would be some benefit to undertaking a detailed and focused floral inventory, including an inventory of both woody and herbaceous species, to refine the alignment of the preferred alternative and to minimize the anticipated effects on adjacent natural heritage features. Furthermore, some targeted faunal surveys to evaluate the presence of locally rare to provincially or federally at risk species is warranted. For example, surveying the Mountsberg East Wetlands in the vicinity of Milborough Line for species such as West Virginia White (*Pieris virginiensis*), provincially designated as Special Concern, warrants consideration. There are also records for Jefferson Salamander (*Ambystoma jeffersonianum*) within the boundaries of the study area and surveying the Guelph Junction Woods and Mountsberg East Wetlands is recommended.

While these habitat edge effects will, over time, be stabilized through natural processes as new edge vegetation begins to establish, there would be some benefits associated with detailed edge mitigation planning prior to implementation, for the selected, preferred alternative.

It is assumed that if partial displacement of lands is required to accommodate the grading requirements for the proposed road improvements, such displacement of lands will occur (and be divided across) both sides of the road, where feasible. Furthermore, it is anticipated that if displacement of lands is required, it will be balanced to minimize impact on land use types

considered to be more sensitive to road improvements (i.e. residential and institutional land uses), where possible. Maximum efforts will be made in ensuring that the refinements to the selected, preferred alternative minimize impacts on the aquatic and terrestrial natural heritage features.

As part of the detailed design of the preferred alternative, additional detailed biological surveys would be useful to complete to determine optimal locations and characteristics of potential wildlife ecopassages. The scope of these potential surveys should evaluate not only the roadkill “hotspot” areas, but also the daily and seasonal distribution of wildlife (i.e when they are most likely to cross the roads) and correlate these data with the existing and projected traffic volumes (iTrans 2008). For example, amphibians tend to be most active at night and, as such, the implications of the SMC truck traffic (operating from 0600 to 1800) may be minimal, however this will require additional analyses to confirm. Other species such as many snakes are diurnal during the spring and fall but more nocturnal during the summer (Shepard et al, 2008). Therefore, gaining an understanding of the movement patterns of different species will be important. The application of predictive models such as that outlined by Hels and Buchwald (2001) to estimate wildlife-vehicle collisions, based on species-specific information and behaviour, may also warrant consideration.

McGregor et al (2008) have demonstrated that it is in fact the presence and characteristics of the road itself and car avoidance more so than the volume of traffic that discourages crossings by small mammals. For this reason, measures aimed solely at reducing the amount of traffic, speed, or timing will do little to mitigate the effects of roads on the movements of small mammals; however, the construction of suitable wildlife passages and other measures may achieve more desired results. Road avoidance was also highlighted as deterrent to moose in a study by Laurian et al (2008), although it was not determined whether or not this was related to the physical presence of the road or traffic or susceptibility to predation. This same study found that moose were much more likely to cross roads at night.

Under Haul Route 3 alternative, of the 5 watercourse crossings required, only 1 (FCC11-2) is permanent and one of the others (KCCR-3) appears to present an opportunity for improvements to the existing structures. A more detailed assessment of watercourse crossings along alternative Haul Route 3 is recommended in order to evaluate the potential for improvements in existing crossing structures (e.g. FCC11-2 and KCCR-3). This would potentially result in enhanced passage, a natural substrate, and the potential reestablishment of groundwater upwellings and associated potential spawning habitat. All of the crossing structures along the selected preferred alternative route should also be evaluated with a view to assessing the potential to upgrade them to maximize their potential as wildlife ecopassages.

In summary, mitigation work should be detailed for the preferred alternative, especially as it relates to:

- Detailed and focused floral and faunal inventories to identify any potentially locally rare to federally and/or provincially at risk species in order to ensure sound decision-making and the implementation of appropriate mitigation measures including but not limited to refinement of the alignment; Edge restoration plantings;
- Detailed watercourse crossing and culvert replacement/extension;

- Baseline inventories of wildlife crossings and associated habitat features to identify 'hotspot areas' under both existing and projected traffic scenarios;
- Management of roadside areas to reduce the concentration of potential forage or cover plants, basking areas, salt use, etc;
- Wildlife crossing planning (e.g., (seasonal) signage, road speed consideration, culvert suitability for passage, collector/funneling fencing, ecopassages, etc.); and, traffic adjustments to accommodate key wildlife movement periods.

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SAVANTA INC.



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Tom W. Hilditch, B.Sc.  
President

## Appendices

## APPENDIX A.

Photographs – June 18, 2008



**BCC11-3 East**



**BCC11-3 West**



**BCC11-3 West**



**BCCR3 North**



**BCCR3 South**



**BCCR4 North**



**BCCR4 South**



**BCCR5 North**



**BCCR5 South**



**BCCR6 East**



**BCCR6 West**



**FCC11-2 East**



**FCC11-2 West**



**KCCR-2 North**



**KCCR-2 South**



**KCML-1 East**



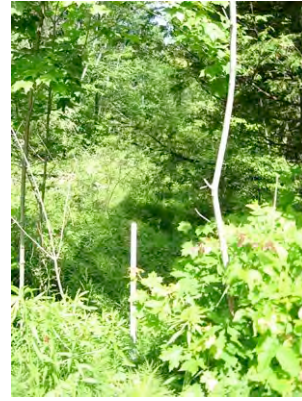
**KCML-1 West**



**MCC11-1 North**



**MCC11-1 South**



**MCC11-2 North**



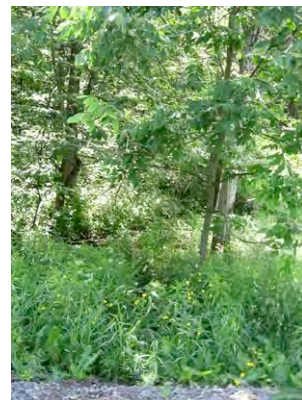
**MCC11-2 North**



**MCC11-2 South**



**MCC11-3 North**



**MCC11-3 South**



**MCC11-4 North**



**MCC11-4 South**



**MCML-7 East**



**MCML-7 West**

## **APPENDIX B**

TANTEC 2008 NATURAL HERITAGE EXISTING CONDITIONS REPORT FOR  
FLAMBOROUGH QUARRY HAUL ROUTE STUDY



**NATURAL HERITAGE EXISTING  
CONDITIONS REPORT FOR  
FLAMBOROUGH QUARRY HAUL  
ROUTE STUDY**

File No. 160960345

Prepared for:

St. Marys Cement (Canada) Inc.

