Environmental Study Report

Britannia Road (Regional Road 6) Transportation Corridor Improvements

The Regional Municipality of Halton

TN1390TNA00

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1.0 INTRODUCTION

Halton Region has completed a Schedule 'C' Class Environmental Assessment (EA) Study to identify transportation corridor improvements to satisfy future travel demands on Britannia Road (Regional Road 6), from Tremaine Road (Regional Road 22) to Highway 407, in the Town of Milton pursuant to the Municipal Class EA process (MEA October 2000, as amended in 2007 and 2011) which is an approved process under the Ontario Environmental Assessment Act (EA Act). The purpose of the Class EA Study was to address roadway improvements, taking into consideration the future transportation needs within the corridor while balancing the potential impacts on the natural, socio-economic and cultural environments.

The Halton Region *Transportation Master Plan (2031) – The Road to Change*, identified the need to address transportation capacity issues along the Britannia Road (Regional Road 6) corridor from Tremaine Road (Regional Road 22) to Highway 407. In addressing these issues, a number of road improvement alternatives were examined as part of the study, including widening of the roadway, cross-section improvements, intersection improvements, and enhancement of traffic control.

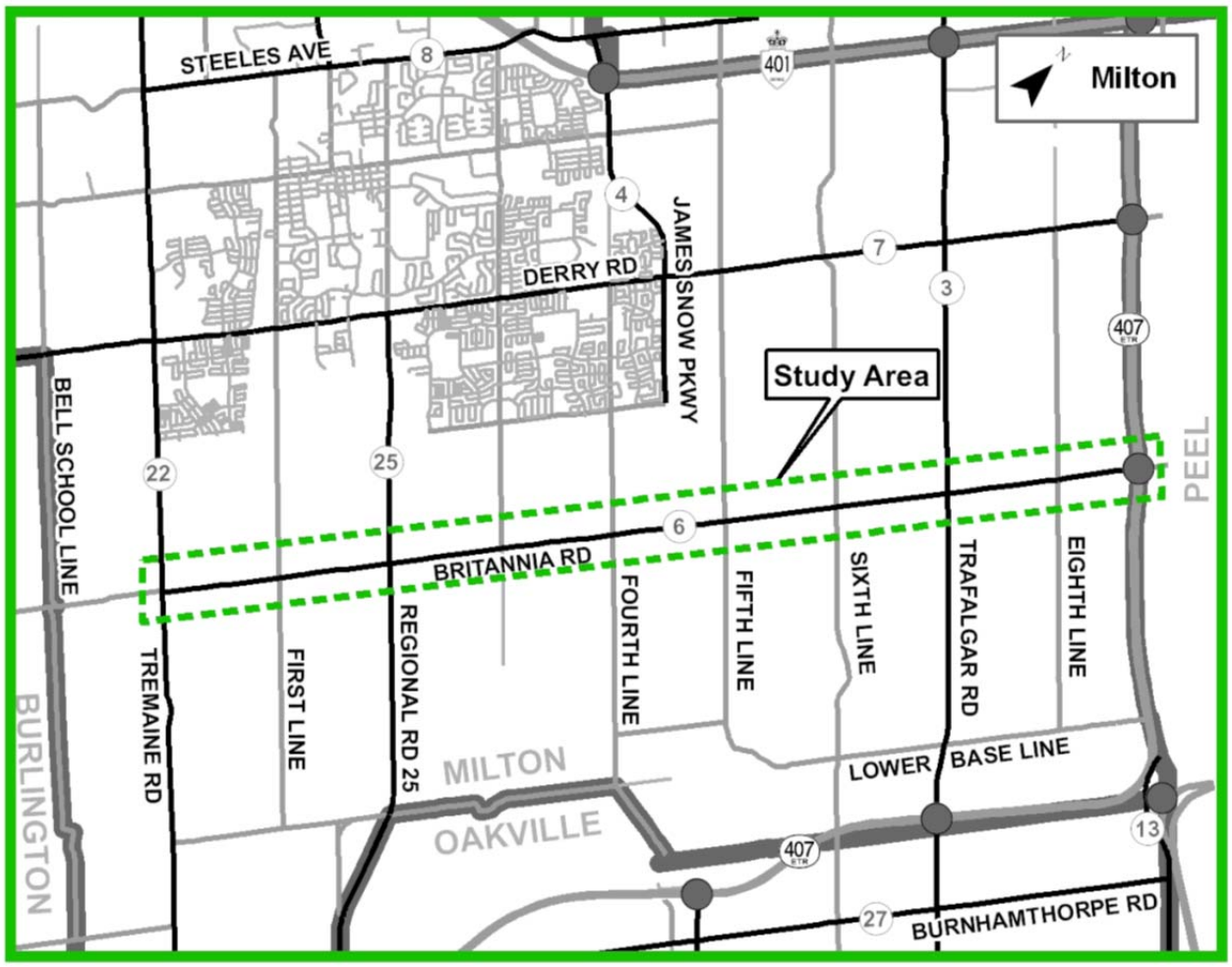
This Environmental Study Report (ESR) documents the Class EA study process undertaken, including:

- Study Background
- Need and justification
- Existing and future conditions
- Identification and evaluation of planning and design alternatives
- Public consultation with stakeholders, agencies and the public
- Selection of the preferred design alternative
- Documentation of anticipated impacts and proposed mitigation measures.

1.1. Study Area

Britannia Road (Regional Road 6) is a major east-west arterial roadway under the jurisdiction of Halton Region, in the Town of Milton. The project limits for this study extend from Tremaine Road (Regional Road 22) in the west to Highway 407 in the east, as shown in **Figure 1-1**, a length of approximately 12.5 kilometres.

Figure 1-1: Study Area



1.2. Class EA Approach

This ESR documents the planning process undertaken in completing the Class EA & Preliminary Design for the Britannia Road Corridor, from Tremaine Road to Highway 407, in Halton Region. This project was classified as a Schedule 'C' Study in accordance with the *Municipal Class Environmental* Assessment *(October 2000, as amended in 2007 and 2011)* and fulfills the requirements for a Category 'B' Study under the Ministry of Infrastructure's *Class EA Process for Realty Activities Other Than Electricity Projects (Approved 2004, amended September 11, 2008).*

1.3. The Municipal Class EA Process

As noted above, this study has been undertaken and prepared in accordance with the Municipal Class EA process (October 2000, as amended in 2007 and 2011) and has been identified as a Schedule 'C' Class EA. Schedule 'C' projects generally include the construction of new facilities and major expansions to existing facilities.

Under the Class EA process, municipal road projects are categorized according to their environmental significance and the effects they may impose on the environment. These categories, described by specific Class EA "schedules", prescribe planning methodologies for each category. At present, there are four schedule classification types including Schedule A, A+, B and C. The main difference between each of the schedule types is the degree to which each project may adversely affect the existing environment. The various Schedules are described below:

Schedule A
- limited in scale and have minimal adverse environmental impacts;
- includes a number of municipal maintenance and operational activities;
- are pre-approved and as such, no public notification or documentation is required.

Schedule A+
- limited in scale and have minimal adverse environmental impacts;
- are pre-approved and as such, no documentation is required;
- the public is to be advised of the project prior to implementation.

Schedule B
- have the potential for some adverse environmental impacts;
- the proponent is required to undertake a screening process, involving mandatory contact with the directly affected public and relevant review agencies;
- a project file is required to be prepared and made available for public review.

Schedule C
- have the potential for significant environmental impacts;
- must proceed under the full planning and documentation procedures of the Municipal Class EA process;
- an Environmental Study Report is required to be prepared and filed on the public record for review by the public and review agencies.

Since the Britannia Road Corridor Improvements Class EA study is being completed under the requirements of a Schedule 'C', the 5 Phases of the Class EA process must be undertaken. The first 4 phases will be completed as a part of this study; the 5th phase will be initiated following completion of the study. The 5 phases are summarized as follows:

Phase 1
- identification and description of the problem or opportunity.

Phase 2
- identification of alternative solutions to the problem;
- prepare a physical description of the study area as well as a

general inventory of the natural, social and economic environments;
- evaluation of all reasonable alternatives, including the "do-nothing" scenario;
- consultation with the public and review agencies;
- selection of the preferred solution.

Phase 3

- identification of alternative designs for the preferred solution;
- prepare a detailed inventory of the natural, social and economic environments;
- identification of the potential impacts of the alternative designs;
- evaluation of all alternative designs, including the "do-nothing" scenario;
- consultation with the public and review agencies;
- selection of the preferred design;
- preliminary finalization of preferred design.

Phase 4

- completion of the Environmental Study Report (ESR);
- file the ESR and place on the public record for 30 days for review by the public and review agencies;
- respond to part II order requests during 30 day review period.

Phase 5

- implementation of preferred design.

1.4. Ministry of Infrastructure Class EA Requirements

The MOI Class EA applies to a wide range of realty and planning activities including leasing or letting, planning approvals, disposition, granting of easements, demolition and property maintenance/repair. Due to the project's impact to property owned by the Ministry of Infrastructure (MOI), the MOI's Class EA for any and all realty undertakings on lands managed by Infrastructure Ontario (IO) is also triggered.

The purchase of MOI owned Lands within the study area triggers the requirement for a Category "B" EA under MOI Class EA Act. Section 10.0 of the ESR discusses the requirements of the MOI's Category 'B' Class EA, particularly the "7 point analysis" and how it was addressed in the study.

1.5. Environmental Study Report

An Environmental Study Report (ESR) is required for Schedule 'C' projects and describes the environmental assessment process, which must be carried out prior

to proceeding with the construction of the roadway. In general, the ESR documents the planning and decision making process, including public consultation, which has been followed to arrive at the preferred design. The ESR also sets out the mitigating measures proposed to avoid or minimize environmental impacts. Specifically, this ESR report documents the following:

- The background of the study;
- The need and justification for the study;
- A description of the problem;
- The studies and measures undertaken to resolve the problem;
- The planning, preliminary design and public consultation process followed to arrive at the preferred design;
- The principle environmental impacts of the study;
- The mitigating measures to be employed to offset the anticipated impacts; and
- The next steps required in moving forward with the detailed design of the project.

The filing of the ESR completes the planning and preliminary design stage of the project. The ESR will be placed on public record and made available for review for a 30 calendar day period. A Notice of Study Completion will be published at the time of filing and letters will be mailed to notify agencies, Town of Milton and Stakeholders. Copies of the report are available for review and comment during normal business hours at the following locations:

Clerk's Office Halton Region 1151 Bronte Road Oakville, Ontario L6M 3L1 (905)825-6000	Clerk's Office Town of Milton 150 Mary Street Milton, Ontario L9T 6Z5 (905) 878-7252	Milton Public Library 1010 Main Street East, Milton Ontario L9T 6H7 (905) 875-2665	Beaty Branch Library 945 Fourth Line Milton, Ontario L9T 6P8 (905) 875-2665

1.6. Part II Order Requests

The Class EA process contains a provision that allows for changing the status of a project to a Class EA to an Individual Environmental Assessment. This is called a 'Part II Order.' Members of the public, interest groups, government agencies and others may request that an Individual Environmental Assessment be prepared for a specific project if they feel their concerns have not been addressed through the Class EA planning process. The Minister of the Environment would respond to a Part II Order by deciding whether to deny the request, refer the matter to mediation or require the proponent to comply with Part II of the EA Act. There is one additional option available to the Minister, namely to deny the request with

conditions placed upon the EA. Compliance with Part II of the EA Act refers to the completion of an Individual EA. If the Part II Order is granted, the project cannot proceed unless an Individual EA is prepared. The Individual EA is subject to a formal government review and approval process. Anyone wishing to request a Part II Order of this ESR must submit a written request by the end of the 30 calendar day review period to the Minister of the Environment at the following address with a copy sent to Halton Region:

Minister of the Environment
Environmental Approvals Branch
2 St. Clair Avenue West,
Floor 12A
Toronto, Ontario,
M4V 1L5

Halton Region
Attention: Ms. Alicia Jakaitis
Transportation Coordinator,
Transportation Services, Public Works
1151 Bronte Road
Oakville, Ontario L6M 3L1
Telephone: 905-825-6000, Ext. 7556
Fax: 905-847-2192
Email: alicia.jakaitis@halton.ca

1.7. Project Team Organization

Halton Region retained Delcan Corporation as their Prime Consultant to undertake this Class EA Study on their behalf. The "Project Team" consisted of members from Halton Region, Delcan Corporation and specialized sub-consultants needed to address specific requirements of the project. The Project Team is comprised of the following members:

- Halton Region
  - Transportation Planning, Maintenance and Operation
  - Design and Construction
  - Planning
- Delcan Corporation
- Urban & Environmental Management Inc.
- Archaeological Services Inc.
- Aquafor Beech Ltd.
- Valcoustics Canada Ltd.
- Thurber Engineering Ltd.

1.8. Public & Technical Agency Consultation

A key component of the EA process is public consultation throughout the course of the study. For this study, the main points of public consultation were:

- To notify the public and stakeholders that the study was commencing

- To review and receive public and stakeholder input regarding the problem being addressed, planning alternatives and the preliminary plan for proposed road improvements to Britannia Road
- To review and receive public and stakeholder input regarding the preferred alternative and associated mitigation measures
- To review the Environmental Study Report (ESR)

Three Public Information Centres were held as follows:

- The first Public Information Centre (PIC) was held on January 26, 2011. The PIC provided stakeholders, agencies and interested members of the public an opportunity to meet the Project Team, review the study scope and discuss issues related to the study including alternative solutions, environmental considerations and preliminary evaluation criteria.
- The second PIC, held on June 8, 2011 was held to provide stakeholders, agencies and interested members of the public an opportunity to review the comments received at the first PIC, and to comment on the recommended solution and alternative design concepts. An update on the ongoing technical studies was also presented at the meeting.
- The third PIC for the study was held on December 14, 2011 and provided an opportunity for members of the public to review the study findings and provide comments on the preferred alternative.

Technical Agencies were identified at the onset of the study and meetings were held with technical agencies at key milestones in the study. Consultation undertaken with technical agencies is documented in Section 6.0 and Appendix I.

Additional meetings were held with Conservation Halton (CH) during the study process to discuss environmental issues related to the project. Details pertaining to consultation with CH are provided in Section 6.0 and Appendix I.

Other major stakeholders including property owners were notified about the study and were requested to provide their input at key milestones. Please refer to Section 6.0 and Appendix I for all stakeholder consultation.

Halton Region also developed a project website for members of the public and interested stakeholders to obtain updated information on the Britannia Road Class EA.

1.9. First Nations

As part of the public consultation process, First Nations were contacted directly by Halton Region by letter dated December 17, 2010 to inform them of the Britannia Road Transportation Corridor Improvements Class Environmental Assessment. The letter also advised that a Stage 1 Archaeological Assessment Study of the entire study corridor is to be completed as part of the Environmental Assessment Study. First Nations were also notified of the public information centres held during the study and at study completion in April 2014, informing them when the ESR was filed for public review with a copy of the Stage 1 Archaeological Assessment Study attached. Copies of the letters are provided in Appendix I.

2.0 NEEDS & JUSTIFICATION

2.1. 2004 TMP - Halton Region Transportation Master Plan

In June 2004, the Halton Transportation Master Plan (2004 TMP) was completed and approved by Council (PPW92-04) and outlined the transportation strategy to 2021. The vision for the 2004 TMP focused on minimizing the impacts on the environment, satisfying travel demands by making efficient use of the existing infrastructure and by providing the facilities and services to encourage active transportation and transit. It recommended improving Britannia Road to a 4 lane cross section.

Subsequent to the completion of the 2004 TMP, the Province introduced its Provincial Policy Statement entitled "Places to Grow," which impacted population and employment forecasts for the Region to 2031.

2.2. 2011 TMP - Halton Region Transportation Master Plan (2031)

Halton Region's Transportation Master Plan (2031) – The Road to Change was conducted to meet Phases 1 and 2 of the Municipal Class Environmental Assessment process (October 2000, as amended in 2007 and 2011). The purpose of the study was to develop a strategy that reflects Halton's transportation vision over the next 20 years to 2031, which would be a dynamic integrated transportation strategy that considers all modes of transportation. The preferred transportation strategy to 2031 for Halton Region includes policies and initiatives to support Transportation Demand Management and Active Transportation, enhanced transit services and additional capacity in the Regional roadway network. The TMP identifies a number of Regional roadway infrastructure improvements required to 2031 including the ultimate widening of Britannia Road from Tremaine Road to Highway 407 to a 6 lane corridor, including HOV lanes in a 47m ROW.

Elements of the Halton Region Transportation Master Plan have identified Britannia Road:

- As a 47 metre right-of-way with an urban cross section, including 3.0 metre off road multi-use pathways and 1.8 metre on road cycling lanes on both sides of the roadway
- To be maintained as 4 general purpose lanes plus 2 lanes for transit/high occupancy vehicles.

The Britannia Road improvements have been programmed in the Region's Roads Capital Project (2013-2031) as the following separate projects:

1. Widening from 2 to 6 lanes from Tremaine Road to Regional Road 25
2. Widening from 2 to 4 lanes from Regional Road 25 to James Snow Parkway

3. Widening from 2 to 4 lanes from James Snow Parkway to Trafalgar Road
4. Widening from 2 to 4 lanes from Trafalgar Road to Highway 407
5. Widening from 4 to 6 lanes from James Snow to Eighth Line (by 2031).

The Region's Transportation Master Plan (2031) – The Road to Change, reaffirmed the need to widen Britannia Road. As part of an integrated transportation strategy, Halton Region has identified the Britannia Road corridor to ultimately provide four general purpose lanes plus two lanes for High Occupancy Vehicles (HOV)/Transit. The Region's long term vision is to transform Britannia Road from a 2 lane rural corridor to a pedestrian and cyclist-friendly Regional arterial road.

2.3. Britannia Road in Halton's Accelerated Transportation Capital Program

In response to the anticipated growth in south Milton – north Oakville, Regional Council approved accelerated construction of a number of road improvements in the Region, including reconstruction of Britannia Road.

The evidence from traffic issues encountered during the 2010 and 2011 construction seasons indicates that construction activities significantly impact traffic within the Regional Road network. Traffic diverted due to construction activities on Derry Road during the 2010 construction season resulted in traffic volumes on Britannia Road that were 2.4 times those observed in 2011. Significant growth in the Boyne Secondary Plan Area and construction activity associated with the implementation of these developments and planned water, wastewater and road works may also significantly impact short term traffic volumes in this area.

To help address these concerns, the Region proposes to construct Britannia Road from Tremaine Road to Regional Road 25 (Capital Project I.D. 3985) to the ultimate six lane road configuration identified in the 2011 TMP Preferred Network. This will ensure that interim traffic demands are met and avoid the need to undertake future widening within the area. This recommendation was adopted by Regional Council on November 16, 2011 (through PW-63-11).

2.4. Existing Traffic Conditions

A review of the existing traffic conditions was undertaken to evaluate current operational performance and the historical collision history.

2.4.1. Physical Description

Through the study area, Britannia Road is classified as a Major Arterial Roadway in the Regional Official Plan and in the Regional Transportation Master Plan. Within the Town of Milton, Britannia Road travels east and west parallel to Highway 401.

The roadway serves as a significant link between Halton Region and the Region of Peel. Britannia Road is a 2-lane rural corridor, with left turn lanes at some of the major intersections.

The existing Britannia Road right-of-way (ROW) varies significantly throughout the study area, between approximately 20m and 35m. The posted speed limit varies throughout the corridor but, is generally 80 km/hr from Tremaine Road to Highway 407 except for two 60 km/hr speed zones in the settlements of Omagh and Drumquin.

Regional road improvements adjacent to the study area include the reconstruction of Regional Road 25 from Derry Road to Britannia Road (commenced in 2012) and the reconstruction of Trafalgar Road from Britannia Road to Highway 401 (completed in 2010).

It should be noted that the intersection of Britannia Road and Tremaine Road is included in the study area of the Tremaine Road Corridor Improvements Class EA study (completed 2012). As part of that study, a roundabout was identified as the preferred alternative. As such, the Tremaine Road intersection is not included in this Class EA Study.

Within the study area, Britannia Road intersects 10 roads and has intersections including the off ramps at the Highway 407 terminal. Traffic control at the intersections ranges from 2-way stop-control to full signalization. A summary of the intersections is provided in **Table 2-1**. There are a number of driveways providing access to adjacent residential, commercial and farming properties along the corridor.

Table 2-1: Intersection Summary

Road	Classification	Control
Tremaine Road	Regional	2-way stop
Bronte Street/1st Line	Local	4-way stop
Regional Road 25	Regional	Signalized
Thompson Road	Local	Signalized
4th Line	Local	Signalized
James Snow Parkway	Regional	Signalized
5th Line	Local	Signalized

Road	Classification	Control
6th Line	Local	Signalized
Trafalgar Road	Regional	Signalized
8th Line	Local	2-way stop
Northbound Highway 407 Off Ramp	Provincial	Signalized
Southbound Highway 407 Off Ramp	Provincial	Signalized

2.4.2. Level Railway Crossings

There are two level roadway-railway crossings within the project limits. Britannia Road crosses an active Canadian National (CN) Railway line and an Ontario Hydro spur connecting to Canadian Pacific (CP) Railway line. Britannia Road crosses the CN Halton Subdivision (Mileage 38.72) between Tremaine Road and First Line/Bronte Street. This crossing has approximately 25 train movements per day and is controlled by active protection including crossbucks and flashing lights. Britannia Road crosses the CP spur line immediately west of Highway 407. This crossing is characterized by infrequent rail movements (less than 1 per year). Passive protection is currently provided at this crossing.

2.4.3. Structures

There are two bridge structures within the project limits, the Boyne River Bridge and Drumquin Bridge. The Boyne River Bridge was constructed in 1962 and spans the Main branch of 16 Mile Creek, approximately 0.7km west of Thompson Road. The existing structure is a rigid frame bridge with a span opening of 19.8 m and roadway elevation of 177.02 m. The most recent bridge condition survey noted that the bridge structure is in generally fair to good condition; however it would require rehabilitation within the next 6 to 10 years.

The Drumquin Bridge was constructed in 1960 and spans the east branch of 16 Mile Creek, approximately 0.1km west of Trafalgar Road. The existing structure is a rigid frame bridge with a span opening of 24.4 m and a roadway elevation of 181.27 m. The most recent bridge condition survey noted that the bridge structure is in generally fair to good condition; however it would require rehabilitation within the next 6 to 10 years.

2.4.4. Intersections

There are twelve intersections along Britannia Road from Tremaine Road to Highway 407. However, only eleven are within the project limits for this study as the intersection of Britannia Road at Tremaine Road was included in the Tremaine

Road Corridor Improvements Class EA (completed 2012). Traffic signal control is provided at nine intersections, all way stop control is provided at the intersection with Bronte Street/First Line and two way stop control is provided at Eighth Line. The existing configuration and traffic control at the intersections along Britannia Road are illustrated in **Figure 2-1**.

2.4.5. Roadway Volumes

Volumes, classification of vehicles and vehicle operating speeds were collected through the use of automatic traffic recorders (ATR). This information was analyzed to establish the traffic characteristics and patterns on Britannia Road within the project limits. Both 2008 and 2010 ATR volumes were reviewed to assess significant changes in traffic characteristics within the study corridor.

Generally the traffic characteristics have remained similar over the two data sets with traffic growth focused more in the western end of the corridor. At the west end of the study area, 2010 two-way vehicle volumes (refer to **Table 2-2**) are in the range of 480-660 vehicles per hour during the Weekday AM (morning) and PM (afternoon) peak hours. At the east end of the study area, 2010 two-way vehicle volumes are in the range of 1,200-1,600 vehicles per hour during the Weekday AM and PM peak hours. The Weekday PM peak hour volume is typically in the range of 10-15% of the daily traffic volume. On a daily basis, commercial and heavy vehicles represent about 2%-3% of the total traffic on Britannia Road. A review of historical ATR data reveals that peak hour traffic volumes on Britannia Road has increased at approximately 4 to 12% per annum since 2005.

The majority of traffic on Britannia Road is travelling eastbound during the Weekday AM peak hour and travelling westbound during the Weekday PM peak hour. Peak hour directional volumes in the eastern section exceed 850 vehicles per hour, the practical capacity of a two-lane roadway.

Figure 2-1: Existing Lane Configurations and Traffic Control

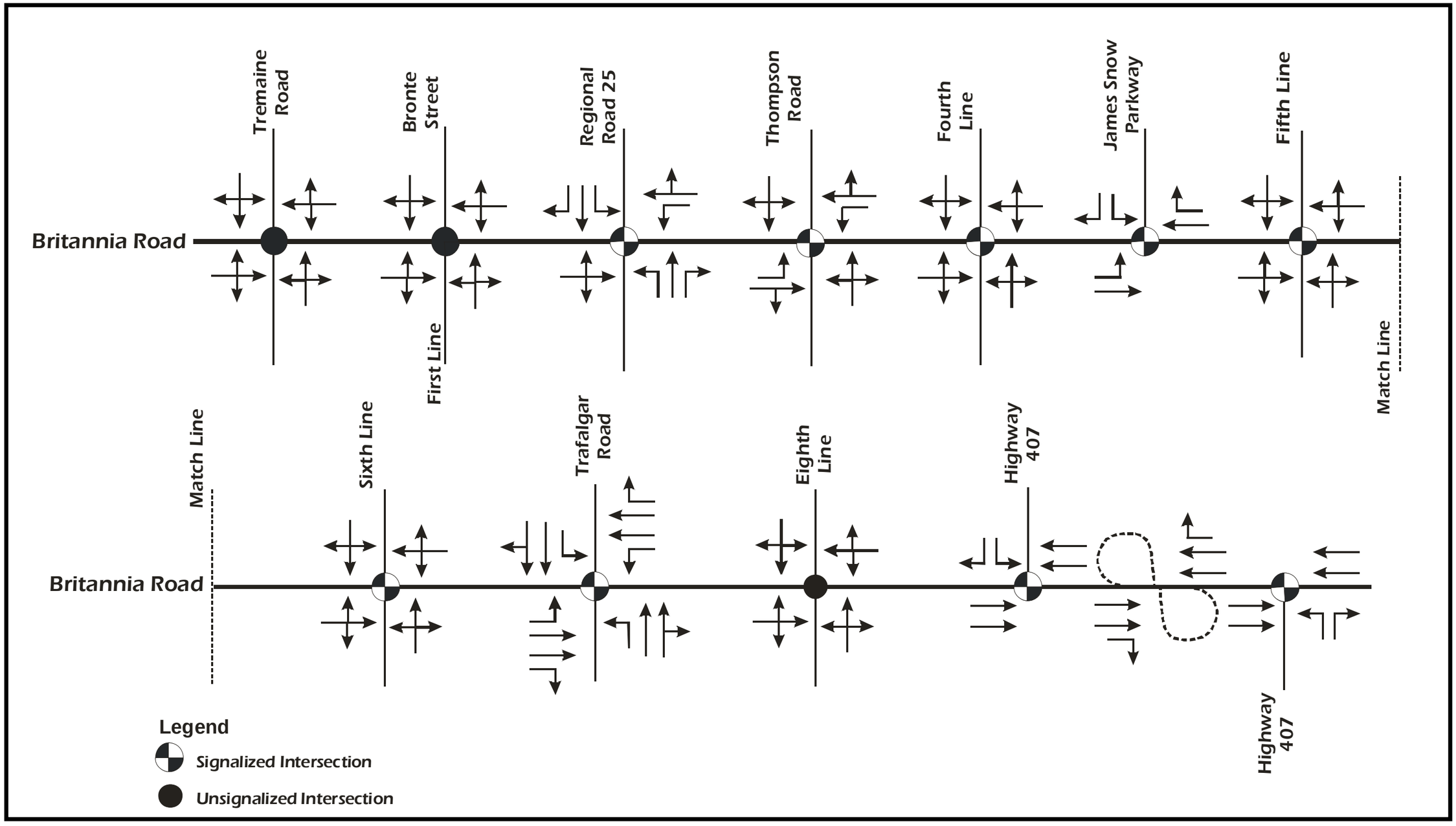


Table 2-2: Britannia Road Traffic Volumes (2010 ATR Data)

Road Section	Peak Hour Volumes				% Heavy Vehicles
	AM	PM	24-hr Volume	%PM	
Tremaine Road – First Line	499	482	3,722	13%	1.8%
First Line – Regional Road 25	637	656	5,528	12%	1.5%
Regional Road 25 to Fourth Line	1,192	1,151	11,158	10%	2.3%
Fourth Line – Sixth Line	1,451	1,449	15,070	10%	2.4%
Sixth Line – Trafalgar Road	1,446	1,557	15,640	10%	1.7%
Trafalgar Road – Eighth Line	1,515	1,605	13,514	12%	1.2%
Eighth Line – Highway 407	778	1,983	13,387	15%	2.0%

2.4.6. Weekday Peak Hour Traffic Volumes

Halton Region provided intersection turning movement counts data (TMCs) within the study area for all the crossing roadways. A review of this traffic data reveals that entering traffic volumes at the study intersections do not reach their highest levels during the same hour either in the morning or afternoon. The weekday morning peak at the study intersections occurs within the period from 7:00 a.m. to 8:45 a.m. and the afternoon peak hour occurs within the period from 4:15 p.m. to 6:00 p.m. The corridor is busiest in the morning from 7:30 a.m. to 8:30 a.m. and in the afternoon from 4:45 p.m. to 5:45 p.m. Since the TMC data was collected over a three year period on different days, a selected number of volumes were adjusted to ensure that the traffic flows were reasonably balanced through the corridor. The balanced 2011 Weekday AM and PM peak hour traffic volumes are illustrated in **Figure 2-2** and in **Figure 2-3**, respectively.

Figure 2-2: Balanced 2011 Weekday AM Peak Hour Traffic Volumes

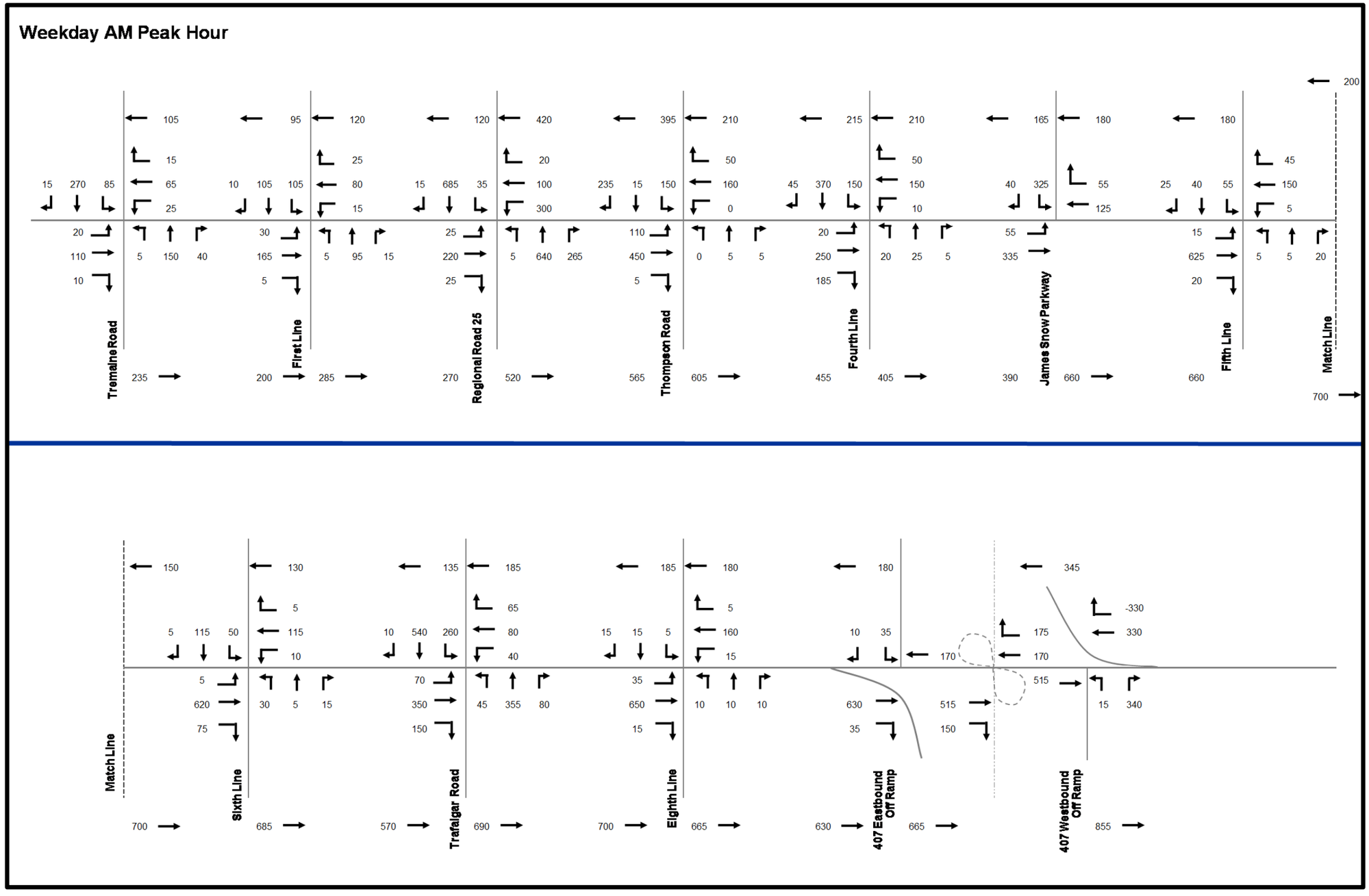
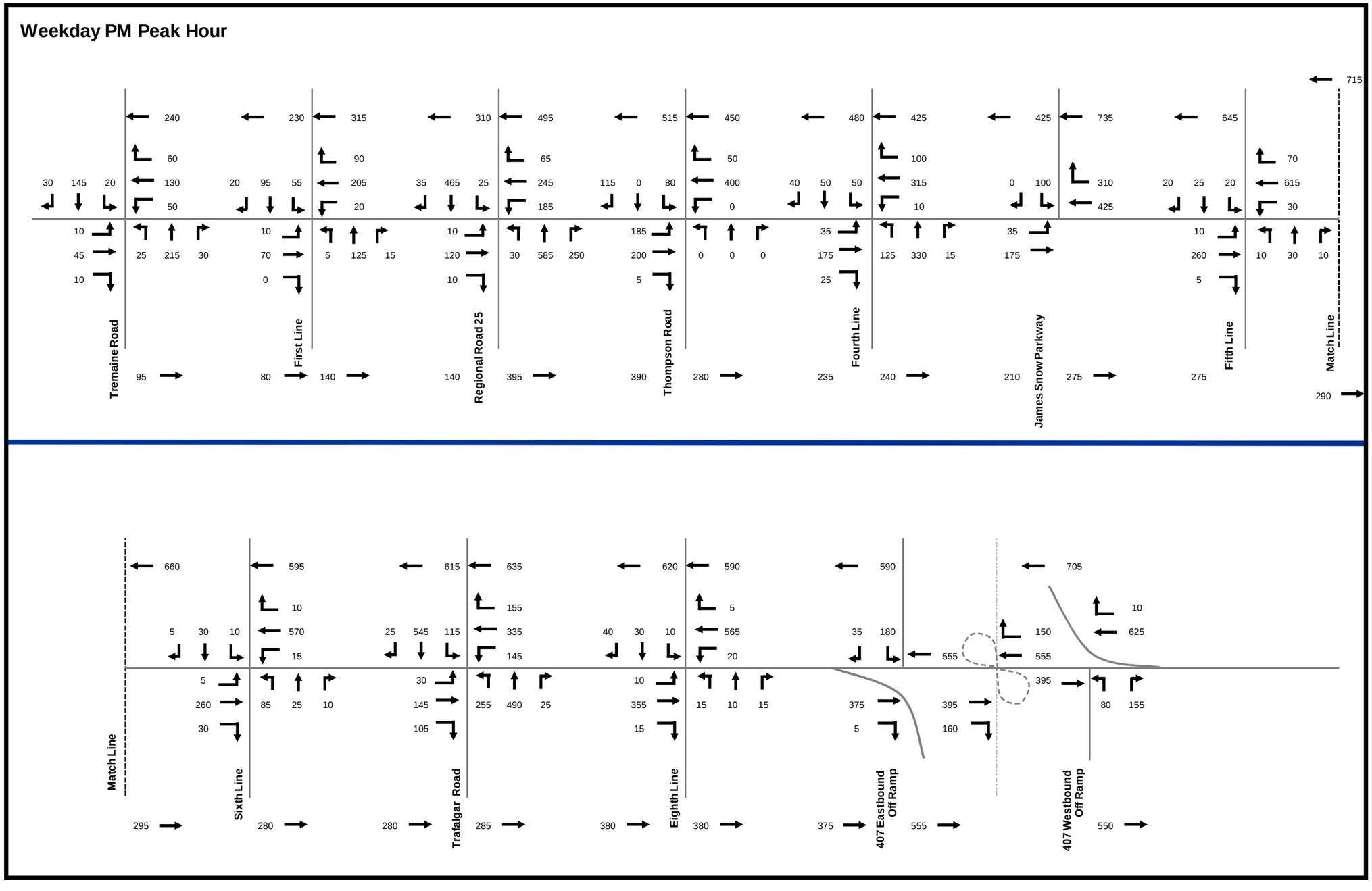


Figure 2-3: Balanced 2011 Weekday PM Peak Hour Traffic Volumes



The operational performance of the study intersections along Britannia Road made use of the *Highway Capacity Manual (HCM)* techniques for signalized and unsignalized intersections as employed by the Synchro-SimTraffic package (Version 7). In this study, the operational performance of the signalized intersections was measured by the intersection (overall) Volume-to-Capacity (v/c) ratio and the corresponding level of service (LOS). Those movements/lane groups with either a v/c ratio in excess of established thresholds or a LOS below D or both were identified as "critical" movements. The operational performance of unsignalized intersections was measured by the level of service (LOS) of the lowest priority movements, that is, the left turn movements from the STOP controlled approaches.

The results of the operational performance of the intersections during the AM and PM peak times are presented in **Table 2-3**.

Table 2-3: Existing (2011) Operational Performance

Intersection	Intersection Movement	HCM Performance Measures					
		Weekday AM			Weekday PM		
		Delay (s)	V/C	LOS	Delay (s)	V/C	LOS
Britannia Road and Bronte Street/First Line *(Stop Control)*	Eastbound LTR	10.2	0.30	B	9.4	0.14	A
	Westbound LTR	9.3	0.18	A	12.4	0.49	B
	Northbound LTR	9.2	0.17	A	10.1	0.25	B
	Southbound LTR	10.5	0.33	B	10.6	0.29	B
	Overall	**10.0**		**A**	**11.2**		**B**
Britannia Road and Regional Road 25 *(Traffic Signal)*	Westbound Left	71.9	0.97	E			
	Overall	**32.9**	**0.89**	**C**	**21.4**	**0.69**	**C**
Britannia Road and Thomson Road *(Traffic Signal)*		*No Critical Movements*					
	Overall	**22.8**	**0.62**	**C**	**15.2**	**0.54**	**B**
Britannia Road and Fourth Line *(Traffic Signal)*	Southbound LTR	31.8	0.86	C			
	Northbound LTR				58.7	0.99	E
	Overall	**23.9**	**0.76**	**C**	**29.0**	**0.75**	**C**

Intersection	Intersection Movement	HCM Performance Measures					
		Weekday AM			Weekday PM		
		Delay (s)	V/C	LOS	Delay (s)	V/C	LOS
Britannia Road and James Snow Parkway *(Traffic Signal)*		*No Critical Movements*					
	Overall	**11.7**	**0.56**	**B**	**6.9**	**0.48**	**A**
Britannia Road and Fifth Line *(Stop Control)* *(Subsequent to existing conditions analysis temporary signals were installed)*	Northbound LTR	16.2	0.09	C			
	Southbound LTR	25.8	0.42	D			
	Overall	N/A			N/A		
Britannia Road and Sixth Line *(Traffic Signal)*		*No Critical Movements*					
	Overall	**13.5**	**0.60**	**B**	**9.6**	**0.57**	**A**
Britannia Road and Trafalgar Road *(Traffic Signal)*		*No Critical Movements*					
	Overall	**20.6**	**0.49**	**C**	**20.2**	**0.55**	**C**
Britannia Road and Eighth Line *(Stop Control)*	Northbound LTR	21.2	0.12	C	27.3	0.22	D
	Southbound LTR	16.8	0.11	C	24.5	0.33	C
	Overall	N/A			N/A		
Britannia Road and Highway 407 N to E/W *(Traffic Signal)*		*No Critical Movements*					
	Overall	**5.7**	**0.43**	**A**	**5.1**	**0.43**	**A**
Britannia Road and Highway 407 S to E/W *(Traffic Signal)*		*No Critical Movements*					
	Overall	**9.7**	**0.51**	**A**	**5.3**	**0.39**	**A**

The signalized intersections are currently operating with an overall level of service C, or better, during the weekday peak hours, although short-term congestion may be experienced at these intersections. Traffic conditions characterized by level of

service C, or better, are considered acceptable. The signalized ramp terminals at the Highway 407 and Britannia Road interchange are operating well.

The stop controlled approaches at the unsignalized intersections are operating at level of service D or better. Level of service D is associated with traffic conditions approaching capacity conditions. It is intended that this capacity analysis modelling will serve as the basis for evaluating intersection performance for the future 2031 horizon year.

2.4.7. Vehicle Operating Speeds

Operating speed is a basic measure of traffic performance and there are a number of ways of describing vehicle operating speeds. The primary measure of vehicle operating speeds is the 85th percentile speed of "free floating" traffic as computed from speed data collected at a specific location or several locations. Use of the 85th percentile speed is based on the theory that that large majority of drivers are reasonably competent, reasonably prudent, want to avoid collisions yet have a desire to reach their destination in the shortest possible time. In addition to the 85th percentile speed, it is also useful to examine other operating speed characteristics including average speeds and the percentage of non-compliance with the legal speed limit.

Available vehicle operating speed data was obtained from the April 2008 and September 2008 ATR data for selected locations along the Britannia Road corridor as provided by Halton Region. The speed limit on Britannia Road varies from 80 km/hr from Tremaine Road to just west of Fourth Line where the speed limit is reduced to 60 km/hr until just west of Fifth Line where the 80 km/hr speed zone is resumed. A second 60 km/hr speed zone is introduced mid-way between Sixth Line and Trafalgar Road and is terminated mid-way between Trafalgar Road and Eighth Line where the 80 km/hr speed zone is resumed. The speed limit is reduced to 70 km/hr east of Ninth Line.