Prepared by:

Stantec Consulting Ltd.  
361 Southgate Drive  
Guelph ON N1G 3M5

April 2008

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## **1.0 Introduction**

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St. Marys Cement has proposed to develop a Dolostone Quarry in the City of Hamilton at a location between Centre Rd. and Milborough Line, north of Concession 11. As part of the project, haul route(s) will be selected between the proposed quarry and future aggregate markets. A study has been undertaken to understand the impacts of the increased heavy traffic movement on traffic safety, social features and the natural environment. Stantec Consulting Ltd. has been retained to conduct a natural heritage assessment for the proposed quarry, including input to the assessment of the alternative haul routes.

### **1.1 STUDY TERMS OF REFERENCE**

A Terms of Reference was submitted to the City of Hamilton in April 2006 (Dillon Consulting Ltd, 2006) outlining the proposed study of the alternative haul routes. The Terms of Reference proposes the following steps:

1. Define Study Parameter Assumptions
2. Review of Alternative Solutions
3. Identify Alternative Routes Within the Study Area
4. Describe Baseline Conditions
5. Develop the Evaluation Approach
6. Assess Effects of the Alternative Routes
7. Comparatively Evaluate and Recommend the Preferred Route(s)
8. Describe Effects and Mitigation for the Preferred Route(s)
9. Prepare Draft and Final Evaluation Reports

### **1.2 STUDY PURPOSE**

The purpose of this report is to describe the natural heritage features along each of the alternative haul routes. Identification of such features permits route comparisons during the route selection process. It also allows for feature avoidance, and minimization and mitigation of impacts to the features during construction and operation of the route(s). The focus of this report is to describe the natural heritage baseline conditions along each of the alternative haul routes, which will be used in the comparative evaluation and route selection process.

## **2.0 Approach**

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The approach of the haul route evaluation is outlined in the Terms of Reference: Mountsberg Quarry Haul Route Evaluation, April 2006 (Dillon Consulting Ltd, 2006). Before the natural heritage evaluation was initiated, reasonable alternative routes were selected. The alternative routes were to extend from the proposed quarry site to the entrance point of Ontario “400” series highways in all directions. Natural heritage features along these alternative routes were then identified and assessed.

### **2.1 BACKGROUND RESOURCES**

A variety of background resources were consulted to characterize the alternative routes and assess the significance of features. Significant features within 100-metres of the alternative routes were identified, mapped and their features summarized. Background material included:

- Natural Heritage Information Centre (NHIC) database (accessed November 2005 and January 2008);
- Bronte Creek Watershed Study (Conservation Halton, 2002);
- Nature Counts Project: Hamilton Natural Areas Inventory Vol. I and II (Hamilton Naturalists Club, 2003);
- Halton Region Environmentally Sensitive Areas Study (Dwyer, 2006); and,
- Ecological Survey of the Niagara Escarpment Biosphere Reserve (Riley et al., 1996).

### **2.2 VEGETATION COMMUNITIES**

Field investigations were conducted to identify the existing vegetation communities. Vegetation communities were delineated on aerial photographs (May and June, 2004; 1:20,000) and checked in the field; community characterizations (ecosites and ecotypes) were then based on the Ecological Land Classification for Southern Ontario (ELC) (Lee et al., 1998). Common and scientific nomenclature of plant species generally follows Newmaster et al. (1998). The vegetation field studies focused on secondary roads where upgrades may be required. Field studies were not conducted along Highway 6, but instead background material was used to identify areas of significant vegetation communities.

Vegetation community field studies were conducted on:

- November 3,4 and 9 2005;
- November 22, 2006;
- December 1, 2006; and,
- October 31, 2007

## **2.3 AQUATIC RESOURCES**

A review of the Bronte Creek Watershed Study (Conservation Halton, 2002) was completed to identify the thermal regime and presence of sensitive fish species in the watercourses that cross the alternative haul routes. Aquatic field investigations were conducted by Stantec to supplement the background review and determine the relative sensitivity of the crossing locations. The field investigations include aquatic habitat assessments for water-crossing features along the alternative routes. Field surveys were completed on November 22 - 23 and December 21, 2006.

Fish habitat notes were recorded at each water crossing. Habitat assessments included observations on the following stream attributes:

- In-stream Cover;
- Percent Cover;
- Bank Stability;
- Stream Dimensions and Morphology;
- Canopy Cover; and,
- Adjacent Land Use.

### **3.0 Alternative Routes**

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Five reasonable alternative routes were chosen for evaluation by iTrans, the transportation consultant. Each route extends from the proposed quarry site to a 400-series Highway and is shown on **Figure 1, Appendix A**.

#### Alternative Route 1

Truck traffic destined for Highway 401 east and west would travel west on Concession 11 E and then north on Highway 6 to the Highway 401 on-ramps. Truck traffic destined for Highway 403 east or west would travel west on Concession 11 E and then south on Highway 6 to the Highway 403/QEW east or west bound on-ramps.

#### Alternative Route 2

Truck traffic destined for Highway 401 east or west would travel west on Concession 11 E, then north on Centre Road, then west on Campbellville Road, and then north on Highway 6 to the Highway 401 on-ramps. Truck traffic destined for Highway 403 east or west would travel west on Concession 11 E, then north on Centre Road, then west on Campbellville Road, and then south on Highway 6 to the Highway 403/QEW on-ramp.