A summary of the vehicle operating speed characteristics are provided in **Table 2-4**.

There are sections where the motorists are travelling higher than the posted speed limit, predominantly in the eastbound direction. One section of non-compliance is between Fourth Line and Sixth Line, which could be due to the transition in the posted speed limit from 80 km/hr to 60 km/hr at Fourth Line. Additionally, the section between Sixth Line and Trafalgar Road exhibits non-compliance as shown in **Table 2-4**.

Table 2-4: Existing Operating Speed Characteristics

Road Section	Speed Characteristics		
	Posted Speed at Sampling Point	Mean Speed	85th Percentile Speed
Eastbound			
Tremaine Road to First Line	80 km/hr	85 km/hr	93 km/hr
First Line to Regional Road 25	80 km/hr	82 km/hr	91 km/hr
Regional Road 25 to Fourth Line	80 km/hr	81 km/hr	82 km/hr
Fourth Line to Sixth Line	60 km/hr	74 km/hr	82 km/hr
Sixth Line to Trafalgar Road	80 km/hr	91 km/hr	104 km/hr
Trafalgar Road to Eighth Line	80 km/hr	76 km/hr	82 km/hr
Eighth Line to Highway 407	80 km/hr	73 km/hr	81 km/hr
Westbound			
Tremaine Road to First Line	80 km/hr	74 km/hr	83 km/hr
First Line to Regional Road 25	80 km/hr	80 km/hr	91 km/hr
Regional Road 25 to Fourth Line	80 km/hr	82 km/hr	90 km/hr
Fourth Line to Sixth Line	60 km/hr	63 km/hr	72 km/hr
Sixth Line to Trafalgar Road	80 km/hr	59 km/hr	73 km/hr
Trafalgar Road to Eighth Line	80 km/hr	67 km/hr	72 km/hr
Eighth Line to Highway 407	80 km/hr	76 km/hr	82 km/hr

2.4.8. Roadway-Railway Crossing Protection – CNR Halton Subdivision

Railway crossings on roadways represent a critical design element subject to strict regulations under the *Railway Safety Act*. Prevailing guidelines (or warrants) developed by the Transportation Association of Canada (TAC) and Transport Canada rely on the use of a cross-product of daily roadway volume and daily train movements. The need for grade separation is established if either the existing or future cross-product exceeds 200,000.

The CN Halton Subdivision is a major railway line in Southern Ontario. Owned and operated by Canadian National Railway (CN), it was first constructed in the late 1860's, and runs from CN's MacMillian Yard in Vaughan, Ontario, where it continues as the CN York Subdivision to its junction with the CN Oakville Subdivision in Burlington, Ontario. The CN Halton Subdivision passes through and services the York, Peel and Halton Regions. It is Canada's fourth busiest rail line by volume of train movements. CN's Halton Subdivision crosses Britannia Road at Mileage 38.72. There is only one set of tracks at this crossing.

There are typically 25 freight trains that travel on the CNR Halton Subdivision crossing Britannia Road. The number of rail cars range from 25 to 140. Britannia Road between Tremaine Road and First Line carries approximately 3,700 vehicles on a daily basis (based on 2010 ATR data). The current value of the cross-product for the level CNR crossing at Britannia Road is 92,500 (3,700 x 25).

2.4.9. Roadway-Railway Crossing Protection – CP / Ontario Hydro Spur Line

An at-grade railroad crossing is located between Eighth Line and Highway 407 on the Ontario Hydro Spur. This crossing is a private spur connecting the Hydro One Trafalgar Transformer Station north of Highway 403 to the CPR Galt Subdivision (at Mileage 26.50) to the north. The crossing is currently protected with the National Transportation Association (NTA) standard crossbuck signs. The crossing is used infrequently (less than one train movement a year) and is dependent on when new transformers are needed at the Hydro One transformer station. According to the Board Order, all train movements are to be protected by a member of the train crew and train speeds cannot exceed 5 mph. The current exposure does not warrant any improvements to the rail crossing warning system.

2.4.10. Collision Analysis

Collision summary data and collision diagrams for Britannia Road from Tremaine Road to Highway 407 for the period from January 1, 2005 to June 30, 2010 were provided by Halton Region. During this time period, a total of 312 collisions occurred on Britannia Road within the project limits. Of those 312 collisions, 201 (about 64%) occurred at the study intersections.

Comprehensive Road Safety Action Plan (CROSAP)

As part of the Comprehensive Road Safety Action Plan (CROSAP) adopted by Halton Region, a number of Safety Performance Functions (SPFs) were developed for different categories of road sections and intersections within Halton Region. Based on these functions, a Potential for Safety Improvement (PSI) index was developed for each road section and intersection in the Region. The PSI index identifies the difference between a specific locations' safety performance in the long run versus the safety performance expected for a comparable group of locations (with similar design and operating characteristics) in the Region. If the PSI for a particular location is greater than zero, it represents an opportunity for improvement (from a safety perspective) at that location, since more collisions are occurring at that location than typically occur at a similar/comparable group of locations in the Region. Conversely, if a location has a PSI index less than zero, fewer collisions occur at that location than at a comparable group of locations and therefore, it is performing better than the "norm" for that type of facility.

For this study, Halton Region provided the results from the 2010 CROSAP network screening for locations within the project limits. **Table 2-5** shows the value of the PSI index, and corresponding rank within the Region, for the intersection and mid-block locations along Britannia Road within the project limits.

Nine Britannia Road sections and/or intersections appear in the PSI top 100 Region-wide ranking from the Region's *2010 Comprehensive Road Safety Action Plan (CROSAP)*. Based on the findings presented in Table 2-4, opportunities exist to enhance safety within the Britannia Road corridor through roadway and traffic control improvements.

Macro-Analysis of Collision Experience

Macro-analysis allows us to determine if any apparent trends exist in the collision summary data. A summary of the macro-analysis of the collision experience within the study area is summarized as follows:

- **Collision Frequency**
  - The highest number of collisions, on an annual basis, occurred in 2008. The total number of collisions in 2009 was less than 2008.
- **Collision Experience by Season**
  - More collisions occur in winter and fall and this is consistent with provincial collision experience (based on collision statistics published by the Ministry of Transportation for 2002-2008).

Table 2-5: 2010 CROSAP Screening Results – Britannia Road

Britannia Road	PSI Index Value	Region Wide Rank
At Tremaine Road	9.61	82
Between Tremaine Road and First Line	< 1	187
At First Line	< 1	318
Between First Line and Regional Road 25	< 1	185
At Regional Road 25	1.60	158
Between Regional Road 25 and Thompson Road	9.55	59
At Thompson Road	16.90	55
Between Thompson Road and Fourth Line	3.22	111
At Fourth Line	< 1	276
Between Fourth Line and Fifth Line	< 1	180
At Fifth Line	56.38	12
Between Fifth Line and Sixth Line	< 1	181
At Sixth Line	14.00	63
Between Sixth Line and Trafalgar Road	25.85	15
At Trafalgar Road	13.47	67
Between Trafalgar Road and Eighth Line	18.75	24
At Eighth Line	16.68	56
Between Eighth Line and Highway 407	5.62	79

- **Collision Experience by Month**
  - The months of December and March experienced the most collisions. About 30% of all collisions occurred during the winter months. The provincial experience indicates January and December are the months with highest frequency in collisions.

- **Collision Experience by Day of Week**
  - More collisions occur on Monday, Tuesday, and Wednesday as compared to the rest of the week. Provincial experience (based on statistics for 2002-2008) indicates that Friday (17%) followed by Thursdays (16.4%) experience the highest frequency of collisions.
- **Weekday versus Weekend**
  - The majority of collisions (about 81%) occur on weekdays. This is higher than the provincial experience of 76% of collisions occurring on weekdays.
- **Collision by Time of Day**
  - About 49% of collisions occurred during off-peak hours and overnight. More than 20% of collisions occur during the morning peak period (7:00 – 9:00 am) and during the afternoon peak period (4:00-6:00 pm). This is much higher than provincial experience.
- **Initial Impact Type**
  - The majority of collisions (about 35%) within the study area were "rear-end" type collisions. Turning movement and Single Motor Vehicle (SMV) type collisions accounted for about 14% and 18% of the total collisions, respectively.
  - The common initial impact patterns differ from the provincial experience which indicates that Single Motor Vehicle (SMV) type collisions are the majority at 28.7% followed by rear-end type (28.5%) collisions.
- **Light Condition**
  - The majority of collisions (approximately 72%) occurred during daylight conditions. This is higher than the average provincial experience of 70% in the period from 2002-2008.
- **Pavement Surface Condition**
  - The majority of collisions (approximately 71%) occurred on dry roads. This is higher than the provincial average experience of 66% in the period from 2002-2008.
- **Environmental Condition**

The majority of collisions (about 70%) occurred when visibility was clear. This is slightly less than the provincial experience of 78% in the period from 2002-2008.

Collision Patterns

The most notable collision patterns that were identified within the study limits are summarized in **Table 2-6**.

Table 2-6: Notable Collision Patterns

Collision Attribute	Description
Types	Rear-end, turning movement, single motor vehicle
Location	Intersections
Light Conditions	Daylight
Weather Conditions	Clear
Time of Day	Off-peak, overnight, PM peak period
Day of Week	Monday, Tuesday and Wednesday
Month	March, December
Season	Winter

The collision experience along the Britannia Road corridor is typical of a commuter route that is more heavily travelled during the weekdays, experiencing highest traffic volumes during the weekday morning and afternoon peak periods. The predominant collision patterns suggest that some of the collisions may be alleviated by corridor improvements which would result in improved traffic operations during the typical weekday peak periods. Possible improvements relate to provision of auxiliary lanes, additional through lanes and improved traffic control to reduce turning movement and rear-end collisions.

2.5. Future Traffic Conditions

Halton Region is one of the most rapidly growing communities in Ontario based on the best planning estimates established through the Sustainable Halton process, the Region will grow from a population of approximately 492,000 with employment of 262,000, 2010 to approximately 780,000 residents and 390,000 jobs by 2031, as outlined in the Region's TMP to 2031.

There are two developments being planned by the Town of Milton which will influence travel demand and behavior along the Britannia Road corridor. The Boyne Secondary Plan is the third of three residential growth areas within the current Urban Expansion Area and is located on the north side of Britannia Road between Tremaine Road to James Snow Parkway. The Boyne Secondary Plan was approved

by Milton Council in June 2010 and at full occupancy is expected to accommodate 50,000 residents.

On the west side of Tremaine Road between Britannia Road and Derry Road, the Milton Education Village Area is planned for future development, including a university campus with an expected student population of 15,000. The Town of Milton is currently in the early stages of the planning process for these lands.

Additional details of the Boyne Survey Secondary Plan and Milton Education Village, including illustrations, are provided in Section 4.1.1.

2.5.1. Future Transportation Demands

Traffic forecasting is an integral part of the transportation planning process. Forecasting serves as an analysis tool for transportation planners and assists decision-makers in the evaluation of transportation road networks. Traffic projections for the study area were derived from modeling growth rates for the Britannia Road corridor provided by Halton Region.

2.5.2. Population & Employment

Best Planning Estimates, approved by Regional Council on July 13, 2011, formed the basis of the forecasts of population and employment land use (BPE v3.032) in Halton Region to 2031. The Town of Milton, one of the fast-growing communities in Ontario, is expected to continue to grow in both population and employment over the next twenty years. In 2011, the Town of Milton represented 18% of the Region's population and employment and this is expected to increase to nearly 31% by 2031.

2.5.3. Transportation Model

The Halton Region transportation demand forecasting model is a four-stage model incorporating trip generation, mode choice, trip distribution and trip assignment. The Region's model provides directional travel demands on modelled road sections (or links) based on a set of road network improvements, future land use and development scenarios, trip rates and travel patterns. The Halton transportation planning model incorporates the final approved Best Planning Estimates (BPE v3.032), land use (as approved by Regional Council in July 2011) as well as the final improvements phasing plan (as outlined in the Halton Transportation Master Plan and Capital Projects List). The Britannia Road corridor from Tremaine Road to Highway 407 was modelled as four lanes in the 2021 planning horizon and with four general purpose lanes and two High Occupancy Vehicles (HOV) lanes in the 2031 planning horizon. The Halton TMP model also incorporates the final transit mode share targets recommended in the 2011 TMP. The transit mode share target for 2006-2021 is 10% and the overall transit mode share target for 2031 is 20%.

2.5.4. Future Traffic Forecasts

The development of 2021/2031 forecasts at the intersection level was developed from existing turning movement counts and year 2021 and 2031 approach and departure volumes (as forecasted from the Halton TMP model) using the methodology described in National Cooperative Highway Research Program Report (NCHRP) 255, *Highway Traffic Data for Urbanized Area Project Planning and Design* (Transportation Research Board, 1982)[1]. As the transportation model volumes represent PM peak hour volumes, to determine AM peak hour volumes, existing counts were used to determine the relationship between the AM peak hour and PM peak hour.

The 2031 daily traffic volumes are expected to be in the range of 19,000 to 42,500 vehicles per day. The weekday AM and PM peak hour volumes in the general purpose lanes are expected to range from 1,890 to 3,305 vehicles per hour.

The future 2021 Weekday AM and PM peak hour traffic volumes are illustrated in **Figure 2-4** and in **Figure 2-5**, respectively.

The future 2031 Weekday AM and PM peak hour general purpose traffic volumes are illustrated in **Figure 2-6** and in **Figure 2-7**, respectively.

[1] "Highway Traffic Data for Urbanized Area Project Planning and Design", National Cooperative Highway Research Program (NCHRP), TRB Record No. 255, December 1982.; Jones, Steven L, Arnold, Eugene D, "Estimating Intersection Turning Movements" Technical Assistance Report, Virginia Transportation Research Council, VTRC 99-TAR8, May 1999.

Figure 2-4: 2021 Weekday AM Peak Hour Traffic Volumes

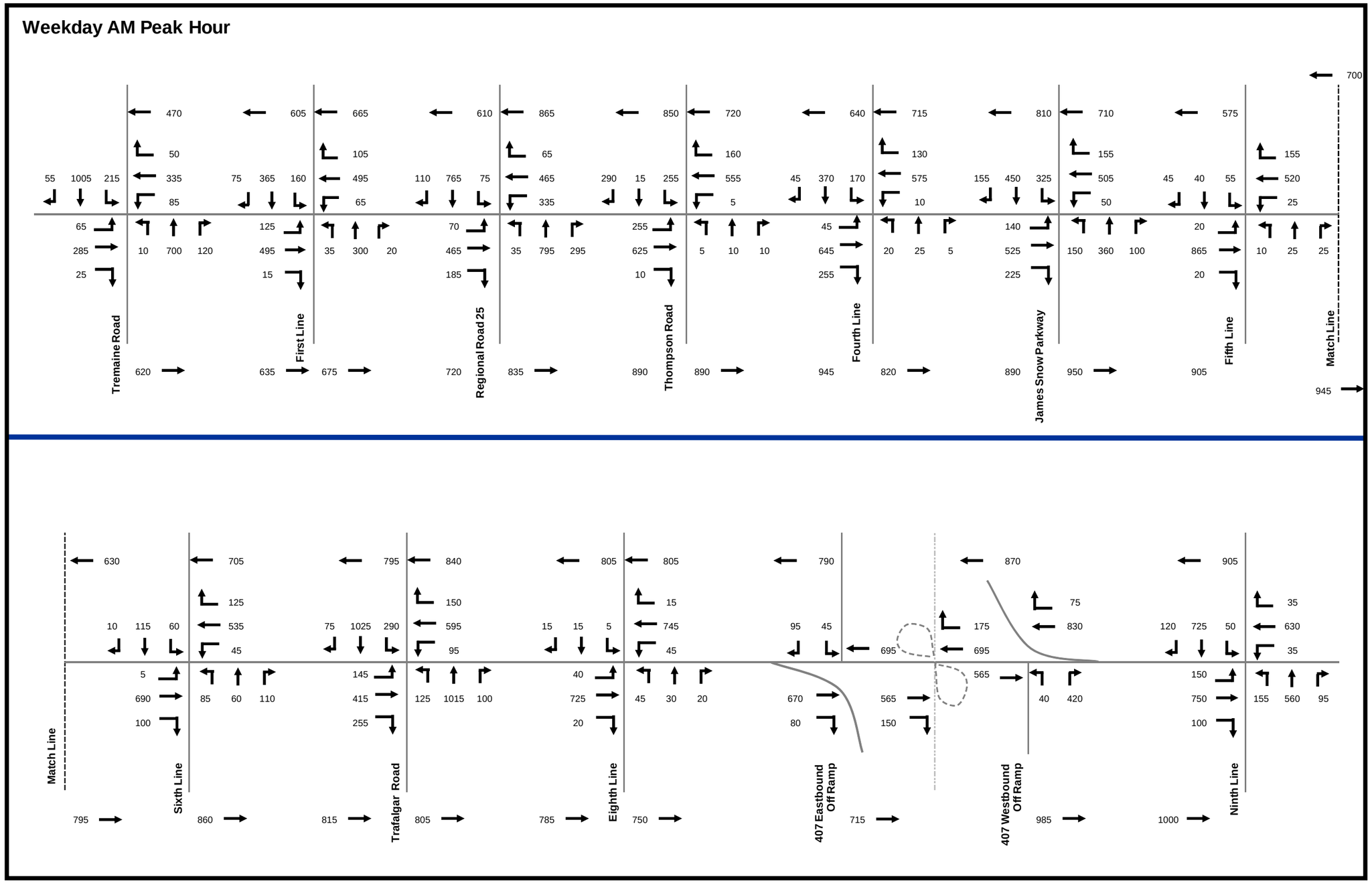


Figure 2-5: 2021 Weekday PM Peak Hour Traffic Volumes

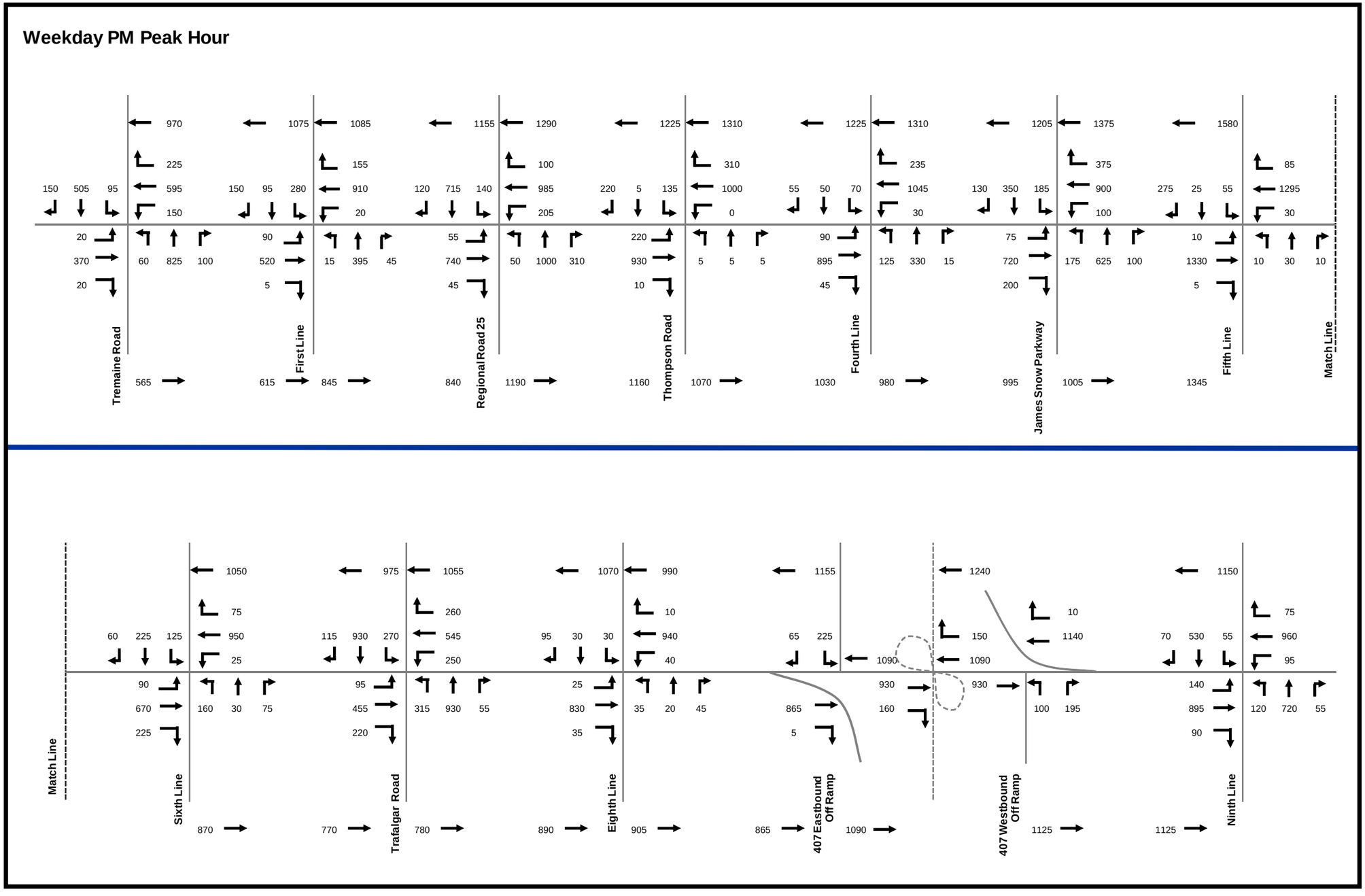


Figure 2-6: 2031 Weekday AM Peak Hour Traffic Volumes

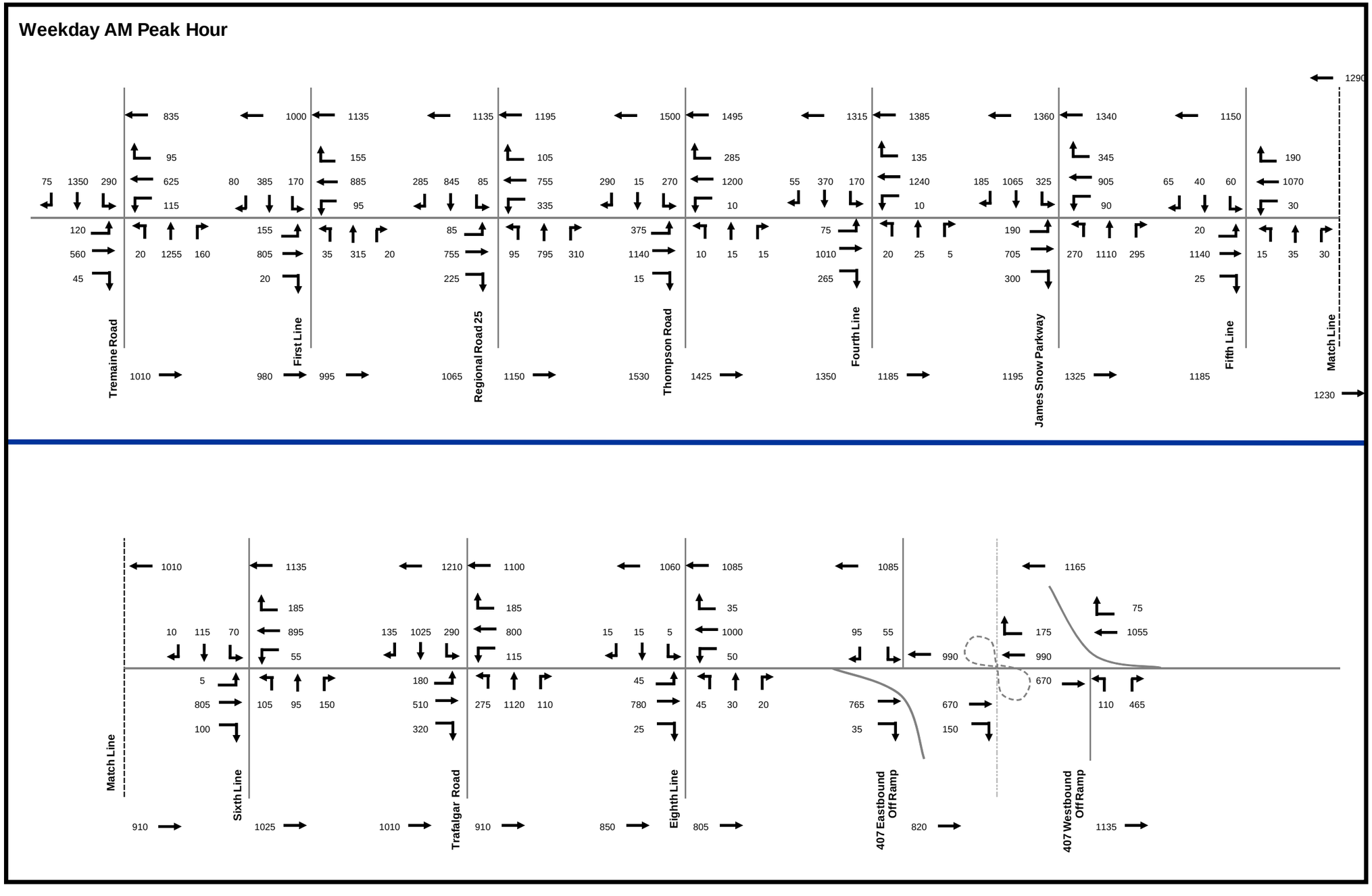
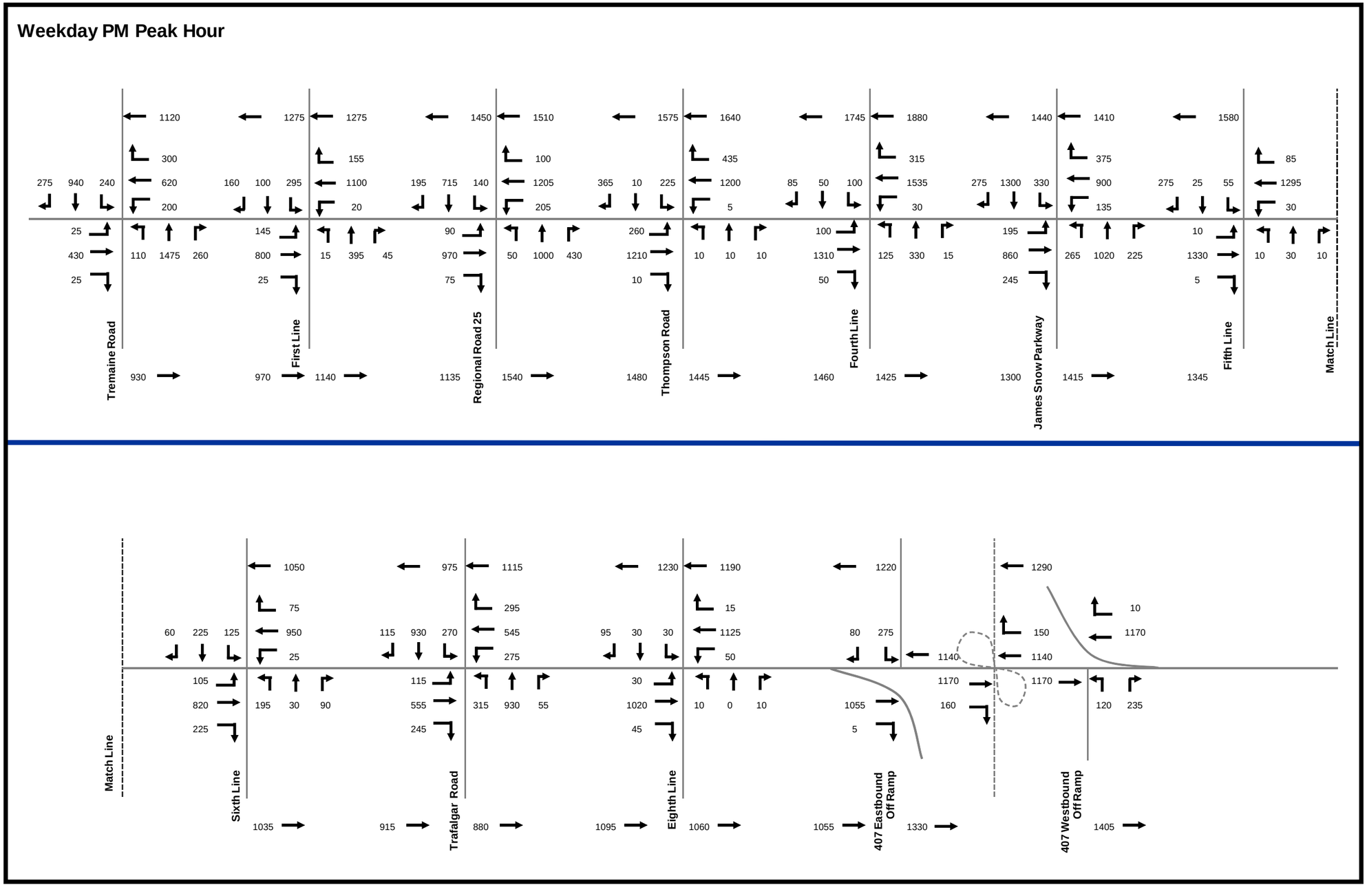


Figure 2-7: 2031 Weekday PM Peak Hour Traffic Volumes - General Purpose Lanes



2.5.5.Future (2021) Traffic Conditions

The operational performance of the intersections within the Britannia Road corridor project limits was evaluated in 2021 under two scenarios: (1) Do Nothing and (2) as per the Region's Capital Program List by 2021.

At the time the transportation assessment was completed, the 2021 programmed roadway improvements included the widening of Britannia Road within the project limits from two lanes to four lanes, programmed improvements to Regional Road 25 at Britannia Road, implementation of traffic control at Bronte Street/First Line, Fifth Line and Eighth Line, provision of exclusive left turn lanes on all intersection approaches and optimized signal phasing and timing. Subsequently, in November 2011, Regional Council approved the reconstruction of Britannia Road from Tremaine Road to Regional Road 25 to the ultimate six lane road configuration identified in the 2011 TMP Preferred Network. These additional two lanes will operate as general purpose lanes in the interim, but will be converted to HOV lanes later when the corridor is widened to the ultimate 6 lanes from Regional Road 25 westerly. The traffic analysis was completed under the ultimate roadway lane configuration.

In the case of future traffic analyses, the established thresholds for the critical movements were increased to a V/C ratio of 0.90 for overall intersection operation, for through movements or for shared through-turning movements and a V/C of 1.00 for exclusive turning movements (e.g., left or right).

The results of the operational performance assuming no improvements are undertaken are summarized in **Table 2-7** and displayed graphically in **Figure 2-8**.

Assuming the programmed transportation infrastructure improvements are not delivered by 2021, weekday peak hour traffic conditions along Britannia Road will deteriorate in the section between Tremaine Road and the Highway 407 and the corridor will experience severe congestion. All intersections except for the signalized Highway 407 ramp terminals are expected to not accommodate the 2021 travel demands at an acceptable level. These findings reveal the existing configuration of Britannia Road between Tremaine Road and Highway 407 cannot adequately accommodate the 2021 travel demands.

Considering the implementation of the interim four lane configuration, the results of the operational performance are summarized in **Table 2-8** and are displayed graphically in **Figure 2-9**.

Table 2-7: 2021 Operational Performance – Do Nothing

Intersection	Intersection Movement	HCM Performance Measures			
		Weekday AM		Weekday PM	
		V/C	LOS	V/C	LOS
Britannia Road and First Line *(All-way Stop Control)*	Eastbound LTR	1.79	F	1.87	F
	Westbound LTR	1.88	F	3.25	F
	Northbound LTR	1.01	F	1.37	F
	Southbound LTR	1.68	F	1.58	F
	Overall		**F**		**F**
Britannia Road and Regional Road 25 *(Signal Control)*	Eastbound LTR	1.42	F	19.82	F
	Westbound L	1.10	F	1.18	F
	Westbound TR			1.36	F
	Northbound T	1.34	F	1.60	F
	Southbound T	1.07	F		
	Overall	**1.41**	**F**	**9.21**	**F**
Britannia Road and Thompson Road *(Signal Control)*	Eastbound L	1.06	F	1.30	F
	Westbound TR	1.12	F	1.27	F
	Southbound LTR	1.12	F	1.16	F
	Overall	**1.11**	**F**	**1.22**	**F**
Britannia Road and Fourth Line *(Signal Control)*	Eastbound LTR	0.99	D	1.43	F
	Westbound LTR				
	Northbound LTR			1.36	F
	Southbound LTR	1.08	F		
	Overall	**1.03**	**E**	**1.41**	**F**
Britannia Road and James Snow Parkway *(Signal Control)*	Eastbound L			1.04	F
	Eastbound TR	0.97	D	1.08	F
	Westbound T			0.89	C
	Northbound TTR	0.96	F	1.11	F
	Southbound L	0.92	E	1.02	F
	Overall	**0.97**	**D**	**1.10**	**E**
Britannia Road and Fifth Line *(Signal Control)*	Eastbound LTR				
	Westbound LTR				
	Northbound LTR			>1.0	F
	Southbound LTR	1.66	F	>1.0	F
	Overall				
Britannia Road and Sixth Line *(Signal Control)*	Eastbound LTR			1.18	F
	Westbound LTR			0.99	D
	Northbound LTR			1.14	F
	Southbound LTR			1.10	F
	Overall	**0.79**	**B**	**1.17**	**F**

Intersection	Intersection Movement	HCM Performance Measures			
		Weekday AM		Weekday PM	
		V/C	LOS	V/C	LOS
Britannia Road and Trafalgar Road *(Signal Control)*	Eastbound L			1.12	F
	Eastbound TR			0.95	E
	Westbound L			1.15	F
	Westbound TR	0.92	E		
	Northbound L			1.09	F
	Northbound TR	1.08	F	0.93	D
	Southbound L	1.02	F	1.03	F
	Southbound TR			1.04	E
	Overall	**0.94**	**E**	**1.07**	**E**
Britannia Road and Eighth Line *(Stop Control)*	Eastbound LTR				
	Westbound LTR				
	Northbound LTR	1.54	F	>1.0	F
	Southbound LTR	0.38	F	>1.0	F
	Overall				
Britannia Road and Highway 407 N to E/W *(Signal Control)*	No Critical Movements				
	Overall	**0.40**	**A**	**0.61**	**A**
Britannia Road and Highway 407 S to E/W *(Signal Control)*	No Critical Movements				
	Overall	**0.67**	**A**	**0.61**	**A**

As shown in Table 2-8 and Figure 2-9, the interim configuration for Britannia Road can accommodate the 2021 travel demands on the Britannia Road corridor. The intersections are expected to operate at level of service D, or better, during the Weekday AM and PM peak hours. As previously noted, in November 2011, Regional Council approved the reconstruction of Britannia Road from Tremaine Road to Regional Road 25 to the ultimate six lane road configuration identified in the 2011 TMP Preferred Network. Accordingly, the intersections between Tremaine Road to Regional Road 25 will operate better than as reported in Table 2-8.

Figure 2-8: 2021 Operational Performance – Do Nothing

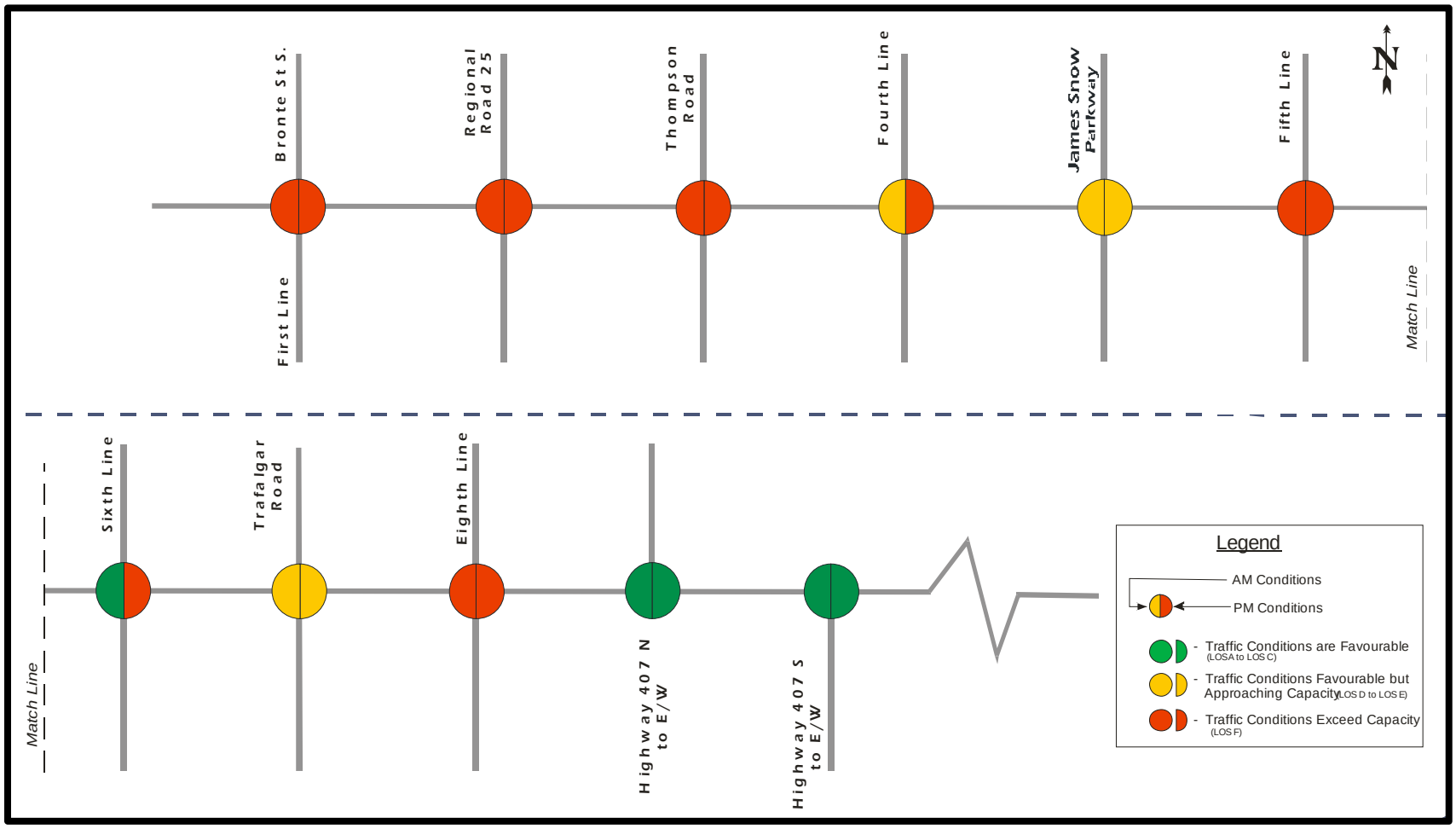
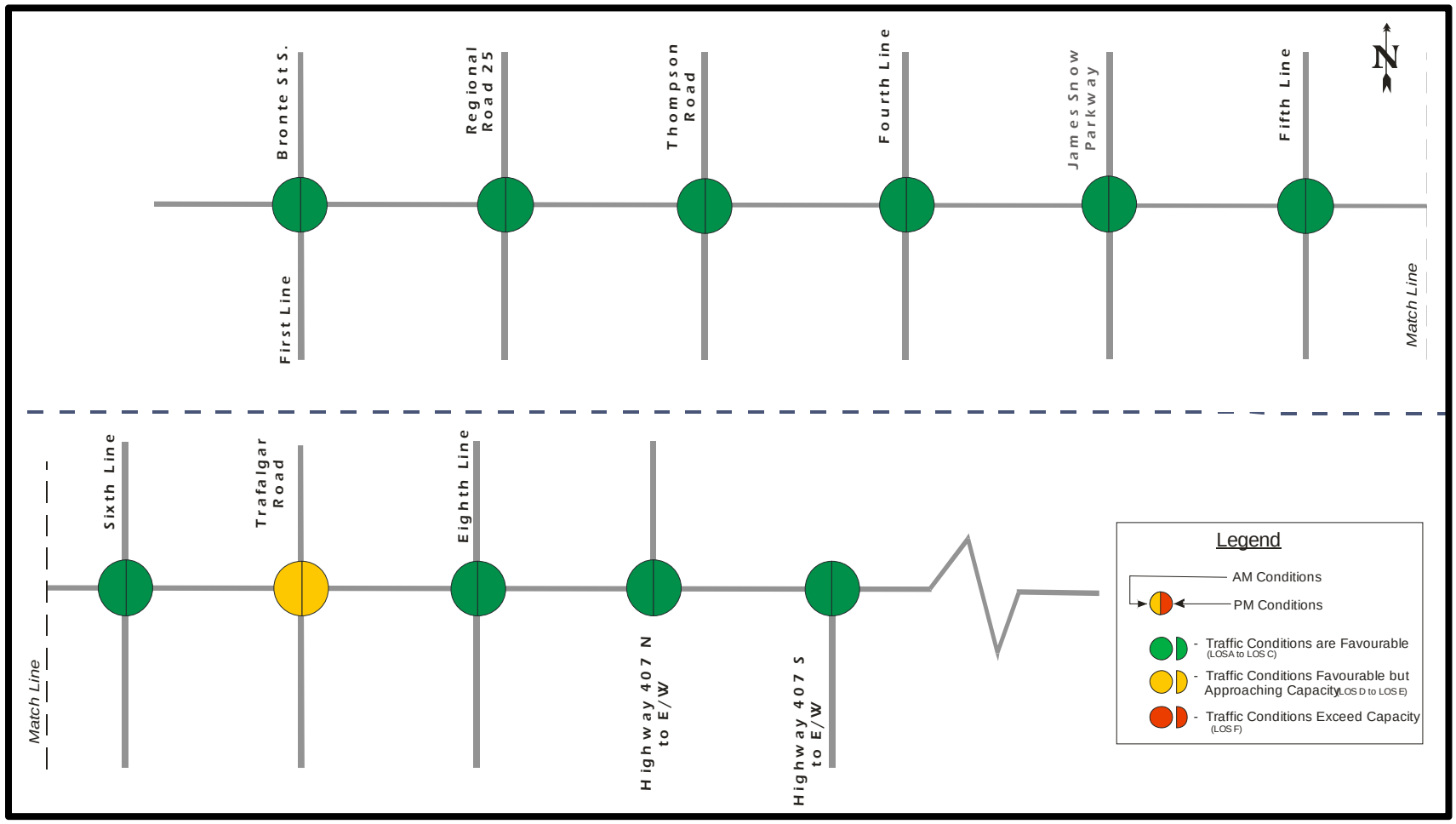


Table 2-8: 2021 Operational Performance – With 2021 TMP Improvements

Intersection	Intersection Movement	HCM Performance Measures					
		Weekday AM			Weekday PM		
		Delay (s)	V/C	LOS	Delay (s)	V/C	LOS
Britannia Road and First Line		*No Critical Movements*					
	Overall	12.2	0.57	B	22.4	0.84	C
Britannia Road and Regional Road 25		*No Critical Movements*					
	Overall	22.5	0.66	C	34.7	0.76	C
Britannia Road and Thomson Road		*No Critical Movements*					
	Overall	20.7	0.56	C	17.4	0.69	B
Britannia Road and Fourth Line		*No Critical Movements*					
	Overall	13.3	0.62	B	13.8	0.67	B
Britannia Road and James Snow Parkway		*No Critical Movements*					
	Overall	18.1	0.69	B	22.6	0.83	C
Britannia Road and Fifth Line		*No Critical Movements*					
	Overall	12.7	0.38	B	15.1	0.70	B
Britannia Road and Sixth Line		*No Critical Movements*					
	Overall	10.6	0.37	B	13.4	0.56	B
Britannia Road and Trafalgar Road		*No Critical Movements*					
	Overall	35.8	0.81	D	38.6	0.89	D
Britannia Road and Eighth Line		*No Critical Movements*					
	Overall	11.7	0.33	B	12.0	0.38	B
Britannia Road and Highway 407 N to E/W		*No Critical Movements*					
	Overall	6.5	0.30	A	10.5	0.54	B
Britannia Road and Highway 407 S to E/W		*No Critical Movements*					
	Overall	12.7	0.56	B	10.3	0.53	B
	Northbound TR				35.8	0.88	D
	Overall	34.8	0.90	C	29.2	0.89	C

Figure 2-9: 2021 Operational Performance – With 2021 TMP Improvements



2.5.6.Future (2031) Traffic Conditions

The operational performance of the intersections within Britannia Road corridor project limits was evaluated as envisioned by the Region's 2031 TMP. This includes the additional of HOV lanes along the entire corridor.