#### Alternative Route 3

Truck traffic destined for Highway 401 east or west would travel north on Milborough Line, then east on Campbellville Road, north on Twiss Road, east on Reid Sideroad and then north on Guelph Line to the Highway 401 on-ramp. Truck traffic destined for Highway 403/QEW east or west would travel north on Milborough Line, then east on Campbellville Road, north on Twiss Road, east on Reid Sideroad to the Highway 401 on-ramp. From here, there are several alternatives to reach the destination including taking the 407 ETR south to Highway 403.

#### Alternative Route 4

Truck traffic destined for Highway 401 east would travel north on Milborough Line, then east on Campbellville Road, north on Twiss Road, east on Reid Sideroad to the Highway 401 eastbound on-ramp. Truck traffic destined for Highway 401 west would travel west on Concession 11 E and then north on Highway 6 to the Highway 401 westbound on-ramp. Truck traffic destined for Highway 403 east or west would travel west on Concession 11 E and then south on Highway 6 to the Highway 403 on-ramps.

#### Alternative Route 5

Truck traffic destined for Highway 401 east would travel north on Milborough Line, then east on Campbellville Road, north on Twiss Road, east on Reid Sideroad to the Highway 401 eastbound on-ramp. Truck traffic destined for Highway 401 west would travel west on Concession 11 E, then north on Centre Road, then west on Campbellville, and then north on Highway 6 to the Highway 401 westbound on-ramp. Truck traffic destined for Highway 403 east

**NATURAL HERITAGE EXISTING CONDITIONS REPORT FOR FLAMBOROUGH QUARRY HAUL  
ROUTE STUDY**

Alternative Routes  
April 2008

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would travel west on Concession 11 E, then north on Centre Road, then west on Campbellville, and then south on Highway 6 to the Highway 403/QEW eastbound on-ramp.

As the route alternatives share various roads, the routes have been split into Links which will be used throughout the report for discussion purposes. The Links are as follows...

- Link 1: Centre Road from Concession 11 to Campbellville
- Link 5: Milborough Line from Concession 11 to Campbellville
- Link 11: Campbellville Road from Hwy 6 to Centre Road
- Link 13: Campbellville Road from Milborough Line to Twiss Road
- Link 17: Concession 11 from Hwy 6 to Centre Road
- Link 18: Concession 11 from Centre Road to Milborough Line
- Link 23: Highway 6 from Hwy 401 to Campbellville Road
- Link 24: Highway 6 from Campbellville Road to Concession 11
- Link 25: Highway 6 from Concession 11 to Highway 403
- Link 26: Twiss Road from Campbellville to Reid Sideroad
- Link 27: Reid Sideroad from Twiss Road to Guelph Line

## **4.0 Baseline Conditions**

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### **4.1 DESIGNATED FEATURES**

Regionally significant features within 100-metres of the alternative routes are shown in **Figure 2, Appendix A**. Designated features include Environmentally Significant Areas (ESA), Areas of Natural or Scientific Interest (ANSI) and Provincially Significant Wetlands (PSW) which provide a wide variety of ecological functions. Some of these functions may be directly impacted by loss of vegetation or an increase in heavy traffic related to the proposed haul route. These functions are discussed in more detail below.

Portions of fourteen ESA's and one ANSI lie within 100-metres of one or more of the alternate routes. **Table 4.1, Appendix B** summarizes the functions of each ESA, according to Dwyer (2003, 2006).

#### **4.1.1 Linkage Function**

Many of the ESA's provide a linkage function for wildlife movement. Typically larger, more expansive natural areas provide more extensive linkages across the landscape. The presence of wildlife linkages should be considered where an increase in heavy traffic is predicted, as it may result in fragmented corridors or an increase in wildlife mortality.

#### **4.1.2 Wintering Deer Yard**

Wintering deer yards are areas of dense conifer cover which provide white-tailed deer with shelter from deep snow and allow ease of movement. When snow cover is deep, deer remain in the core area of the yard, feeding on shrubs. However, when snow accumulation is light, the deer will move into adjacent lands, such as agricultural fields, to forage (OMNR, 2000). An increase in heavy traffic near or through deer yards may result in an increase in wildlife mortality.

#### **4.1.3 Rare or Sensitive Vegetation Communities**

Many of the ESA's are known to contain rare or sensitive vegetation communities. The location of these communities should be considered when vegetation removal during road upgrades is required. In addition, an increase in road runoff, dust, emissions etc, may impact sensitive vegetation communities adjacent to the road.

#### **4.1.4 Maintenance of Water Quality**

Often wetlands within ESA's form the headwater of local creeks and tributaries. These wetlands can act as natural storage reservoirs and filters to maintain flow and water quality of the headwaters. An increase in road runoff during construction may impact such functions.

## **4.2 VEGETATION COMMUNITIES**

The vegetation communities identified along the secondary roads, based on the Ecological Land Classification (ELC) system, are shown in **Figure 3 (Appendix A)**. **Table 4.2 (Appendix B)** provides a description of each vegetation community. The lands along the proposed routes were generally characterized by agricultural fields mixed with forest and swamp communities. Vegetation communities that would be more sensitive to disturbances include natural wetland communities (i.e. SWD2, SWD3, SWD8, SWT2, SWT3, SWM1, SWM2, SWM4 and MAM2-11) and mature forested communities (FOC1, FOM7, FOM9, FOD5). Larger blocks of mature swamp and forest were located along Concession 11 (Links 17 and 18), Milborough Line (Link 5) and the portion of Campbellville Road running east towards Guelph Line (Link 13).

## **4.3 AQUATIC RESOURCES**

The proposed alternative haul routes cross numerous watercourses of four sub-watersheds of Bronte Creek. The four sub-watersheds include: Bronte Creek Tributaries, Mountsberg Creek, Flamboro Creek and Kilbride Creek. **Figure 4, Appendix A** shows the water crossings along each alternative haul route. A summary of the aquatic resources at each permanent watercrossing is provided in **Table 4.3 (Appendix B)**. The following text describes the aquatic habitat observed at the permanent watercourse crossing along the proposed routes, organized by sub-watershed.