The transportation assessment completed as part of the TMP recommended four general purpose lanes and two HOV lanes for Britannia Road between Tremaine Road and Highway 407. The 2031 link volumes for the general purpose and HOV lanes along Britannia Road reveal the general purpose directional volumes far exceed the HOV directional volumes. Accordingly, the capacity of the intersections along Britannia Road in 2031 is expected to be governed by the general purpose lanes.

Anticipated HOV Share

Halton Region's TMP has established a desired future modal split to promote alternative modes of transportation, including HOV, transit, pedestrians and cyclists. This was utilized in the Regional model for estimating future transportation demands. The 2031 PM peak hour general purpose (GP) and HOV volumes are included in **Table 2-9**.

For the Britannia Road corridor the TMP has recommended 4 GP lanes plus 2 HOV/transit lanes. This design concept includes two travel lanes in each direction for general purpose traffic and a dedicated curb lane for exclusive use by cars with two or more occupants and public transit. Provision for curbside bus bays that facilitate the efficient operation of buses will be considered as part of the long term operations for the corridor by 2031. Bus bays allow the HOV lanes to be open for use by eligible vehicles and thus helps reduce delays. Separate right turn lanes will also be protected and provided at major intersections along the Britannia Road corridor to accommodate queuing right-turning vehicles without impacting the through HOV vehicle. This will require that the right-turning vehicles cross the curb HOV lane to access the right turn lane. An operational plan supporting the HOV lanes will be undertaken as part of detail design for the long term improvements by 2031.

The operational performance of the intersections within the Britannia Road corridor project limits were evaluated in 2031 under two scenarios: (1) Do Nothing and (2) as per the Region's Capital Program List to 2031, including the ultimate operation of 4 GP plus 2 HOV/transit lanes along Britannia Road. The results are discussed in the text below.

Table 2-9: 2031 PM Peak Hour GP and HOV Volumes

Road Section	PM Peak Hr.		
	GP	HOV	Total = GP + HOV
Tremaine Road to First Line	2245	585	2830
First Line to Regional Road 25	2585	748	3333
Regional Road 25 to Fourth Line	3055	1279	4334
Fourth Line to James Snow Parkway	3305	1285	4590
James Snow Parkway to Sixth Line	2825	1255	4080
Sixth Line to Trafalgar Road	2085	846	2931
Trafalgar Road to Eighth Line	1995	620	2615
Eighth Line to Highway 407	2250	605	2855

2031 Do-Nothing

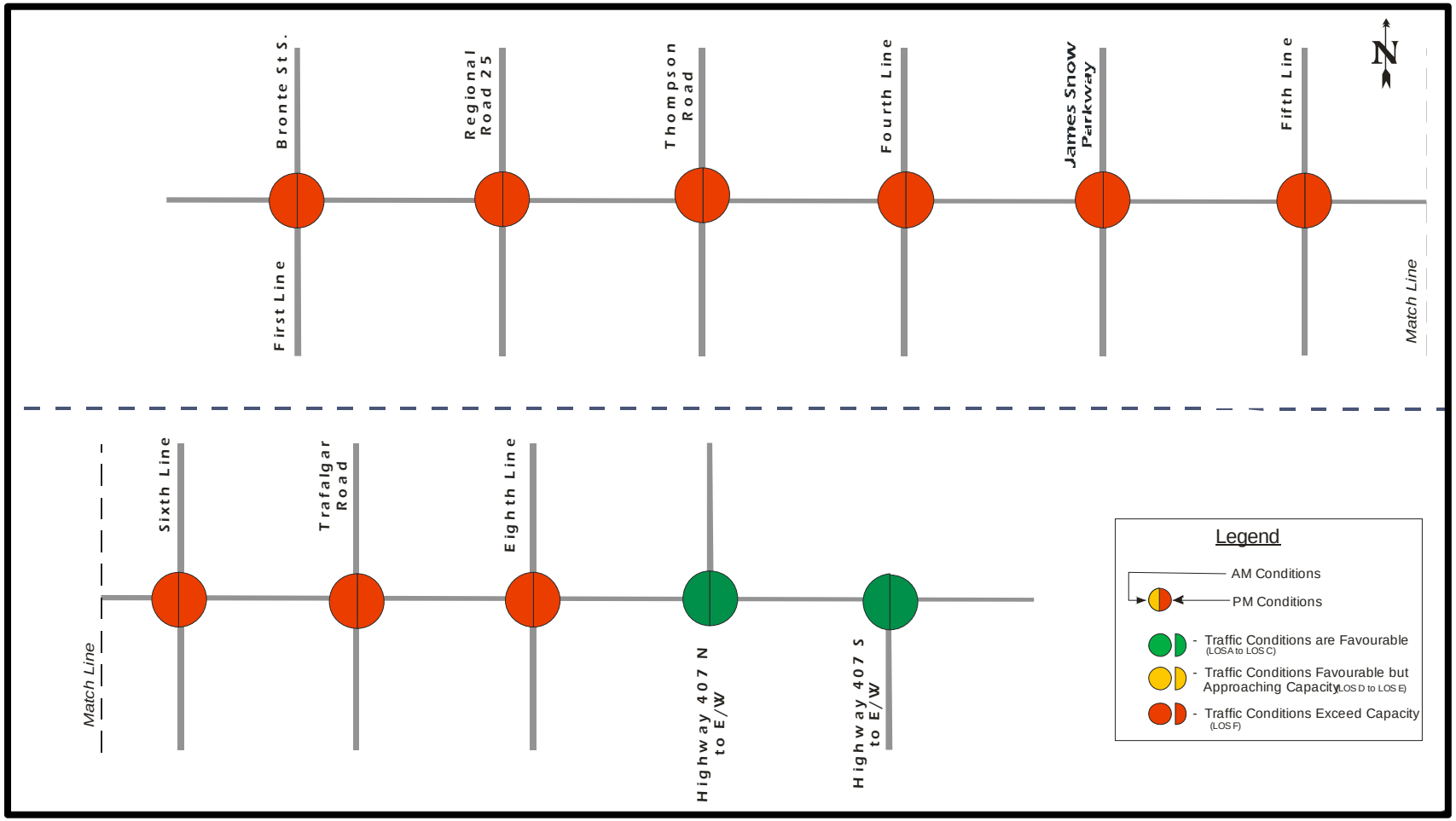
The results of the operational performance assuming no improvements are undertaken are summarized in **Table 2-10** and displayed graphically in **Figure 2-10**.

Table 2-10: 2031 Operational Performance – Do Nothing

Intersection	Intersection Movement	HCM Performance Measures			
		Weekday AM		Weekday PM	
		V/C	LOS	V/C	LOS
Britannia Road and First Line *(All-way Stop Control)*	Eastbound LTR	2.75	F	2.95	F
	Westbound LTR	3.20	F	3.83	F
	Northbound LTR	1.05	F	1.37	F
	Southbound LTR	1.78	F	1.67	F
	Overall		**F**		**F**
Britannia Road and Regional Road 25 *(Signal Control)*	Eastbound LTR	18.47	F	38.50	F
	Westbound L	1.51	F	1.17	F
	Westbound TR	1.06	F	1.63	F
	Northbound L	2.00	F		
	Northbound T	1.38	F	1.60	F
	Southbound T	1.19	F		
	Overall	**10.00**	**F**	**16.79**	**F**
Britannia Road and Thompson Road *(Signal Control)*	Eastbound L	1.56	F	1.54	F
	Eastbound TR	1.23	F	1.00	F
	Westbound TR	2.33	F	1.59	F
	Southbound LTR	1.16	F	2.07	F
	Overall	**1.76**	**F**	**1.59**	**F**
Britannia Road and Fourth Line *(Signal Control)*	Eastbound LTR	1.42	F	1.52	F
	Westbound LTR	1.56	F	1.22	F
	Northbound LTR			1.41	F
	Southbound LTR	1.10	F	1.15	F
	Overall	**1.39**	**E**	**2.10**	**F**
Britannia Road and James Snow Parkway *(Signal Control)*	Eastbound L	1.70	F	1.36	F
	Eastbound TR	1.48	F	1.58	F
	Westbound L			1.15	F
	Westbound T	1.28	F	1.30	F
	Northbound L	1.49	F	1.57	F
	Northbound TTR	1.54	F	1.33	F
	Southbound L	1.56	F	1.69	F
	Southbound TTR	1.28	F	1.60	F
	Overall	**1.62**	**F**	**1.66**	**F**
Britannia Road and Fifth Line *(Signal Control)*	Eastbound LTR				
	Westbound LTR				
	Northbound LTR	>1.0	F	>1.0	F
	Southbound LTR	>1.0	F	>1.0	F
	Overall				

Intersection	Intersection Movement	HCM Performance Measures			
		Weekday AM		Weekday PM	
		V/C	LOS	V/C	LOS
Britannia Road and Sixth Line *(Signal Control)*	Eastbound LTR			1.41	F
	Westbound LTR	1.31	F	1.00	D
	Northbound LTR	1.05	F	1.38	F
	Southbound LTR			1.10	F
	Overall	**1.24**	**F**	**1.40**	**F**
Britannia Road and Trafalgar Road *(Signal Control)*	Eastbound L	1.03	F	1.52	F
	Eastbound TR			1.15	F
	Westbound L	1.19	F	1.26	F
	Westbound TR	1.23	F		
	Northbound L	2.21	F	1.09	F
	Northbound TR	1.19	F	0.93	D
	Southbound L	1.02	F	1.03	F
	Southbound TR			1.04	E
	Overall	**1.57**	**F**	**1.22**	**F**
Britannia Road and Eighth Line *(Stop Control)*	Eastbound LTR				
	Westbound LTR				
	Northbound LTR	>1.0	F	>1.0	F
	Southbound LTR	0.89	F	>1.0	F
	Overall				
Britannia Road and Highway 407 N to E/W *(Signal Control)*	No Critical Movements				
	Overall	**0.50**	**A**	**0.65**	**A**
Britannia Road and Highway 407 S to E/W *(Signal Control)*	No Critical Movements				
	Overall	**0.78**	**B**	**0.67**	**B**

Figure 2-10: 2031 Operational Performance – Do Nothing



2031 With TMP Improvements

The results of the operational performance of the 2031 configuration for Britannia Road are summarized in **Table 2-11** and are displayed graphically in **Figure 2-11**.

Based on the completed traffic forecasts, traffic volumes on Britannia Road between Tremaine Road to 8th Line will approach or exceed the critical capacity levels of a 4 lane cross section in the peak direction by 2021; and projected volumes, including the anticipated HOV travel demand, will significantly exceed critical capacity levels for a 4 lane roadway by 2031. This clearly indicates that improvements to Britannia Road are required to provide acceptable levels of services conditions in the future.

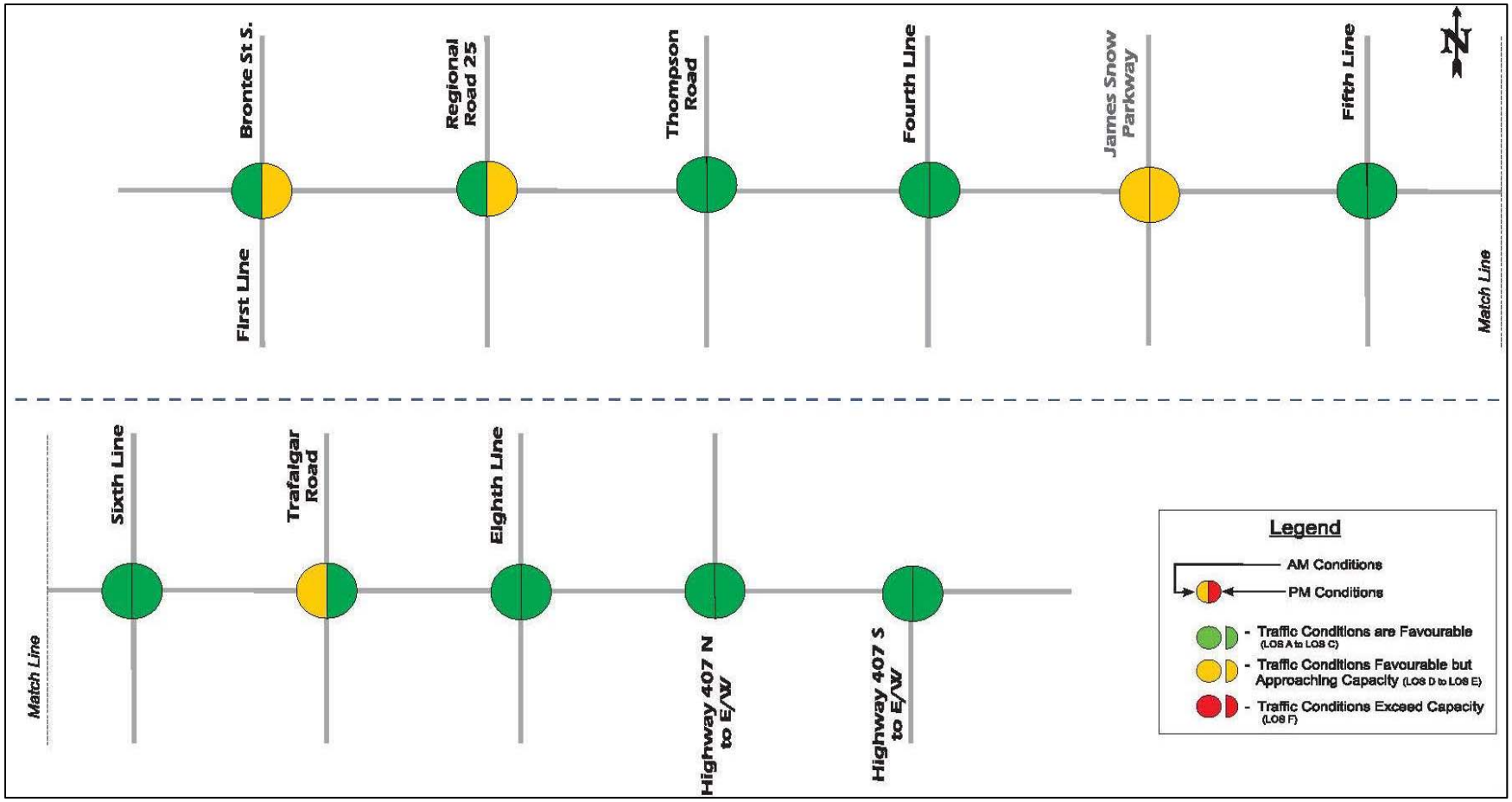
As shown in Table 2-10 and Figure 2-11, the long-term configuration for Britannia Road can accommodate the 2031 travel demands on the Britannia Road corridor. The intersections are expected to operate at level of service D, or better, during the Weekday AM and PM peak hours.

Table 2-11: 2031 Operational Performance – With 2031 TMP Improvements

Intersection	Intersection Movement	HCM Performance Measures					
		Weekday AM			Weekday PM		
		Delay (s)	V/C	LOS	Delay (s)	V/C	LOS
Britannia Road and First Line		*No Critical Movements*					
	Overall	16.5	0.69	B	35.2	0.84	D
Britannia Road and Regional Road 25		*No Critical Movements*					
	Overall	26.9	0.70	C	36.7	0.77	D
Britannia Road and Thomson Road		*No Critical Movements*					
	Overall	30.6	0.80	C	20.8	0.67	C
Britannia Road and Fourth Line		*No Critical Movements*					
	Overall	15.7	0.72	B	20.8	0.84	C
Britannia Road and James Snow Parkway *(James Snow Parkway to be extended south by 2031)*	Eastbound L	57.8	0.87	E	80.7	0.96	E
	Westbound L				76.7	0.85	E
	Westbound TT	48.3	0.86	D	47.8	0.85	D
	Northbound LL	58.8	0.72	E	61.8	0.76	D
	Northbound TT	44.3	0.87	D	37.3	0.77	D
	Southbound LL	68.0	0.84	E	81.9	0.92	E

Intersection	Intersection Movement	HCM Performance Measures					
		Weekday AM			Weekday PM		
		Delay (s)	V/C	LOS	Delay (s)	V/C	LOS
	Southbound TT	41.1	0.83	D	56.1	0.97	E
	Overall	41.8	0.83	D	45.9	0.87	D
Britannia Road and Fifth Line		*No Critical Movements*					
	Overall	8.1	0.55	A	14.0	0.69	B
Britannia Road and Sixth Line		*No Critical Movements*					
	Overall	12.1	0.48	B	12.5	0.58	B
Britannia Road and Trafalgar Road	Westbound T	63.7	0.94	E			
	Southbound TR	47.6	0.91	D			
	Northbound TR	56.6	0.97	E	41.6	0.95	D
	Overall	51.6	0.88	D	32.5	0.98	C
Britannia Road and Eighth Line		*No Critical Movements*					
	Overall	12.2	0.42	B	7.7	0.52	A
Britannia Road and Highway 407 N to E/W		*No Critical Movements*					
	Overall	7.4	0.45	A	13.1	0.65	B
Britannia Road and Highway 407 S to E/W		*No Critical Movements*					
	Overall	17.2	0.75	B	11.3	0.62	B

Figure 2-11: 2031 Operational Performance – With 2031 TMP Improvements



Integration of HOV Lanes

The existing Highway 407 interchange currently consists of four travel lanes along Britannia Road. In discussion with MTO and Highway 407 ETR, there are no plans for the widening of this facility within for the foreseeable future.

As such, if the two HOV lanes (six lane cross-section) are carried to this interchange, there would be some operational and lane geometry conflicts with the entrance and exit ramps. Specifically, in the eastbound direction the HOV lane would become the W-S on-ramp lane. Therefore, the HOV restriction on this lane would have to be terminated prior to the interchange to allow for general purpose traffic to access the highway ramp. Also, HOV traffic not wishing to enter the Highway would have to change lanes prior to the interchange. This is not a desirable configuration as drivers could inadvertently be directed onto the Toll highway.

In the westbound direction the additional traffic lane can be introduced at the N-E/W off ramp, channelizing the south right turn movement and directing the vehicle into this new lane. In this situation the HOV designation would commence further west allowing for non HOV traffic to change lanes. Given the close proximity of the Ontario Hydro Spur Line, the HOV designation would start at some point west of the rail line.

In both cases it is recommended that the transition between the 6 lane cross-section (with HOV lanes) and the four lane cross-section should occur at the Eighth Line intersection and that priority measure (e.g. signals, queue jump, etc.) be provided for both the east and westbound HOV traffic. This location will provide for a smooth transition and minimize weaving and conflicts as traffic approaches and departs the Highway 407 interchange.

Therefore the recommended staging for the roadway improvements is recommended as follows:

- Initial widening of Britannia Road will include six general purpose lanes between Tremaine Road and Regional Road 25 and four lanes between Regional Road 25 and Highway 407.
- By 2031, the Britannia Road corridor will be widened to the ultimate four general purpose lanes plus two HOV lanes (Regional Road 25 to Eighth Line) including transitioning the six general purpose lanes between Tremaine Road to Regional Road 25 to four general purpose lanes and two HOV lanes.

2.5.7. Future Roadway-Railway Crossing Protection – CN Subdivision

The need for grade separation at the CN Halton Subdivision crossing on Britannia Road (at Mileage 38.67) was evaluated with the future traffic volumes. Weekday PM Volumes on Britannia Road, between Tremaine Road and Bronte Street/First Line, are expected to increase to 1,700 vehicles/hour by 2021. Since the Weekday PM peak hour volume is typically in the range of 8-12% of the daily traffic volume, 2021 daily traffic volumes are

expected to be in the range of 14,200 - 21,200. Assuming the daily number of train movements at this crossing remain at 25 freight trains, the value of the cross-product (of daily vehicle volumes on Britannia Road multiplied by the daily train movements at the level crossing) is expected to be in the range of 355,000 - 530,000 by 2021.

Since the value of the cross-product by 2021 will exceed the threshold value of 200,000, a grade separation is justified at this level crossing. The daily train movements and the 2021 weekday peak hour volumes on Britannia Road at CN Halton at-grade crossing are expected to result in significant delays for road users. Accordingly, it is recommended that grade separation be considered part of the 2021 roadway improvements.

2.5.8.Future Roadway-Railway Crossing Protection – CP Spur

Train movements are not frequent at the CP Galt Subdivision spur at-grade crossing on Britannia Road. While grade separation is not recommended at this time, the crossing protection should be improved to provide for flashing lights and bells to supplement the standard cross-buck signs until the line is formally abandoned by CP.

2.6. Problem Statement

As a result of the proposed expansion of Milton's Urban Area and development proposed in the Sherwood, Boyne Survey and Milton Education Village Secondary Plan Areas, the study area and adjacent lands will experience significant transformation from the existing rural character to an urban landscape. With this transformation, there will be an increase of transportation demand on the adjacent road network, including Britannia Road. The existing corridor will need to provide an urban arterial function providing access to adjacent development lands and support a variety of transportation functions and uses including transit and active transportation.

Travel demand forecasts provide justification of the need for the expansion and improvements to Britannia Road and specific requirements for roadway/intersection configurations and geometry to support travel demand to 2031. The design of the Britannia Road improvements need to be closely coordinated with planning and urban design of the adjacent developments to ensure appropriate right-of-way standards are applied.

3.0 ALTERNATIVE SOLUTIONS

As identified in the problem statement described in Section 3.0, additional capacity will be needed along Britannia Road by the year 2031. Under Phase 2 of the Class EA process, all reasonable solutions (i.e. planning alternatives) to the problem are identified and described, including the "Do Nothing" alternative. After general inventories of the natural, social and economic environments are prepared and potential environmental impacts are determined for each alternative, the net positive and negative effects are identified and the alternatives are evaluated resulting in a recommended solution. The recommended solution is then presented to the public, stakeholders and agencies to solicit input into the selection of the "preferred solution".

3.1. Development of Alternative Solutions

Planning alternatives are alternative solutions to the problem or deficiency in the transportation network. Planning alternatives are identified by taking into consideration factors such as the existing environment as well as public, stakeholders and agency input at the project onset and establishing a preferred solution. The EA Act requires that all reasonable alternatives, including the "Do Nothing" alternative, be considered during the decision making process.

Table 3-1 presents the 7 planning alternatives that were identified and evaluated as part of the Britannia Road Class EA.

Table 3-1: Alternative Planning Solutions Considered

Alternative Planning Solutions		Description
1	Do nothing	The existing transportation system is not changed
2	Limit Development	Restrict development of the surrounding land now and in the future
3	Travel Demand Management Measures	Introduce Travel Demand Management measures (such as carpooling, etc.)
4	Accommodate Other Travel Modes	Accommodate other modes of travel (e.g. transit, cycling, walking)
5	Intersection Improvements	Improve intersection operations including traffic signal timing and/or adding through and turn lanes at existing and proposed intersections
6	Improve Adjacent Roads	Widen adjacent east-west road networks (e.g. Derry Road, Steeles Avenue)
7	Provide Additional Traffic Lanes	Provide additional capacity along Britannia Road through additional lanes

3.2. Evaluation Criteria

In order to properly assess and compare each alternative and the "do-nothing" scenario, a broad range of criteria was developed. The evaluation of the alternatives based on these criteria would form the basis and justification of the selection of the preferred planning solution. The various criteria were separated into the following four categories:

- Transportation/Technical
- Socio-Economic
- Natural Environment
- Cost

The evaluation criteria was reviewed and adjusted throughout the EA process to more accurately reflect the wants and needs of the existing and future users of Britannia Road.

Tables 3-2 to **3-5** describe the various criteria (i.e. transportation/technical, socio-economic, natural environment and cost) that were used in evaluating the planning alternatives.

Table 3-2: Transportation / Technical Evaluation Criteria Descriptions

Criteria	Description
Roadway Performance	• How does the alternative impact traffic congestion (delay) and levels of service?
Roadway Safety	• Does the alternative provide for the safety of all road users?
Other Modes	• Is the alternative able to provide facilities for other road users/modes, i.e. pedestrians, cyclists and transit?
Network Continuity	• How does the alternative fit in with the surrounding and greater road network?
Commercial Vehicles	• What impacts does the alternative have to the ability for commercial vehicles to utilize the road?
Emergency Services	• How does the alternative affect the response times for emergency services vehicles along the road?
Planning Objectives	• Is the alternative able to meet Halton Region's planning objectives as identified in the Transportation Master Plan?
Utility Relocations	• What impacts does the alternative have to existing utilities and are there any potential relocations required?

Table 3-3: Socio-Economic Evaluation Criteria Descriptions

Criteria	Description
Direct Property Impacts	• Does the alternative require the purchase of property and if so, is it relatively more or less than other alternatives?
Compatibility with Area Land Uses	• Does the alternative make sense with the existing and future land uses?
Business Access Impact	• How does the alternative impact access to businesses along Britannia Road?
Noise Impact	• Will the noise generated from traffic increase, decrease or stay the same along the corridor? • Can these impacts be mitigated?
Illumination Impact	• Will the illumination required for the alternative have any negative impacts on the surrounding lands?
Visual/Aesthetic Impact	• Will the alternative be able to provide for streetscaping features?
Archaeology and Cultural Heritage Resources	• Will the alternative impact existing archaeological sites and/or built and cultural heritage resources?
Construction Disruption	• What effect will the construction of the alternative have on local residents/business and road users?

Table 3-4: Natural Environment Evaluation Criteria Descriptions

Criteria	Description
Vegetation Impact	• What impact does the alternative have on the existing roadside vegetation?
Wildlife and Habitat Impact	• What impact does the alternative have on the existing wildlife and their habitats?
Special Designation Areas	• Does the alternative impact and special designation areas?
Fish Community/ Habitat	• What impact does the alternative have on the existing fish community and their habitats?
Ground Water Impacts	• Does the alternative have the potential to impact the existing ground water?
Surface Water Impacts	• Does the alternative have the potential to impact the existing surface water?
Air Quality	• Will this alternative be relatively more, less or equal to the other alternatives?
Natural Hazards	• Impacts to natural hazards?

Table 3-5: Cost Evaluation Criteria Descriptions

Criteria	Description
Capital Cost	• What is the cost to construct the alternative?
Operation and Maintenance	• Will this alternative be relatively more, less or equal to the other alternatives?
Property Costs	• What will be the cost to acquire the property needed to construct this alternative?

Table 3-6: Evaluation of Alternative Solutions

Alternatives		Technical	Socio-Economic Environment	Natural Environment	Cost	Recommendation
1	Do Nothing	× Does not address capacity requirements or support other modes × Indirect impacts due to decreasing safety and increasing congestion from area development × Does not meet Region's planning objectives	✓ No direct impacts to properties or business access ✓ No impacts to archaeology and cultural heritage resources ✓ No disruptions due to construction	× Poor air quality from increasing congestion ✓ No direct impacts from construction to vegetation, wildlife and wildlife habitat ✓ No direct impact to ground water and surface water	✓ No direct cost impacts from construction ✓ No property costs ✓ No direct increase in maintenance costs	**Not to be Carried Forward**
2	Limit Future Development	× Traffic capacity deficiencies will continue to degrade due to background traffic growth × Does not support other modes including transit, pedestrian and cyclist requirements × Does not meet Region's planning objectives	✓ No direct impacts to properties or business access ✓ No impacts to archaeology and cultural heritage resources ✓ No disruptions due to construction	× Poor air quality from increasing congestion from background traffic/traffic outside the study area ✓ No direct impacts from construction to vegetation, wildlife and wildlife habitat ✓ No direct impact to ground water and surface water	✓ No direct cost impacts from construction ✓ No property costs ✓ No direct increase in maintenance costs	**Not to be Carried Forward**
3	Travel Demand Management Measures	× Traffic capacity deficiencies will continue to degrade ✓ Encourages increased transit use, cycling and walking × Indirect impacts due to decreasing safety and increasing congestion from area development × Does not meet Region's planning objectives	✓ No direct impacts to properties or business access ✓ No impacts to archaeology and cultural heritage resources ✓ No disruptions due to construction	× Poor air quality from increasing congestion ✓ No direct impacts from construction to vegetation, wildlife and wildlife habitat ✓ No direct impact to ground water and surface water	✓ No direct cost impacts from construction ✓ No property costs ✓ No direct increase in maintenance costs	**Recommended to be Carried Forward**
4	Accommodate Other Travel Modes	✓ Provides minor improvements to local traffic operations ✓ Addresses pedestrian and cyclist requirements × Indirect impacts due to decreasing safety and increasing congestion from area development	• Potential for some impacts to properties or business access • Potential for some impacts to archaeology and cultural heritage resources • Some disruptions due to construction	× Poor air quality from increasing congestion ✓ No direct impacts from construction to vegetation, wildlife and wildlife habitat ✓ No direct impact to ground water and surface water	• Moderate cost impacts from construction • Moderate property costs • Minor direct increase in maintenance costs	**Recommended to be Carried Forward**
5	Intersection Improvements	✓ Provides minor improvements to local traffic operations × Does not address pedestrian and cyclist requirements × Indirect impacts due to decreasing safety and increasing congestion from area development	• Potential for some impacts to properties or business access • Potential for some impacts to archaeology and cultural heritage resources • Some disruptions due to construction	× Poor air quality from increasing congestion • Potential for some impacts from construction to vegetation, wildlife and wildlife habitat • Potential for some impacts to ground water and surface water	• Moderate cost impacts from construction • Moderate property costs • Minor direct increase in maintenance costs	**Recommended to be Carried Forward**
6	Improve Adjacent Roads	✓ Provides minor improvements to local traffic operations × Does not address pedestrian and cyclist requirements along study route × Indirect impacts due to decreasing safety and increasing congestion from area development × Planned improvements to adjacent roads is already underway as part of the TMP to 2031	• Potential for some impacts to properties or business access along adjacent roads • Potential for some impacts to archaeology and cultural heritage resources on adjacent roads • Some disruptions due to construction	× Poor air quality from increasing congestion • Potential for some impacts from construction to vegetation, wildlife and wildlife habitat • Potential for some impacts to ground water and surface water	× Potential for high costs due to construction on adjacent roads × Potential for high costs due to property requirements on adjacent roads × Potential for high increase in maintenance costs on adjacent roads	**Alternative has Already Been Carried Forward by the Region Through the TMP**
7	Provide Additional Traffic Lanes	✓ Positive impact on overall traffic operations ✓ Allows for pedestrian and cyclist infrastructure improvements ✓ Positive impact on safety ✓ Meets Region's Planning objectives	• Moderate impacts to properties or business access • Moderate impacts to archaeology and cultural heritage resources • Temporary disruptions due to construction	✓ Positive net effect to air quality due to reduced congestion × Direct impacts to vegetation, wildlife and wildlife habitat from construction × Direct impact to ground water and surface water	× High construction cost × High property costs × Direct increase in maintenance costs	**Recommended to be Carried Forward**

Most Preferred Somewhat Preferred Least Preferred

3.3. Evaluation of Alternative Solutions

The evaluation of the alternative planning solutions was completed using the evaluation criteria previously developed. An evaluation matrix table was developed to provide a summary of the evaluation and is presented in Table 3-6.

3.4. Selection of Preferred Solution

Based on the results of the evaluation of the alternative solutions documented in the previous sections, the Preliminary Preferred Solution included a combination of the following:

Alt. 3. Travel Demand Management Measures

Alt. 4. Accommodate other modes of travel (e.g. transit, cycling, walking)

Alt. 5. Improve intersection operations including traffic signal timing and/or adding through and turn lanes at existing and proposed intersections

Alt. 7. Provide additional capacity along Britannia Road with additional lanes

3.5. Confirmation of Class EA Schedule

As required by the Class EA process, following the selection of the Preferred Solution, the status of the project was confirmed to be a Schedule 'C'.

4.0 EXISTING & FUTURE CONDITIONS

4.1. Socio-economic Environment

Key land use planning guides that were used in establishing the area's socio-economic environment include Halton's Regional Official Plan, Town of Milton Official Plan and Town of Milton Trails Master Plan.

Regional Official Plan/Sustainable Halton

In 2006, Halton Region launched the Sustainable Halton process to respond to the Province's Places to Grow Plan, the Greenbelt Plan and the Provincial Policy Statement. The Sustainable Halton process helped develop Halton's growth management strategy to 2031. In 2009, as part of Sustainable Halton, the Region initiated two Official Plan Amendments to the Region's Official Plan. These amendments are Regional Official Amendment No. 37 (ROPA 37) and Regional Official Plan Amendment No. 38 (ROPA 38) intended to incorporate the results of the Sustainable Halton process and a comprehensive review of the Regional Official Plan (2006).

Regional Council adopted ROPA 38 on December 16, 2009. The amendment was forwarded to the Ministry of Municipal Affairs and Housing for approval. Subsequently the Ministry approved ROPA 38 on November 24, 2011. ROPA 38 currently sits under appeal at the Ontario Municipal Board.

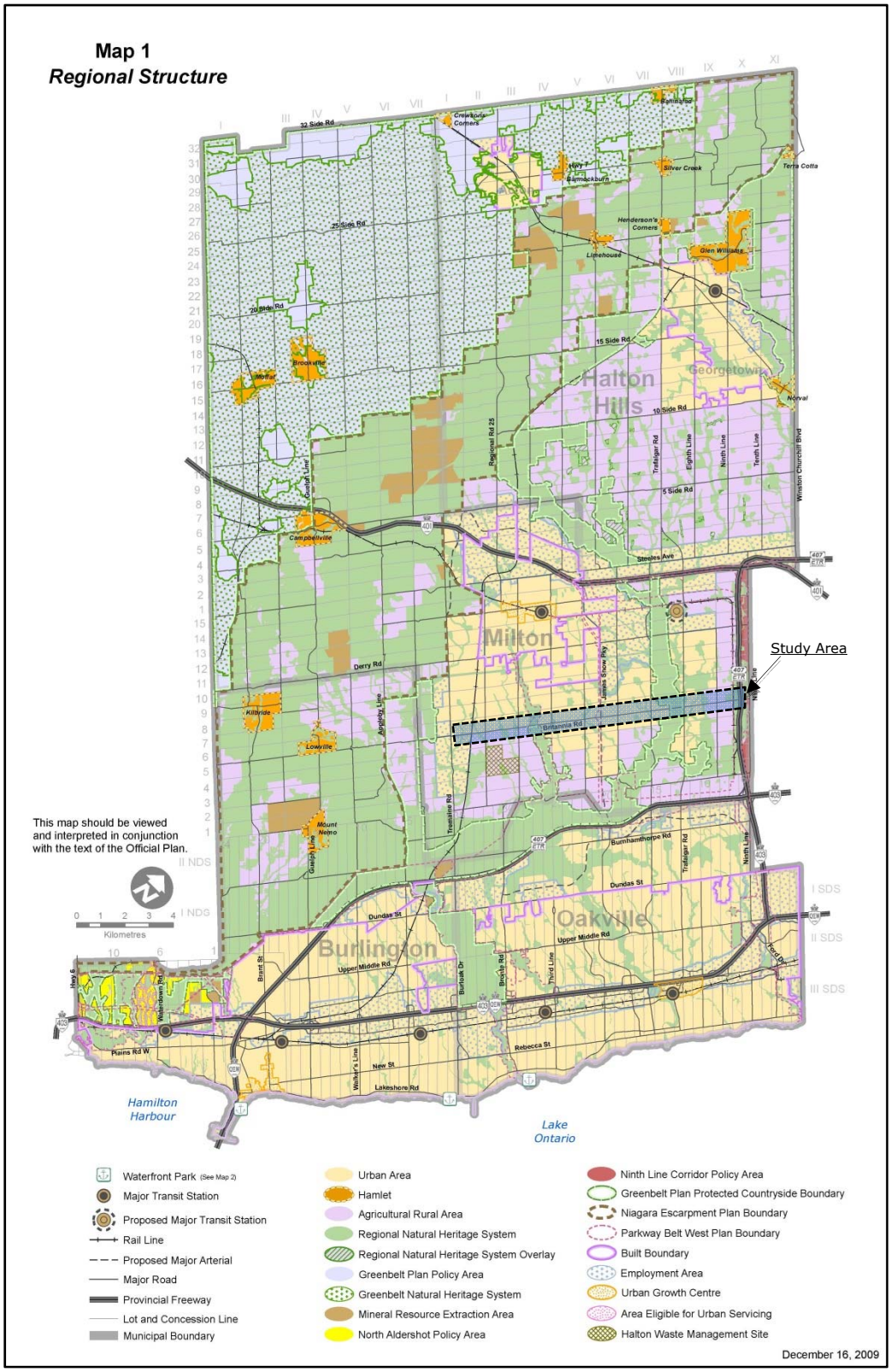
Figure 4-1 presents the ROPA 38 map of Regional Structure indicating the Britannia Road study area within the Regional context.

Town of Milton Official Plan and Trails Master Plan

The Town's Official Plan (2008) provides polices with regard to land use planning and a framework for growth management. The lands adjacent to the Britannia Road study area are part of the Boyne Survey Secondary Plan area, rural agriculture and post 2021 Urban Expansion Area lands (pending ROPA 38 approval) as well as the ongoing Milton Education Village Secondary Plan.

The Town of Milton Trail Master Plan (2007) provides a vision and guide to the development of a trail network in Milton. It identifies a Town-wide on and off road trail system connecting to various hamlets and rural destinations in Milton, as well as a more detailed urban trail system that links destinations and neighbourhoods within the Town's Urban Expansion Area. Britannia Road has been identified to have on-street bike lanes and multi-use pathways.

Figure 4-1: ROPA Regional Map Structure



Source: Amendment No. 38 to The Regional Official Plan

4.1.1.Existing Land Use & Planned Development

Land use surrounding the subject portion of Britannia Road is primarily agricultural with some residential, commercial, recreational and institutional land uses also present. Summaries of the existing land uses within the study area are provided below. Land use designations for lands adjacent to the subject portion of Britannia Road, as identified in the *Town of Milton Official Plan (August 2008)*, are summarized in **Figure 4-2**. The Boyne Survey Secondary Plan and Milton Education Village areas (as described below) are illustrated in **Figure 4-3**.

Agricultural

Throughout the study limits, the landscape on both sides of Britannia Road generally consists of active farms and agricultural fields.

Commercial

Commercial areas within the study area that have access onto Britannia Road include:

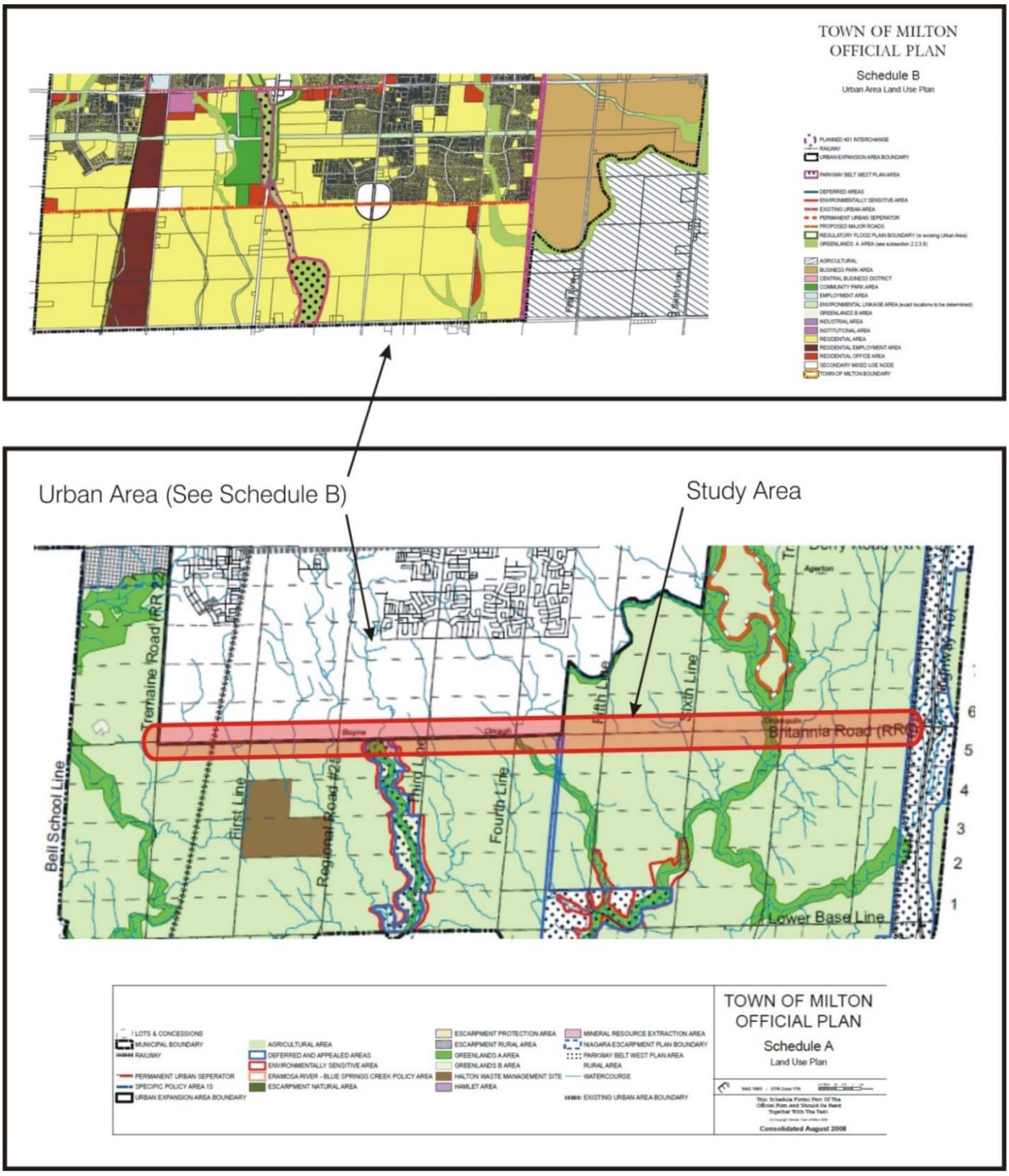
- Terra Greenhouses (12800 Britannia Road). Located at the southwest corner of the Britannia Road and Trafalgar Road intersection, this property has three full movement accesses onto Britannia Road.
- Willis Family Fruit Farm (6063 Fifth Line). Located at the corner of Fifth Line and Britannia Road, this property has one full movement access onto Britannia Road.
- Esso Gas Station (6004 Trafalgar Road). Located at the northwest corner of the Trafalgar Road and Britannia Road intersection, this property has one full movement access onto Britannia Road.