### **4.3.1 Bronte Creek Tributaries**

The proposed haul routes include three permanent watercourse crossings over Bronte Creek Tributaries. Two of these crossings are located on Campbellville Road towards Highway 6 (Link 11), with the remaining crossing on the 11<sup>th</sup> Concession.

The western most water crossing along Campbellville Road (Link 11) is a permanently flowing Bronte Creek Tributary which runs through an open box culvert. According to the Bronte Creek Watershed Study, this section of Bronte Creek has a warm water thermal regime (Conservation Halton, 2002). At the crossing location, the stream has an average width of 6 m and an average depth of 0.4 m. Substrates were composed of a mixture of gravel, sand, cobble and boulder with some silt deposition along the slow-flowing edge waters. Upstream of the road, the surrounding residential/agricultural land provided very little shading and natural riparian habitat. However, the woodlot observed downstream of the crossing provided excellent canopy cover and riparian habitat to the tributary. The Bronte Creek Watershed Study (Conservation Halton, 2002) suggests that brook trout are likely to use this portion of the tributary, and that reddsides may occur downstream between Campbellville Road and 11<sup>th</sup> Concession. The habitat identified at this water crossing would provide suitable spawning, nursery, feeding and wintering grounds for many of the fish species found in this section of Bronte Creek.

The second Bronte Creek Tributary crossing on Campbellville Road (Link 11) is located approximately 1.25 km to the east of the previous crossing. At this location the tributary crosses

the road through a 1 m corrugated steel pipe. The Bronte Creek Watershed Study shows records of both brook trout and redbreast dace downstream of this crossing. The average width and depth of this tributary was observed to be 0.8 m and 0.2 m respectively. Originating from a marsh the moderately flowing stream flowed under Campbellville Road into a mixed forest. Small trees and shrubs provide a moderate amount of canopy cover on both sides of the road crossing. The densities of aquatic grasses identified in the stream channel suggest that the flow levels become significantly reduced during the summer months. Additionally, the Bronte Creek Watershed Study lists this section of Bronte Creek as having a thermal regime of "Dry" (Conservation Halton, 2002). Between the small size and low summer flows, the quality of direct fish habitat in this portion of the tributary is relatively low, although it may support redbreast dace in isolated refuge pools.

The 11<sup>th</sup> Concession (Link 17) crossing of the Bronte Creek Tributary is located approximately 1.5 km east of Highway 6 and is through a 5 m wide open box culvert. This section of Bronte Creek has been identified as having a cool water thermal regime (Conservation Halton, 2002). Sensitive species in this portion of the Bronte Creek Tributary may include both brook trout and redbreast dace (Conservation Halton, 2002). Average width and depth of the stream was estimated to be 7 m and 0.7 m respectively. Stream flows at this location were observed to be a mixture runs and pools with some flats. Substrates were composed primarily of sand, cobble and gravel with some muck, detritus and boulder. The deciduous swamp surrounding the tributary provided a moderate amount of canopy cover. Habitat for all critical life stages, spawning, nursery, and feeding, was observed from the current right-of-way.

#### **4.3.2 Mountsberg Creek**

The proposed alternative haul routes include the crossing of one permanently-flowing section of Mountsberg Creek along 11<sup>th</sup> Concession (Link 18), approximately 500 m east of Centre Road. The existing crossing consists of a 7.3 m wide open box culvert. At this location Mountsberg Creek is a swift flowing riffle, pool, run complex with an average width of 7 m and depth of 0.4 m. Despite evidence of local ground water input at several locations along Mountsberg Creek, it provides only warm water habitat (Conservation Halton, 2002). The Bronte Creek Watershed Study (Conservation Halton, 2002) indicates that no sensitive species are known to occur in Mountsberg Creek below the reservoir. Substrates in this fast-flowing stream were dominated by coarse boulders, cobbles and gravel with small amount of fines in the deep slow-flowing pool sections. A moderate amount of canopy cover was provided by the abundant trees located on the adjacent residential properties. This section of Mountsberg Creek provides suitable habitat for all critical life stages within the vicinity of the existing right-of-way.

### **4.3.3 Flamboro Creek**

The proposed alternative haul routes include one crossing location of Flamboro Creek, located on the 11<sup>th</sup> Concession (Link 18) approximately 500 m west of Milborough Line. The existing crossing is composed of a 0.4 m corrugated plastic pipe. Average stream width and depth was estimated to be 0.8 m and 0.1 m respectively. Upstream of the road crossing Flamboro Creek originated a broad very slow flowing thicket swamp with excellent canopy cover and muck substrate. Downstream of the crossing the watercourse became a shallow, moderately flowing meandering stream through a forest. Substrates in the downstream section were composed of sand, gravel and detritus. The thermal regime at this location of Flamboro Creek is currently unknown; however, a marginal cool water habitat is predicted at the 10<sup>th</sup> Concession crossing. The Bronte Creek Watershed Study (Conservation Halton, 2002) suggests that brook trout may occur downstream of the 11<sup>th</sup> Concession crossing. Low oxygen levels upstream of the 11<sup>th</sup> Concession and low flow conditions during the summer months limit the variety of fish able to utilize the section of Flamboro Creek for all critical life stages.

### **4.3.4 Kilbride Creek**

The proposed alternative haul routes include one crossing of a permanently flowing section of Kilbride Creek, located on Campbellville Road approximately 1.5 km east of Milborough Line (Link 13). The existing crossing is composed of three, 1.8 m diameter corrugated steel pipes. The predicted thermal regime of this watercourse is listed to be "marginal cool" (Conservation Halton, 2002). The Bronte Creek Watershed Study (Conservation Halton, 2002) suggests that brook trout may occur in this portion of Killbride Creek. Average width and depth of the creek was estimated to be 5 m and 0.3 m respectively. The stream flow habitat in the vicinity of the crossing was primarily runs with some pools and flats. Substrates were a mixture of gravel, sand and cobble in the flowing runs with muck detritus and silt accumulating in the pools. The surrounding maple swamp provided excellent canopy cover and riparian habitat to watercourse. Although not limited to the crossing location, the habitat observed in Kilbride Creek would be suitable to support several critical life stages of the fish species found in the area.