Residential

Residential properties are scattered throughout the study area, adjacent to Britannia Road along both sides of the corridor. Within the study area, the Britannia Road corridor contains several distinct settlements; Boyne, Omagh and Drumquin. The village of Boyne is located at the intersection of Britannia Road and Regional Road 25, Omagh is located at the intersection of Britannia Road and Fourth Line, and the historic community of Drumquin is located at Trafalgar Road, on the banks of Sixteen Mile Creek.

Through the Boyne Survey Secondary Plan, the village of Omagh was identified as a Special Study Area, based on its historical significance to the Town of Milton. The Special Study is currently underway. The purpose of the Study is to identify and conserve the cultural heritage and character of the Omagh village area.

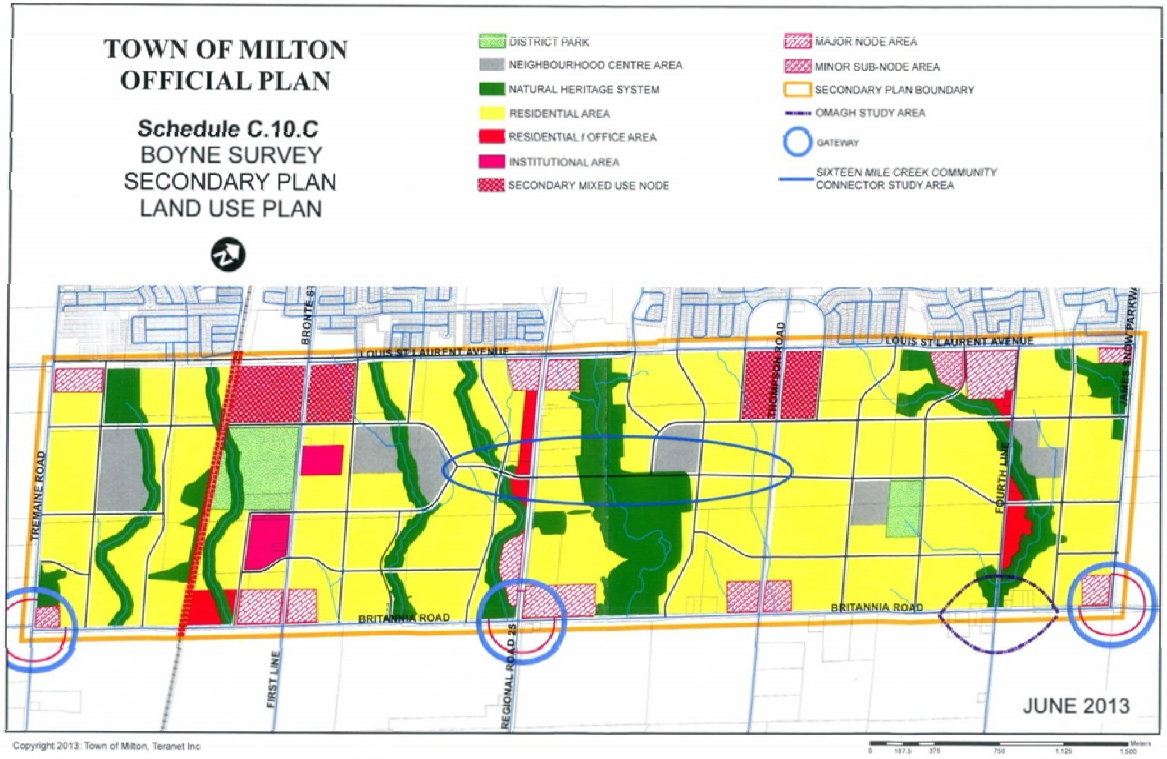
Figure 4-2: Land Use Plan

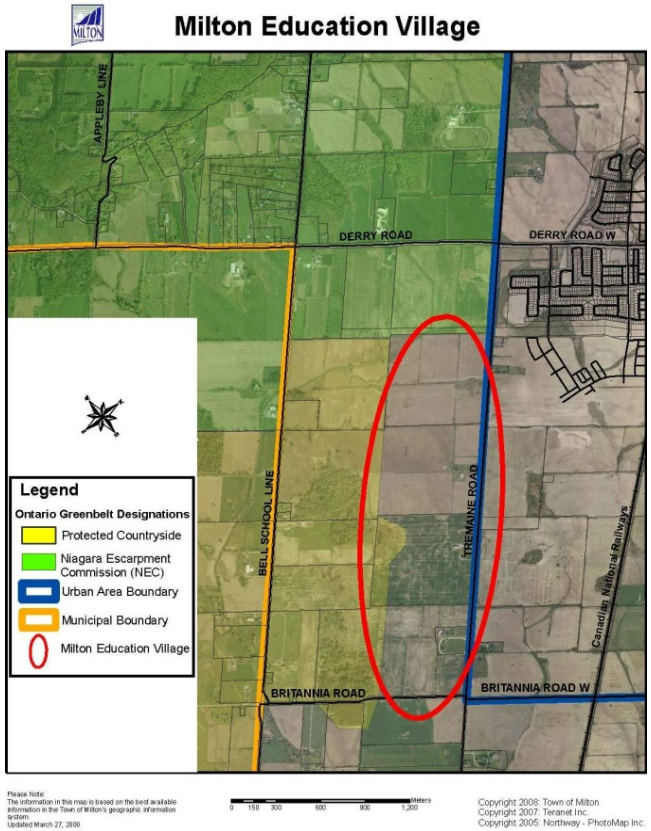


Recreational

Recreational facilities adjacent to the study corridor include the Boyne Soccer Field, Omagh Ball Diamond and Drumquin Park (consisting of walking trails and two baseball diamonds).

Figure 4-3: Boyne Survey Secondary Plan and Milton Education Village





Institutional

Institutional uses adjacent to the study corridor include the Omagh Presbyterian Church and Cemetery just west of Thompson Road; the Omagh Church of Christ and Cemetery, located just west of Fourth Line; and former Percy Merry Halton District School Board property (currently being used for storage purposes only, with no plans for further use), located at the northwest corner of the Britannia Road and Trafalgar Road intersection.

Parkway Belt West Plan Area

A Special Complementary Use Area is identified in the *Town of Milton Official Plan* on either side of Britannia Road, at Oakville Creek, between Regional Road 25 and Thompson Road. Under the Parkway Belt West Plan, this area permits agricultural and open-space uses. At the eastern limits of the study area, running adjacent to Highway 407 there is another Parkway Belt West Plan use, designated as an Electric Power Facility that crosses Britannia Road. This facility is under the jurisdiction of the Ministry of Infrastructure and managed by Infrastructure Ontario.

Boyne Survey Secondary Plan Area

The Britannia Road study area is located within the Town of Milton Urban Area which includes the Boyne Survey Secondary Plan Area (Figure 5-3), south of the existing Bristol Survey and Sherwood Survey Secondary Plan areas. The area is approximately 930 hectares (2,300 acres) in size and is bounded by Louis St. Laurent Avenue to the north, James Snow Parkway to the east, Britannia Road to the south and Tremaine Road to the west. On June 14, 2010, Town of Milton Council passed By-law No. 068-2010, which adopted the proposed Boyne Survey Secondary Plan (Official Plan Amendment Number 30) under Section 17(23) of the Planning Act. The Secondary Plan was approved by Halton Region in September 2013. The Boyne Survey Secondary Plan Area is one of three residential growth areas within the Town of Milton's Urban Expansion Area, being implemented as part of the Halton Urban Structure Plan to accommodate growth to the year 2021. This Secondary Plan Area is planned to accommodate an additional 50,000 residents when fully developed.

Milton Education Village

The Town of Milton is actively engaged in a project called the Milton Education Village (MEV), with the goal of bringing a university campus to Milton within the next few years. The MEV site is located south of Derry Road, west of Tremaine Road and north of Britannia Road. The MEV will be a comprehensively planned, 400 acre integrated neighbourhood that will include:

- A university campus (between 10,000 and 15,000 students);

- Student housing and residential developments;
- Research/business park;
- Commercial supporting services;
- 250-metre oval cycling track (Milton Velodrome).

The proposed Milton Education Village is illustrated in Figure 4-3.

4.1.2. Noise

As part of the EA Study, a noise assessment was completed to assess the impacts of the proposed road improvements. 63 Noise Sensitive Area (NSA) receptor locations (all residential dwellings) were analyzed in detail. An NSA is defined as a noise sensitive land use with an outdoor living area, which includes: single family houses (typically back yard), townhouses (typically back yard), multiple unit buildings such as apartments with outdoor living areas for use by all occupants, as well as hospital and nursing homes, where there are outdoor living areas for the patients.

Based on the MTO/MOE noise protocol, where an existing roadway is proposed to be modified/widened adjacent to a Noise Sensitive Area (NSA), MOE requires that the future noise levels without the proposed improvements be compared to the future noise levels with the proposed improvements. The provision of noise mitigation is to be investigated should the future noise level with the proposed improvements result in a greater than 5 dBA increase over the future noise level without the proposed improvements. The Region of Halton Noise Abatement Policy for Regional Roads indicates that for local improvement or retrofit noise walls, a daytime sound exposure of 60 dBA is the objective for outdoor amenity areas. Based on the noise assessment, existing (2010) daytime sound exposures to the identified NSAs within the study area are below 60 dBA.

It should be noted that any future new residential subdivision developments along the Britannia Road corridor will have to carry out noise analyses in accordance with MOE requirements as part of the application process under the Planning Act. These studies would recommend indoor and outdoor noise mitigation measures and the inclusion of noise warning clauses on title of affected properties. These are outside the scope of this study.

The *Noise Assessment* report is provided in **Appendix A**.

4.2. Natural Environment

4.2.1. Site Description

The study area is located east of the Niagara Escarpment within the Bronte Creek watershed in the Town of Milton. The overall topography of the area is gently undulating with low relief and moderate drainage. The study area is drained by tributaries within both the Bronte Creek and Sixteen Mile Creek Watersheds. The western limits of the study area are within the Indian Creek subwatershed, a tributary of Bronte Creek. The remaining study area is contained within three subwatersheds of Sixteen Mile Creek: the West Branch subwatershed, the Lower Middle Branch subwatershed, and the East-Lisgar Branch subwatershed. There are nineteen watercourse crossings within the study area.

Lands surrounding the study area are historically cleared for agriculture and cash crop agriculture remains the primary land use. Other anthropogenic land uses within the study area include rural residential, commercial (Terra Greenhouses), recreational (Omagh Community Centre and baseball diamond), transportation infrastructure (CN railway) and institutional (Halton District School Board).

4.2.2. Study Approach

Available background natural environment information in the vicinity of the study area was collected from a number of sources, including the Ontario Ministry of Natural Resources (MNR) and its Natural Heritage Information Centre (NHIC), Conservation Halton (CH), Halton Region and the Town of Milton. The background information review focuses primarily on the lands within the study area that may be directly or indirectly impacted by the proposed works (i.e. approximately 50 metres on either side of the existing Britannia Road ROW and an additional 30 meters upstream or 150 downstream of each watercourse crossing).

4.2.3. Existing Environmental Conditions - Terrestrial Resources

A comprehensive field survey and assessment of terrestrial resources was undertaken to document existing conditions as part of the EA process. Summaries of the existing conditions pertaining to the area's terrestrial resources are provided below. Additional information regarding survey methodologies, environmental resources used and the fieldwork that was undertaken is provided in the *Terrestrial and Aquatic Resources* Report in **Appendix B**.

4.2.3.1. *Ecological Land Classification*

Sixteen Mile Creek Main Branch

Four vegetation communities were identified along the creek including cultural meadow (CUM1-1), dry-fresh sugar maple deciduous forest (FOD5-1), dry-fresh hickory deciduous forest (FOD2-3), and silver maple mineral deciduous swamp

(SWD3-2). The majority of the study area consisted of flood plain occupied by the cultural meadow community. The silver maple swamp was less than one hectare in size and was found in the flood plain. The slopes of the valley were comprised of the upland forest communities FOD5-1 and FOD2-3. The soil texture in all communities was classified as sandy clay loam. The soil moisture class varied from 3 (very fresh) on slopes to 4 (moderately moist) within the floodplain. A more detailed description of each of the communities is provided below.

Cultural Meadow (CUM1-1) - This community occupies the floodplain of Sixteen Mile Creek. The cultural meadow is partly dominated by Canada goldenrod (*Solidago canadensis*), riverbank grape (*Vitis riparia*), and red raspberry (*Rubus idaeus*) with a lesser abundance of New England aster (*Symphyotrichum novae-angliae*), cow vetch (*Vicia cracca*), and giant hogweed (*Heracleum mantegazzianum*). There are scattered trees and shrubs throughout this community where successional processes are leading to the transition of this community to a cultural thicket/woodland in parts.

Dry-fresh sugar maple deciduous forest (FOD5-1) - This community is found along the valley slopes on both east and west slopes of the valley north of Britannia Rd. The canopy is composed primarily of sugar maple (*Acer saccharum*) with a lesser abundance of bur oak (*Quercus macrocarpa*), red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*) and bitternut hickory (*Carya cordiformis*). The understory is partly composed of sugar maple, hop hornbeam (*Ostrya virginiana*) and choke cherry (*Prunus virginiana*). The dominance in ground cover species varies with the slope due to differences in microclimate where the northeast facing slope is more shaded than the southwest. Ground cover species includes spreading dogbane (*Apocynum androsaemifolium*) dames rocket (*Hesperis matrionalis*), zigzag goldenrod (*Solidago flexicaulis*) and garlic mustard (*Alliaria petiolata*) to name a few.

Dry-fresh hickory deciduous forest (FOD2-3) - The hickory deciduous forest community is located on the drier and warmer west facing slope on the east side of Sixteen Mile Creek Main Branch south of Britannia Rd. The dominant canopy species is bitternut hickory followed by shagbark hickory with a lesser abundance of hop hornbeam and black cherry (*Prunus serotina*). The understory was dominated by hop hornbeam and the understory contained a moderate abundance of enchanters nightshade (*Circaea lutetiana*), poison ivy (*Rhus rydbergii*), Virginia creeper (*Parthenocissus quinquefolia*), and spreading dogbane.

Silver maple mineral deciduous swamp (SWD3-2) - The silver maple swamp is located in the floodplain north of Britannia Rd. The only canopy species in this community was silver maple. Few individuals of black walnut (*Juglans nigra*) were found in the understory. The groundcover was dominated by giant hogweed.

Sixteen Mile Creek East Branch

Five vegetation communities were identified along the creek including cultural meadow (CUM1-1), cultural thicket (CUT1-1), dry-fresh hickory deciduous forest (FOD2-3), dry-fresh white ash deciduous forest (FOD4-2), and dry-fresh sugar maple-ironwood deciduous forest (FOD5-4). The majority of the study area consisted of flood plain occupied by the cultural meadow community. The cultural thicket was located partly on the flood plain and along the slope north of Britannia Rd, east of the Creek. The slopes of the valley were comprised of the upland forested communities. The soil texture in all communities was classified as silty clay loam. The soil moisture class varied from 3 (very fresh) on slopes to 4 (moderately moist) within the floodplain. A more detailed description of each of the communities is provided below.

Cultural Meadow (CUM1-1) - This community occupies the floodplain of Sixteen Mile Creek in the study area. The cultural meadow is mainly dominated by Canada goldenrod, reed canarygrass (*Phalaris arundinacea*), New England aster, and panicled aster (*Symphyotrichum lanceolatum*) with a lesser abundance of cow vetch (*Vicia cracca*), and riverbank grape to name a few. There are scattered trees and shrubs throughout this community including white ash (*Fraxinus americana*), American elm (*Ulmus americana*), hybrid willow (*Salix* x *rubens*) and Manitoba maple (*Acer negundo*).

Cultural Thicket (CUT1-1) - The cultural thicket community is located partly in the floodplain and partly up the slope of the valley. This thicket represents an early successional community partly composed of white ash, apple species (*Malus pumila*), willow species (*Salix* spp.) and hawthorn species (*Crataegus* spp.) in the sub-canopy and shrub layers. The groundcover is mainly composed of asters, goldenrods, wild carrot (*Daucus carota*), and butter-and-eggs (*Linaria vulgaris*).

Dry-fresh hickory deciduous forest (FOD2-3) - The hickory deciduous forest community is located on the drier and warmer west facing slope on the east side of Sixteen Mile Creek East Branch south of Britannia Rd. The dominant canopy species is bur oak, and white ash which only provide a 10-25% canopy cover. The dominant sub-canopy species were bitternut hickory with a lesser abundance of bur oak, white ash, and American elm with a canopy cover over 60%. Although the dominant canopy species were bur oak and white ash, based on the prism sweep these species were much less abundant than bitternut hickory which had a higher relative abundance resulting in the classification of this community as a hickory deciduous forest. The understory was dominated by black cherry, shagbark hickory, and to a lesser abundance American elm and hawthorn species. The ground cover was sparse, covering only 10-25%, including such species as common buckthorn (*Rhamnus cathartica*), Virginia strawberry (*Fragaria virginiana*), avens species (*Geum* spp.), and enchanters nightshade (*Circaea lutetiana*).

Dry-fresh white ash deciduous forest (FOD4-2) - This community is found along the valley slopes on the west slope of the valley, south of Britannia Rd. The canopy is composed mainly of white ash and bur oak a much lesser abundance of hybrid willow. The subcanopy includes species found in the canopy as well as American elm, and shinning willow (*Salix lucida*). The understory is partly composed of common buckthorn, white ash, black walnut, and black locust (*Robinia pseudo-acacia*). The ground cover was sparse with only a 10-25% cover and included Virginia strawberry, riverbank grape, Canada goldenrod, poison ivy (*Rhus rydbergii*) with a lesser abundance of herb robert (*Geranium robertanium*).

Dry-fresh sugar maple – ironwood deciduous forest (FOD5-4) - The sugar maple forest is located on the west valley slope north of Britannia Rd. Sugar maple was the dominant canopy species with a lesser abundance of bur oak, red oak, and American elm, The sub-canopy was also dominated by sugar maple with a lesser abundance of hop hornbeam, red oak, and common buckthorn. Common buckthorn dominated the understory which also included hawthorn species, white ash, and trembling aspen (*Populus tremuloides*). The groundcover was sparse (10-25% cover) and included Canada goldenrod, large-leaved aster (*Eurybia macrophylla*), Pennsylvania sedge (*Carex pennsylvanica*), and much lesser abundance of Virginia strawberry, Canada anemone (*Anemone canadensis*), and poison ivy to name a few.

At the Ecotone of the toe-slope of this community and the cultural meadow community was a small (<0.5 ha) meadow marsh inclusion containing wetland species, including American bur-reed (*Sparganium americanum*), hard-stemmed bulrush (*Scirpus acutus*), soft-stemmed bulrush (*Scirpus validus*), and broad-leaved water-plantain (*Alisma plantago-aquatica*). These species were mainly found surrounding a seasonally wet depression that is devoid of vegetation indicating the presence of a vernal pond.

Floristics - East and Main Branches of Sixteen Mile Creek

Summary statistics for all plants identified within each of the vegetation types identified along the East and Main branches of Sixteen Mile Creek are provided in the *Terrestrial and Aquatic Resources* Report in Appendix B.

Native Floristic Quality Index (FQI) and Native Mean C provide a measure of "naturalness" of a vegetation community and the degree to which a vegetation community is composed of plant species that are habitat demanding or require more unique or rare natural habitat conditions. Typically, an urban plant community composed of predominantly native species is found to have a Native Mean C of over 4 and a native FQI greater than 40 (NSE 2011). The floristic of all of these communities is relatively low, which is likely a result of a single season

inventory. Floristics of the East and Main Branches of Sixteen Mile Creek are provided in **Table 4-1**.

Table 4-1: Floristics of the East and Main Branches of Sixteen Mile Creek

Ecosite	Number of Native Plant Species	Number of Non-native Plant Species	Total	Percent Non-native Plants	Native FQI	Native Mean C
East Branch						
CUM1-1	37	18	58	31	17.91	2.94
CUT1-1	13	10	25	40	9.61	2.67
FOD2-3	12	4	19	21	10.71	3.09
FOD4-2	16	4	21	19	12.00	3.00
FOD5-4	32	4	39	10	17.91	3.17
Main Branch						
CUM1-1	41	17	59	29	17.48	2.73
FOD2-3	21	7	31	23	17.37	3.79
FOD5-1	33	11	48	23	21.68	3.77
SWD3-2	16	2	20	10	13.71	3.43

Western Woodland

The Western Woodland is situated on the south side of Britannia Road between First Line and Regional Road 25 and is composed of a Fresh-Moist Shagbark Hickory

Deciduous Forest (FOD9-4), with a Grey Dogwood Cultural Thicket (CUT1-4) complex present along the western and eastern margins. A Mineral Meadow Marsh flanks the west tributary of Sixteen Mile Creek between the woodland and agricultural fields to the west.

In terms of landscape position, the Western Woodland is situated on the tablelands and undergoes a slight decline in elevation in a north-south direction. Vernal pooling was observed throughout the woodland (particularly within the northern half), and many pools still contained standing water a few centimeters deep at the time of field activities. The soil texture was a heavy clay, and composed of a thick A horizon (16cm) stained black with humus. Mottling was observed at the boundary of the A and B horizons, consequently indicating the woodland is very moist (engendered by the heavy clay soil).

The dominant canopy species include shagbark hickory, green ash, basswood (*Tilia americana*) and sugar maple, with lesser amounts of bur oak, American elm, ironwood, red maple (*Acer rubrum*) and red oak. Sugar maple (*Acer saccharum*) becomes more dominant as one travels south through the woodland. A few scattered individuals of white oak, American beech (*Fagus grandifolia*) and bitternut hickory were also observed as canopy trees. The shrub layer contained mostly regenerating tree species (particularly shagbark hickory and green ash) along with grey dogwood (*Cornus foemina*), European buckthorn and muslclewood (*Carpinus caroliniana*). Hawthorns (*Crataegus* spp.) and European buckthorn are more common along the eastern margin (particularly in the northern half) of the woodland where light penetration is more pronounced. Dominant groundcover species include wild geranium (*Geranium maculatum*), Virginia waterleaf (*Hydrophyllum virginianum*), garlic mustard, and enchanter's nightshade (*Circaea lutetiana*).

A Grey Dogwood Cultural Thicket complex was noted on the eastern and western margins of the woodland. The dominant species include grey dogwood, European buckthorn and various hawthorn species. Scattered American elm and bur oak trees were also observed. The groundcover consisted of a mix of both facultative species, including Kentucky blue grass (*Poapratensis* ssp. *pratensis*), cow vetch (*Vicia cracca*), smooth brome (*Bromus inermis*), and panicled aster (*Symphyotrichum lanceolatum*). Scattered wetland species such as American water-horehound (*Lycopus americana*) and fragrant bedstraw (*Galium triflorum*) were noted in wetter hollows.

A Mineral Meadow Marsh (MAM2) dominated almost exclusively by meadow foxtail (*Alopecurus pratensis*) has developed along the west tributary of Sixteen Mile Creek between the Western Woodland and agricultural fields to the west. Only scattered individuals of path rush (*Juncus tenuis*), broad-leaved cattail (*Typha latifolia*),

narrow-leaved cattail (*Typha angustifolia*), cursed crowfoot (*Ranunculus sceleratus*) and curly dock (*Rumex crispis*) were found amongst the broad expanse of meadow foxtail. Western chorus frog was found to be breeding within the tributary (see Section 3.1.5).

ELC mapping for the Western Woodland is provided in **Figure 4-4**.

Figure 4-4: ELC Mapping for the Western Woodlot and Adjacent Natural Areas

Eastern Woodland

The Eastern Woodland is found on the north side of Britannia Road just west of Highway 407. Based on surveys from the roadside and adjacent ORC lands, the Eastern Woodland is composed of a Fresh-Moist Ash Lowland Deciduous Forest (FOD7-2) with a Meadow Marsh (MAM) present within a cleared area in the centre of the polygon. Despite being more heavily dominated by green ash, the Eastern Woodland consists of a similar assemblage of moist, upland species when compared to the Western Woodland, including shagbark hickory, red oak, ironwood, enchanter's nightshade and Virginia waterleaf. Nannyberry (*Viburnum lentago*),

one-seeded hawthorn (*Crataegus monogyna*), sensitive fern (*Onoclea sensibilis*), multiflora rose (*Rosa multiflora*), common apple (*Malus pumila*), horse nettle (*Laportea canadensis*) and zigzag goldenrod (*Solidago flexicaulis*) are species found in the Eastern Woodland but not in the Western Woodland. The Meadow Marsh was not visible from the roadside or adjacent ORC lands.

ELC mapping for the Eastern Woodland is provided in **Figure 4-5**.

Figure 4-5: ELC Mapping for the Eastern Woodlot and Adjacent Natural Areas

4.2.3.2. *Tree Inventory*

A total of 221 trees were surveyed and assessed within 40 meters north and south of Britannia Road. A detailed list of all trees surveyed, including information regarding species, location, tree condition and vigor class is provided in the *Terrestrial and Aquatic Resources* Report in Appendix B. A summary of the identified tree species is provided in **Table 4-2**.

Of the 31 tree species that were recorded, 21 are native and 10 are non-native species (see Table 4-2). The majority of the trees recorded (172 of the 221; 78%) are species native to southern Ontario. Of the non-native trees recorded Manitoba

maple, Norway maple, Scott's pine, black locust, and hybrid willow are considered invasive species.

Table 4-2: Tree Inventory Summary

Trees Recorded		Total Recorded	Total in each Tree Vigor Class				
Scientific Name	Common Name		1	2	3	4	5
**Acer negundo*	Manitoba maple	15	2	11	1	1	
**Acer platanoides*	Norway maple	5	3		1	1	
Acer rubra	red maple	1		1			
Acer saccharinum	silver maple	18	3	8	1	5	1
Acer saccharum	sugar maple	5	2			2	1
Acer x freemanii	Freeman's maple	6	3		1	1	1
Betula papyrifera	white birch	2	2				
Carya cordiformis	bitternut hickory	3	2	1			
Carya ovata	shagbark hickory	21	11	8	1	1	
**Catalpa speciosa*	catalpa	1	1				
Crataegus sp.	hawthorn species	3		1	2		
Fraxinus americana	white ash	25	5	10	9		1
Fraxinus pennsylvanica	green ash	1		1			
Juglans nigra	black walnut	3	3				
**Malus pumila*	common apple	11	3	7		1	
**Picea abies*	Norway spruce	1	1				
Picea glauca	white spruce	2	2				
**Picea pungens*	blue spruce	2	2				
**Pinus nigra*	Austrian pine	2	2				
Pinus strobus	white pine	1	1				
**Pinus sylvestris*	Scots pine	2	1	1			
Populus balsamifera	balsam poplar	1		1			
Populus tremuloides	trembling aspen	1			1		
Quercus alba	white oak	1				1	

Trees Recorded		Total Recorded	Total in each Tree Vigor Class				
Scientific Name	Common Name		1	2	3	4	5
Quercus macrocarpa	bur oak	54	21	27	4	2	
Quercus rubra	red oak	5	3		1	1	
**Robinia pseudo-acacia*	black locust	1			1		
**Salix x rubens*	hybrid willow	9	1	5	2	1	
Tilia americana	basswood	10	2	5	3		
Ulmus americana	American elm	9	5	2	2		
	TOTAL	221					
* *denotes non-native species*							

4.2.3.3. *Wetlands*

Two wetland areas were identified near the intersection of Britannia Road East and Eighth Line: a meadow marsh within the Eastern Woodland, and a meadow marsh within a cleared area. These wetlands were staked and the boundaries verified by Conservation Halton staff on October 4th, 2011. The following provides a brief description of the wetlands.

Meadow Marsh Within the Eastern Woodland

A meadow marsh community was identified within the Eastern Woodland along Britannia Road, east of Highway 407. This community is located within a portion of the woodland that appears to have been recently cut. Dominant species include reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), red osier dogwood (*Cornus stolonifera*), American bugleweed (*Lycopus americanus*) and several different species of sedge. Several piles of felled trees were located within and at the perimeter of this wetland community. Within the clearing, non-wetland portions were dominated by grass-leaved goldenrod (*Euthamia graminifolia*), lance-leaved aster (*Symphyotrichum lanceolatum*) and Canada goldenrod (*Solidago canadensis*). Trembling aspen (*Populus tremuloides*) is beginning to regenerate along the western edge of the clearing, some reaching 2 m in height.

Meadow Marsh Within the Cleared Area

A meadow marsh community was identified within cleared areas located north of Britannia Road East and east of Eighth Line. This community borders Britannia Road and Eighth Line, and the adjacent woodland. This community is dominated by purple loosestrife, several species of willowherb (*Epilobium* spp.), Small-flowered water plantain (*Alisma plantago-aquatica*), *Eleocharis* spp., cattail (*Typha*

angustifolia) and redtop (*Agrostis gigantea*). Reed canary grass is dominant along ditches, adjacent to the roadway. Upland portions of the field are dominated by wild carrot (*Daucus carota*), curly dock (*Rumex crispus*) and Canada thistle (*Cirsium arvense*).

4.2.3.4. *Calling Amphibian Surveys*

A total of 12 amphibian monitoring stations were selected based on the results of an initial reconnaissance-level site assessment conducted in late winter, 2013. One additional monitoring station was added during the first survey, bringing the total number to thirteen 13.

Over the course of three site visits, spring peeper (*Pseudacris crucifer*), western chorus frog (*Pseudacris triseriata*), American toad (*Bufo americanus*), northern leopard frog (*Rana pipiens*), grey treefrog (*Hyla versicolor*) and green frog (*Rana clamitans*) were heard.

Four of the five species recorded (spring peeper, American toad, leopard frog, and green frog) have stable populations in the Great Lakes Basin (Tozer, 2013) and are considered common and widely distributed. They are also fairly tolerant of urbanization and will persist even in populated areas if their breeding ponds and associated upland feeding habitats remain relatively undisturbed. Neither the Committee on the Status of Species at Risk in Ontario (COSSARO) nor the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed the status of spring peeper, green frog or American toad. Northern leopard frog is currently listed as Not at Risk by COSSARO and Not at Risk by COSEWIC.

Western chorus frogs were heard during the first two surveys at monitoring station 11, adjacent to the Western Woodland. This species is federally listed as threatened by COSEWIC. COSSARO has designated this species as Not-at-Risk. Chorus frogs require both breeding ponds devoid of fish predators and adjacent terrestrial habitat such as moist woods or meadows to feed and overwinter.

Additional details of the Calling Amphibian Surveys that were undertaken as part of the study are provided in the *Terrestrial and Aquatic Resources* in Appendix B.

4.2.3.5. *Breeding Bird Survey*

Road side breeding bird point counts recorded 41 species of birds along Britannia Road (roadside). Most of the birds recorded are common to agricultural fields and smaller woodlots including species such as killdeer, eastern wood-pewee, eastern kingbird, warbling vireo, horned lark, gray catbird, chipping sparrow, and yellow warbler. Barn swallow and bobolink (both threatened species under the Endangered Species Act) as well as eastern wood-pewee (listed as special concern

federally) were also observed. A discussion of significant bird species recorded is provided in Section 4.3.3.3.

Within the Western Woodland and lands immediately adjacent, a total of 17 species were detected. Only one species was a 'Confirmed' breeder: Barn Swallow; which was observed visiting a nest site in a culvert running under Britannia, slightly to the West of the woodland. 7 species were assigned 'Probable' breeding status, all of which were detected within the woodland, and 7 species were assigned 'Possible' breeding status, of which 3 were solely in the woodland. 1 species was observed both within the woodland and in the adjacent lands, with no evidence of breeding.

Of the species detected, 2 are listed as Species at Risk either federally (COSEWIC) and/or provincially (COSSARO). Barn Swallow (*Hirundo rustica*), listed as 'Threatened' provincially and federally, was confirmed as breeding in the culvert running under Britannia Road, just to the west of the woodland. Eastern Wood-pewee (*Contopus virens*), a federal species of 'Special Concern', was assigned 'Possible' breeding status within the woodland, as a result of a singing male frequenting the width of the Northern part of the woodlot. 3 of the detected species are listed as 'Uncommon' breeding summer residents in the Halton Natural Areas Inventory (2006). These three species (Horned Lark, Vesper Sparrow and Willow Flycatcher) were all found in the lands immediately adjacent to the woodland and were assigned 'Possible' breeding status, as a result of detection of singing males.

It is worth noting that the breeding status of all detected species may have been under-estimated, as this designation is based upon only one visit. According to the *Atlas of the Breeding Birds of Ontario* (Cadman et al. 2007), a *"'Probable' status can be assigned where a permanent territory is presumed through registration of territorial song on at least two (2) days, a week or more apart, at the same place."*

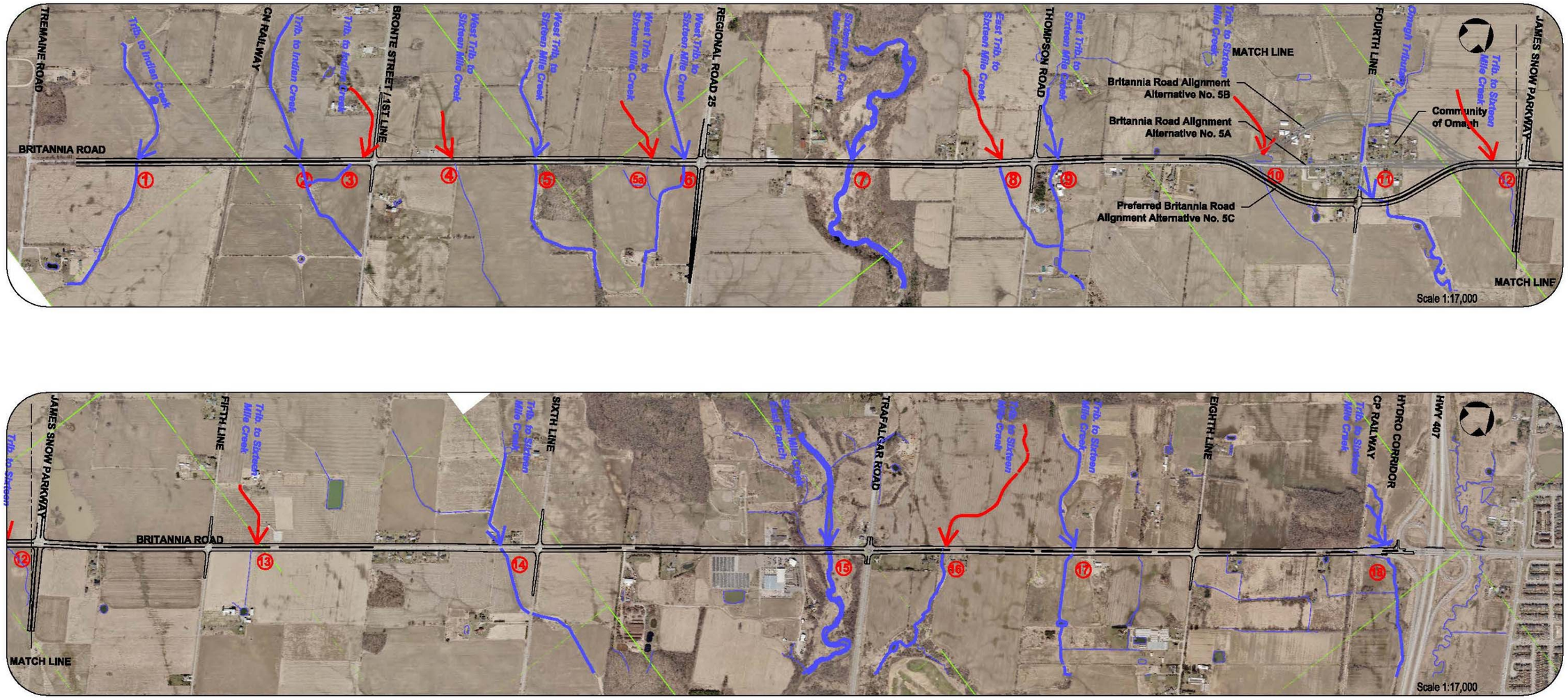
4.2.4. Existing Environmental Conditions - Aquatic Resources

Within the boundaries of the Study Area, Britannia Road crosses over three watercourses within the Indian Creek subwatershed, six watercourses within both the West Branch and Lower Middle Branch subwatersheds (which include crossings of both the Main Branch and East Branch of 16 Mile Creek), and three watercourses within the East-Lisgar Branch subwatershed. In total, within the 12 km study area, Britannia Road crosses 19 watercourses (numbered 1 to 18 and 5a) within four subwatersheds. These crossings are illustrated in **Figure 4-6**.

As part of the EA process, a comprehensive field survey and assessment of aquatic resources was undertaken to determine existing conditions and permit an assessment of potential environmental impacts of identified alternatives.

Additional information on the stream crossings, survey methodologies, environmental resources used and the fieldwork that was undertaken is provided in the *Terrestrial and Aquatic Resources* Report in Appendix B.

Figure 4-6: Study Area Stream Crossings



4.2.4.1. *Main Branch 16 Mile Creek*

This permanent watercourse is contained within an incised valley known as the Sixteen Mile Creek Valley Environmentally Sensitive Area (ESA). The reach immediately upstream of the current Britannia Road Bridge is split into pool/riffle/run habitat dominated by cobble substrate. Downstream of the bridge is split into riffle/run/riffle habitat that is dominated by cobble, gravel and bedrock substrate. Instream cover is excellent consisting mostly of unembedded rock, boulders, instream macrophytes and woody debris. There is a moderate amount of overhanging vegetation consisting mostly of grasses and shrubs. Approximately 1-30% of the stream is shaded by trees or shrubs that are more than 1m above the surface of the water.

Riparian vegetation consisting mainly of grasses and shrubs cover approximately 10% of the surface area of the watercourse. Giant Hogweed is located on both downstream banks. The left downstream bank is stable while the right bank is slightly unstable containing areas of undercut banks. Both upstream banks are stable. There are no barriers to fish movement within the vicinity of the Britannia Road Bridge.

4.2.4.2. *East Branch 16 Mile Creek*

This permanent watercourse is contained within a valley west of Trafalgar Road. The upstream reach consists of both pool and run habitat with a weir located approximately 27m upstream of Britannia Road Bridge. Substrate consists mainly of gravel and cobble within the run habitat and boulders and silt within the pool habitat. Instream cover is good, consisting of boulders, cobble, woody and organic debris. Vegetation provides cover to approximately 10% of the stream and mainly consists of submergent and emergent macrophytes and terrestrial vegetation. Approximately 1-30% of the stream is shaded by vegetation that stands more than 1m above the water surface. Overhanging riparian vegetation covers approximately 5% of the watercourse surface area. The weir does provide a barrier to fish movement; however, there is a side channel that provides passage to upstream reaches.

The side channel is located on the right bank and bypasses the weir, providing a mechanism for fish passage. Although there is no instream vegetation, instream cover is relatively good consisting of undercut banks, boulders, cobble and woody and organic debris. The substrate consists of gravel, sand, silt and boulders. This side channel is almost completely shaded with trees and other vegetation more than 1m above the surface of the water. Overhanging riparian vegetation covers approximately 10% of the watercourse surface area. There are no obstructions to fish movement in the side channel.

The downstream reach contains run, flat and riffle habitat. The run and flat habitat is dominated by gravel and sand while the riffle habitat is dominated by cobble and gravel. Instream cover is good, consisting of undercut banks, cobble, woody and organic debris as well as instream and overhanging vegetation. Instream vegetation consists of emergent vegetation and covers approximately 10% of the watercourse. Overhanging riparian vegetation covers approximately 20% of the water's surface area and consists of grasses and shrubs. Approximately 1-30% of the stream is shaded with trees and other vegetation standing more than 1m above the surface of the water. There are no obstructions to fish movement within the downstream reach.

4.2.4.3. *Fish Habitat Assessment and Drainage Feature Classification*

Fish habitat assessments were completed at each road crossing within the study area. To characterize fish habitat, surveys were completed in accordance with *Ministry of Transportation (MTO) Environmental Guide for Fish and Fish Habitat protocols (2009)*. Detailed habitat descriptions following MTO protocols were conducted within reaches 20 m upstream and 50 m downstream of each road crossing, together with the drainage feature classification and level of constraint associated with each watercourse. Results of the fish habitat assessments for each watercourse crossing are provided in **Table 4-3**. Upstream and downstream of the detailed habitat assessments, general habitat mapping was continued for an additional 30 m upstream and 150 m downstream. General habitat maps for each road crossing, as well as field Sheets and photo documentation for each watercourse can be found in the *Terrestrial and Aquatic Resources* Report in Appendix B.

4.2.4.4. *Fish Population Assessment*

Topographic maps, drainage maps, aerial photography and subwatershed studies were initially utilized to collect information regarding watercourse features located along the study corridor. The Aurora District MNR and CH were contacted to obtain all relevant background fisheries and aquatic habitat information on the watercourses that traverse the study area.

The fish population assessment was completed using existing fish collection data and through electrofishing surveys at road crossings that were classified as indirect or direct fish habitat. The field surveys were completed between August 30 and November 24, 2011. The results of the fish population assessment are summarized in **Table 4-4**.

Table 4-3: Results of the Fish Habitat Assessments for each Watercourse Crossing

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
Indian Creek	1 - upstream	Seasonal	Medium	Run % of area: 100 Mean wetted depth (m): 0.14 Mean wetted width (m): 1.10 Mean bankfull width (m): 1.60 Mean bankfull depth (m): 0.45	This intermittent reach is located within an agricultural field and consists of a run throughout its length. Instream cover occurs throughout 65% of the surface area and consists of undercut banks, woody and organic debris as well as instream and overhanging macrophytes. Approximately 30-60% of the stream is shaded by shore cover.	Substrate is dominated by sand and silt deposits. Both left upstream bank and right upstream bank are slightly unstable. Approximately 10% of the 20 m section contains undercut banks.	All instream / Riparian vegetation consists of emergent vegetation which covers approximately 35% of the stream. Approximately 10% of instream cover is provided by instream macrophytes and 25% provided by overhanging vegetation.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.
	1 - downstream	Seasonal	Medium	Flat % of area: 100 Mean wetted depth (m): 0.15 Mean wetted width (m): 1.65 Mean bankfull width (m): 2.9 Mean bankfull depth (m): 0.5	This intermittent reach is located within an agricultural field and consists of a flat throughout its length. Instream cover occurs over 80% of the stream's surface area and consists of undercut banks, organic debris and both instream and overhanging vegetation. Approximately 60-90% of the stream is shaded by shore cover.	Substrate is dominated by clay and sand. Both left and right downstream banks are slightly unstable. Approximately 5% of the 50 m section contains undercut banks.	Instream vegetation covers approximately 20% of the stream and consists of both floating algae and emergent grasses and cattails. Overhanging riparian vegetation covers approximately 50% of the stream and consists mainly of grasses.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.
	2 – upstream	Seasonal	Medium	Run % of area: 100 Mean wetted depth (m): 0.1 Mean wetted width (m): 2.1 Mean bankfull width (m): 2.5 Mean bankfull depth (m): 0.45	This intermittent reach is located within an agricultural field and consists of a run throughout its length. Instream cover is high, with 90% of the stream's surface area covered by vascular macrophytes, mainly emergent cattails. Overhanging riparian grasses also cover parts of this reach. Approximately 60-90% of the stream is shaded by shore cover.	Substrate is dominated by clay and sand. Both left and right upstream banks are stable. There are no undercut banks throughout the length of this reach.	Emergent instream vegetation covers approximately 90% of the surface area of this reach. This vegetation is dominated by cattails and grasses.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.
	2 – downstream	Seasonal	Medium	Dry % of area: 100 Mean wetted depth (m): - Mean wetted width (m): - Mean bankfull width (m): 1.95 Mean bankfull depth (m): 0.44	This intermittent reach was dry when sampled on Oct 12, 2011, suggesting ephemeral flow. Stream runs through an agriculture field. Instream cover occurs over 85% of the stream's surface area and consisted only of emergent macrophytes and overhanging vegetation. 90-100% of the stream is shaded by shore cover.	Substrate is dominated by clay and sand. Both left and right downstream banks are stable. There are no undercut banks throughout the length of this reach.	Emergent and riparian vegetation covers approximately 85% of the surface area of this reach and is dominated by cattails and grasses.	The ephemeral nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
	3 – upstream	Drainage Ditch – Not Fish Habitat	Low					
	3 - downstream	Simple Contributing	Low	<u>Dry</u> % of area: 100 Mean wetted depth (m): - Mean wetted width (m): - Mean bankfull width (m): 0.75 Mean bankfull depth (m): 0.14	This simple contributing stream was dry when sampled on Oct 12, 2011, suggesting ephemeral flow. Stream runs through an agricultural field. Instream cover occurs over 100% of the stream's surface area and consists equally of instream and overhanging vegetation. 60-90% of the stream is shaded by trees or shrubs that are more than 1 m above the water surface.	Substrate is dominated by clay and silt. Both left and right downstream banks are stable. There are no undercut banks throughout the length of this reach.	Emergent and riparian vegetation covers approximately 100% of the surface area of this reach and is dominated by cattails and grasses.	The ephemeral nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.
West Branch	4 – upstream	NOT FISH HABITAT	Low					
	4 - downstream	Simple Contributing	Low	<u>Run</u> % of area: 100 Mean wetted depth (m): 0.24 Mean wetted width (m): 0.6 Mean bankfull width (m): 0.8 Mean bankfull depth (m): 0.43	This simple contributing stream is located within an agricultural field and consists of a run throughout its length. Moderate instream cover covers approximately 50% of the streams surface area and consists of organic debris as well as instream and overhanging vegetation. 60-90% of the stream is shaded by trees or shrubs that are more than 1 m above the water surface.	Substrate is dominated by sand and clay. Both left and right downstream banks are slightly unstable. Undercut banks account for approximately 5% of the total surface area within the reach.	Instream and riparian vegetation cover approximately 35% of the surface area of the stream, consisting of grasses, shrubs and cattails.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.
	5 – upstream	Seasonal	Medium	<u>Dry</u> % of area: 80 Mean wetted depth (m): - Mean wetted width (m): - Mean bankfull width (m): 0.9 Mean bankfull depth (m): 0.5 <u>Run</u> % of area: 15 Mean wetted depth (m): 0.5 Mean wetted width (m): 0.35 Mean bankfull width	This intermittent reach is located between agricultural fields and the 20 m reach upstream from the culvert was dry throughout 80% of its length. Of the wetted length, 5% was pool habitat and 15% was run habitat. Moderate instream cover covers approximately 50% of the streams surface area, consisting primarily of emergent and overhanging vegetation. 30-60 % of the stream is shaded by trees or shrubs that are more than 1 m above the water surface.	The dry and run habitat consisted of both sand and silt whereas the pool consisted of both clay and sand substrates. Both left and right upstream banks are slightly unstable.	Instream and riparian vegetation cover approximately 50% of the streams surface area and consist mainly of cattails and grasses.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 0.9 Mean bankfull depth (m): 0.55 <u>Pool</u> % of area: 5 Mean wetted depth (m): 0.35 Mean wetted width (m): 4.5 Mean bankfull width (m): 5.4 Mean bankfull depth (m): 0.45				
	5 - downstream	Seasonal	Medium	<u>Run</u> % of area: 85 Mean wetted depth (m): 0.25 Mean wetted width (m): 1.10 Mean bankfull width (m): 1.80 Mean bankfull depth (m): 0.52 <u>Pool</u> % of area: 15 Mean wetted depth (m): 0.28 Mean wetted width (m): 2.8 Mean bankfull width (m): 3.4 Mean bankfull depth (m): 0.34	This intermittent reach is bordered by an agricultural field to the west and a small woodlot to the east. 85% of the downstream reach was dominated by run habitat, while pool habitat accounted for the other 15%. Instream cover is good, with approximately 95% of stream surface area covered by organic debris and instream/overhanging vegetation. 30-60% of the stream is shaded by trees or shrubs that are more than 1 m above the surface of the water.	Run habitat is dominated by a clay substrate and pool habitat is dominated by sand substrate. Both left and right downstream banks are stable.	Instream and riparian vegetation cover approximately 95% of the stream surface area and consist mainly of grasses, cattails and herbaceous shrubs.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution.
	6 - upstream	Seasonal	Medium	<u>Run</u> % of area: 100 Mean wetted depth (m): 6.25 Mean wetted width (m): 1.6 Mean bankfull width	This intermittent reach runs through agricultural fields next to Regional Road 25. The whole of the upstream reach is run habitat with a clay/silt substrate. Instream cover is good, with approximately 75% of stream surface area covered by organic debris and instream/overhanging vegetation. 60-90% of the stream is shaded by trees or shrubs	Substrate within this reach is dominated by clay and silt. Both left and right upstream banks are stable.	Instream and riparian vegetation cover approximately 70% of the stream surface area and consist mainly of grasses and cattails.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 4.6 Mean bankfull depth (m): 0.62	that are more than 1 m above the surface of the water.			
	6 – downstream	Seasonal	Medium	<u>Run</u> % of area: 100 Mean wetted depth (m): 0.26 Mean wetted width (m): 0.75 Mean bankfull width (m): 1.85 Mean bankfull depth (m): 0.53	This intermittent reach runs through agricultural fields next to Regional Road 25. The whole of the downstream reach is run habitat with clay/silt substrate. Instream cover is good with approximately 90% of stream surface area covered by instream and overhanging vegetation. 60-90% of the stream is shaded by trees or shrubs that are more than 1 m above the surface of the water.	Substrate within this reach is dominated by clay and silt. Both left and right downstream banks are stable.	Instream and riparian vegetation cover approximately 90 of the stream surface area and consist mainly of grasses shrubs and cattails.	The intermittent nature of this stream is the only barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution, especially being in such close proximity to Regional Road 25.
	7- upstream	Permanent	High	<u>Pool</u> % of area: 60 Mean wetted depth (m): 0.56 Mean wetted width (m): 9.0 Mean bankfull width (m): 10.6 Mean bankfull depth (m): 1.00 <u>Run</u> % of area: 30 Mean wetted depth (m): 0.181 Mean wetted width (m): 10.45 Mean bankfull width (m): 12.5 Mean bankfull depth (m): 0.77 <u>Riffle</u> % of area: 10 Mean wetted depth (m): 0.18 Mean wetted width (m): 9.2 Mean bankfull width (m): 11.4 Mean bankfull depth	This permanent watercourse is contained within an incised valley known as the Sixteen Mile Creek Valley Environmentally Sensitive Area (ESA). The upstream reach is split into pool/riffle/run habitat dominated by cobble substrate. Instream cover is excellent consisting mostly of unembedded rock, boulders and instream macrophytes. There is a moderate amount of overhanging vegetation, mostly grasses and shrubs. Approximately 1-30% of the stream is shaded by trees or shrubs that are more than 1m above the surface of the water. Giant hogweed located on both banks. Incidental fish sightings include both sucker and cyprinid sp.	Substrate within this reach is dominated by cobble. Both left and right upstream banks are stable.	Riparian vegetation provides good cover, covering approximately 10% of the surface area of the watercourse and consisting mainly of grasses and shrubs. Instream vegetation consists primarily of submergent moss, as well as some emergent vegetation.	There are no barriers to fish movement in the upstream reach of this river. Giant hogweed is located on both banks. The Britannia Rd bridge is a possible source of pollution.

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 0.93				
	7 - downstream	Permanent	High	Riffle % of area: 30 Mean wetted depth (m): 0.143 Mean wetted width (m): 15.7 Mean bankfull width (m): 17.9 Mean bankfull depth (m): 0.89 Run % of area: 10 Mean wetted depth (m): 0.257 Mean wetted width (m): 8.3 Mean bankfull width (m): 9.6 Mean bankfull depth (m): 0.78 Riffle % of area: 60 Mean wetted depth (m): 0.214 Mean wetted width (m): 10.1 Mean bankfull width (m): 11.1 Mean bankfull depth (m): 0.57	This permanent watercourse is contained within an incised valley known as the Sixteen Mile Creek Valley Environmentally Sensitive Area (ESA). The downstream reach is split into riffle/run/riffle habitat dominated by cobble, gravel and bedrock substrate. Instream cover is excellent consisting mostly of unembedded cobble, boulders, instream macrophytes and woody debris. There is a moderate amount of overhanging vegetation, mostly grasses and shrubs. Approximately 1-30% of the stream is shaded by trees or shrubs that are more than 1m above the surface of the water. Giant hogweed located on both banks. Incidental fish sightings include both sucker and cyprinid sp.	Substrate within riffle habitat is dominated by cobble. The run is dominated by bedrock and gravel. Left downstream bank is stable while the right downstream bank is slightly unstable containing undercut banks.	Riparian vegetation provides good cover, covering approximately 5% of the surface area of the watercourse along the banks. Riparian vegetation consists mainly of grasses and shrubs. Instream vegetation consists primarily of submergent moss, hornwort and other submergent vegetation.	There are no barriers to fish movement in the upstream reach of this river. Giant hogweed is located on both banks. The Britannia Rd bridge is a possible source of pollution.
	8 – upstream	NOT FISH HABITAT	Low					
	8 – downstream	NOT FISH HABITAT	Low					
	9 – upstream	Simple Contributing	Low	Did not receive permission to enter private property				
	9 – downstream	Seasonal	Medium	Did not receive permission to enter private property				
Lower Middle Branch	10 – upstream	NOT FISH HABITAT	Low					

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
	10 – downstream	NOT FISH HABITAT	Low					
	11 – upstream	Seasonal	Medium	<u>Run</u> % of area: 100 Mean wetted depth (m): 0.04 Mean wetted width (m): 6.0 Mean bankfull width (m): 8.7 Mean bankfull depth (m): 0.34	This intermittent stream runs in a ditch alongside the west side 4th Line for approximately 50 m before passing under the road and continuing north. A tributary draining into the upstream reach of this stream is classified not fish habitat. The entire 50 m upstream is run habitat that is almost completely overgrown with cattails, providing cover for about 90% of the streams surface area.	Substrate throughout the reach is clay. Both banks are slightly unstable, the right bank consisting of a steep incline directly off of 4th Line.	Riparian vegetation consists of small roadside shrubs. Emergent cattails dominate this reach, covering more than 60% of the stream.	The intermittent nature of this stream and the density of cattails are the barriers to fish movement. The surrounding transportation and agricultural land use may be a source of pollution, especially being in such close proximity to 4th Line.
	11 – downstream	Seasonal	Medium	<u>Pool</u> % of area: 60 Mean wetted depth (m): 0.20 Mean wetted width (m): 4.1 Mean bankfull width (m): 5.2 Mean bankfull depth (m): 0.65 <u>Dry</u> % of area: 40 Mean wetted depth (m): - Mean wetted width (m): - Mean bankfull width (m): 1.2 Mean bankfull depth (m): 0.2	This intermittent reach runs through agricultural fields next to 4th Line. 60% of the downstream reach is pool habitat with the other 40% dry during the survey. Substrate is dominated by clay and sand. Instream cover is good with approximately 45% of stream surface area covered by instream vegetation and organic debris. 60-90% of the stream is shaded by overhanging vegetation more than 1 m above the surface of the water.	Substrate is dominated by clay and sand throughout the reach. Both left and right downstream banks are stable.	Riparian vegetation covers approximately 40% of stream surface area and consists of grasses and shrubs. Instream vegetation covers another 40% of stream surface area and consists mainly of emergent cattails, but also floating duckweed.	The intermittent nature of this stream is a barrier to fish movement. The surrounding transportation and agricultural land use may be a source of pollution, especially being in such close proximity to 4th Line.
	12 - upstream	NOT FISH HABITAT	Low		Upstream of crossing 12 is a roadside ditch.			
	12 - downstream	Simple Contributing	Low	<u>Run</u> % of area: 100 Mean wetted depth (m): 0.36 Mean wetted width (m): 0.60 Mean bankfull width	This simple contributing habitat flows within an agricultural field and the downstream reach consisted of a run throughout its length. There was no riparian vegetation or instream cover and the substrate was dominated by gravel and clay. Given the lack of riparian vegetation, there was no apparent shore cover and both left and right banks were	Substrate is dominated by clay and gravel throughout the reach. Both left and right downstream banks are moderately unstable.	There is no riparian or instream vegetation.	The intermittent nature of this stream is a barrier to fish movement. The surrounding transportation and agricultural land use may be a source of

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 1.00 Mean bankfull depth (m): 0.47	moderately unstable.			pollution.
	13 – upstream	NOT FISH HABITAT	Low					
	13 - downstream	NOT FISH HABITAT	Low					
	14 – upstream	Simple Contributing	Low	Run % of area: 100 Mean wetted depth (m): 0.12 Mean wetted width (m): 2.45 Mean bankfull width (m): 4.2 Mean bankfull depth (m): 0.23	This simple contributing habitat is a grassy swale flowing between two residential properties. Both properties mowed their lawn right to the stream bank and there is therefore little riparian vegetation. Instream macrophytes cover more than 95% of the stream surface area and are dominated by grasses. Substrate throughout the reach consists of clay and left and right banks are both stable.	Substrate is dominated by clay. Both left and right banks are stable.	There is very little riparian vegetation, whereas instream vegetation covers most of the reach. Both riparian vegetation and instream vegetation consist of only grasses.	The intermittent nature of this stream is a barrier to fish movement. The surrounding residential land use and lack of riparian area may be a source of pollution.
	14 - downstream	Seasonal / Permanent	High/Medium	Run % of area: 100 Mean wetted depth (m): 0.1 Mean wetted width (m): 0.60 Mean bankfull width (m): 2.3 Mean bankfull depth (m): 0.6	This downstream reach flows within agricultural land and consists of a run throughout its reach. Instream cover is good with approximately 40% of the surface area of the stream covered by emergent cattails and another 30% by overhanging riparian vegetation. Organic debris also provides instream cover to about 10% of the stream. 90-100% of the stream is shaded by vegetation that stands more than 1m above the water surface. Incidental fish sighting confirms that this reach is used as direct fish habitat. To classify reach as seasonal or permanent, multiple season electrofishing surveys would need to be completed.	Substrate throughout the reach is dominated by clay. Both left and right banks are slightly unstable.	Overhanging riparian vegetation covers approximately 30% of the streams surface area and consists mainly of grasses. Instream vegetation, mainly cattails, covers an additional 40% of the stream surface area.	The surrounding agriculture land use may be a source of pollution.
	15 – upstream	Permanent	High	Run % of area: 70 Mean wetted depth (m): 0.32 Mean wetted width (m): 15.0 Mean bankfull width (m): 18.7 Mean bankfull depth (m): 0.60	This permanent river is contained within a valley west of Trafalgar road. The upstream reach consists of both pool and run habitat, with a weir approximately 27 m upstream of the Britannia Rd bridge. There is a side channel that also flows around the weir to the east. Instream cover is good, consisting of boulders, cobble, woody and organic debris. Vegetation provides cover to approximately 10% of the stream consisting of submergent and emergent macrophytes and riparian terrestrial	Substrate within the run habitat consists mainly of gravel and cobble. Substrate within the pool consists mainly of boulders and silt. The left upstream bank is stable, whereas the right upstream bank is slightly unstable with few undercut banks.	Overhanging riparian vegetation covers approximately 5% of the surface area of the stream. Instream vegetation consists of submergent macrophytes and emergent arrowhead, providing cover to an additional 5% of the stream.	The weir provides a barrier to fish migration; however the side channel provides passage to upstream reaches. Surrounding transportation corridors, agriculture and upstream golf courses are possible pollution sources.

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				Pool % of area: 30 Mean wetted depth (m): 0.50 Mean wetted width (m): 12.6 Mean bankfull width (m): 13.7 Mean bankfull depth (m): 0.74	vegetation. Approximately 1-30% of the stream is shaded by vegetation that stands more than 1 m above the water surface.			
	15 – upstream (side channel)	Permanent	High	Riffle (upstream) % of area: 10 Mean wetted depth (m): 0.24 Mean wetted width (m): 2.6 Mean bankfull width (m): N/A Mean bankfull depth (m): 0.59 Pool % of area: 20 Mean wetted depth (m): 0.51 Mean wetted width (m): 5.5 Mean bankfull width (m): 6.2 Mean bankfull depth (m): 0.74 Riffle (downstream) % of area: 15 Mean wetted depth (m): 0.2 Mean wetted width (m): 4.1 Mean bankfull width (m): 6.0 Mean bankfull depth (m): 0.56 Run % of area: 55 Mean wetted depth	This side channel connects the river above and below the weir and provides a mechanism for fish passage. Although there is no instream vegetation, instream cover is relatively good consisting of undercut banks, boulders, cobble and both woody and organic debris. Substrate consists of gravel, sand, silt and boulders throughout the reach. The side channel is almost completely shaded with trees and other vegetation more than 1 m above the surface of the water covering most of the streams surface area.	Substrate Upstream riffle: Gravel and sand Pool: Sand and Silt Downstream Riffle: Boulders and sand Run: Gravel and silt Left bank is stable. Right bank is slightly unstable with undercut banks occurring over approximately 10% of the stream.	There is no instream vegetation within the side channel. Overhanging riparian vegetation covers approximately 10% of the streams surface area.	There are no obstructions to fish movement in the side channel. Surrounding transportation corridors, agriculture and upstream golf courses are possible pollution sources.

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 0.28 Mean wetted width (m): 5.0 Mean bankfull width (m): 6.1 Mean bankfull depth (m): 0.53				
	15 – downstream	Permanent	High	<u>Run</u> % of area: 50 Mean wetted depth (m): 0.25 Mean wetted width (m): 15 Mean bankfull width (m): 16.5 Mean bankfull depth (m): 0.58 <u>Flat</u> % of area: 30 Mean wetted depth (m): 0.17 Mean wetted width (m): 7.2 Mean bankfull width (m): 8.65 Mean bankfull depth (m): 0.79 <u>Riffle</u> % of area: 20 Mean wetted depth (m): 0.19 Mean wetted width (m): 5.75 Mean bankfull width (m): 6.6 Mean bankfull depth (m): 0.65	The downstream reach of crossing 15 contains run, flat and riffle habitat. Instream cover is good, consisting of undercut banks, cobble, woody and organic debris as well as instream and overhanging vegetation. Instream vegetation consists of emergent vegetation and cover approximately 10% of the reach. Overhanging riparian vegetation covers approximately 20% of the reach. 1-30% of the stream is shaded with trees and other vegetation standing more than 1 m above the surface of the water.	The run and flat habitat is dominated by gravel and sand. Within the riffle habitat the dominate substrate is cobble and gravel. Both left and right banks are slightly unstable both containing areas with undercut banks.	Instream vegetation consists of arrowhead and rush sp. and covers approximately 10% of the streams surface area. Overhanging riparian vegetation covers approximately 20% of the streams surface area and consists of grasses and shrubs.	There are no obstructions to fish movement within the downstream reach. Surrounding transportation corridors, agriculture and upstream golf courses are possible pollution sources.
East-Lisgar	16 - upstream	NOT FISH HABITAT	Low					
	16 – downstream	Simple Contributing	Low	<u>Run</u> % of area: 100 Mean wetted depth	This simple contributing habitat is a grassy swale flowing between two residential properties. Both properties mowed their lawn right to the stream bank and there is	Substrate consists of silt throughout the reach. Both left and right banks are	Instream and riparian vegetation consists of mowed grass.	The intermittent nature of this stream is a barrier to fish movement. The

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 0.09 Mean wetted width (m): 0.40 Mean bankfull width (m): 0.9 Mean bankfull depth (m): 0.5	therefore little riparian vegetation. Instream macrophytes cover most of the stream surface area and are dominated by grasses. Substrate throughout the reach consists of silt and left and right banks are both stable. This reach has no shore cover.	stable.		surrounding residential land use and lack of riparian area may be a source of pollution.
	17 – upstream	Seasonal / Complex Contributing	Medium	<u>Run</u> % of area: 100 Mean wetted depth (m): 0.07 Mean wetted width (m): 6.2 Mean bankfull width (m): 8.4 Mean bankfull depth (m): 0.36	The upstream reach flows between two agricultural fields and consists of run habitat throughout the detailed section. Instream and riparian vegetation provide instream cover to 100% of the stream and consists mainly of cattails. Riparian vegetation is dominated by grasses. Substrate consists of clay and silt throughout the reach and both left and right banks are stable. 60-90% of the reach is shaded by vegetation standing greater than 1 m from the surface of the water. No fish during sampling suggests that this reach is not permanent fish habitat. However, to classify reach as seasonal or contributing, multiple season electrofishing surveys would need to be completed.	Substrate consists of clay and silt throughout the reach. Both left and right banks are stable.	Instream and riparian vegetation cover 100% of the stream, dominated mostly by cattails. Riparian vegetation consists mainly of grasses.	The intermittent nature of this stream is a barrier to fish movement.
	17 – downstream	Seasonal / Complex Contributing	Medium	<u>Run</u> % of area: 100 Mean wetted depth (m): 0.17 Mean wetted width (m): 1.90 Mean bankfull width (m): 5.4 Mean bankfull depth (m): 0.47	The downstream reach flows through an open meadow and consists of run habitat throughout the detailed section. There is a small riparian area, approximately 5 m on each bank, and on the left bank the grass is mowed up to the edge of the riparian area. Instream and riparian vegetation provide instream cover to approximately 70% of the stream and consists only of grasses. Organic debris provides an additional 5% of instream cover. Substrate consists of clay and silt throughout the reach and both banks are stable. 30-60% of the reach is shaded by vegetation standing greater than 1 m from the surface of the water. No fish during sampling suggests that this reach is not permanent fish habitat. However, to classify reach as seasonal or contributing, multiple season electrofishing surveys would need to be completed.	Substrate consists of clay and silt throughout the reach. Both left and right banks are stable.	Instream and riparian grasses provide cover to approximately 70% of the downstream reach.	The intermittent nature of this stream is a barrier to fish movement.
	18 – upstream	Seasonal	Medium	<u>Run</u> % of area: 70 Mean wetted depth	This reach runs directly beside the off ramp to the 407. Instream and riparian vegetation provide cover to approximately 20% of the reach, consisting mainly of	Substrate consists of clay and silt throughout the reach. Both left and right banks are	Instream and riparian vegetation provide cover to approximately 20% of the stream and consist of cattails and grasses. There are	The intermittent nature of this stream is a barrier to fish

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				(m): 0.04 Mean wetted width (m): 1.6 Mean bankfull width (m): 5.6 Mean bankfull depth (m): 0.62 <u>Pool</u> % of area: 30 Mean wetted depth (m): 0.08 Mean wetted width (m): 5.45 Mean bankfull width (m): 11.25 Mean bankfull depth (m): 0.91	cattails and grasses. Instream cobble provides cover to a further 10%. Substrate consists of clay and silt throughout the reach and both banks are stable. 1-30% of the reach was shaded by vegetation standing greater than 1 m from the surface of the water. Brook Stickleback and pumpkinseed caught during sampling indicated that this reach is direct fish habitat. However, dry conditions downstream suggest that this stream is seasonal fish habitat.	stable.	no submergent or floating vegetation.	movement.
	18 - downstream	Seasonal	Medium	<u>Pool</u> % of area: 35 Mean wetted depth (m): 0.28 Mean wetted width (m): 6.9 Mean bankfull width (m): 9.6 Mean bankfull depth (m): 0.83 <u>Run</u> % of area: 55 Mean wetted depth (m): 0.07 Mean wetted width (m): 4.0 Mean bankfull width (m): 8.2 Mean bankfull depth (m): 0.88 <u>Pool</u> % of area: 10 Mean wetted depth (m): 0.09 Mean wetted width (m): 5.0	This reach runs through a utility corridor and parallel to Highway 407. Instream and riparian provide cover to approximately 60% of the surface area of the stream, consisting mainly of cattail and duckweed. Instream cover is also provided by boulders, cobble and woody / organic debris. Substrate consists of muck, cobble, silt and gravel. 60-90% of the reach is shaded by vegetation standing greater than 1 m from the surface of the water. One Lepomis sp. and one juvenile largemouth bass we spotted but not captured, indicating that the reach is direct fish habitat. However, dry conditions downstream suggest that this stream is seasonal fish habitat.	Substrate consists of muck and cobble in the pool directly downstream of the culvert, and gravel and silt in the run and pool further downstream. Both left and right banks are stable.	Instream vegetation provides in-stream cover to approximately 50% of the reach and consists mainly of emergent cattail, but also floating duckweed. Riparian vegetation provides cover to approximately 10% of the reach, consisting mainly of grasses.	The intermittent nature of this stream is a barrier to fish movement. Highway 407 running directly to the east is a possible source of pollution.

Sub-watershed	Crossing #	Drainage Classification	Fisheries Constraint Level	Station Characteristics	Habitat Description	Substrate Composition and Bank Stability	Instream / Riparian Vegetation	Fish Barriers and other Disturbances
				Mean bankfull width (m): 7.8 Mean bankfull depth (m): 0.56				

Table 4-4: Results of the Fish Population Assessment for each Watercourse Crossing

		Crossing Number																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Watercourse Classification		S	S	u/s: NFH d/s: SC	u/s: NFH d/s: SC	S	S	P	NFH	u/s: SC d/s: S	NFH	S	u/s: NFH d/s: SC	NFH	u/s: SC d/s: S / P	P	u/s: NFH d/s: SC	S / C	S
Species	**Common Name**																		
Ameiurus nebulosus	Brown Bullhead															X[CH]			
Ambloplites rupestris	Rock Bass							X[CH]								X[CH]			
Catostomus commersonii	White Sucker							X[CH]								X[CH]			
Cottus bairdii	Mottled Sculpin							X[CH]											
Culaea inconstans	Brook Stickleback	X[LGL]				X[LGL;CH]						X[CH]				X[CH]			X[ABL]
Cyprinid sp.															*X[ABL]				
Esox lucius	Northern Pike															X[CH]			
Etheostoma caeruleum	Rainbow Darter							X[CH]								X[CH]			
Etheostoma flabellare	Fantail Darter							X[CH]								X[CH]			
Etheostoma nigrum	Johnny Darter							X[CH]								X[CH]			
Hypentelium nigricans	Northern Hog Sucker							X[CH]								X[CH]			
Lepomis gibbosus	Pumpkinseed						X[CH]	X[CH]								X[CH]			X[ABL]
Lepomis macrochirus	Bluegill Sunfish															X[CH]			
Luxilus cornutus	Common Shiner							X[CH]											
Micropterus dolomieu	Smallmouth Bass							X[CH]								X[CH]			
Micropterus salmoides	Largemouth Bass															X[CH]			*X[ABL]
Moxostoma erythrurum	Golden Redhorse															X[CH]			
Nocomis micropogon	River Chub							X[CH]								X[CH]			
Notemigonus crysoleucas	Golden Shiner															X[CH]			
Notropis photogenis	Silver Shiner							X[CH]								X[CH]			
Notropis rubellus	Rosyface Shiner							X[CH]								X[CH]			
Noturus flavus	Stonecat							X[CH]								X[CH]			
Oncorhynchus mykiss	Rainbow Trout							X[CH]								X[CH]			
Oncorhynchus tshawytscha	Chinook Salmon							X[CH]								X[CH]			

		Crossing Number																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Watercourse Classification		S	S	u/s: NFH d/s: SC	u/s: NFH d/s: SC	S	S	P	NFH	u/s: SC d/s: S	NFH	S	u/s: NFH d/s: SC	NFH	u/s: SC d/s: S / P	P	u/s: NFH d/s: SC	S / C	S
Species	**Common Name**																		
Osmerus mordax	Rainbow Smelt							X[CH]											
Perca flavescens	Yellow Perch							X[CH]											
Petromyzon marinus	Sea Lamprey															X[CH]			
Pimephales notatus	Bluntnose Minnow							X[CH]								X[CH]			
Pimephales promelas	Fathead Minnow						X[LGL;CH]	X[CH]		X[CPA;LGL]						X[CH]			
Pomoxis nigromaculatus	Black Crappie															X[CH]			
Rhinichthys atratulus	Blacknose Dace							X[CH]								X[CH]			
Rhinichthys cataractae	Longnose Dace							X[CH]		X[CH]						X[CH]			
Salmo trutta	Brown Trout							X[CH]											
Semotilus atromaculatus	Creek Chub		X[LGL]					X[CH]								X[CH]			

LEGEND

X – Species present at road crossing.
LGL – Electrofishing collections conducted by LGL Limited in 2007 and 2008.
CPA – Electrofishing collections conducted by C. Portt and Associates in 2008.
ABL – Electrofishing collections conducted by Aquafor Beech Limited in 2011.
CH – Conservation Halton Fish Community Database
* incidental observations

Watercourse Classification
P - Permanent
S – Seasonal
C – Contributing (Complex or Simple)
SC – Simple Contributing
NFH – Not Fish Habitat

4.2.5. Significant Species

4.2.5.1. *Significant Plant Communities*

The Natural Heritage Information Centre (NHIC) database notes one plant community as S3S4 (vulnerable – apparently secure): dry-fresh hickory deciduous forest type (FOD2-3). According to the Halton Region Environmental Impact Assessment Guidelines (2005) this community is considered a significant woodland within Halton Region because it is greater than 4 ha and located outside the Urban Area but below the Escarpment Brow. Furthermore, the woodlands found on the slopes of the main branches of Sixteen Mile Creek are connected to a woodland system that is greater than 10 ha, therefore qualifying as Provincially Significant Woodlands.

4.2.5.2. *Significant Flora Species*

Provincially Significant Flora

No provincially significant species were documented during the field surveys.

The Natural Heritage Information Centre (NHIC) database notes five provincially significant plant species documented from the general area: Carey's sedge (*Carex careyana*), northern hawthorn (*Crataegus dissona*), Schreber's wood aster (*Eurtbia schreberi*), Virginia lungwort (*Mertensia virginica*), and large round-leaved orchid (*Platanthera macrophylla*). These are ranked S2 (imperiled), S3 (vulnerable), S2S3, S3, and S2 respectively using the provincial standards for rarity[2]. These species were not observed within the study area during field studies.

The MNR reported no records for flora Species at Risk within the study area.

Regionally Significant and Uncommon Flora

The survey of the Main Branch of Sixteen Mile Creek found four species ranked as uncommon and two ranked as rare. The four uncommon species include shinning willow, great ragweed (*Ambrosia trifida*), smooth goldenrod (*Solidago gigantea*), and hairy aster (*Symphyotrichum pilosum*); these species are ranked S5 in the province. The two species ranked as rare include common juniper (*Juniperus communis*) and river wild-rye (*Elymus riparius*); these species are ranked as S5 and S4 respectively within the province. All of the regionally significant floral species were located within the cultural meadow (CUM) community.

[2] S1– Critically imperiled – Critically imperilled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
S2– Imperilled – Imperiled in the province because of rarity due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province.
S3– Vulnerable – Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

The survey of the east branch of Sixteen Mile Creek found four species ranked as uncommon (HU) and two ranked as rare (HR) based on the Halton Natural Areas Inventory (2006) species ranks for rarity. The four uncommon species include speckled alder (*Alnus incana* spp. *Rugosa*), shinning willow (*Salix lucida*), ditch-stonecrop (*Penthorum sedoides*), and cow parsnip (*Heracleum lanatum*); these species are all ranked as S5 (secure - common, widespread, and abundant within the province). The two species ranked as rare include hard-stemmed bulrush (*Scirpus acutus*) and American bur-reed (*Sparganium americanum*); these species are ranked as S4 (apparently secure within the province) and S5 respectively. All of the regionally significant floral species were located within the cultural meadow (CUM) community.

The survey of the Western Woodland yielded no rare (HR) species and six uncommon (HU) species based on the Halton Natural Areas Inventory (2006). The six uncommon species include hairy wood sedge (*Carex hirtifolia*), blunt broom sedge (*Carex tribuloides*), fleshy hawthorn (*Crataegus succulenta*), jumpseed (*Polygonum virginianum*), arrow-leaved aster (*Symphyotrichum urophyllum*) and Le Conte's violet (*Viola affinis*). The blunt broom sedge was found as a dense patch within one of the dry vernal pools in the northern half of the study area. Fleshy hawthorn was observed near the border of one of the Grey Dogwood Cultural Thicket polygons, and may occur in more than one location within the woodland. Jumpseed was found throughout the woodland, while the remaining species were found only as single (or a small clump of) stems.

4.2.5.3. *Significant Fauna Species*

Federally and Provincially Significant Bird Species

Bobolink, listed as threatened provincially with COSSARO and federally with COSEWIC was recorded at four point count locations during the breeding bird surveys. There were two pairs recorded as probable breeders, one individual observed entering the field, and one individual carrying food. Bobolink is a ground-nesting grassland species that nests and forages in native tall-grass prairies, agricultural fields such as hayfields consisting of timothy (*Phleum pratense*), clover (*Trifolium* sp.), and other broadleaved plants, pasture, and a variety of other grassland habitats (COSEWIC, 2010). Bobolink has been listed as threatened due to the trending decline in population mainly due to habitat loss. Although hayfields provide suitable habitat for breeding, the continual decline of this species has been attributed in large part to early cutting of these fields (COSEWIC, 2010).

Barn Swallow, listed as threatened provincially with COSSARO and federally with COSEWIC, was observed foraging for insects during both surveys. Historically, Barn Swallow nesting habitat consisted primarily of natural features such as caves, holes, crevices and ledges associated with rocky cliff faces. However, since

European settlement the species has largely shifted to anthropogenic structures that provide either a horizontal nesting surface (e.g. a ledge) or a vertical face, usually with an overhang that provides shelter. Barn Swallow nests are frequently located in and around open barns, garages, bridges, road culverts or on structures such as posts, light fixtures and ledges over windows and doors. Foraging habitat consist of a variety of open areas, including grassy fields, pastures, farmland, the shorelines of lakes and rivers, wetlands, cleared rights-of-way and forest clearings (COSEWIC 2011a). The reasons for the decline of the barn swallow are not well understood, but one reason for the possible decline is the removal of nesting sites, such as old barns (COSEWIC, 2011b). Many of the open areas of the study area have the potential to function as Barn Swallow foraging habitat.

Eastern Wood-pewee (*Contopus virens*), a federal species of 'Special Concern', was assigned 'Possible' breeding status within the woodland, as a result of a singing male frequenting the width of the northern part of the woodlot. This species breeds in deciduous and mixed woods, and prefers nesting sites adjacent to open areas (e.g. agricultural fields, etc.) It is not area-sensitive and is generally considered tolerant of adjacent urban development.

Western chorus frogs were heard during the first two surveys, adjacent to the Western Woodland. As described earlier, this species is federally listed as Threatened by COSEWIC. COSSARO has designated this species as Not-at-Risk. Chorus frogs require both breeding ponds devoid of fish predators and adjacent terrestrial habitat such as moist woods or meadows to feed and overwinter.

Regionally Significant Bird Species

Five species classified as uncommon in the Halton Natural Areas Inventory (2006) were recorded during the field surveys, they include, willow flycatcher, horned lark, northern rough-winged swallow, northern mockingbird, and vesper sparrow. Two additional species, blue-winged teal and red-bellied woodpecker, were incidentally recorded by K. Barrett of Conservation Halton in the Eastern Woodland and Western Woodland, respectively.

Area Sensitive Bird Species

Three birds recorded during the surveys are considered area sensitive species, they include:

- Hairy woodpecker
- Savannah sparrow (also classified as Special Concern by COSEWIC)
- Bobolink (also classified as Threatened by both COSEWIC and COSSARO).

Hairy woodpecker are mildly area sensitive forest nesting birds that require relatively large woodlands (>10ha) for breeding. There was one individual

observed during the survey. Savannah sparrow and bobolink are both grassland nesting species that require large areas for nesting. Savannah sparrow was observed at 19 out of the 22 survey locations with a breeding status of probable at three point count locations.

4.2.5.4. *Historic Records of Provincially Significant Fauna*

The NHIC has documented three provincially significant fauna species from the vicinity of the study area, they include: northern long-eared bat, eastern milksnake, and Jefferson X blue-spotted salamander. The most recent record for northern long-eared bat was in the year 1920 suggesting either this species is no longer present within this area or surveys for this species have not been conducted. The records for eastern milksnake and Jefferson X blue-spotted salamander are 1990 and 2002 respectively.

The Jefferson X blue-spotted salamander is ranked as S2 (imperilled) in the province. These salamanders require vernal ponds for breeding. Vernal ponds suitable for breeding are most often found in and around woodlands where the salamanders forage and overwinter. A vernal pond is located at the base of the western valley slope of the East Branch of Sixteen Mile Creek, approximately 100 m north of Britannia Road. It may be possible that this vernal pond is suitable for amphibian breeding. There may also be vernal ponds located within the larger woodlands located along Britannia Road. Surveys for salamanders and vernal pools were not completed as part of this study, per direction received from the MNR.

Eastern milksnake, an S3 species considered special concern federally and provincially, inhabits old fields and open woodlands. There is suitable habitat for eastern milksnake along Britannia Rd. Eastern milksnake are often found along hedgerows, specifically in rock piles and around larger rocks/boulders scattered in the hedgerows.

4.2.5.5. *Significant Aquatic Species*

The Silver Shiner (Notropis photogenis) is now designated threatened in the province of Ontario by the Committee on the Status of Species at Risk in Ontario (COSSARO). It was upgraded from Special Concern in June, 2011. Silver Shiner is present in the East Branch of Sixteen Mile Creek and was caught near the Britannia Road crossing in 2011 by Conservation Halton staff. Conservation Halton recorded Silver Shiner (a provincially Threatened Species regulated by the Endangered Species Act) at crossings 7 and 15. Further information about Silver Shiner and the regulations applicable to the species is presented in the ESR.

4.2.5.6. *Significant Woodland Assessments*

As part of the requirements of the EA, the Western and Eastern Woodlands were assessed following criteria in Part III (Land Stewardship Policies) of Halton Region's Official Plan (Region of Halton, 2006) and Halton Region's Environmental Impact Statement Guidelines (Region of Halton, 2005). In order to be considered significant, a woodland must meet one or more of the following four criteria:

1) the Woodland contains forest patches over 99 years old;
2) the patch size of the Woodland is 2 ha or larger if it is located in the Urban Area, or 4 ha or larger if it is located outside the Urban Area but below the Escarpment Brow, or 10 ha or larger if it is located outside the Urban Area but above the Escarpment Brow;
3) the Woodland has an interior core area of 4 ha or larger, measured 100 m from the edge; or
4) the Woodland is wholly or partially within 50m of a major creek or certain headwater creek or within 150m of the Escarpment Brow.

The Eastern Woodland has an approximate area of 6.14 hectares, and thus meets the patch size criteria for regional significance as it is located in the Rural Area. The Western Woodland is approximately 4.66ha, and as such also meets the patch size criteria. The woodlands do not meet any of the other three criteria, thus, significance under the Regional Official Plan is based on size alone.