## **5.0 Summary**

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Five alternative haul routes between the proposed SMC Flamborough Quarry and 400-series Highways have been identified. Natural heritage features have been identified and summarized along each of the alternative routes. The natural heritage information is to be used, in conjunction with road safety and social studies, in the comparative evaluation and route selection process. Once the final route(s) have been selected and road construction requirements identified, it is recommended that further field studies be completed to develop specific avoidance, minimizing and mitigation measures for the construction and operation of the selected haul route.

## **6.0 References**

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# **Appendix A**

## **Figures**

# **Appendix B**

## **Table**

Appendix B

<b>Table 4.1 - Summary of Environmentally Significant Areas</b>					
<b>ESA</b>	<b>Location</b>	<b>Linkage Function</b>	<b>Wintering Deer Yard</b>	<b>Rare or Sensitive Vegetation Community</b>	<b>Maintenance of Water Quality</b>
Puslinch Southeast Swamp	Highway 6	X			X
Fletcher Creek Swamp Forest	Highway 6	X	X	X	X
Beverly Swamp	Highway 6	X	X	X	X
Freelton Esker-Wetland Complex	Highway 6; Concession 11				
Strabane North Wetlands	Highway 6				X
Hayesland Swamp	Highway 6	X			X
Harper Corners East Wetlands	Highway 6				X
Millgrove South Woodlot	Highway 6				X
Parkside Drive Woodlot	Highway 6	X			X

Appendix B

<b>Table 4.1 - Summary of Environmentally Significant Areas</b>					
<b>ESA</b>	<b>Location</b>	<b>Linkage Function</b>	<b>Wintering Deer Yard</b>	<b>Rare or Sensitive Vegetation Community</b>	<b>Maintenance of Water Quality</b>
Clappison Escarpment Woods	Highway 6	X		X	X
Borer's Falls-Rock Chapel	Highway 6	X		X	
Mountsberg East Wetlands	Concession 11; Milborough Line; Mountsberg Rd	X			X
Carlisle North Forest	Concession 11; Milborough Line	X			X
Guelph Junction Woods and Extensions	Milborough Line; Campbellville Rd; Reid Sideroad	X			X

Source: Dwyer, 2003 and Dwyer, 2006

<b>Table 4.2 - Ecological Land Classification Vegetation Communities</b>	
<b>ELC Type</b>	<b>Description</b>
<b>CONIFEROUS FOREST (FOC)</b>	
<b>FOC2-2</b> Dry-Fresh White Cedar Coniferous Forest	This community contained a dense canopy of eastern white cedar along with a small amount of birch, elm and white pine. Sugar maple and eastern white cedar composed the sub-canopy layer. There was no understorey or ground cover.
<b>FOC4-1</b> Fresh-moist White Cedar Coniferous Forest	This community had a dense canopy of white cedar with very little sugar maple. The very thin understorey of white cedar was well shaded.
<b>MIXED FOREST (FOM)</b>	
<b>FOM</b> Mixed Forest	This was a variably composed community, representing late-successional development on formerly agricultural lands. The tree canopy composition was variable with several species present in different proportions, e.g. white pine, white cedar, hemlock, sugar maple, trembling aspen, large-tooth aspen, black cherry, white birch, white and green ash, beech and bitternut hickory. Depending on the composition and density of the tree layer, understorey vegetation may be equally diverse.
<b>FOM2-3*</b> Dry-fresh White Pine – Aspen Mixed Forest	A younger forest community of white pine with both large-toothed and trembling aspen. White ash was also prevalent in the canopy and subcanopy layers. A dense understorey was comprised of hawthorn, honeysuckle and raspberry.
<b>FOM3-2</b> Dry-Fresh Sugar Maple – Hemlock Mixed Forest	A mid-aged community dominated by sugar maple and to a lesser extent, eastern hemlock. White pine, black cherry and paper birch were also present in the canopy in lesser amounts. Sugar maple was found in the sub-canopy and understorey as well. The ground layer consisted of ferns throughout and asters and goldenrods at the edges. Rocky substrates were found near the roadside.
<b>FOM4-1</b> Dry-fresh White Cedar - White Birch Mixed Forest	The tree canopy was dominated by white cedar and white birch with a diversity of other trees i.e. white ash, eastern hemlock, red maple and white pine. The understorey was comprised of white cedar, choke cherry and mountain holly.
<b>FOM7-2</b> Fresh-moist White Cedar - Hardwood Mixed Forest	A variable community comprised of an open canopy of white birch and black cherry. White cedar formed a thick subcanopy with scattered eastern hemlock. Very little understorey was found under the dense shade of the white cedars.
<b>FOM7-2a</b> Fresh-moist White Cedar – Hardwood Mixed Forest	This mid-aged community was dominated by eastern white cedar and balsam poplar. Larch, white birch, swamp maple and American elm were occasionally found throughout the dense canopy. Eastern white cedar, larch and chokecherry make up the dense sub-canopy. Sensitive ferns and goldenrods were commonly found throughout the understorey. Cattails and low, dense cedars are found along the road edge.