4.2.5.7. *Significant Wildlife Habitat*

During the site visits a survey for potential significant wildlife habitat was conducted. Significant Wildlife Habitat is defined in the *Significant Wildlife Habitat Technical Guide* (SWHTG) (2000) as habitat that is "*ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System. Criteria for determining significance may be recommended by the Province, but municipal approaches that achieve the same objective may also be used*." Examples of significant wildlife habitat include areas where there are seasonal concentrations of wildlife, rare vegetation communities, specialized wildlife habitat, wildlife movement corridors, and habitat of species of conservation concern.

The Western Woodland is a good candidate for consideration as significant wildlife habitat.

As the northern reaches of the MAM2 community (see Figure 3-3) adjacent to the woodland contains breeding Western Chorus Frog. This species is listed as Threatened. As a result the western chorus frog should be considered a "species of conservation concern", and the breeding pond itself may be considered "specialized

habitat for wildlife" as a woodland breeding pond. Furthermore, Eastern Wood-Pewee (a federally threatened species) is a possible breeder in the woodland, and as such should also be considered a "species of conservation concern".

Additional potential significant wildlife habitat identified during field surveys includes areas of grass land adjacent to Britannia Road that provide habitat for the area-sensitive bird species recorded. The valley systems associated with the East and Main Branches of Sixteen Mile Creek that serve as wildlife movement corridors are also considered potential significant wildlife habitat. Also any habitat that provides breeding habitat for a rare species is potential significant wildlife habitat according to Table Q-3 of the SWHTG (2000) - *Criteria for Identification of Species/Habitats of Conservation Concern*.

4.3. Stormwater Management

4.3.1. Existing Conditions

The study area falls within the Indian Creek and Sixteen Mile Creek watersheds. In total, there are nineteen stream crossings, including two significant crossings at the Main Branch of Sixteen Mile Creek and the East Branch of Sixteen Mile Creek. The topography within the study area is relatively flat. Surficial soils consist primarily of clay loam which exhibits medium to high runoff potential. The surficial soils belong to Hydrologic Group C and D with poor drainage characteristics and low infiltration rates.

Given that landuses over the study area are predominantly rural in nature, historical stormwater drainage works have been limited to conveyance improvements such as straightening of channels, roadside ditches and culvert crossings. The existing rural-residential lands within the study area have been developed without any stormwater management measures for control of water quality, erosion, or flooding.

4.3.2. Draft Functional Stormwater and Environmental Management Strategy (FSEMS), Boyne Survey Secondary Plan Area

The western portion of the Britannia Road study reach, from Tremaine Road to James Snow Parkway, is adjacent to the Boyne Secondary Planning Area, where future urban development is planned. The 2011 Draft FSEMS study by AMEC reviews and inventories the existing environmental resources within the Secondary Plan area, identifies development constraints and opportunities, and presents recommended stormwater management and natural heritage strategies for the proposed development. In terms of stormwater management, the study proposes a series of stormwater management ponds on the north side of Britannia Road to provide stormwater quality and quantity control to the proposed development

lands. The study also included hydrologic modelling to establish estimated flood flow rates at many of the stream crossings within the study area.

4.3.3. Draft Milton Urban Expansion Conceptual Fisheries Compensation Plan: Boyne Survey Area

This 2011 study by AMEC developed a fisheries compensation plan to mitigate impacts to fish habitat within the Boyne Secondary Plan area, including the identification of design guidelines and permit requirements. Recommendations relevant to the planning and design for the Britannia Road improvements include the use of dry construction methods for instream works, provision of watercourse crossings which span two times the channel bankfull width for wildlife access and the provision of natural substrate within watercourse crossings for fish passage.

4.3.4. Draft Sixteen Mile Creek Areas 2 and 7 Subwatershed Update Study

This 2010 study by AMEC provides an update to the findings of an earlier (2000) Subwatershed Study. The update focuses on providing greater detailed environmental planning for a number of urban boundary expansion areas within the Town of Milton, including the Boyne Survey Secondary Plan Area adjacent to Britannia Road. The study lays the groundwork for subsequent Functional Stormwater and Environmental Management Studies (FSEMS's), including the 2011 FSEMS for the Boyne Survey SPA.

4.3.5. Final Report Recommendations from FSEMS, CSCP and SUS to be Incorporated During Detailed Design

The reports used in the analyses conducted as part of the EA are in Draft format and therefore the recommendations contained within these reports are subject to change prior to being finalized. While the analyses conducted as part of the EA were completed using the most up-to-date information available at the time it is acknowledged that further updates to the hydraulic, fluvial and storm water analysis may be required at detail design to address any further updates. Once the reports are finalized and approved by Conservation Halton, the information contained in these final reports will need to be incorporated into the detailed design of the roadway corridor where appropriate, particularly with respect to bridge/culvert sizing requirements, future SWM pond / outlet locations and watercourse alignments/requirements upstream of Britannia Road.

4.4. Hydraulics & Fluvial Geomorphology

As part of the Class EA study, hydraulic and fluvial geomorphological assessments were undertaken to provide information on the stream crossings and associated hydraulic structures within the study area.

The hydraulic assessment included:

- An inventory of existing culvert and bridge structures at the stream crossings along the study corridor;
- Hydrologic and hydraulic analyses in support of capacity assessments for these hydraulic structures;
- An analyses to identify conveyance improvements and associated bridge/culvert sizing to meet hydraulic capacity, flooding and environmental targets; and
- Recommendations with respect to stormwater management measures which should be implemented with the road improvements.

In support of the hydraulic assessment, the fluvial geomorphological assessment identified existing physical characteristics at each watercourse crossing to determine the possible influences of culvert extensions, flow capacity increases, and realignments on channel stability.

4.4.1.Stream Crossing Inventory

As discussed earlier, the study area is drained by tributaries within both the Indian Creek and Sixteen Mile Creek Watersheds. In total, there are 19 stream crossing locations along the study reach, numbered 1 to 18 and 5a (Figure 3-5). The first three crossings in the western limits of the study area are within the Indian Creek subwatershed, a tributary of Bronte Creek. The remaining crossings are within three main subwatersheds of Sixteen Mile Creek, including the West Branch subwatershed (also known as Subwatershed 2), the Lower Middle Branch subwatershed (also known as Subwatershed 7), and the East-Lisgar Branch subwatershed.

An inventory was compiled of the existing culvert and bridge structures associated with each of the stream crossings **(Table 4-5)**. As shown in the table, there are two large bridge structures located at the Main Branch of Sixteen Mile Creek and the East Branch of Sixteen Mile Creek (crossing Nos. 7 and 15). The remaining structures consist of concrete box culverts and corrugated steel pipe (CSP) culverts of varying sizes. It should be noted that the culvert structure at crossing No. 6 was just recently replaced during the course of this study, as part of road widening works on Regional Road 25 in the summer of 2012.

Of the nineteen stream crossings in the study area, eleven are regulated by Conservation Halton upstream of Britannia Road. The other eight are associated with smaller drainage features which are unregulated upstream of Britannia Road.

In addition to the 19 stream crossing structures, other small CSP cross-culvert structures which convey drainage between the north and south roadside ditches were also noted within the study area, but are not associated with stream crossings. These small cross-culverts were noted primarily in the east end of study

area, between 8th Line and Highway 407, where topography is relatively flat and drainage is not well defined.

For the purposes of this study, information pertaining to hydraulics is derived from the *Hydraulic Analysis of Stream Crossings & Stormwater Management Alternatives Assessment* in **Appendix C**.

Table 4-5: Existing Hydraulic Structures

Structure / Stream Crossing No.	Watercourse	Regulated upstream of Britannia Road?	Station	Road Elevation (m)	Culvert Type	Upstream Invert (m)	Downstream Invert (m)	Length (m)	Dia. (mm)	Span (mm)	Rise (mm)
1	Trib. of Indian Creek	yes	0 + 673	183.70	Concrete Box	182.15	181.98	7.2	-	2450	1200
2	Trib. of Indian Creek	yes	1 + 360	185.01	Steel Pipe Arch	183.77	183.73	10.8	-	1500	850
3	Trib. of Indian Creek	no	1 + 560	185.63	Concrete Open Footing	184.54	184.39	17.8	-	5250	800
4	West Trib. of Sixteen Mile Creek	no	2 + 000	186.29	C.S.P	185.23	184.99	11.7	420	-	-
5	West Trib. of Sixteen Mile Creek	yes	2 + 430	184.49	Conc. Open Footing	182.65	182.61	18.9	-	2480	1220
5a	West Trib. of Sixteen Mile Creek	no	2 + 800	184.06	C.S.P	183.13	182.98	12.9	400	-	-
6	West Trib. of Sixteen Mile Creek	yes	2 + 964	183.97	Concrete Box (Twin)	181.83	181.69	33.9	-	2400 (twin)	1200
7	Sixteen Mile Creek Main Branch	yes	3 + 660	177.02	Bridge	171.83	171.69	10.3	-	19,800	3650
8	East Trib. of Sixteen Mile Creek	no	4 + 300	190.11	C.S.P	188.44	188.15	19	500	-	-
9	East Trib. of Sixteen Mile Creek	yes	4 + 525	188.94	Concrete Box	187.22	187.00	17.5	-	3000	1200
10	Trib of Sixteen Mile Creek	no	5 + 371	193.53	Concrete Pipe	192.64	192.47	11.6	500	-	-
11	Omagh Tributary	yes	5 + 823	191.20	Conc. Open Footing	189.57	189.27	21.9	-	6000	1200
12	Trib of Sixteen Mile Creek	no	6 + 472	193.07	C.S.P	192.24	192.12	24.4	800	-	-
13	Trib of Sixteen Mile Creek	no	7 + 500	193.59	C.S.P	192.99	192.72	14.4	500	-	-
14	Trib of Sixteen Mile Creek	yes	8 + 540	190.00	Conc. Open Footing	188.66	188.45	10.4	-	1850	1000
15	Sixteen Mile Creek East Branch	yes	9 + 880	181.27	Bridge	175.78	175.75	10.4	-	24,400	4560
16	Trib of Sixteen Mile Creek	yes	10 + 400	186.42	C.S.P	184.79	184.75	11.4	1200	-	-
17	Trib of Sixteen Mile Creek	yes	10 + 900	187.20	C.S.P	185.59	185.40	11.5	900	-	-
18	Trib of Sixteen Mile Creek	yes	12 + 182	191.57	Concrete Box (Twin)	187.00	186.84	47	-	3500 (twin)	2940

4.4.2.Existing vs. Proposed Drainage Scenarios

When estimating flood flow rates for use in the assessment and design of the stream crossing hydraulic structures, consideration was given to both the existing and future drainage conditions anticipated over the study area. Within the western portion of the study area, from Tremaine Road to James Snow Parkway, future urban development is planned on the north side of Britannia Road. This future development area is referred to as the Boyne Survey Secondary Plan Area.

Proposed changes to the drainage within the Boyne area which may impact the design of watercourse crossings at Britannia Road include:

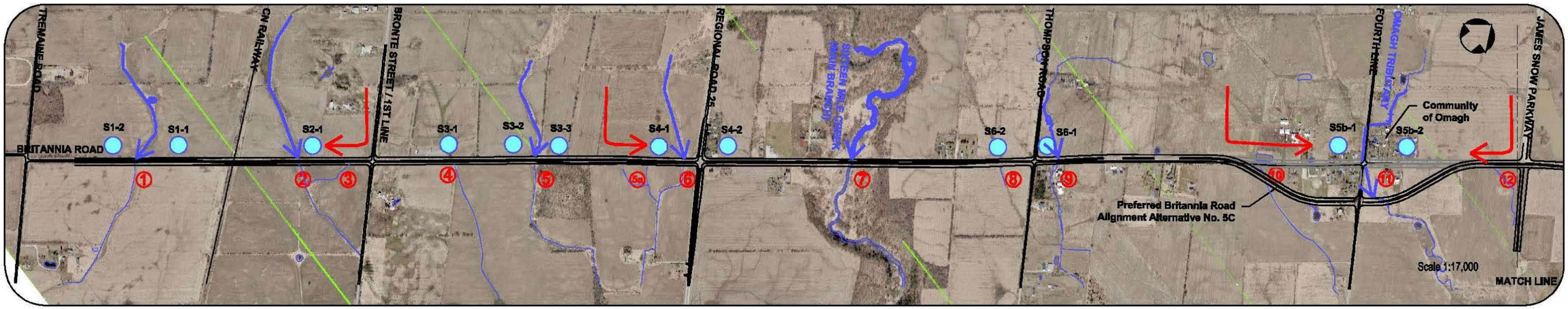
- Construction of stormwater management ponds on the north side of Britannia Road adjacent to stream crossings No. 1, 2, 5, 6, 9, and 11.
- Elimination of unregulated features No. 5a, 10, and 12 upstream of Britannia Road and diversion of the drainage from these features, via urban storm systems, to stormwater ponds which discharge to adjacent streams.
- Elimination of unregulated features No. 4 and 8 upstream of Britannia Road and replacement with urban storm systems draining to stormwater ponds which discharge at the existing stream crossing locations at Britannia Road.

These proposed impacts to the drainage system noted above are illustrated conceptually in **Figure 4-7**. It should be noted that the proposed stormwater management facility locations, taken from the 2011 FSEMS, are conceptual in nature and subject to further change and refinement as planning and design of the development lands proceeds.

Proposed stormwater ponds are to be designed to provide water quality control, erosion control, and post-to-pre flood control for the 2-year to 100-year storm events. Depending on further future grading and feasibility analyses, the stormwater ponds may also be required to provide quantity control storage for the Regional Storm event.

The timing of the Britannia Road improvements will be undertaken in consideration of development within the Boyne Secondary Plan Area. Therefore any associated hydraulic structure improvements will need to meet the conveyance and flooding criteria using flow rates expected under both the existing and future development scenarios.

Figure 4-7: Proposed Changes to Drainage Within Boyne Secondary Plan Area



4.4.3. Stream Crossing Capacity Assessments

Hydrologic and hydraulic analyses were completed in support of capacity assessments at each of the hydraulic structure locations. This included the following:

- Hydrologic assessments to estimate flood flow rates at each of the stream crossing locations.
- Hydraulic analyses to estimate the capacity and flood characteristics of the existing bridge/culvert structures associated with the current 2-lane configuration of Britannia Road.
- Hydraulic analyses to estimate the sizing requirements for proposed bridge/culvert structures which would meet the capacity requirements associated with a wider 6-lane future configuration of Britannia Road (details provided in Section 7.6.1.

4.4.3.1. *Flood Flows*

Flood flow estimates for the subject stream crossings, including 2-year through 100-year and Regional Storm events, are summarized in **Table 4-6**. Information on background reports used and flow estimate methodologies are provided in the *Hydraulic Analysis of Stream Crossing & Stormwater Management Alternatives Assessment* in Appendix C.

Table 4-6: Summary of Estimated Flood Flow Rates

Structure / Stream Crossing No.	Watercourse		Crossing Structure Classification (based on future drainage/SWM scenario)		Drainage Area		Flood Flow Rates							
	Name	Regulated upstream of Britannia Road?	Classification	Notes	Area (ha)	Notes	2-yr (m^3/s)	5-yr (m^3/s)	10-yr (m^3/s)	20-yr (m^3/s)	50-yr (m^3/s)	100-yr (m^3/s)	Regional (m^3/s)	Notes
1	Trib. of Indian Creek	yes	permanent		167	drainage area per Conservation Halton estimate based on future drainage from Mar'11 FSEMS and upstream area north of Louis St.Laurant.	1.62	2.62	3.37	4.14	5.21	6.08	21.00	Flow estimates taken from highest of existing and future landuse scenarios from FSEMS (AMEC, Mar'11)
2	Trib. of Indian Creek	yes	permanent	Mar'11 FSEMS proposes to divert drainage from crossing No.3 to this crossing.	143.7	drainage area per Conservation Halton estimate based on future drainage from Mar'11 FSEMS (includes diversion from crossing No.3) and upstream area north of Louis St.Laurant.	1.48	2.39	3.06	3.74	4.68	5.42	18.60	Flow estimates taken from highest of existing and future landuse scenarios from FSEMS (AMEC, Mar'11)
3	Trib. of Indian Creek	no	temporary (optional)	Mar'11 FSEMS proposes to eliminate this crossing and divert drainage to SWM pond at Crossing No.2. Flow estimates provided to size crossing in case interim culvert is necessary.	70	existing drainage area per Conservation Halton estimate	0.72	1.16	1.49	1.82	2.28	2.64	9.06	Flow estimates developed proportionally from flows at Crossing No.2.
4	West Trib. of Sixteen Mile Creek	no	SWM pond outlet	Mar'11 FSEMS proposes to eliminate the upstream channel and replace with a SWM Pond outletting at Britannia Rd. Flow estimates provided to size crossing for interim scenario.	16.93	existing drainage area per Mar'11 FSEMS	0.61	1.00	1.34	1.74	2.38	2.97	7.50	Existing flow estimates from Sixteen Mile Creek Area 2 & 7 Subwatershed Study Update (AMEC, Jul'10)
5	West Trib. of Sixteen Mile Creek	yes	permanent		163.7	drainage area per Conservation Halton estimate based on future drainage from Mar'11 FSEMS and upstream area north of Louis St.Laurant.	0.55	0.86	1.09	1.33	1.68	1.97	17.06	Flow estimates taken from highest of existing and future landuse scenarios from FSEMS (AMEC, Mar'11)
5a	West Trib. of Sixteen Mile Creek	no	temporary (optional)	Mar'11 FSEMS proposes to divert drainage to SWM pond at crossing No.6. Flow estimates provided to size crossing in case interim culvert is necessary.	16.15	existing drainage area estimated from Mar'11 FSEMS	0.05	0.08	0.11	0.13	0.17	0.19	1.68	Flow estimates developed proportionally from flows at Crossing No.5.
6	West Trib. of Sixteen Mile Creek	yes	permanent	Mar'11 FSEMS proposes to divert drainage from crossing No.5a to this crossing.	224.8	drainage area from MMM Design Brief for Reg.Rd.25 Widening	1.48	3.04	4.34	6.03	7.22	8.60	20.07	Flow estimates from MMM Design Brief for Reg.Rd.25 Widening
7	Sixteen Mile Main Branch	yes	permanent		12870	drainage area estimated from mapping	n/a	49.40	59.60	74.10	87.30	97.60	427.40	Flow estimates provided by Conservation Halton
8	East Trib. of Sixteen Mile Creek	no	SWM pond outlet	Mar'11 FSEMS proposes to eliminate the upstream channel and replace with a SWM Pond outletting at Britannia Rd. Flow estimates provided to size crossing for interim scenario.	36.22	drainage area estimate from Mar'11 FSEMS	0.35	0.60	0.81	1.06	1.47	1.84	4.03	Existing flow estimates from Sixteen Mile Creek Area 2 & 7 Subwatershed Study Update (AMEC, Jul'10)
9	East Trib. of Sixteen Mile Creek	yes	permanent		138	drainage area per Conservation Halton estimate based on future drainage from Mar'11 FSEMS and upstream area north of Louis St.Laurant.	1.03	1.73	2.34	3.06	4.21	5.26	18.75	Flow estimates taken from highest of existing and future landuse scenarios from FSEMS (AMEC, Mar'11)
10 Existing	Trib of Sixteen Mile Creek	no	to be abandoned	Mar'11 FSEMS proposes to divert drainage to SWM pond at crossing No.11. Flow estimates provided to size crossing in case interim culvert is necessary.	12.6	Existing drainage area estimated from Mar'11 FSEMS	0.10	0.15	0.18	0.22	0.27	0.31	0.97	Existing flow estimates from Sixteen Mile Creek Area 2 & 7 Subwatershed Study Update (AMEC, Jul'10)
10 South By-Pass (Alternative 5C)			temporary (optional)											
11 Existing	Omagh Tributary	yes	permanent	Mar'11 FSEMS proposes to divert drainage from crossing Nos.10 and 12 to this crossing.	299.0	drainage area estimated	1.71	2.62	3.35	4.17	5.40	6.46	20.50	Existing flow estimates from Sixteen Mile Creek Area 2 & 7 Subwatershed Study Update (AMEC, Jul'10)
11 South By-Pass (Alternative 5C)			permanent		303.2	drainage area estimated	1.73	2.66	3.40	4.23	5.47	6.55	20.78	Flow estimates developed proportionally from flows at existing Crossing No.11 location.
12	Trib of Sixteen Mile Creek	no	temporary (optional)	Mar'11 FSEMS proposes to divert drainage to SWM pond at crossing No.11. Flow estimates provided to size crossing in case interim culvert is necessary.	4.7	drainage area estimated	0.03	0.04	0.05	0.07	0.08	0.10	0.32	Flow estimates developed proportionally from flows at existing Crossing No.11 location.
13	Trib of Sixteen Mile Creek	no	permanent		6.9	drainage area estimated	0.04	0.06	0.08	0.10	0.12	0.15	0.47	Flow estimates developed proportionally from flows at existing Crossing No.11 location.
14	Trib of Sixteen Mile Creek	yes	permanent		107	drainage area per Conservation Halton estimate based on GIS mapping	1.10	1.78	2.28	2.78	3.48	4.04	13.85	Flow estimates developed proportionally from flows at Crossing No.11.
15	Sixteen Mile East Branch	yes	permanent		14250	drainage area estimated from mapping	n/a	69.80	84.50	105.10	122.60	136.30	587.90	Flow estimates provided by Conservation Halton
16	Trib of Sixteen Mile Creek	yes	permanent		40	drainage area per Conservation Halton estimate based on GIS mapping	0.29	0.41	0.61	0.75	0.78	1.02	4.86	Flow estimates from Aquafor modelling (EPA SWMM)
17	Trib of Sixteen Mile Creek	yes	permanent		344	drainage area per Conservation Halton estimate based on GIS mapping	1.92	3.01	4.46	5.15	5.20	6.51	29.00	Flow estimates from Aquafor modelling (EPA SWMM)
18	Trib of Sixteen Mile Creek	yes	permanent		136	drainage area per Conservation Halton estimate based on GIS mapping	0.68	1.04	1.46	1.74	1.81	2.24	11.54	Flow estimates from Aquafor modelling (EPA SWMM)

4.4.3.2. *Culvert / Bridge Capacity Estimates*

In assessing the adequacy of the study area culverts and bridges, design criteria for hydraulic structures outlined in MTO Directive B-100 was referenced. Following construction of the proposed road improvements, Britannia Road is assumed to be classified as an Urban Arterial roadway. Based on this classification, MTO design standards for hydraulic structures are as follows:

- structures with a span of less than 6 metres should convey the 50-year design flow event with a minimum of 1.0 metres of freeboard; and
- structures with a span greater than 6 metres should convey the 100-year design flow event with a minimum of 1.0 metres of freeboard.

In addition to the above, Halton Region requires that Britannia Road provide flood-free access during emergencies. Therefore, in addition to the above MTO hydraulic criteria, the stream crossing structures are also to be sized to convey the Regional Storm event without overtopping the road.

Hydraulic analyses in support of culvert/bridge capacity estimates were performed using the HEC-RAS and HY8 models. The hydraulic model assessment results for the existing bridge/culvert structures associated with the current 2-lane configuration of Britannia Road are summarized in **Table 4-7**. As shown in the table, many of the existing structures do not meet the above capacity criteria, having less than 1.0 meters of freeboard for the 50-year event and/or are overtopped for the Regional Storm event. Only existing structure No. 18 has sufficient capacity to meet the conveyance capacity criteria for roadways.

It is important to note that existing structure No. 6 was just recently constructed in the summer of 2012 but does not meet the recommended design criteria. The criteria used in the design of this brand new structure was based on the current configuration of Britannia Road as a rural arterial roadway and did not require flood free access for the Regional Storm event. Culvert requirements at this crossing would be confirmed in consultation with Conservation Halton at detail design.

Additional information on hydraulic analysis modelling details are provided in the *Hydraulic Analysis of Stream Crossing & Stormwater Management Alternatives Assessment* in Appendix C.

Table 4-7: Existing Culvert / Bridge Performance

Structure / Stream Crossing No.	Drainage area (ha)	Existing Road Elevation (m)	50-yr Flow			100-yr Flow			Regional Storm Flow			Road Overtopped (Yes/No)	Freeboard > 1 m for the 50-Yr Flow (for spans < 6m)? (Yes/No)	Freeboard > 1 m for the 100-Yr Flow (for spans > 6m)? (Yes/No)	Culvert Meets Hydraulic Criteria? (Yes/No)
			Flow (m^3/s)	Flood Elevation (m)	Freeboard (m)*	Flow (m^3/s)	Flood Elevation (m)	Freeboard (m)*	Flow (m^3/s)	Flood Elevation (m)	Freeboard (m)*				
1	167	183.70	5.21	183.46	0.24	6.08	183.60	0.10	21.00	184.52	Overtopping	Yes	No	-	**No**
2	143.7	185.01	4.68	185.30	Overtopping	5.42	185.36	Overtopping	18.60	185.97	Overtopping	Yes	No	-	**No**
3	70	185.63	2.28	185.53	Overtopping	2.64	185.61	0.02	9.06	186.22	Overtopping	Yes	No	-	**No**
4	16.93	186.29	2.38	186.54	Overtopping	2.97	186.58	Overtopping	7.50	186.86	Overtopping	Yes	No	-	**No**
5	163.7	184.49	1.68	183.32	1.17	1.97	183.40	1.09	17.06	185.21	Overtopping	Yes	Yes	-	**No**
5a	16.15	184.06	0.17	183.79	0.27	0.19	183.82	0.24	1.68	184.21	Overtopping	Yes	No	-	**No**
6**	224.8	183.97	7.22	183.12	0.85	8.60	183.35	0.62	20.07	184.20	Overtopping	Yes	Yes	-	**No**
7	12870	177.02	87.30	174.32	2.70	97.60	174.50	2.52	427.40	178.09	Overtopping	Yes	-	Yes	**No**
8	36.22	190.11	1.47	190.27	Overtopping	1.84	190.30	Overtopping	4.03	190.47	Overtopping	Yes	No	-	**No**
9	138	188.94	4.21	188.23	0.71	5.26	188.39	0.55	18.75	189.68	Overtopping	Yes	No	-	**No**
10	12.56	193.53	0.27	193.18	0.35	0.31	193.25	0.28	0.97	193.62	Overtopping	No	No	-	**No**
11	299.03	191.20	5.40	190.39	0.81	6.46	190.47	0.73	20.50	191.43	Overtopping	Yes	No	-	**No**
12	4.7	193.07	0.08	192.51	0.56	0.10	192.54	0.53	0.32	192.81	0.26	No	No	-	**No**
13	6.9	193.59	0.12	193.35	0.24	0.15	193.40	0.19	0.47	193.64	Overtopping	Yes	No	-	**No**
14	107	190.00	3.48	189.90	0.10	4.04	189.98	0.02	13.85	190.63	Overtopping	Yes	No	-	**No**
15	14250	181.27	122.60	179.22	2.05	136.30	179.34	1.93	587.90	182.32	Overtopping	Yes	-	Yes	**No**
16	40	186.42	0.78	185.57	0.85	1.02	185.72	0.70	4.86	186.65	Overtopping	Yes	No	-	**No**
17	344	187.20	5.20	187.51	Overtopping	6.51	187.56	Overtopping	29.00	188.41	Overtopping	Yes	No	-	**No**
18	136	191.57	1.81	187.61	3.96	2.24	187.67	3.90	11.54	188.46	3.11	No	Yes	-	**Yes**

* Note: Freeboard defined as difference between roadway elevation and flood elevation. "Overtopping" means flood elevation > road elevation, i.e. the road floods.

** Note: Flood elevations for newly constructed crossing No.6 estimated from hydraulic results in MMM Design Brief for Reg.Rd.25 Widening.

4.4.3.3. *Fluvial Geomorphological Conditions*

Existing conditions for each of the watercourses is summarized in **Table 4-8** with respect to adjacent land use, valley setting, channel form, and other defining characteristics of flow and boundary type. As documented in previous studies, the dominant land use within the study area is currently agricultural with local rural residential lots; however, plans for future development are underway on the north side of Britannia Road between Tremaine Road and James Snow Parkway (i.e., Boyne Survey).

Most of the watercourse and drainage features within the study area are relatively small, with drainage areas typically less than 2 – 3 km2. The primary exceptions being the Sixteen Mile Creek Main Branch and East Branch (Crossings 7 and 15 respectively) which drain in the range of 125 – 150 km2.

As is typical of most low-relief headwater features in southern Ontario, the smaller watercourses are not situated within any defined valley landform, but in some cases gradual side-slopes do dip toward a topographic low associated with the watercourse or drainage feature. The primary exceptions are Crossing 7 and 15 (Main and East Branches of Sixteen Mile Creek) which are each situated within well-defined valley landforms incised 15-20 m below the surrounding uplands. Crossing 11 (Omagh Trib.) is also situated within a defined valley landform about 5 m below upland elevations. None of the watercourses or drainage features were considered to be entrenched during field assessments, and thus all watercourse were interpreted to have good floodplain connectivity (however, artificial drainage ditches may be somewhat "entrenched" by design).

Table 4-8: Documentation of Existing Conditions for Each Watercourse at the Britannia Road Crossings

Crossing #	Vantage	Adjacent Land Use	Valley Setting Landform	Bed Material Type	Bank and Riparian Corridor Vegetation	Evidence of Existing Bank Erosion	Presence of Roadside Ditches	Inferred Flow Type	Channel Form
1	Upstream	Agricultural	Valley not well defined, gradual side-slopes	Vegetated (long grasses), fine material	Long grasses, herbaceous	Minor slumping of grass sod	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream								
2	Upstream	Agricultural	Valley not well defined, gradual side-slopes	Vegetated (long grasses, cattails), fine material	Long grasses, herbaceous	None	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream								
3	Upstream	Agricultural	Gradual slopes, no defined valley	Vegetated (turf, long grasses, cattails), fine material	Long grasses, herbaceous	None	Roadside ditch	Ephemeral, intermittent	Roadside ditch (vegetated)
	Downstream						Present, both sides		Vegetated swale
4	Upstream	Agricultural	Gradual slopes, no defined valley	Vegetated (long grasses), fine material	Long grasses, herbaceous, locally bare	Local bare soil	Present, both sides of channel	Ephemeral	Agricultural swale
	Downstream								
5	Upstream	Agricultural and naturalized-wooded	Valley not well defined, gradual side-slopes	Vegetated (turf, long grasses, cattails), fine material	Long grasses, herbaceous	None	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream								
5a	Upstream	Agricultural	Gradual slopes, no defined valley	Vegetated (short, long grasses), fine material	Long grasses, herbaceous, locally bare	None	Roadside ditch	Ephemeral	Agricultural swale (converted to ditch)
	Downstream						Present, both sides		
6	Upstream	Agricultural and naturalized-wooded	Valley not well defined, gradual side-slopes	Vegetated (turf, long grasses, cattails), fine material	Long grasses, herbaceous, local trees and shrubs	None	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream								
7 (Bridge)	Upstream	Naturalized-wooded	Defined valley incised ~20 m below uplands	Cobble, gravel	Long grasses, herbaceous, local trees and shrubs	Cutbanks	None	Perennial	Defined channel, meandering
	Downstream								
8	Upstream	Agricultural	Gradual slopes, no defined valley	Vegetated (short, long grasses), fine material	Short, long grasses, herbaceous, locally bare	None	Present, both sides of channel	Ephemeral	Agricultural swale
	Downstream								
9	Upstream	Pasture (cattle)	Gradual slopes, no defined valley	Vegetated (short, long grasses, cattails), fine material	Short, long grasses, locally bare, trees/shrubs	Bare banks (livestock access)	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, defined
	Downstream	Barn, laneway, residential lot							Online pond
10	Upstream	Cattle lot and barn	Gradual slopes, no defined valley	Vegetated (short, long grasses), fine material	Short, long grasses, herbaceous, locally bare	None	Roadside ditch	Ephemeral	Pond, ditch
	Downstream	Agricultural					Present		Agricultural swale
11	Upstream	Road embankment, residential	No defined valley	Vegetated (short, long grasses, cattails), fine material	Short, long grasses, herbaceous, local trees	None	Parallel to road	Ephemeral, intermittent	Roadside ditch
	Downstream	Agricultural	Valley incised ~5 m below				Present		Vegetated swale,

Crossing #	Vantage	Adjacent Land Use	Valley Setting Landform	Bed Material Type	Bank and Riparian Corridor Vegetation	Evidence of Existing Bank Erosion	Presence of Roadside Ditches	Inferred Flow Type	Channel Form
		(possibly fallow)	uplands						defined
12	Upstream	Agricultural	Gradual slopes, no defined valley	Vegetated (short, long grasses), fine material	Short, long grasses, herbaceous, locally bare	None	Present (locally bare)	Ephemeral	Agricultural swale
	Downstream								
13	Upstream	Orchard, manicured lawn	Gradual slopes, no defined valley	Fine material	Herbaceous, bare	None	Channel flows parallel to road	Ephemeral	Roadside ditch
	Downstream	Agricultural							
14	Upstream	Residential lots, lawns	No defined valley	Vegetated (short, long grasses, turf), fine material	Manicured grasses, locally bare	None, locally bare due to construction	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream	Agricultural	Valley not well defined, gradual side-slopes						
15 (Bridge)	Upstream	Naturalize-wooded	Defined valley incised ~15 m below uplands	Cobble, gravel	Long grasses, herbaceous, local trees and shrubs	Outflanked dam structure	Present	Perennial	Defined channel, meandering
	Downstream					Cutbanks			
16	Upstream	Agricultural	No defined valley	Vegetated (turf, long grasses), fine material	Long grasses, herbaceous	None, local rip-rap	Present, both sides of channel	Ephemeral	Roadside ditch
	Downstream	Residential lots, agricultural	Valley not well defined, gradual side-slopes						Vegetated swale
17	Upstream	Agricultural	Valley not well defined, gradual side-slopes	Vegetated (long grasses), fine material	Long grasses, herbaceous	None	Present, both sides of channel	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream								
18	Upstream	Naturalized-wooded, railway, hydro corridor	Valley partially defined by road embankments, gradual slopes	Vegetated (long grasses, cattails), fine material	Long grasses, herbaceous, locally bare, trees/shrubs	None, local rip-rap	Present	Ephemeral, intermittent	Vegetated swale, partially defined channel
	Downstream								

All small watercourses (17 of 19) were inferred to be dominantly ephemeral channels, with areas of prolonged intermittent surface flow in some cases. Seven of the nineteen drainage features were considered to be completely ephemeral (Table 5-8). As is typical of ephemeral channels in the region, all small watercourses were considered to be vegetation-dominated in terms of morphological processes, whereby vegetated surfaces on the bed and banks restrict the more predictable processes of sediment entrainment and transport. Such headwater channel forms are typically broad swale-like features (or ditches) with poorly defined channel banks and relatively disorganized and opportunistic low-flow patterns. Further, the upland surface geology is dominated by silt and clay (from glacial till and glaciolacustrine sequences; OGS, 1997), with very few sources of coarse grained material. The lack of gravel and cobble bed materials (and thus bedload transport processes) does not typically allow for the formation of regular bed morphologies (e.g., riffle-pool sequences) or alluvial bar formations. Vegetation types within the small watercourses were typically classified as long or short native grasses, turf, and cattails (and other herbaceous cover, and some local tress/shrubs), and were the basis for permissible velocity and shear stress recommendations in the stability analysis (after Fischenich, 2001).

The Main and East Branches of Sixteen Mile Creek were the only two watercourses which were classified as well defined channels with perennial flow regimes. These larger watercourses within incised valleys are characterized by cobble and gravel bed materials, and thus exhibit the expected processes of fluvial bedload transport, planform meandering, and bed morphology development (i.e., shear-dominated channels). Riparian vegetation types within the valley were variable from native grasses to naturalized areas of trees and shrubs.

Minor evidence of local erosion during the field assessment was primarily interpreted to be due to agricultural or local construction activities; livestock disturbances; low-flow avulsions and slumping within vegetation-dominated swales; and bare soil on ditch embankments. Within the larger perennial watercourses, natural processes of cutbank erosion were also evident. Backwater effects within the culverts were observed in 12 of the 19 watercourse crossings along Britannia Road typically due to in- channel vegetation and other obstructions downstream; undersized culverts, or online ponds.

An additional consideration during the field assessment was the location of roadside ditch features contributing to watercourse flows on both the north and south sides of the existing roadway (Table 5-8). These features should be considered during the detailed design stage to ensure that positive drainage is maintained towards the watercourses alongside the new road (or may be integrated into the storm sewer system). With respect to the existing roadside ditches adjacent to the Boyne Survey Secondary Plan Area, it is anticipated that the

roadside ditches will ultimately be eliminated and replaced with an urban drainage system once the Boyne Survey Secondary Plan Area becomes developed.

There are also a number of areas where internal drainage does not directly outlet to existing watercourses (e.g., including but not limited to areas between Crossings 12 and 14; Crossings 14 and 15; and Crossings 17 and 18). In some cases, the existing ditches may have small equalizer culverts crossing under the road. Options to maintain positive drainage in these areas due to road widening might include reinstatement of local roadside ditches and swales, equalizer culverts, and/or collection / integration of flows into the new storm water drainage system for Britannia Road.

Detailed field assessments along the watercourses allowed for documentation of geometric properties and substrate characteristics. Channel bankfull width and depth measurements were conducted at two sites upstream and downstream at each crossing where access was granted to the channel (**Table 4-9**). Three of the 19 crossings have no measurements taken along the watercourse due to either no accessibility or, as in the case for Crossing 13, the channel would be classified as a roadside ditch. In the case of all small ephemeral and intermittent watercourses (with drainage areas typically less than 2 – 3 km2), the term bankfull is used to loosely represent a defined frequent flow channel which may or may not be associated morphologically with annual flood conditions or ~2 year flood frequencies. On the other hand, the bankfull concept is appropriate for the two large Sixteen Mile Creek watercourses at Crossings 7 and 15, and thus these geometric bankfull channel measurements are the most consistent with respect to the terminology.

Table 4-9: Summary of Average Bankfull Width and Depths of Watercourses at Britannia Road Crossings, with Recommended Culvert Spans

Crossing #	Existing				Drainage Area Models[2]			Proposed		
	Culvert Span (m)	Field Avg Width (m)	Field Max Width (m)	Field Avg. Depth (m)	Drainage Area (km^2)	Predicted Avg Width (m)	Upper 95% Prediction Interval	Bankfull Width (m)	2 x Bankfull Width (m)	Culvert Span (m)
1	2.45	2.4	3.3	0.6	1.68	2.3	3.1	2.4	4.8	6.00
2	1.5	3.7	6.0	0.4	1.44	2.1	2.9	3.7	7.4	7.40
3	5.25	1.1	1.4	0.2	0.7	1.6	2.0	1.6	3.2	3.20 [x2]
4	0.42 ø	1.4	2.2	0.3	0.17	0.9	1.0	1.4	-	4.40
5	2.48	3.8	5.4	0.4	1.64	2.3	3.0	3.8	7.6	7.60
5a	(0.4 ø)[1] → eliminated	1.5	1.5	0.4	0.17	0.9	1.0	1.5	-	2.00
6	(0.9 ø x2)[1] → 2.4 [x2]	4.9	9.2	0.6	2.22	2.6	3.5	4.9	9.8	10.20
7	19.8	11.4	12.3	0.7	128.7	13.6	27.0	13.6	27.2	30.00
8	0.5 ø	1.9	1.9	0.1	0.37	1.2	1.4	1.9	-	4.50
9	3.0	-	-	-	1.38	2.1	2.8	2.1	4.2	4.80 [x2]
10	0.5 ø	-	-	-	0.13	0.8	0.9	0.8	-	4.00
11	6.0	7.0	8.7	0.5	2.99	2.9	4.1	7.0	14.0	(6.00)[3]
11 new	-	-	-	-	-	-	-	7.0	14.0	14.40
12	0.8 ø	0.7	1.0	0.3	0.05	0.5	0.5	1.0	-	3.00
13	0.5 ø	-	-	-	0.07	0.6	0.6	0.6	-	2.00
14	1.85	3.6	4.5	0.3	1.07	1.9	2.5	3.6	7.2	7.20
15	24.4	16.0	20.4	0.9	142.5	14.3	28.4	16.0	32.0	32.00
16	1.2	0.9	1.0	0.3	0.4	1.3	1.5	1.3	2.6	2.60
17	0.9 ø	6.9	8.4	0.4	3.44	3.1	4.4	6.9	13.8	13.8
18	3.5 [x2]	9.2	13.5	0.9	1.36	2.1	2.8	~ 3	-	(3.5 [x2])[3]

Notes:

1. Two culverts were replaced during Britannia EA study with upgrades at Regional Road 25 intersection, including Crossing 5a (diverted to ditch drainage) and Crossing 6 (Concrete Box [x2]).
2. Drainage area (A_d) models for bankfull width (w) are based on Phillips and Desloges (2012) relation of $w = a A_d^b$, where for greater Toronto area a = 1.85 and b = 0.41 (average width prediction); and for all of southern Ontario a = (1.2+1.18) and b = 0.5 (upper 95% prediction interval of model statistics).
3. Expected that existing structures to be maintained at Crossings 11 and 18.

Legend

- Culverts – Regulated Watercourses
- Bridges – Regulated Watercourses
- Culverts – Unregulated drainage features, with culverts expected to be maintained for storm water
- Culverts – Unregulated drainage features, with temporary culverts

4.4.3.4. *Stability Analysis*

A stability analysis was completed for all 19 crossings to demonstrate that hydraulic changes resulting from the proposed culverts will not increase risks of channel instability. The two parameters used to assess erosion risks were channel velocity and boundary shear stress. Average cross-sectional velocities were used to assess the local boundary stability in the channel at each crossing, whereas, average boundary shear stress was used to assess reach-scale channel stability in the vicinity of the crossing.

Overall, the results of the stability analysis demonstrate proposed velocity and shear stress decreases compared to existing conditions at all crossings, for nearly all flood frequencies. This finding was expected based on increased culvert spans and capacities, and the final results were arrived at iteratively by adjusting the models to meet hydraulic and ecological criteria, with additional iterations in a few cases to meet stability objectives.

Permissible exceedances of velocity and/or shear stress were noted at some crossings for both existing conditions; however, in all cases the frequency of permissible exceedances has been decreased for proposed conditions (i.e., the return period for exceedance events increases).

For the Main and East Branches of Sixteen Mile Creek (Crossings 7 and 15), recommendations for increased spans at both bridge crossings will not only alleviate flood levels, but will also relieve existing constraints on the channel in terms of geomorphic processes. Natural sediment bedload transport processes are expected to be maintained relative to existing conditions.

Further details on the area's existing fluvial geomorphological conditions and stability analysis are provided in the *Fluvial Geomorphology Study* in **Appendix D**.

4.5. Geotechnical Environment

A preliminary geotechnical investigation consisting of 21 strategically located boreholes was undertaken to determine the pavement and subgrade conditions along the roadway, as well as the foundation conditions at structure locations. The investigation included boreholes at the CN Rail crossing, the Sixteen Mile Creek bridges, the structural culverts, and within the pavement structure at regular intervals.

The study area is located within the Peel Plain physiographic region, a till plain consisting of clayey silt to silty clay which has been modified by a veneer of clay. Approximately 1 km both east and west of Trafalgar Road, the roadway crosses a localized tract of sandy soil overlying the till. Alluvial deposits are present within the low-lying floodplains of the Sixteen Mile Creek main and east branches.

The study area is underlain by red shale bedrock of the Queenston Formation. The bedrock typically lies at depths of 10 to 15 m below the ground surface, and locally at shallow depths within the major creek valleys.

With respect to existing pavement conditions, Britannia Road presently has a two-lane rural cross-section with gravel shoulders and side ditches. The shoulder width varies between 0.3m to 1.5m. The existing pavement surface between Tremaine Road and Trafalgar Road is currently in good to excellent condition with a very smooth ride, slight distortion and wheel track rutting, and intermittent slight to moderate centerline/joint cracking. East of Trafalgar Road, the pavement surface is in fair condition with extensive moderate map cracking, intermittent moderate transverse and longitudinal cracks, as well as moderate raveling and wheel track rutting.

Additional details on the geotechnical conditions within the study area can be found in the *Preliminary Geotechnical Investigation and Pavement Design Report* in **Appendix E**.

4.6. Cultural Heritage Environment

4.6.1. Archaeological Resources

As part of the Class EA, a Stage 1 Archaeological Assessment was conducted which consisted of a background study and property inspection (visual inspection completed on April 15, 20 and 21, 2010). All activities carried out during this assessment were completed in accordance with the terms of the *Ontario Heritage Act* (2005) and the *Standards and Guidelines for Consultant Archaeologists* (MTC 2011).

The Stage 1 Archaeological Assessment identified that the study area exhibits archaeological potential based on several criteria, as summarized below.

Previously Identified Archaeological Sites

Based on a search of the Ministry of Tourism & Culture's Ontario Archaeological Sites Database (OASD) completed in December 29, 2010, 46 archaeological sites have been registered within 1 km of the study area. A review of the geography of the study area also suggests that the study corridor has potential for the identification of Aboriginal and historic archaeological remains.

Water Source

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario after the Pleistocene era, proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

The Sixteen Mile Creek watershed covers 357 km^2 and runs through portions of Milton, Halton Hills, Oakville and Mississauga. The watershed is composed of three broad drainage basins, the West, Middle and Eastern Branches, which converge below the Niagara Escarpment to flow south into Lake Ontario at the Town of Oakville (Conservation Halton n.d.). A number of tributaries of Sixteen Mile Creek cross Britannia Road between First Line and Highway 407.

The Bronte Creek watershed covers 304 km^2 and covers portions of Wellington County, the City of Hamilton, Burlington, Oakville and Milton. The main branch of Bronte Creek is 48 km long and there are 12 primary subwatersheds that feed into the creek (Conservation Halton n.d.). Two tributaries of Bronte Creek cross Britannia Road between Tremaine Road and First Line.

Early Euro-Canadian Settlement

The historical settlements of Boyne (intersection of Britannia Road West and Regional Road 25), Omagh (at Fourth Line), and Drumquin (at Trafalgar Road), are all located along the study corridor.

Early Historical Transportation Routes

Britannia Road is a historically surveyed road containing a number of historic features, such as farmhouses and orchards, churches and cemeteries, cross-roads settlements, railscapes, and waterscapes.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those which are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be captured by proximity to water. An added factor, however, is the development of the network of concession roads and railroads through the course of the nineteenth century. These transportation routes frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 m of an early settlement road, such as Britannia Road, are also considered to have potential for the presence of Euro-Canadian archaeological sites.

Based on the results of the archaeological assessment it was determined that while the Britannia Road right-of-way (ROW) has been heavily disturbed from road construction and utility installation, there is archaeological potential beyond the ROW limits throughout the length of the study corridor. Beyond the disturbed ROW, several areas have remained relatively undisturbed and exhibit archaeological potential. Most of the areas of potential are relatively undisturbed fields that have not been impacted by construction activities. Other areas of potential are located around historic houses or roads. Where road improvements encroach upon undisturbed land beyond the disturbed ROW, a Stage 2 archeological assessment should be conducted as part of detailed design.

Two cemeteries are located in the Britannia Road study corridor. The cemeteries are associated with two churches, the Church of Christ (9850 Britannia Road) and the Omagh Presbyterian Church (2077 Britannia Road). The Britannia Road ROW adjacent to these two properties requires further investigation should the proposed work alter the current road conditions adjacent to either property. Property impacts to be confirmed during detailed design.

The Stage 1 Archaeological Assessment conducted for the Britannia Road Corridor Improvements Class EA is provided in **Appendix F**.

4.6.2.Cultural Landscapes & Built Heritage Features

A cultural landscape is perceived as a collection of individual built heritage features and other related features that together form farm complexes, roadscapes and nucleated settlements. Built heritage features are typically individual buildings or structures that may be associated with a variety of human activities, such as historical settlement and patterns of architectural development. For the purposes of this study, the cultural heritage assessment addressed above ground cultural heritage resources over 40 years old. Use of a 40 year old threshold is a guiding principle when conducting a preliminary identification of cultural heritage resources (Ministry of Transportation 2006; Ministry of Transportation 2007; Ontario Realty Corporation 2007). While identification of a resource that is 40 years old or older does not confer outright heritage significance, this threshold provides a means to collect information about resources that may retain heritage value.

A number of resources were consulted for the preliminary identification of built heritage resources and cultural heritage landscapes along the Britannia Road study corridor, including: the Canadian Register of Historic Places; the Ontario Heritage Properties Database and information publicly available on the Town of Milton's municipal website; and the Cultural Heritage Resource Report for the Boyne Survey Secondary Plan and Education Village Neighbourhood Plan, Milton prepared by Unterman McPhail Associates in 2010 (UMA 2010). In addition, the Planning and Development Department at the Town of Milton was contacted for information concerning properties of cultural heritage interest identified by the Town.

The landscape on either side of Britannia Road is generally characterized by active farms and agricultural fields dating to the nineteenth and early-twentieth centuries. A number of these farmsteads and fields are characterized by concrete corner fence posts. Most are plain and cylindrical, but a few have a square shape and feature decorative features. A small, low-lying woodlot is found on the north side of Britannia Road near the eastern limit of the study corridor and another is located on the south side of the road slightly west of Regional Road 25. Britannia Road intersects three historic settlements, including Boyne (at Regional Road 25), the largest, Omagh (at Fourth Line), and Drumquin (at Trafalgar Road), and crosses two branches of Sixteen Mile Creek. The study corridor also features small pockets of c.1960s homes that occupy small residential lots that were severed from

larger agricultural properties. A handful of more recent, individual residences are intermittently located throughout the study corridor.

A few commercial properties, including a modern gas station, a landscaping enterprise and greenhouses are found along the study corridor and are generally concentrated between Sixth Line and Trafalgar Road. This area, which is located just west of the historic settlement of Drumquin, also features the now-closed Percy W. Merry Public School (1958-2003) and an outdoor recreational complex.

The results of background historic research and a review of secondary source material, including historic mapping, revealed a study corridor with roots in early nineteenth-century settlement and agricultural land use. The field review confirmed that the study corridor retained many features reminiscent of these early roots, mostly in the form of individual farmscapes and historic crossroad settlements.

The following provides a summary of the field review completed in April 2011, data collection findings, and potential impact screening results.

- A total of 50 cultural heritage resources were identified within and adjacent to the study corridor, which include 16 built heritage resources and 34 cultural heritage landscapes;
- The 16 built heritage resources include one former school house, two bridges, 12 residences, and one cairn;
- The 34 cultural heritage landscapes include one railscape, one waterscape, eight roadscapes, 16 farmscapes, two remnant farmscapes, one combined commercial and residential property, three historic settlements, and two churches with cemeteries;
- One cultural heritage resource is designated under Part IV of the Ontario Heritage Act;
- A total of 28 cultural heritage resources have been listed on the Town of Milton's Heritage Inventory;
- A total of six cultural heritage resources have been identified as resources of cultural heritage interest by the Town of Milton or in the Boyne Survey Secondary Plan (UMA 2010); and
- The remaining 14 resources were identified in the course of the field review.

Descriptions of each of the cultural heritage resources identified within and adjacent to the study corridor are provided in **Table 4-10**. Location mapping for each of the features is provided in the *Cultural Heritage Assessment* report in **Appendix G**.

Table 4-10: Identified Built Heritage Resources (BHR) and Cultural Heritage Landscapes (CHL)

Feature	Type	Location	Description
BHR 1	Former school house	6035 Regional Road 25	The former schoolhouse features design elements typical of nineteenth-century schoolhouses, including: gable roof, three-bay symmetrical front façade, round-headed window and door openings topped with decorative brick veneer and a semi-circular window opening in the gable peak. The structure is of frame construction with a brick veneer and the roof is clad in metal sheeting. The former schoolhouse, now a private residence, is part of the historic settlement of Boyne and is illustrated on the 1877 historic atlas map.
BHR 2	Residence	8161 Britannia Road	The one-and-a-half storey, frame residence features a gambrel roof with a gable dormer, a covered porch with a hipped roof, synthetic siding, modern one-over-one pane sash windows, and textured concrete block foundations. Constructed in the mid-twentieth century, the structure exhibits details reminiscent of the Dutch Colonial style.
BHR 3	Bridge	Britannia Road at Sixteen Mile Creek (west of Thompson Road)	The bridge carries Britannia Road over Sixteen Mile Creek and consists of a single span concrete rigid frame road bridge featuring steel vertical bar handrails. The bridge was constructed in 1962.
BHR 4	Residence	9905 Britannia Road	The single-storey vernacular residence features frame construction, a hipped roof, a three-bay front façade, modern windows and doors, and synthetic siding. A gable dormer is a more recent addition and so is the walkway connecting the main residence to a smaller, hipped roof structure. According to the Town of Milton, this residence is one of two workers' cottages that were constructed around the 1930s. The heritage resource is part of the historic settlement of Omagh.
BHR 5	Residence	9965 Britannia Road	The single-storey vernacular residence features frame construction, a hipped roof, a three-bay front façade, concrete foundations, and potentially original two over-two pane sash windows. According to the Town of Milton, this residence is one of two workers' cottages that were constructed around the 1930s. The heritage resource is part of the historic settlement of Omagh.
BHR 6	Residence	9950 Britannia Road	The late-nineteenth century residence features frame construction, a two-storey scale, a hipped roof, stone foundations, and a single-storey bay window with decorative brackets on the front façade (east elevation). The structure has been altered and features synthetic siding and modern windows and doors. The residence, which is located in the historic settlement of Omagh, is reputedly the former parsonage of Church of Christ Disciples (UMA 2010: 24).
BHR 7	Residence	1595 Fourth Line	The one-and-a-half storey residence features solid brick construction, stone foundations and a gable roof with returned eaves clad in metal sheeting. The red-brick structure is characterized by buff-brick quoining and banding. A one-storey accretion has been added to the original structure, the style of which is quite sympathetic. According to the Town of Milton, this house was built in 1862 for Thomas Little. It is located in the historic settlement of Omagh.
BHR 8	Residence	1599 Fourth Line	The one-and-a-half storey vernacular residence features frame construction, a gable roof, a steep centre gable on the front façade, an enclosed porch, and triangular lintels over the two-over-two pane sash windows. Mature and established trees surround the structure. Located in the historic settlement of Omagh, the residence is historically associated with the Smith and Ford families (UMA 2010: 21).
BHR 9	Residence	10025 Britannia Road	The two-storey structure features frame construction, a hipped roof, an external chimney with a brick stack, as well as modern windows and synthetic siding. Part of the historic settlement of Omagh, the structure was used as a hotel and general store. The Town of Milton reports that the residence may have been constructed by John Howell in the 1850s (UMA 2010: 23).
BHR 10	Residence	10043 Britannia Road	The one-storey residence is reported to have been built in 1949 with material from the Omagh General Store building (UMA 2010: 23). It features a gable roof and concrete foundations. It is located in the historic settlement of Omagh. Due to active construction activities at the time of the field review, more detailed assessment and photo documentation was not possible.
BHR 11	Residence	10095 Britannia Road	The one-and-a-half storey residence features frame construction, a gambrel roof with two gable dormers, and a symmetrical five-bay front façade. Located in the historic settlement of Omagh, it is reported that this twentieth-century structure was built using materials from the former Omagh school house that originally stood on this site (UMA 2010: 22).Due to active construction activities at the time of the field review, more detailed assessment and photo documentation was not possible.
BHR 12	Residence	12365 Britannia Road	The one-storey residence features frame construction, a single-storey rear accretion, a hipped roof, textured concrete block foundations, a symmetrical three-bay front façade, and a recessed front entrance. Stylistically, this residence is of typical mid-twentieth century vernacular architecture. However, a residence associated with William Tolson is illustrated at this location on the 1877 atlas map. Established tree lines surround the rectangular property parcel, the west boundary of which was established by 1877.
BHR 13	Residence	6018 Trafalgar Road	The frame structure has an L-shaped footprint comprised of a one-and-a-half storey front section with a hipped gable roof on the front façade, and a rear two-story section with a hipped roof. The residence features an internal chimney as well as two enclosed porches with hipped roofs. The structure has been altered and is currently clad in stucco. It is located within the historic settlement of Drumquin.
BHR 14	Residence	6007 Trafalgar Road	The frame structure features a one-and-a-half storey scale, a gable roof, a one-story rear tail, an internal chimney with a brick stack, and a four-bay front façade. Mature trees and fence lines surround the residence and associated outbuildings. The residence, which is part of the historic settlement of Drumquin, was potentially constructed in the mid- to late-

Feature	Type	Location	Description
			nineteenth century.
BHR 15	Bridge	Britannia Road over Sixteen Mile Creek, west of Trafalgar Road	The bridge carries Britannia Road over Sixteen Mile Creek, just west of Trafalgar Road. The bridge consists of a single span concrete rigid boat frame bridge featuring steel vertical bar handrails. The bridge was constructed in 1960.
BHR 16	Commemoration	West of 12705 Britannia Road	This cairn commemorates the rural school sections that closed in 1958 following the opening of the Percy W. Merry Public School. The cairn, which features an old school bell, was erected in 1970 by the Drumquin Women's Institute. An additional plaque commemorating the Percy W. Merry Public School was added to the cairn in 2003 following its own closure.
CHL 1	Farmscape	5703 Tremaine Road	The farmscape includes two farmhouses, three gable-roofed outbuildings, and a number of landscape features evocative of earlier agricultural land use. The earliest residence, Which dates to the nineteenth century, features a one-and-a-half storey scale, brick construction and/or veneer, a salt-box roof clad in metal sheeting, a symmetrical three-bay front façade, external chimneys at both gable ends, and potentially original twelve-over-twelve pane sash windows. The second residence, which was potentially constructed in the late nineteenth or early twentieth century, features a two-and-a-half storey scale, a brick construction and/or veneer, a veranda that runs along two sides and a hipped roof with multiple gables featuring returned eaves and round-top windows. A farmhouse with orchard associated with John Hunter is illustrated at this location on the 1877 atlas map. The property is located more than 300 m south of Britannia Road and should not be impacted by the proposed undertaking.
CHL 2	Farmscape	6081 Tremaine Road	The farmscape includes a nineteenth century vernacular farmhouse with Ontario Gothic detailing, at least two outbuildings, and a number of landscape features evocative of early agricultural land use. The one-and-a-half storey frame residence features a single-storey rear accretion, a gable roof with a centre gable on the front façade, a belvedere on the rear accretion, an external chimney with a brick stack, a covered front veranda, decorative brackets, and vergeboard in the centre gable. Landscape features include a long gravel driveway that leads from Tremaine Road to the built structures, fence lines, and mature trees. A farmhouse with orchard associated with James Weir is illustrated at this location on the 1877 atlas map. The property is located over 300 m north of Britannia Road and should not be impacted by the proposed undertaking.
CHL 3	Farmscape	6116 Tremaine Road	The farmscape includes a late-nineteenth century farmhouse, a barn and a number of other outbuildings, a race track, as well as a number of landscape features evocative of early agricultural land use. The residence features a one-and-a-half storey scale, a single-storey rear accretion, brick construction and/or veneer, and a cross-gable roof with two gables on the front façade each with rounded-top window openings. The structure has been altered and features modern windows and doors. A long gravel driveway leads from Tremaine Road to the built structures which are surrounded by mature trees. A farmhouse with orchard associated with James Weir is illustrated at this location on the 1877 atlas map. The property is located about 300 m north of Britannia Road and should not be impacted by the proposed undertaking.
CHL 4	Roadscape	Tremaine Road	Historically, Tremaine Road forms the road allowance between Concession I in the Township of Trafalgar North and Concession VII in the Township of Nelson, Halton County. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by agricultural fields and intermittent tree lines both north and south of Britannia Road.
CHL 5	Railscape	CN Rail	Now part of the Canadian National (CN) Rail, the railscape follows the route of the Hamilton & Lake Erie Railway which was incorporated in 1875. Shortly thereafter, it was reorganized as the Hamilton and North Western Railway and is illustrated as such in the 1877 atlas map. In 1879, the HNWR amalgamated with the Northern Railway of Canada as Northern & Northwestern Railway, and in 1888 became part of the Grand Trunk Railway. CN took over in 1923 (UMA 2010: 39). The railway consists of a single track on a slightly raised embankment. Wooden planks facilitate vehicular crossing on Britannia Road.
CHL 6	Farmscape	1510 Bronte Street South	The farmscape includes: a one-and-a-half storey stone farmhouse; a large gable barn, silo, and a number of other outbuildings; as well as various landscape features evocative of early settlement and agricultural land use. The residence features a gable roof, two internal chimneys, a symmetrical five-bay front façade, and a one-and-a-half storey rear accretion. The farmhouse reportedly has a date stone of 1849 and is believed to have been constructed by Andrew Suitor (UMA 2010: 40). It is associated with Robert Suiter in the 1877 atlas. According to the Town of Milton, the farmhouse represents one of the oldest residences in the former Township of Trafalgar and is one of the few remaining stone residences. The long gravel drive from Bronte Street South is lined with mature trees.
CHL 7	Remnant farmscape	5761 Bronte Street South	The built structures on the property at 5761 Bronte Street South were demolished or in the process of being demolished at the time of the field assessment. Remaining structures included a small gable barn and the partial foundations of another. A review of available online aerial mapping reveals that the farmhouse was situated to the west of the extant barn and that the property also featured a large gambrel barn that had been expanded as well as a silo. The property still retains mature trees and older post-and-rail fence lines. A farmhouse associated with John Bowes is illustrated at this located on the 1877 atlas map.
CHL 8	Roadscape	Bronte Street South/First Line	Historically, Bronte Street South forms the road allowance between Concessions I and II in the Township of Trafalgar North. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by agricultural fields and intermittent tree lines both north and south of Britannia Road.

Feature	Type	Location	Description
CHL 9	Residential/Commercial	6003/6009 Regional Road 25	As of April 2011, this heritage resource consisted of a mid-nineteenth century one-and-a-half storey frame residence and a former garage constructed in 1925. The residence has been much altered and features a low-pitched gable roof, a gable dormer, and modern siding, windows, and doors. Part of the old gas station, the single-storey garage features a textured concrete-block construction, a stepped roof parapet on the front elevation, a c.1940s frame addition with a salt-box roof and board-and-batten siding. The garage is located quite close the Britannia Road right-of-way. The property has been the site of a blacksmith shop, a garage, and a grocery store since the nineteenth century (UMA 2010: 33). Heritage Milton considers this property, known as the "Boyne Service Station" or the "Dolby Garage", to be a local landmark and has requested that it be designated under Part IV of the Ontario Heritage Act and that it not be demolished. Since completion of field survey activities conducted as part of the present environmental assessment, it has been confirmed that the garage has been, or is planned to be, removed. Based on a review of publicly accessible documents, Milton Council recommended that the demolition request be approved and that "the Region of Halton erect a commemorative structure in the general location of the former garage/workshop building, to reflect the historical significance of this property with the historic village of Boyne and to act as a landmark at the intersection of Regional Road 25 and Britannia Road in lieu of revising the proposed Britannia Road realignment." It was also recommended that "Heritage Milton be consulted regarding the location, design and content of the commemorative structure, which is to act as a gateway feature to the expanded Milton Urban Area…" (Town of Milton 2011). The Heritage Milton Annual Report (December 19, 2011) indicates that "…in accordance with this request the Region have saved many of the rock-faced 'imitation stone' concrete blocks from the garage so that these can be incorporated into the commemorative structure when the road works are complete." The Planning and Development department at the Town of Milton confirmed that a heritage impact assessment for the property was prepared, that the garage has been demolished and the house is now vacant and boarded up. It was also confirmed that the concrete blocks were saved by the Region and they will be using them in a commemorative structure, the design of which has not yet been finalized (email communication, Feb 21, 2012).
CHL 10	Historic Settlement	Boyne - Britannia Road and Regional Road 25	The historic settlement of Boyne developed at the intersection of what is now Britannia Road and Regional Road 25. It comprises the Dolby Garage and residence at 6003/6009 Britannia Road (CHL 9), a former nineteenth-century school house at 6035 Regional Road 25 (BHR 1), and a few twentieth-century residences. It is surrounded by a number of farm complexes.
CHL 11	Farmscape	8240 Britannia Road	The farmscape, presently known as Creek View Farm, is comprised of a nineteenth-century Regency farmhouse, a number of barns and other agricultural outbuildings, and various landscape features evocative of early settlement and agricultural land use. The farmhouse features a one-storey scale, solid brick construction, a hipped roof with a roof cap, and potentially original six-over-six pane sash windows. A large, nineteenth-century gable barn is located quite close to the Britannia Road right-of-way. It sits on stone foundations and is banked on its north elevation facing Britannia Road. A smaller gable barn with textured concrete block foundations sits kitty-corner to the larger barn. A number of mature and established trees are found around the built structures and Sixteen Mile Creek meanders through part of the property. A farmhouse and orchard associated with Thomas Crozier is illustrated at this location on the 1877 atlas map. The farmhouse was the home of John White, Milton's first MP (UMA 2010: 31)
CHL 12	Farmscape	8321 Britannia Road	The farmscape, presently known as Rivermore Stable, is comprised of a two-story residence, an older gable barn, as well as a number of more recent stable buildings and other outbuildings. The Boyne Survey Secondary Plan suggests that the residence dates to the late-twentieth century, the presence of an internal chimney suggests that it might be older. Its location far back from Britannia Road precluded a more detailed analysis. A review of the 1877 atlas map reveals that a farmhouse associated with William Alderson was located closer to Britannia Road, around the location of the current outbuildings. A farmhouse and orchard are also illustrated just outside the limits of the property, on the west side of Sixteen Mile Creek. The atlas also reveals that the irregular property boundaries, which seem to follow the high banks of the creek, were in place by 1877.
CHL 13	Church and cemetery	8815 Britannia Road	The Omagh Presbyterian Church and cemetery was founded on May 4th, 1838. The current church, which was constructed in 1909, is of frame construction with a red brick veneer, a front fable roof, stone foundations and sills, and Gothic-style architectural details such as pointed arch window and door openings. The cemetery is located to the side and rear of the church, which is located quite close to the Britannia Road right-of-way. Mature and established trees are found on the property.
CHL 14	Roadscape	Thompson Road	Historically, Thompson Road forms the road allowance between Concessions III and IV in the Township of Trafalgar North. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by agricultural fields to the north of Britannia Road, and tree-lined properties to the south.
CHL 15	Farmscape	1487 Thompson Road	The farmscape is comprised of a two-storey farmhouse, a gable barn and other outbuildings, and a number of landscape features evocative of early agricultural land use. The residence features a hipped roof, brick construction and/or veneer, and potentially dates to c. 1930s (UMA 2010: 27). Mature trees surround the built structures and tree lines form boundaries between different fields. While the large agricultural property extends to and along Britannia Road, the built structures are located approximately 300 metres from the right-of-way. A farmhouse associated with Robert Elliot is illustrated at this location on the 1877 atlas map.
CHL 16	Farmscape	1635 Thompson Road	This farmscape consists of a nineteenth-century farmhouse, a large nineteenth-century barn complex with various other modern outbuildings, and a number of landscape features evocative of early settlement and agricultural land use. The farmhouse, which dates to c.1860s-70s features a two-storey scale, solid brick construction, a hipped roof, a two-storey

Feature	Type	Location	Description
			rear accretion, a symmetrical five-bay front façade, a deep and covered front veranda, a central enclosed porch on the upper-storey, two end brick chimneys, and potentially original windows and doors. The barn complex includes at least three barns that sit on stone foundations, the larger of which has a gambrel roof and is banked on the north elevation facing Britannia Road. The other two feature gable roofs. A small woodlot is located to the rear of the residence, a small orchard is found north and west of the residence, and mature and established trees are found throughout the property. A small creek flows between the residence and the farm buildings and there is a small pond immediately south of the Britannia Road right-of-way. A remnant fence line featuring concrete posts is found along the northern and western limit of the property. Two farmhouses and a large orchard associated with George Buck are illustrated at this location on the 1877 atlas map.
CHL 17	Farmscape	9815 Britannia Road	The farmscape consists of a c.1920s farmhouse, a large nineteenth-century barn, two silos, and a number of other agricultural outbuildings of various ages. The residence consists of a one-and-a-half storey Arts and Crafts bungalow with a side gable roof, a gable front dormer, an enclosed veranda, brick construction and/or veneer, and an external brick chimney. The extensive barn complex sits prominently on the flat and open landscape. . According to the Town of Milton, the c.1920s residence is one of the few remaining such houses within Trafalgar Township.
CHL 18	Church and Cemetery	9850 Britannia Road	The Omagh Presbyterian Church was constructed in the late-nineteenth century and features frame construction, a front gable roof, a gable roof covered entrance area, and large rounded-top window openings on all elevations. The cemetery is located on the east, south, and west sides of the church. A number of established trees are found on the property. A church is illustrated at this location on the 1877 atlas map.
CHL 19	Remnant farmscape	5752 Fourth Line	The remnant farmscape is comprised of a gable barn potentially dating to the nineteenth century, a silo, and two smaller gable outbuildings. The large barn features a metal-clad roof, vertical board siding, and a centrally-located diamond-shaped window opening on its east elevation. While there is no farmhouse associated with the agricultural structures, the barn and fields are still very much active. The large property at 5752 Fourth Line also features a number of landscape features evocative of early agricultural land use including a long gravel driveway partly lined with established trees, and fence lines that include concrete corner posts – one of which is topped with a decorative, angled cube. A review of aerial mapping reveals that a small creek meanders through the property and that a pond is located behind the barn. A farmhouse with orchard associated with Alex Patterson is illustrated at this location on the 1877 atlas map.
CHL 20	Farmscape	1501 Fourth Line	The farmscape is comprised of a nineteenth-century farmhouse, two large gable barns, a silo, various other outbuildings, as well as a number of landscape features evocative of early settlement and agricultural land use. The residence features a one-and-a-half storey scale, brick construction, a side gable roof, and chimneys with brick stacks at both gable ends. The red brick structure is characterized by buff brick quoining and banding under the roof line. The structure also features a single-storey rear tail with a covered veranda. The gravel drive is lined with mature trees and the property features a number of fence lines of different styles, including older post-and-beam fencing within the property. A review of aerial mapping reveals that a small creek meanders through the large property and that a pond is located behind the barn complex. A farmhouse with orchard associated with Henry Robinson is illustrated at this location on the 1877 atlas map.
CHL 21	Remnant farmscape	10080 Britannia Road	The farmscape is comprised of an early-twentieth century farmhouse and landscape features evocative of early agricultural land use. A review of available aerial mapping and the Boyne Survey Secondary Plan (UMA 2010: 22) indicates that, until recently, the property also featured a large gambrel barn and other outbuildings. At the time of the field assessment, these structures were no longer extant and a large area to the southeast of the residence was surrounded by temporary fencing. The farmhouse, which appears to be presently abandoned, features a two-and-a- half storey scale, textured concrete block foundations, a hipped roof with an eyebrow dormer (also known as a witch's eye), and a symmetrical three-bay front façade with a covered porch. Established trees line the driveway and the agricultural fields on the large property are still active.
CHL 22	Roadscape	Fourth Line	Historically, Fourth Line forms the road allowance between Concessions IV and V in the Township of Trafalgar North. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by remnants of the historic crossroad settlement of Omagh, as well as active agricultural fields to the north and south of Britannia Road.
CHL 23	Historic Settlement	Omagh – Britannia Road and Fourth Line	The historic settlement of Omagh developed at the intersection of Britannia Road and Fourth Line. Today, the settlement features a small grouping of nineteenth and twentieth century residences, neighbouring farm complexes, and churches. According to the Town of Milton, Omagh is the largest and most significant of the historic settlements that remain from the former Township of Trafalgar and are recommending that it be designated as a Heritage Conservation District
CHL 24	Farmscape	10720 Britannia Road	The farmscape is comprised of an early-twentieth century farmhouse, a gable barn, silo and various other outbuildings, as well as landscape features evocative of early agricultural land use. The farmhouse features a two-and-a-half storey scale, a solid brick construction, a hipped roof with an eyebrow dormer (also known as a witch's eye), a symmetrical three-bay front façade with a centrally-located enclosed porch, and potentially original three-over-one pane windows. The house features an extensive, modern rear addition. The barn sits on stone foundations and features vertical board siding. The gravel driveway is lined with established trees. A farmhouse and orchard associated with William Ford is illustrated at this location on the 1877 atlas map.

Feature	Type	Location	Description
CHL 25	Farmscape	5691 Fifth Line	The farmscape, presently known as Fairford Farm, is comprised of an early twentieth-century farmhouse, a large gambrel barn, silos, and various other agricultural outbuildings, as well as landscape features evocative of early agricultural land use. The farmhouse, which is characterized by Arts and Crafts architectural details, features a one-an-a-half storey scale, brick construction and/or veneer, a side gable roof with a large front gable dormer, a covered veranda, and chimneys at each gable end. The large gambrel barn sits on stone foundations and all outbuildings appear to be in excellent condition. Established trees line the gravel drive and the post and wire fence features a concrete corner post topped with a decorative angled cube. A farmhouse with orchard associated with James C. Earl is illustrated on the 1877 atlas map. While the large agricultural property extends to, and along, Britannia Road, the built structures are located approximately 250 m from the right-of-way.
CHL 26	Farmscape	6063 Fifth Line	The farmscape is comprised of a large residential complex, a number of gable barns, a large orchard, agricultural fields, and other landscape features evocative of early settlement and agricultural land use. The residential structure seems to be comprised of two separate houses that have been connected by a third, single-storey section. The eastern part of the residence is a one-and-a-half storey Ontario Gothic house with a centre gable and a covered veranda. The western part of the residence is a two-storey, vernacular structure with an L-shaped footprint and a cross gable roof. The barn complex features a gambrel barn and at least three gable barns, all with metal roofs and vertical board siding. A few mature trees are located near the built structures. A farmhouse with orchard associated with Robert Bigger is illustrated on the 1877 atlas map. The property currently operates as the Willis Family Fruit Farm and Market. While the large agricultural property extends to, and along, Britannia Road, the built structures are located approximately 250 m from the right-of-way.
CHL 27	Roadscape	Fifth Line	Historically, Fifth Line forms the road allowance between Concessions V and VI in the Township of Trafalgar North. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by active farmsteads both north and south of Britannia Road.
CHL 28	Roadscape	Sixth Line	Historically, Sixth Line forms the road allowance between Concessions VI and VII in the Township of Trafalgar North. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by active farmsteads both north and south of Britannia Road.
CHL 29	Historic Settlement	Drumquin – Britannia Road and Trafalgar Road	The historic crossroads community of Drumquin, which was founded around 1820, developed at the intersection of what is now Britannia Road and Trafalgar Road. Today, the historic settlement features a small grouping of nineteenth and twentieth-century residences, adjacent farmsteads, and a modern gas station.
CHL 30	Remnant farmscape	6119 Trafalgar Road	The remnant farmscape at 6119 Trafalgar Road is located on the high tablelands on the east bank of Sixteen Mile Creek (east branch), and is effectively shielded from the road through a combination of topography and vegetation. According to the Town of Milton, the structure(s) on this property might have been previously demolished. The large agricultural property, which extends to and along Britannia Road, features at least one extant outbuilding with a gable roof clad in metal sheeting, a winding gravel driveway with a gate, post-and-wire fencing, part of Sixteen Mile Creek, and large open fields. At the time of the field assessment, an excavator was parked on the site. The driveway leading to the remnant built structure(s) is located approximately 375 m from Britannia Road. A farmhouse and orchard associated with William Hood are illustrated at this location on the 1877 atlas map.
CHL 31	Farmscape	13875 Britannia Road	The farmscape is comprised of two residences, a large gable barn and other agricultural outbuildings, an orchard, agricultural fields, and other landscape features evocative of early agricultural land use. One of the farmhouses was constructed around the 1920s in the Arts and Crafts style (top photo) and features a one-and-a-half storey scale, a side gable roof with a large front gable dormer, a covered veranda, and chimneys at both gable ends. The other farmhouse (middle photo) features a two-storey frame dwelling with a single-storey rear accretion. The scale and visible material fabric of the latter could suggest a more recent construction date. However, it's location on the landscape in relation to the gable barn and its T-shaped footprint are evocative of late-nineteenth century residential development patterns. An orchard, but no farmhouse, is illustrated at this approximate location on the 1877 atlas map.
CHL 32	Roadscape	Eighth Line	Historically, Eighth Line forms the road allowance between Concessions VIII and IX in the Township of Trafalgar North. The roadscape is characterized by a narrow, two-lane paved road with little to no shoulders and shallow ditches. It is framed by active farmsteads both north and south of Britannia Road.
CHL 33	Roadscape	Britannia Road	Historically, Britannia Road forms the road allowance between Lots 5 and 6 in the Township of Trafalgar North. Generally, the roadscape is characterized by a narrow, two-lane paved road with gravel shoulders and shallow ditches. In some areas, the right-of-way has been improved, such as at the intersection of more major north-south routes such as Trafalgar Road, James Snow Parkway, and Regional Road 25. The landscape it travels through is one generally characterized by active farmsteads dating to the nineteenth and early twentieth centuries. It also intersects three historic settlements and crosses two branches of Sixteen Mile Creek.
CHL 34	Waterscape	Sixteen Mile Creek, two branches	The various branches of Sixteen Mile Creek flow southward through the Region of Halton into Lake Ontario in Oakville. As early settlement tended to take place in the vicinity of waterways, Sixteen Mile Creek is historically associated with the agricultural settlement of the land in the former Township of Trafalgar and continues to contribute to the character of the existing rural agricultural landscape.

4.7. Utilities & Services

Milton Hydro lines run along the north and south side of Britannia Road within the study limits along with overhead Bell Canada cable lines. Union Gas pipeline is present along the south side of Britannia Road as well. Rogers Communications has buried and aerial fiber/coax throughout the Britannia Road corridor.

Prior to detailed design, utility locates should be completed to confirm the size, type and alignment of all above ground and buried utilities within the study area.

As Britannia Road is currently located outside of the urban area boundary, there are no existing municipal services (i.e. watermain, sanitary sewer) within the ROW.

4.8. Access

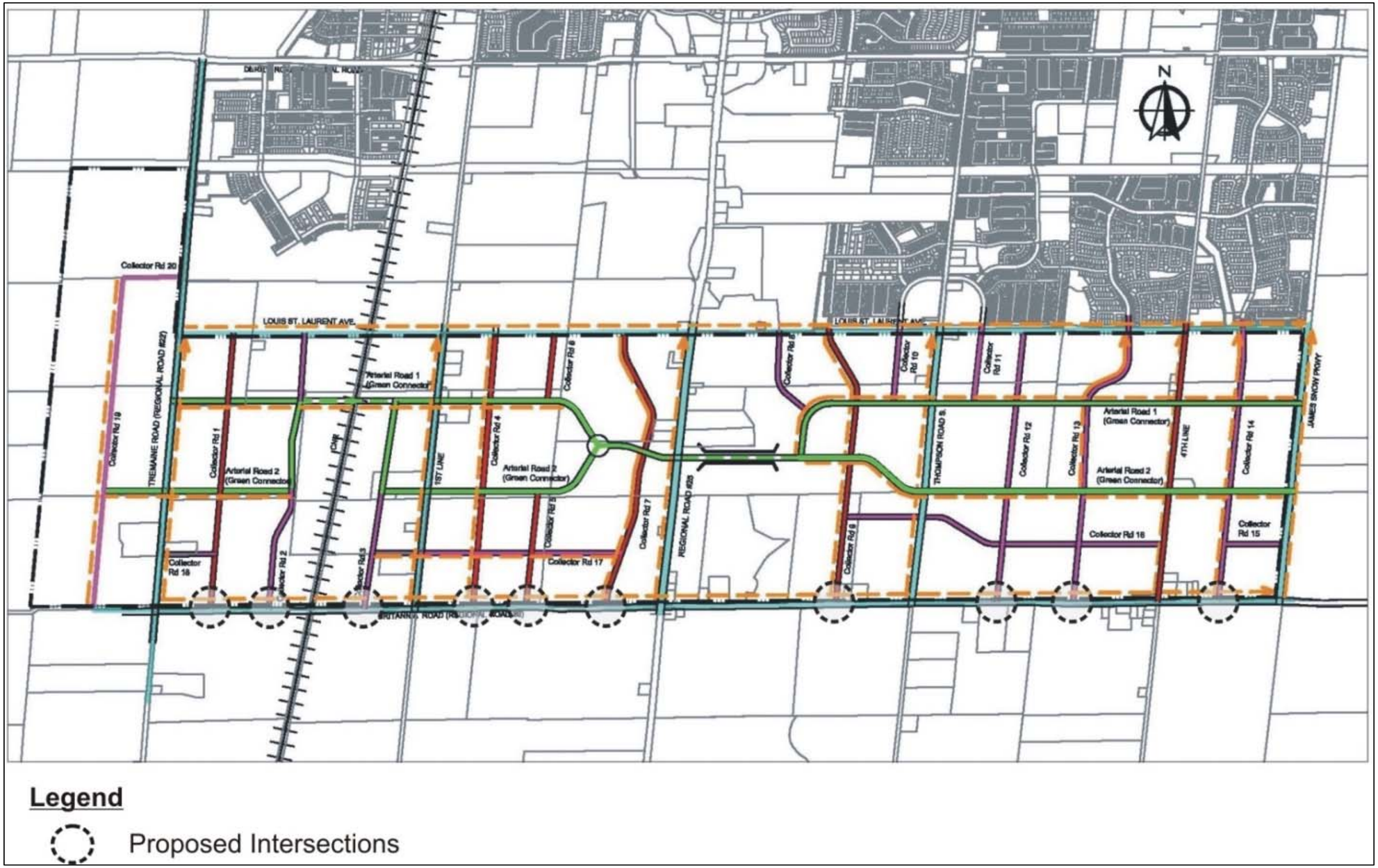
There are a number of residential driveways providing access to Britannia Road from existing residences/farmland on both the north and south sides of the corridor. As identified in Section 4.1.1, there are also a number of commercial, recreational and institutional properties providing access to Britannia Road along the study corridor and 11 existing intersections.

As part of the Boyne Secondary Plan area, 10 new intersections are proposed along the corridor (specific locations to be determined at such time as the lands develop). The proposed locations of these intersections are illustrated in **Figure 4-8.**

4.9. Illumination

There is currently no illumination provided along the midblock portions of Britannia Road. Most of the intersections have partial illumination, with full illumination at James Snow Parkway.

Figure 4-8: Proposed Intersection Locations within the Boyne Secondary Plan Area



Source: Boyne Survey Secondary Plan and Milton Education Village Transportation Strategy Report, Final Draft, December 2010

5.0 ALTERNATIVE DESIGN CONCEPTS FOR PREFERRED SOLUTION

Under Phase 3 of the Class EA, a range of design concepts that might be adopted to implement the preferred solution (as identified in Phase 2) are identified and evaluated based on functionality and impacts to the surrounding environment. The recommended design is then presented to the public, stakeholders and agencies to solicit input into the selection of the "preferred design". Similar to the process followed during Phase 2 of the study, the *EA Act* requires that all reasonable design concepts, including the "Do Nothing" alternative, be considered during the decision making process. For this study, the design concepts that were considered focused on (1) the Britannia Road corridor cross section and road widening requirements (2) minimizing impacts on the historic community of Omagh (3) crossing requirements for the CN railway west of Tremaine Road and (4) stormwater management techniques.

5.1. Britannia Road Cross Section Requirements

The *Halton Transportation Master Plan (2031) - The Road to Change*, identifies Britannia Road as an urban arterial roadway requiring a 47m ROW. As per the TMP, this cross section includes 6x3.5m travel lanes, 5m median, 2x1.8m bike lanes, as well as protection for 2x3.0m multi-use paths and 3.0m boulevards (see typical cross section in **Figure 5-1**) as part of the ultimate configuration required by 2031.

A 4-lane interim design consisting of 4x3.5m travel lanes, 5m median, 2x1.8m bike lanes, as well as protection for 2x3.0m multi-use paths and 3.0m boulevards is proposed for the section of Britannia Road extending from Regional Road 25 to Highway 407 (see typical cross section in **Figure 5-2**). These were utilized in the subsequent development of road widening and corridor alignment options for Britannia Road.

5.2. Alternative Widening Options for Britannia Road

With the cross section requirements for the Britannia Road corridor already established through the TMP and transportation analysis completed as part of the EA, alternative road widening options to accommodate a 47 m ROW for the Britannia Road corridor were developed. The alternatives that were considered are described in the text below.

Alternative 1 – Do-Nothing

The do-nothing scenario is included as an alternative to act as a base-line for comparison purposes, as per the EA Act. In the do-nothing alternative, the existing transportation system is not changed. Although this alternative does not address the problem statement, it was carried forward for further evaluation, primarily for comparison purposes.