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**Table 4.2 - Ecological Land Classification Vegetation Communities**

<b>FOM7-3*</b> Fresh-moist White Cedar – White Elm Mixed Forest	This community was characterized by a thick subcanopy of white cedar. Above the white cedar was an open canopy of American elm. A sparse understory of white cedar was found under the subcanopy.
<b>FOM 9-1*</b> Dry-fresh Sugar Maple – White Ash – White Cedar Mixed Forest	Several examples of this community were observed along the routes. All had a canopy dominated by sugar maple and white ash. Other elements that were observed in the canopy include white cedar, trembling aspen and white birch. The understory had small white ash and white cedar with alternate-leaved dogwood.
<b>DECIDUOUS FOREST (FOD)</b>	
<b>FOD4-2</b> Dry-Fresh White Ash Deciduous Forest	The canopy cover consisted mainly of white ash with some white pine and sugar maple. The sub-canopy had white pine and white ash and a smaller amount of eastern hemlock. The understory was fairly dense with white ash and American beech. A small Bluejoint/Cattail Shallow Marsh (MAS) was found in this community. Cattails and reed canary grasses were abundant in the ditches.
<b>FOD5-1a</b> Dry-Fresh Sugar Maple Deciduous Forest	A diverse canopy layer dominated by sugar maple. Other canopy elements included bitternut hickory, American basswood, white ash and bur oak. The understory was largely comprised of prickly ash thickets with some white ash and sugar maple. The ground layer contained euonymus, meadowrue and carrion flower.
<b>FOD5-1b</b> Dry-Fresh Sugar Maple Deciduous Forest	This community had a relatively open canopy of sugar maple with some American basswood. Sugar maple, American basswood and black cherry formed the subcanopy. The well-developed understory contained white ash, chock cherry. The ground layer was dominated by goldenrods and asters.
<b>FOD5-1c</b> Dry-Fresh Sugar Maple Deciduous Forest	Sugar maple was the leading canopy species and the other hardwoods or softwoods (for example white ash, beech, hemlock) were present in small amounts. Maple and white ash saplings composed the well developed shrub layer, where also occurring blue beech, alternate-leaved dogwood, prickly gooseberry or, rarely, leatherwood.
<b>FOD5-1d</b> Dry-Fresh Sugar Maple Deciduous Forest	This mid-aged community was dominated by sugar maple in the canopy. Sugar maple was also abundant in the sub-canopy and white ash, American beech and ironwood were found in smaller amounts. Alternate-leaved dogwood was the main species in the sparse understory, and zig-zag goldenrod and ferns were in the ground layer. Large boulders and rocky outcrops were common throughout the community.
<b>FOD5-1e</b> Dry-Fresh Sugar Maple Deciduous Forest	This community consisted of a variety of deciduous species. Sugar maple dominated the canopy, with smaller amounts of trembling aspen and white ash. The sub-canopy contained white ash, eastern white cedar and riverbank grape. Chokecherry was found in the understory.
<b>FOD5-2</b> Dry-fresh Sugar Maple – Beech Deciduous Forest	Sugar maple was the dominant canopy species with American beech, eastern hemlock, white ash, white birch and white pine. American beech, sugar maple, bitternut hickory, white elm and some white cedar was observed in the understory. Ferns dominated the ground layer. These communities were mature.

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<b>Table 4.2 - Ecological Land Classification Vegetation Communities</b>	
<b>FOD5-3a</b> Dry-fresh Sugar Maple – Oak Deciduous Forest	A mature forest community of sugar maple with red oak, bur oak and to a lesser part American basswood. The understory was comprised of sugar maple, choke cherry and alternate-leaved dogwood.
<b>FOD5-3b</b> Dry-fresh Sugar Maple – Oak Deciduous Forest	This community was dominated by sugar maple and white oak with American beech. The understory was dominated younger individuals of the same species. The ground layer contained zigzag goldenrod and other forest forbs.
<b>FOD5-8</b> Dry-fresh Sugar Maple – White Ash Deciduous Forest	Sugar maple and white ash were the principal tree species, followed by small amounts of other trees such as white pine, American elm and black cherry. Choke cherry, red raspberry, white ash seedlings and sometimes European buckthorn composed most of the shrub stratum. In the herb layer grew tall goldenrod, enchanter's nightshade, various sedges, herb-Robert, white avens, running strawberry-bush, zigzag goldenrod and several other species. This community was mid-age to mature.
<b>PLANTATION (CUP)</b>	
<b>CUP3-1</b> Red Pine Coniferous Plantation	Mid aged plantations of red pine with regeneration of young hardwoods, principally sugar maple. Understorey was poorly developed to non-existent.
<b>CUP3-2</b> White Pine Coniferous Plantation	Old plantations that were still dominated by white pine, but with several hardwoods entering the community, most importantly sugar maple, white elm and white birch. Scattered remnant hawthorn was in decline. The understory was poorly developed to non-existent.
<b>CUP3-12*</b> White Spruce Coniferous Plantation	A young, relatively open plantation of white spruce. Scattered white ash were mixed among the spruce with a dense ground cover of goldenrods and asters.
<b>CUP3-13*</b> Norway Spruce Cultural Plantation	Mid aged plantation of Norway spruce. No regeneration of other tree species was observed and no understory had been developed.
<b>CUP3-14*</b> Scotch Pine – Red Pine Coniferous Plantation	A young plantation dominated by Scotch pines with less red pine. No regeneration of other tree species was observed and no understory had been developed.
<b>CULTURAL MEADOW (CUM)</b>	
<b>CUM1-1</b> Dry–Moist Old Field Meadow (open)	A regenerating community of invasive native and introduced plants on formerly agricultural land. The main species included Canada goldenrod, New-England aster, timothy, red-top, wild basil, ribgrass, wild carrot, tufted vetch, red clover and white sweet clover. Although some shrubs and trees were present, they were a minor component of this community type. A small inclusion of red-osier dogwood swamp thicket was found along with standing water in depressions.

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**Table 4.2 - Ecological Land Classification Vegetation Communities**

<b>CULTURAL THICKET (CUT)</b>	
<b>CUT1-7*</b> White Pine – White Ash Cultural Thicket	An open canopy of white pine and white ash was surrounded by hawthorn, apple and some European buckthorn. The ground cover was characteristic of old fields with asters, goldenrods and grasses.
<b>CUT1-8*</b> White Ash Cultural Thicket	A diverse thicket dominated by white ash but containing hawthorn, white cedar, staghorn sumac and black cherry. Mature sugar maple and American beech were present along a hedgerow in this community. The ground cover was characteristic of old fields with asters, goldenrods and grasses.
<b>CUT1-9*</b> Hawthorn Cultural Thicket	A canopy of white ash, hawthorn, staghorn sumac and Manitoba maple covered the thicket of hawthorn. The ground cover was composed of smooth brome grass, asters and goldenrods.
<b>CUT1-10*</b> Mixed Maple Cultural Thicket	This open thicket, regenerating open old fields is composed of scattered apple trees, hawthorn, and young trees of sugar maple, black cherry, white pine, white elm, white ash and bitternut hickory. The ground cover retains old field meadow characteristics, such abundance of Canada goldenrod, fescue, ox-eye daisy, and many others.
<b>CULTURAL SAVANNA (CUS)</b>	
<b>CUS1-4*</b> White Ash Cultural Savannah	A pioneering community that was dominated by white ash. Young red cedar and red-osier dogwood were also present. The ground layer was characteristic of old fields with goldenrods, asters and grasses.
<b>CULTURAL WOODLAND (CUW)</b>	
<b>CUW1-3*</b> White Ash – White Pine Cultural Woodland	Young woodland that was dominated by white ash and white pine with some sugar maple. The understory consisted of white ash, hawthorn and buckthorn. The ground cover was sparse.
<b>CUW1-4*</b> White Ash Cultural Woodland	The woodland canopy was exclusively white ash. Staghorn sumac, white ash and trembling aspen were present in the subcanopy. European buckthorn was present in the understory and the ground layer consisted of goldenrods and asters.
<b>CUW1-6*</b> White Cedar Cultural Woodland	This community resembles an old field with goldenrods, Queen Anne's lace and grasses. Covering most of the community were young white cedars.
<b>CUW1-7*</b> Maple – Ash – Hawthorn Cultural Woodland	This community consisted of an open canopy of sugar maple and white ash with white pine. The dense understory contained white ash, hawthorn and European buckthorn. Raspberry, asters and goldenrods could be found on the ground layer.
<b>CUW1-8*</b> Cottonwood - Norway Spruce Cultural Woodland	A small community dominated by mature eastern cottonwood and Norway Spruce. Sugar maple, white ash and black walnut were also present. Red raspberry, goldenrods and asters cover the ground layer.

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<b>Table 4.2 - Ecological Land Classification Vegetation Communities</b>	
<b>CUW1-9*</b> Mixed Cultural Woodland	A diverse community of sugar maple, white birch, white ash and white pine. The understorey was formed by honeysuckle and highbush cranberry. Grass was the dominant ground cover.
<b>CONIFEROUS SWAMP (SWC)</b>	
<b>SWC1-2</b> White Cedar – Conifer Mineral Coniferous Swamp	A community composed of eastern white cedar and larch. The sub-canopy contained eastern white cedar, and there was no understorey or ground layer. A red-osier dogwood thicket swamp inclusion contained broad-leaved cattails, reed canary grasses and low cedars.
<b>MIXED SWAMP (SWM)</b>	
<b>SWM1-1</b> White Cedar – Hardwood Mineral Mixed Swamp	A swamp forest that was composed of white cedar and with a diversity of associates, including black ash, trembling aspen, red or white ash, yellow birch, white elm, balsam fir, white spruce and silver maple. White cedar saplings dominated the shrub layer, but other saplings and true shrubs including red-osier dogwood, red raspberry, Virginia creeper, prickly gooseberry, alternate-leaved dogwood and riverbank grape. Sensitive fern was observed in the ground layer.
<b>SWM1-1a</b> White Cedar – Hardwood Mineral Mixed Swamp	Swamp maple, American elm and green ash dominated the canopy of this mid-aged community. The sub-canopy was denser than the canopy and was composed of eastern white cedar, American elm, green ash, and some white spruce. Eastern white cedar, dogwood and white spruce made up the dense understorey, and canary reed grass and asters composed the dense ground layer.
<b>SWM1-1b</b> White Cedar – Hardwood Mineral Mixed Swamp	This mid-aged community consists of balsam poplar and American elm in the canopy. Eastern white cedar is abundant in the sub-canopy with equal amounts of American elm and larch. Cattails, eastern white cedar and dogwood make up the dense understorey. Dead spruce (no living specimens) were found throughout the community. Standing water was common.
<b>SWM2-2</b> Silver Maple – Conifer Mineral Mixed Swamp	Silver maples dominated the canopy with white cedar and little American elm and black ash. Red-osier dogwood formed a shrub layer and reed canary grass dominated the ground layer.
<b>SWM4-1</b> White Cedar – Hardwood Organic Mixed Swamp	Tree canopy was discontinuous and generally short (12-15 m). Trembling aspen formed the upper layer, with white cedar growing in the lower layer. Other common species were black ash, American elm and yellow birch. The shrub layer was composed of red-osier dogwood, common elderberry and young white cedar. The herb layer was rich, with such species as ferns, sedges and cattails.
<b>DECIDUOUS SWAMP (SWD)</b>	
<b>SWD2-1</b> Black Ash Deciduous Swamp	Black ash dominated this community with other elements including silver maple, American elm, white birch and eastern hemlock. The understorey consisted of young trees of the same species composition. The ground layer was characteristic of swamp communities with ferns and sedges.

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<b>Table 4.2 - Ecological Land Classification Vegetation Communities</b>	
<b>SWD2-2</b> Green Ash Mineral Deciduous Swamp	Green ash dominates the canopy of this community with occasional sightings of American elm. The canopy is considered open with ~40% tree cover. The sub-canopy is sparse and canary reed grass is dominant throughout the understorey. The community is flooded with several inches of standing water.
<b>SWD3-1a</b> Red Maple Mineral Deciduous Swamp	A mature swamp community that had an open canopy of red maple with some American elm. Red-osier dogwood and mountain holly were found in the understorey with young red maple and American elm. The ground layer consisted of sedges. Abundant dead, standing snags characterized this community.
<b>SWD3-1b</b> Red Maple Mineral Deciduous Swamp	Tree composition of this community was dominated by red maple and black cherry but other elements included black ash and white cedar. Reed canary grass dominated the ground layer.
<b>SWD3-2a</b> Silver Maple Mineral Deciduous Swamp	This community was heavily dominated by silver maple with variety of other components including black ash, red maple, American elm and white cedar. Shrubs, namely red osier-dogwood and honeysuckle, dominated the understorey. Sensitive ferns and sedges were observed in the ground layer.
<b>SWD3-2b</b> Silver Maple Mineral Deciduous Swamp	Dominated by silver maple, with abundances of trembling aspen, red maple, Freeman's maple (hybrid between red and silver maples), green ash, white birch and American elm. The tree canopy reached 25 meters in height. The shrub layer is generally poorly developed, composed of saplings of elm and white cedar, along with red osier dogwood, alder-leaved buckthorn, and red raspberry. The herb layer was continuous and rich in species, such as sensitive fern, sedges and grasses.
<b>SWD3-3a</b> Swamp Maple Mineral Deciduous Swamp	Red maple and swamp maple are the most dominant canopy species. White ash and American elm are occasionally found in the canopy. Silver maple is abundant in the sub-canopy and understorey, and a variety of mixed woody species compose these two layers. Such species include American elm, paper birch, eastern white cedar and hemlock. The ground layer is also dense with a variety of ferns, Canada bluejoint, and asters. Canary reed grass was found in the ditches.
<b>SWD3-3b</b> Swamp Maple Mineral Deciduous Swamp	A mature community that is dominated by swamp maple. American elm and white ash are also found in the canopy. Swamp maple is abundant in the sub-canopy and blue beech is occasionally present throughout. The understorey mainly consists of goldenrod.
<b>SWD4-2</b> White Elm Mineral Deciduous Swamp	This community had an open canopy dominated by American elm with associations of trembling aspen, red maple and willow. Black ash, red-osier dogwood and white cedar formed an understorey. The ground layer consisted of wetland plants such as reed canary grass and sedges.
<b>SWD4-5*</b> Poplar – Ash – Elm Mineral Deciduous Swamp	This community had an open canopy of balsam poplar with American elm and black ash. Young black ash and American elm formed an understorey. White cedar seedlings were abundance in the ground layer. Other ground layer vegetation included cattails and Bindens sp.

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**Table 4.2 - Ecological Land Classification Vegetation Communities**

<b>SWD8-1*</b> Silver Maple – Black Ash Mineral Deciduous Swamp	The canopy of this community was comprised of silver maple with some black ash and very little black cherry. Young black ashes were very abundant in the understorey. White cedar was also present in the understorey.
<b>THICKET SWAMP (SWT)</b>	
<b>SWT2</b> Mineral Thicket Swamp	Scattered short red maple and elm trees were present, but the community was essentially composed of red-osier dogwood and cedar saplings. In more open places there were patches of reed-canary grass. Because of the lack of clearly defined dominants and uneven physiognomy, this unit could not be defined at the ecosite level.
<b>SWT2-13*</b> Black Ash – Red-Osier Dogwood Mineral Thicket Swamp	The open canopy of young black ash overtopped the thicket of red-osier dogwood with some willow shrubs. Canary reed grass, narrow-leaved cattails and sedges compose a dense ground layer.
<b>SWT3-2</b> Willow Organic Thicket Swamp	A dense community composed of Bebb's willow, with abundances of red-osier dogwood and young white cedar. Tall saplings of white birch, American elm, trembling aspen and sugar maple overtopped the main tall shrub layer. Reed-canary grass, cattails ferns and sedges form the rich ground cover.
<b>MEADOW MARSH (MAM)</b>	
<b>MAM2-2</b> Reed Canary Grass Mineral Meadow Marsh	These dense meadows were almost exclusively dominated by reed-canary grass, with only small amounts of localized red-top and tall white aster or sensitive fern.
<b>MAM2-11*</b> Mixed Mineral Forb – Graminoid Meadow Marsh	This meadow had a dense ground cover of cattails, reed canary grass and asters. Young red maples were scattered though the community. This community appeared to be cultural in origin.

<b>Table 4.3 - Summary of Aquatic Resources at water crossings with permanent flow.</b>							
<b>Water Crossings</b>	<b>Current Crossing</b>	<b>Thermal Regime</b>	<b>Sensitive Species</b>		<b>Substrate</b>	<b>Canopy Cover</b>	<b>Flows</b>
			<b>Brook Trout</b>	<b>Redside Dace</b>			
Bronte Creek Trib. / Campbellville Rd (west)	Open box culvert	Warm water	Recent records near crossing	Recent records downstream	Gravel / sand / cobble	Good downstream	Good
Bronte Creek Trib. / Campbellville Rd (east)	Corrugated steel pipe	Dry	Recent records downstream	Recent records downstream	Grassy	Moderate	Moderate - Low
Bronte Creek / 11 <sup>th</sup> Concession	Open box culvert	Cool water	Recent records near crossing	Recent records near crossing	Sand / cobble / gravel	Moderate	Good
Mountsberg Creek / 11 <sup>th</sup> Concession	Open box culvert	Warm water	No recent records	No recent records	Boulders / cobbles / gravel	Moderate	Swift
Flamboro / 11 <sup>th</sup> Concession	Corrugated plastic pipe	Cool/warm water	Recent records downstream	No recent records	Musk upstream & sand/gravel downstream	Excellent	Moderate - low
Killbride Creek / Campbellville Rd.	Corrugated steel pipe	Marginal cool water	Recent records near crossing	No recent records	Gravel / sand / cobble	Excellent	Good