Figure 5-1: Ultimate Typical Cross Section

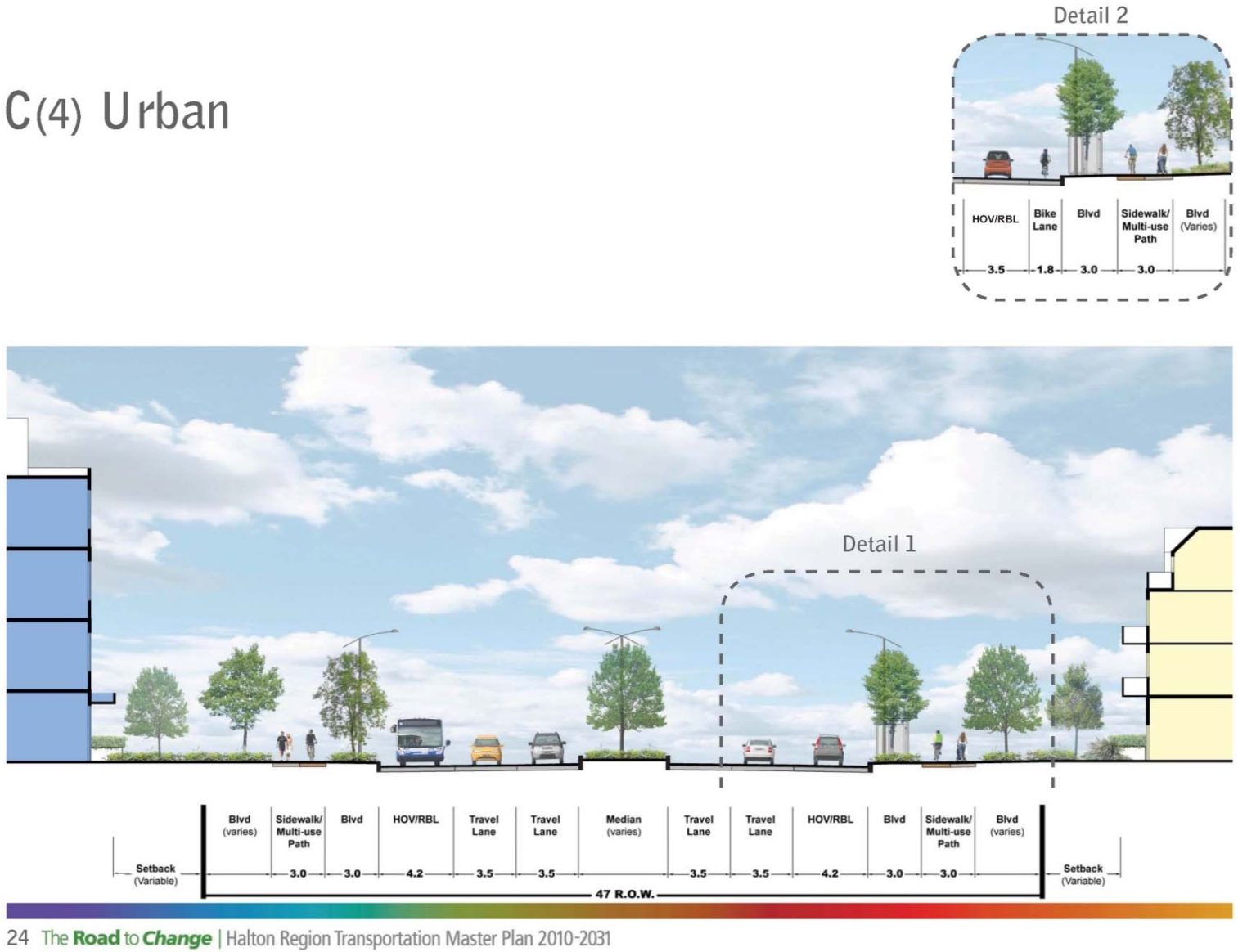


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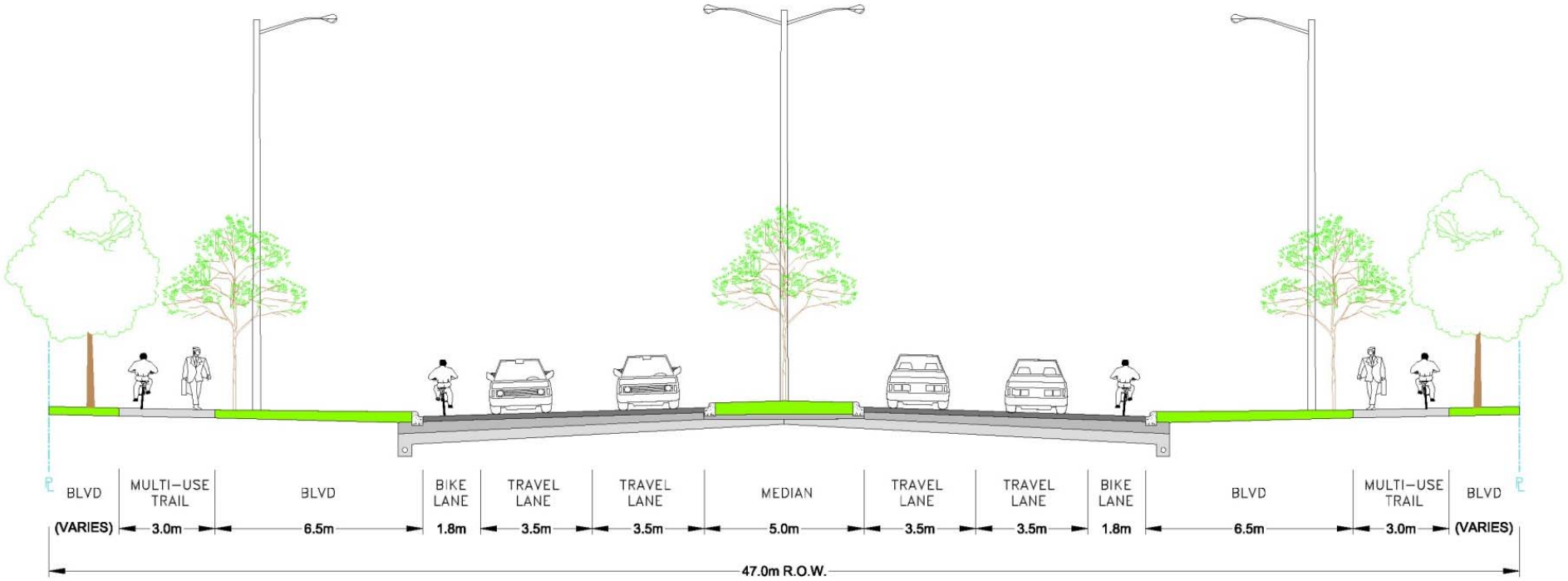
Figure 5-2: Interim Typical Cross Section



Alternative 2 – Symmetrical Widening

This alternative considered a symmetrical widening about the centerline of the existing road. As previously identified, a 47m ROW is required, and as such the new ROW limits would extend 23.5m from either side of the centerline of the existing road.

Alternative 3 – Widening to the North

This alternative considered widening to the north of the existing ROW only. The limits of the existing ROW on the south would remain, with the proposed 47m ROW extending to the north from this limit.

Alternative 4 – Widening to the South

Similar to Alternative 3, this alternative considered widening to the south of the existing ROW only. The limits of the existing ROW on the north would remain, with the proposed 47m ROW extending to the south from this limit.

Alternative 5 – Combination of Alternatives 2, 3 and 4

This alternative considered widening the existing ROW along both the north and south sides of Britannia Road, but varying the alignment of the ROW to minimize the impacts to the adjacent properties or significant features (natural, archeological, buildings, etc.). In areas where the proposed cross-section would result in significant impacts to lands on both sides of the existing ROW a modified cross-section would be considered to maintain the multi-modal elements but reduce other features (e.g. median, boulevards, etc.). These would be customized to specific areas, where warranted.

5.2.1. Design Criteria

In accommodating a widened 47 m ROW for Britannia Road, various design criteria were developed to ensure consistent design standards were used throughout. The design criteria were developed based on *Transportation Association of Canada* (TAC) standards as well as the Region's design standards in consultation with the project team. Design criteria were developed for various road classifications (i.e. major arterial, minor arterial, local) and considered items including, but not limited to; design and posted speeds, horizontal and vertical alignments, cross section and ROW widths. The design criteria sheet containing key design requirements for the Britannia Road improvements is provided in **Appendix H**.

5.2.2. Evaluation Criteria for Britannia Road Widening

The evaluation criteria developed in Phase 2 of the EA process for evaluating the alternative planning solutions (see Section 3.2) were also used to assess and compare each of the alternative design concepts. However, during this phase of the study, the key categories included the transportation/technical, cultural, natural and socio-economic environments. For the purpose of the evaluation in this phase of the Class EA study, the cost criterion was included under the 'transportation/technical' category.

5.2.3.Evaluation of Britannia Road Widening Options

The evaluation of the alternative options for implementing a widened Britannia Road cross section was completed using the evaluation criteria previously developed. The goal of the evaluation was to develop a solution for the subject portion of Britannia Road that meets the requirements of the problem statement, while minimizing impacts to the environment, as defined in the *EA Act*. An evaluation table was developed to provide a summary of the evaluation and is presented in **Table 5-1**.

Table 5-1: Evaluation of Alternative Options for Widening the Britannia Road Corridor

CATEGORY	CRITERIA	ALTERNATIVE 1 (DO NOTHING)	ALTERNATIVE 2 (SYMMETRICAL WIDENING)	ALTERNATIVE 3 (WIDEN TO THE NORTH)	ALTERNATIVE 4 (WIDEN TO THE SOUTH)	ALTERNATIVE 5 (COMBINATION OF ALTERNATIVES 2, 3 AND 4)
Transportation / Technical	• Roadway Performance • Roadway Safety • Other Modes • Network Continuity • Commercial Vehicles • Emergency Services • Planning Objectives • Utility Relocations • Construction and Property Costs	× No improvements to existing roadway. Does not meet the technical criteria. × Reduced travel time reliability × Does not adequately accommodate alternative modes of travel (e.g. transit, cyclists, pedestrians) × Does not support the goals of the Region's TMP ✓ No capital or property cost associated with road widening × Increased operational and maintenance cost	✓ Meets technical objectives of the study (e.g. roadway geometrics, capacity requirements) ✓ Accommodates alternative modes of travel (e.g. transit, cyclists, pedestrians) ✓ Addresses requirements of commercial and EMS vehicles ✓ Meets the transportation corridor objective for additional capacity and improved network continuity of the TMP • Utility relocations required × Significant capital and property costs to implement	✓ Meets technical objectives of the study (e.g. roadway geometrics, capacity requirements) ✓ Accommodates alternative modes of travel (e.g. transit, cyclists, pedestrians) ✓ Addresses requirements of commercial and EMS vehicles ✓ Meets the transportation corridor objective for additional capacity and improved network continuity of the TMP • Utility relocations required × Significant capital and property costs to implement	✓ Meets technical objectives of the study (e.g. roadway geometrics, capacity requirements) ✓ Accommodates alternative modes of travel (e.g. transit, cyclists, pedestrians) ✓ Addresses requirements of commercial and EMS vehicles ✓ Meets the transportation corridor objective for additional capacity and improved network continuity of the TMP • Utility relocations required × Significant capital and property costs to implement	✓ Meets technical objectives of the study (e.g. roadway geometrics, capacity requirements) ✓ Accommodates alternative modes of travel (e.g. transit, cyclists, pedestrians) ✓ Addresses requirements of commercial and EMS vehicles ✓ Meets the transportation corridor objective for additional capacity and improved network continuity of the TMP • Utility relocations required • Significant capital costs and moderate (reduced) property costs
Cultural Environment	• Effects on Archaeological, Cultural Landscape and/or Built Heritage Resources	✓ No impacts.	• Potential archaeological impacts in previously undisturbed areas to be determined via a Stage 2 Archaeological Assessment during detailed design × Significant impacts to cultural heritage landscape and built heritage resources adjacent to Britannia Road	• Potential archaeological impacts in previously undisturbed areas to be determined via a Stage 2 Archaeological Assessment during detailed design × Significant impacts to cultural heritage landscape and built heritage resources adjacent to Britannia Road on the north side (e.g. 19th and 20th century residences, commemorative cairn, historic Drumquin structures, etc)	• Potential archaeological impacts in previously undisturbed areas to be determined via a Stage 2 Archaeological Assessment during detailed design • Moderate encroachment into cultural heritage landscape resources adjacent to Britannia Road on the south side	• Potential archaeological impacts in previously undisturbed areas to be determined via a Stage 2 Archaeological Assessment during detailed design ✓ Least amount of impacts to cultural heritage landscape and built heritage resources
Natural Environment	• Vegetation Impact • Wildlife and Habitat Impact • Special Designation Areas • Fish Community/Habitat • Ground Water Impacts • Surface Water Impacts • Air Quality • Natural Hazards	✓ No impacts.	Moderate to significant impacts to terrestrial features on both sides of the corridor. Potential impacts include: × Moderate to significant impacts to significant wildlife habitat (i.e. Western and Eastern woodlands) and marsh habitat that contains breeding habitat for western chorus frog and wood-pewee • Moderate impacts to flora and vegetation communities at East and Main Branch of Sixteen Mile Creek × Impacts to roadside trees (e.g. removals, damage, etc.) • Moderate amount of wetland removed in meadow marsh communities located along the north portion of the corridor between Eighth Line and the Eastern Woodland west of Highway 407, and the south portion of the corridor at crossing nos. 2 and 3. • Salt and light impacts as a result of increased traffic • Moderate removal of Bobolink edge habitat and Barn Swallow foraging	Significant impacts to terrestrial features on the north side of the corridor. Potential impacts include: × Significant encroachment into significant wildlife habitat (i.e. Eastern woodland) × Significant impacts to flora and vegetation communities north of the East Branch of Sixteen Mile Creek (regionally significant species include two rare species: hard-stemmed bulrush (*Scirpus acutus*) and American bur-reed (*Sparganium americanum*) × Impacts to roadside trees (e.g. removals, damage, etc.) along the north portion of the corridor × Significant amount of wetland (≥10m) removed in meadow marsh community along the north portion of the corridor between Eighth Line and the Eastern Woodland west of Highway 407 • Salt and light impacts as a result of increased traffic × Significant removal of Bobolink habitat and Barn Swallow foraging	Significant impacts to terrestrial features on the south side of the corridor. Potential impacts include: × Significant encroachment into significant wildlife habitat (i.e. Western woodland) and marsh habitat that contains breeding habitat for western chorus frog and wood-pewee × Significant impacts to flora and vegetation communities south of the Main Branch of Sixteen Mile Creek (e.g. Provincially rare Hickory forest) × Impacts to roadside trees (e.g. removals, damage, etc.) along the south portion of the corridor × Significant amount of wetland (≥10m) removed in meadow marsh community along the south portion of the corridor at crossing nos. 2 and 3 • Salt and light impacts as a result of increased traffic × Significant removal of Bobolink habitat and Barn Swallow foraging habitat.	Potential impacts to terrestrial natural heritage features are not anticipated to be significant as the proposed road alignment shifts away from more sensitive natural heritage features. Potential impacts include: ✓ Limited impacts to significant wildlife habitat (i.e. Western woodland) ✓ Limited impacts to flora and vegetation communities at East and Main Branch of Sixteen Mile Creek × Impacts to roadside trees (e.g. removals, damage, etc.) ✓ Limited (≤10 m) amount of wetland removed in meadow marsh communities located along the north portion of the corridor between Eighth Line and the Eastern Woodland west of Highway 407, and the south portion of the corridor at crossing nos. 2 and 3. • Salt and light impacts as a result of increased traffic ✓ Impacts to Bobolink include removal of no more than 10m of edge habitat The greatest potential for impacts are to the two permanent watercourses (Main

CATEGORY	CRITERIA	ALTERNATIVE 1 (DO NOTHING)	ALTERNATIVE 2 (SYMMETRICAL WIDENING)	ALTERNATIVE 3 (WIDEN TO THE NORTH)	ALTERNATIVE 4 (WIDEN TO THE SOUTH)	ALTERNATIVE 5 (COMBINATION OF ALTERNATIVES 2, 3 AND 4)
			habitat. The greatest potential for aquatic impacts are to the two permanent watercourses (Main and East branches of Sixteen Mile Creek) and include: • Removal of vegetation from riparian areas; • Downstream sedimentation, and; • Addition of deleterious substances into the watercourse. Impacts to seasonal and contributing aquatic habitat would be limited to the removal of vegetation from riparian areas. • Potential reduction in air quality resulting from the proposed road widening would be mitigated through air quality management initiatives identified in the *Transportation Master Plan (2031) – The Road to Change* (identified in Section 8.2.4) • Impacts from natural hazards (e.g. flooding and erosion due to road widening) would be mitigated	habitat. The greatest potential for aquatic impacts are to the two permanent watercourses (Main and East branches of Sixteen Mile Creek) and include: • Removal of vegetation from riparian areas; • Downstream sedimentation, and; • Addition of deleterious substances into the watercourse. Impacts to seasonal and contributing aquatic habitat would be limited to the removal of vegetation from riparian areas. • Potential reduction in air quality resulting from the proposed road widening would be mitigated through air quality management initiatives identified in the *Transportation Master Plan (2031) – The Road to Change* (identified in Section 8.2.4) • Impacts from natural hazards (e.g. flooding and erosion due to road widening) would be mitigated	The greatest potential for aquatic impacts are to the two permanent watercourses (Main and East branches of Sixteen Mile Creek) and include: • Removal of vegetation from riparian areas; • Downstream sedimentation, and; • Addition of deleterious substances into the watercourse. Impacts to seasonal and contributing aquatic habitat would be limited to the removal of vegetation from riparian areas. • Potential reduction in air quality resulting from the proposed road widening would be mitigated through air quality management initiatives identified in the *Transportation Master Plan (2031) – The Road to Change* (identified in Section 8.2.4) • Impacts from natural hazards (e.g. flooding and erosion due to road widening) would be mitigated	and East branches of Sixteen Mile Creek) and include: • Removal of vegetation from riparian areas; • Downstream sedimentation, and; • Addition of deleterious substances into the watercourse. Impacts to seasonal and contributing habitat would be limited to the removal of vegetation from riparian areas. • Potential reduction in air quality resulting from the proposed road widening would be mitigated through air quality management initiatives identified in the *Transportation Master Plan (2031) – The Road to Change* (identified in Section 8.2.4) • Impacts from natural hazards (e.g. flooding and erosion due to road widening) would be mitigated
Socio-Economic Environment	• Direct Property Impacts • Compatibility with Area Land Uses • Business Access Impact • Noise Impact • Illumination Impact • Visual/Aesthetic Impact • Construction Disruption	× Significant impacts including air and noise quality due to increasing congestion over time × Reduced travel time reliability and transportation access to area properties	• Property impacts would be shared equally between both sides of the roadway corridor • Moderate potential for noise impacts greater than 5 dBA on noise sensitive areas adjacent to the existing corridor • Moderate potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor • Temporary disruption (noise, access, dust) to residents adjacent to the roadway corridor due to construction.	× Significant impacts to agricultural, residential (including displacement), recreational, commercial and institutional properties (including displacement) along the north side of the roadway corridor × Significant potential for noise levels to exceed 60 dBA on noise sensitive areas to the north of, and adjacent to, the existing corridor × Significant potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor on the south side • Temporary disruption (noise, access, dust) to residents adjacent to the roadway corridor due to construction.	× Significant impacts to agricultural, residential (including displacement) and commercial properties (including business disruption – ie. loss of parking) along the south side of the roadway corridor × Significant potential for noise levels to exceed 60 dBA on noise sensitive areas to the south of, and adjacent to, the existing corridor × Significant potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor on the south side • Temporary disruption (noise, access, dust) to residents adjacent to the roadway corridor due to construction.	✓ Adjusted ROW and alignment reduces impacts to adjacent properties. Property impacts would be shared/mitigated between both sides of the roadway corridor ✓ Noise levels are not expected to exceed 60 dBA on noise sensitive areas adjacent to the existing corridor • Potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor would be minimized • Temporary disruption (noise, access, dust) to residents adjacent to the roadway corridor due to construction.
Recommendation		Not Recommended	Not Recommended	Not Recommended	Not Recommended	**Recommended**

✓ Most Preferred • Somewhat Preferred × Least Preferred

5.2.4. Selection of Preferred Option for Widening Britannia Road

Based on the results of the evaluation, including consultation with stakeholders and technical agencies, the study team selected Alternative 5 as the preferred alternative for accommodating the widened cross section for Britannia Road. By varying the alignment of the ROW to the north or south, depending on the constraints within the corridor, this alternative would minimize impacts to adjacent properties and significant features (natural, archeological, buildings, etc.). As stated earlier, in areas where the proposed cross-section would result in significant impacts to lands on both sides of the existing ROW, a modified cross-section would be considered while still maintaining the multi-modal elements. These would be customized to specific areas, where warranted.

5.3. Alternative Corridor Alignments Through Omagh

The community of Omagh, located at the intersection of Britannia Road and Fourth Line, is the largest and most significant of the old historic villages that remain in Milton from the former Township of Trafalgar. The village retains many heritage buildings and its traditional character. Omagh is comprised of approximately 16 residential properties, a church, a baseball diamond, and is surrounded by farm lands (including an operating beef farm on the north-west quadrant). The existing ROW width is 20m with many of the buildings in close proximity to the existing ROW. Accommodating the required 47m ROW in this area could therefore result in significant impacts to a number of residences and buildings of cultural heritage significance, including the church property and adjacent cemetery.

To minimize impacts through the Omagh community, alternative alignments for the roadway corridor were considered at this location, building on the preferred design concept selected for Britannia Road (Alternative 5 – widening the existing ROW along both the north and south sides of Britannia Road and varying the alignment of the ROW to minimize the impacts to adjacent properties or significant features). These alternatives are further described below and illustrated in **Figure 5-3**.

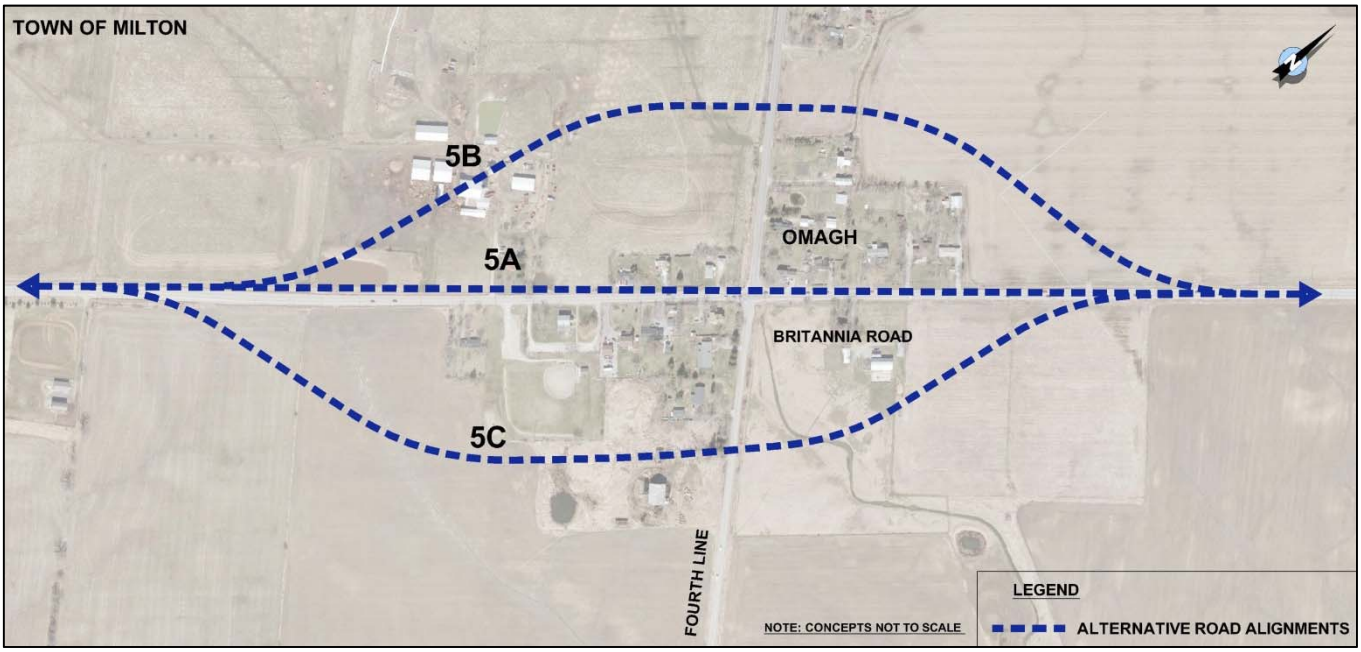
Alternative 5A - Follow Existing ROW Through Omagh

The road alignment would follow the existing ROW through the community of Omagh. In accordance with the established cross section requirements and preferred option to accommodate the widened Britannia Road corridor (Alternative 5), the road alignment would deviate from the centreline of the existing road in an attempt to minimize impacts to properties / natural environment / cultural heritage features, etc.

Alternative 5B - Bypass Omagh to the North

The road alignment would bypass the community of Omagh to the north of the existing road.

Figure 5-3: Alternative Corridor Alignments Through Omagh



Alternative 5C - Bypass Omagh to the South

The road alignment would bypass the community of Omagh to the south of the existing road.

5.3.1. Evaluation Criteria for Alternative Corridor Alignments Through Omagh

The evaluation criteria developed in Phase 2 of the EA process for evaluating the alternative planning solutions (see Section 3.2) were also used to assess and compare each of the alternative corridor alignments through Omagh. However, during this phase of the study, the key categories included the transportation/technical, cultural, natural and socio-economic environments. For the purpose of the evaluation in this phase of the Class EA study, the cost criterion was included under the 'transportation/technical' category.

5.3.2. Evaluation of Alternative Corridor Alignments Through Omagh

The evaluation of the alternative Britannia Road corridor alignments developed for the Community of Omagh is presented in **Table 5-2**.

Table 5-2: Evaluation of Alternative Omagh Alignments

CATEGORY	CRITERIA	ALTERNATIVE 5A (FOLLOW EXISTING ROW THROUGH OMAGH)	ALTERNATIVE 5B (BYPASS OMAGH TO THE NORTH)	ALTERNATIVE 5C (BYPASS OMAGH TO THE SOUTH)
Transportation / Technical	• Roadway Performance • Roadway Safety • Other Modes • Network Continuity • Commercial Vehicles • Emergency Services • Planning Objectives • Utility Relocations • Construction and Property Costs	× In order to protect the significant cultural and heritage features in the Omagh Community, the resulting roadway does not meet technical objectives × cannot accommodate all modes of transportation × cannot accommodate required intersection geometry × cannot accommodate private accesses × cannot accommodate ultimate roadway cross section. × Significant construction costs. × Significant cost to purchase residential and institutional property.	✓ Roadway meets technical objectives (capacity, safety, geometrics etc.). × Significant construction costs. × Significant cost to purchase entire farming operation north of Britannia Road.	✓ Roadway meets technical objectives (capacity, safety, geometrics etc.). × Significant construction costs. • Moderate impacts to existing rural/agricultural property to the south of Omagh community. • Property costs for road corridor.
Cultural Environment	• Effects on Archaeological, Cultural Landscape and/or Built Heritage Resources	• Potential for impacts within previously undisturbed areas. Stage II archaeological assessment to be completed during detail design. × Significant impacts to built heritage and cultural heritage landscapes (potential to directly or indirectly impact 13 properties, including church and cemetery)	• Potential for impacts within previously undisturbed areas. Stage II archaeological assessment to be completed during detail design. • Moderate impacts to built heritage and cultural heritage landscapes (potential to directly or indirectly impact 5 properties).	• Potential for impacts within previously undisturbed areas. Stage II archaeological assessment to be completed during detail design. • Moderate impacts to built heritage and cultural heritage landscapes (potential to directly or indirectly impact 4 properties).
Natural Environment	• Vegetation Impact • Wildlife and Habitat Impact • Special Designation Areas • Fish Community/Habitat • Ground Water Impacts • Surface Water Impacts • Air Quality • Natural Hazards	× Removal of existing trees within the ROW. • Impacts to Bobolink habitat include removal of no more than 10 m from edge of hay fields. ✓ No removal of anthropogenic structures: no impacts to Barn Swallow breeding habitat. × Removal of vegetation from riparian areas. × Downstream sedimentation. × Addition of deleterious substances into the watercourse.	• Removal of trees adjacent to Fourth Line. × Removal of potential Bobolink breeding habitat × Removal of barns within the proposed ROW that may function as potential Barn Swallow breeding habitat. × Removal of vegetation from riparian areas. × Downstream sedimentation. × Additional impacts associated with constructing new crossings to the north.	× South bypass minimizes impacts to existing trees × Removal of potential Bobolink breeding habitat × Removal of vegetation from riparian areas. × Downstream sedimentation. × Additional impacts associated with constructing new crossings to the south.
Socio-Economic Environment	• Direct Property Impacts • Compatibility with Area Land Uses • Business Access Impact • Noise Impact • Illumination Impact • Visual/Aesthetic Impact • Construction Disruption	× Significant impacts to residential and institutional properties within the Omagh community, including possible displacement of residences. × The Village of Omagh has been identified as a Special Study Area based on its historical significance to the Town of Milton. A study is currently underway by the Town of Milton to identify and conserve the cultural heritage and character of the Omagh Community. × Significant potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor • Temporary disruption (noise, access, dust) to residents adjacent to the roadway corridor.	× Significant impacts to farming operation north of Omagh and would require purchase of entire cattle farm business as the alignment would bisect and render the working farm inoperable. • Alignment located within the Boyne Secondary Plan Area. • Moderate potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor ✓ Avoids significant property impacts and temporary disruptions due to construction (noise, access, dust) to residential and institutional properties in Omagh community.	• Moderate impacts to existing agricultural property to the south of Omagh community. Roadway alignment impacts northern limit of property. Farming operation can be maintained. • Alignment located within the future urban area (post 2021). • Moderate potential for visual intrusion and illumination impacts on properties adjacent to the existing corridor ✓ Avoids significant property impacts and temporary disruptions due to construction (noise, access, dust) to residential and institutional properties in Omagh community.
Recommendation		Not Recommended	Not Recommended	**Recommended**

✓ Most Preferred • Somewhat Preferred × Least Preferred

5.3.3. Selection of Preferred Omagh Alignment

Based on the results of the evaluation, including consultation with stakeholders and technical agencies, the study team selected alternative 5c (Bypass Omagh to the South) as the preferred Omagh alignment for Britannia Road. Alternative 5c complies with the Regional and Town of Milton's planning objectives by avoiding significant impacts to the Omagh community, avoids/minimizes impacts to Omagh's cultural and/or built heritage resources, and avoids significant impacts to existing business (i.e. farming) operations to the north. Although implementing this design concept would require the crossing of 2 watercourses south of the Omagh community, these impacts can be mitigated.

5.4. Alternative CN Rail Crossing Concepts

As identified in the transportation analysis, the CN railway crossing west of Tremaine Road meets the warrants for grade separation prior to 2021 (see Section 2.5.7). The three options considered were:

1. Maintain existing at-grade crossing (do-nothing)
2. Underpass (road under rail)
3. Overpass (road over rail)

5.4.1. Evaluation Criteria for CN Rail Crossing

Similar to the evaluation criteria that was used in selecting the recommended solution in Phase 2 and the recommended design concept for Britannia Road, the criteria used to evaluate the alternative rail crossing concepts were separated into four main categories: technical, socio-economic environment, natural environment and cost. A further breakdown of the actual criteria used in the evaluation is identified in the evaluation matrix table in **Table 5-3**.

5.4.2. Evaluation of Alternative CN Rail Crossing Concepts

The evaluation of the alternatives developed for the CN rail crossings was completed using the evaluation criteria previously developed. An evaluation matrix table was developed to provide a summary of the evaluation and is presented in Table 5-3.

Table 5-3: Evaluation of Alternative Railway Crossing Solutions

Criteria	Alternatives		
	Alternative 1 AT-Grade Rail Crossing	Alternative 2 Below Grade Crossing (Road Under Rail)	Alternative 3 Above Grade Crossing (Road Over Rail)
Technical			
Ability to accommodate future traffic operations	× Significant delay/congestion would occur whenever trains utilize the crossing	✓ No delay/congestion due to trains crossing intersection	✓ No delay/congestion due to trains crossing intersection
Ability to accommodate active transportation	× Significant delays to pedestrians and cyclists whenever trains utilize the crossing	✓ No delays to pedestrians and cyclists due to trains crossing ✓ Provides shelter from the elements (e.g. wind, rain, etc.) ✓ Minor changes to elevation for active transportation modes • Feeling of isolation within underpass (can be mitigated via incorporation of 'v' shape sidewalls and lighting features that can provide a safe, open and airy environment)	✓ No delays to pedestrians and cyclists due to trains crossing × Significant changes to elevation for active transportation modes × Overpass design may need to include sidewalls to limit wind nuisance and provide greater sense of security to cyclists. ✓ Open view of environment creates feeling of safety
Impact on safety	× Increased number of conflict points between users of Britannia Road and trains	✓ Eliminates conflict points between road users and trains	✓ Eliminates conflict points between road users and trains
Accommodates Region's planning objectives	× The cross product of vehicles and trains at the subject location warrants a grade separation by 2021. An at-grade crossing at this location would not support Policy 173 (31) of the Halton Region Official Plan, which supports the provision of a safe and efficient railway network through grade separations of railways and Arterial Roads where warranted	✓ Supports the Halton Region Official Plan's policy of providing a safe and efficient railway network for the movement of goods and people through the subject location	✓ Supports the Halton Region Official Plan's policy of providing a safe and efficient railway network for the movement of goods and people through the subject location
Ability to accommodate railway and roadway traffic during construction	✓ Minimal delay to railway traffic. Two-way vehicular traffic can be maintained through traffic staging/diversions	× Railway track diversion required to construct new underpass × Roadway detour would be required as part of structure construction ✓ Two-way vehicular traffic maintained through traffic staging / diversions	✓ New overpass can be constructed with minimal delay to railway traffic speeds and schedules × Roadway detour may be required as part of structure construction ✓ Two-way vehicular traffic maintained through traffic staging / diversions
Ability to meet Transport Canada requirements	× Does not meet future Transport Canada railway crossing requirements based on cross product of road/rail traffic	✓ Meets future Transport Canada railway crossing requirements based on cross product of road/rail traffic	✓ Meets future Transport Canada railway crossing requirements based on cross product of road/rail traffic
Socio-Economic Environment			
Noise impacts	• Future residential development will be required to mitigate both rail and roadway traffic noise	• Future residential development will be required to mitigate both rail and roadway traffic noise ✓ Moderate reduction of roadway noise due to vehicles driving below existing grade of surrounding land	• Future residential development will be required to mitigate both rail and roadway traffic noise × Higher noise impacts due to vehicles driving above existing grade of surrounding land
Visual aesthetics	• Visual impacts to adjacent properties would remain unchanged from existing	✓ Improved aesthetics as short section of road would be removed from sight • Building specifications including 'v' shape sidewalls and lighting features can serve to provide a safe, open and airy environment	• Poor aesthetics due to increased elevation of road can be partially mitigated through plantings and earth embankments ✓ Naturally lit and open view of surrounding environment.
Property impacts	✓ Can be accommodated within the 47m ROW	× Would require significant amount of property based on Regional OP (3.5 ha) • Temporary use of property would be required to construct roadway diversion	× Would require significant amount of property based on Regional OP (3.5 ha) • Temporary use of property would be required to construct roadway diversion
Natural Environment			
Impacts to natural features	✓ No additional impacts to natural features	✓ No additional impacts to natural features	✓ No additional impacts to natural features
Drainage impacts	✓ Storm water drainage can be achieved by gravity sewers	× Storm water drainage will need to utilize pumping station and forcemain, ongoing operation and maintenance required	✓ Storm water drainage can be achieved by gravity sewers
Cost			
Capital and ongoing maintenance costs	✓ Lower capital costs for road construction and rail crossing equipment	× Significant capital costs, including track relocation and roadway detour costs, plus operating and maintenance costs of pumping station	• Significant capital costs, including roadway detour costs
Recommendation	**Not Recommended**	**Not Recommended**	**Recommended**

✓ Most Preferred • Somewhat Preferred × Least Preferred

5.4.3. Selection of Preferred CN Rail Crossing Concept

Based on the results of the evaluation, including considerable consultation with technical agencies, the technically preferred alternative is Alternative 3 (Above Grade/Road over Rail Crossing) with a commitment to designing an aesthetically pleasing grade separation while taking into consideration t he accommodation of active transportation. Although Alternatives 2 and 3 rank similarly in terms of transportation, cultural and natural environment and property impacts, road over rail crossings are generally preferred by the rail authority, particularly from a capital and ongoing cost perspective, as they tend to reduce construction and maintenance costs and eliminate the need for track diversions during construction. Alternative 1 does not adequately address the technical criteria and would result in significant delays for road users and was therefore not recommended to be carried forward as a viable option.

5.5. Alternative Stormwater Management Techniques

A number of techniques to provide stormwater management control for the proposed Britannia Road improvements were considered:

1. *Infiltration / LID measures, including grassed swales/ditches or exfiltration systems.* There are several types of Low Impact Development (LID) stormwater management techniques which provide environmental benefits through infiltration of stormwater. Such techniques reduce runoff volumes and trap contaminants before discharging to the receiving streams. In addition to these water quality benefits, infiltration-type LID methods may also provide thermal benefits through heat transfer to the infiltration media, allowing stormwater runoff to cool. In the context of a road system, the techniques would be classified as "conveyance" controls, in which stormwater is infiltrated while being conveyed via the drainage system. This could include roadside swales/ditches, bio swales, or storm sewers designed to exfiltrate stormwater.

2. *Stormwater management ponds.* Stormwater ponds utilize a permanent pool of water to remove pollutants from stormwater runoff and have been found to be efficient in reducing particulate matter such as suspended solids, organic nutrients, heavy metals, and biological oxygen demand (BOD). A wet pond may also provide extended detention storage for erosion and flood control and can also enhance baseflow, thereby providing an opportunity to improve downstream aquatic habitat.

3. *Oil / grit separators.* These devices typically service small drainage areas associated with roadways or parking areas, and provide water quality control by trapping oils on the surface and settling heavy sediment.

5.5.1. Evaluation Criteria: Stormwater Management Techniques

The primary criteria used to evaluate the alternative stormwater management techniques included type of roadway cross section to be implemented (i.e. urban vs. rural), soil type, overall drainage area and quality control requirements.

5.5.2. Evaluation of Alternative Stormwater Management Techniques

Infiltration / LID Measures

Given that the road is to be designed with an urban cross-section with a curb and gutter / storm sewer system, opportunities to infiltrate stormwater runoff via roadside ditches are expected to be limited. Further, due to the predominantly impermeable clay soils in this region, opportunities to utilize storm sewer exfiltration techniques may be also be limited. On their own, such techniques are therefore not considered suitable for this area. Notwithstanding the above, opportunities to use LID methods in conjunction with other stormwater controls such as oil-grit separators (see below) should be explored as subsequent designs proceed, subject to feasibility and Region design standards. Priority would be given to those areas discharging to streams with more sensitive fisheries such as Silver Shiner.

Stormwater Management Ponds

A significant limitation in the use of stormwater ponds is the size of the contributing drainage area. The *MOE Stormwater Management Planning and Design Manual* suggests a minimum drainage area of at least 5 ha to 10 ha for stormwater ponds. This target is often difficult to achieve for a roadway drainage system consisting of a long, narrow catchment with frequent stream crossings and drainage divides. However, a portion of the Britannia Road study reach is adjacent to the Boyne Secondary Planning Area, where future urban development and associated stormwater ponds are planned. Therefore, there is an opportunity to overcome the drainage area limitations for Britannia Road by itself, by combining the future roadway drainage into the larger adjacent Boyne stormwater pond catchments.

Oil-Grit Separators

Oil-grit separators are recommended at the outlets from the storm sewer system for those segments of the road which will not be serviced by future adjacent stormwater ponds. This would include the area east of James Snow Parkway as well as the south bypass of Omagh.

5.5.3. Selection of Preferred Stormwater Management Techniques

Based on the results of the evaluation of the alternative stormwater management techniques, including consultation with technical agencies (e.g. Conservation Halton), the preferred stormwater management system for the subject portion of the Britannia Road corridor will include the use of stormwater ponds and oil-grit separators.

The timing of the Britannia Road improvements would be undertaken in consideration of development within the Boyne Secondary Plan Area. Therefore, the planning and design of the Britannia Road storm sewer drainage system should be undertaken to anticipate future connections to the proposed stormwater management ponds within the Boyne Secondary Plan Area. As such, for the portion of Britannia Road that is adjacent to the Secondary Plan area, the storm sewer system should be designed with outlets on the north side of the road. Further, sizing for future stormwater management ponds should include sufficient water quality and quantity storage to provide treatment for the future drainage from Britannia Road. It is assumed that the same water quality, erosion, and quantity control targets identified for lands in the Boyne Secondary Plan area would also be applied to any contributing lands from the Britannia Road right-of-way.

In addition to Level 1 water quality control, it is recommended that design of future stormwater ponds also include measures to minimize thermal impacts. Potential techniques which could be incorporated into the designs include bottom-draw outlet pipes, gravel trenches / french drains at the outfalls and shade plantings.

Oil-grit separators are recommended at the outlets from the storm sewer system for those segments of the road which will not be serviced by future adjacent stormwater ponds. This would include the area east of James Snow Parkway as well as the south bypass of Omagh. Devices within the study area should be sized to provide Level 1 water quality control. As noted above, opportunities to use LID methods to provide thermal benefits in conjunction with oil-grit separators should be explored as subsequent designs proceed, subject to feasibility and Region design standards. Priority would be given to those areas discharging to streams with more sensitive fisheries such as Silver Shiner.

Conceptual stormwater pond locations in the Boyne Secondary Plan Area (which are subject to further change and refinement) and the adjacent portion of Britannia Road which could potentially be serviced by these ponds are presented in Section 7.6.2 and further discussed in the *Hydraulic Analysis of Stream Crossing & Stormwater Management Alternatives Assessment* in Appendix C.

6.0 CONSULTATION

For the successful completion of this study, an effective public/stakeholder consultation process throughout the duration of the project was essential. A consultation plan was used to engage and inform stakeholders and members of the public about the study and to present them with opportunities throughout the project to provide their input. The goal of this plan was early issue identification and consensus building among stakeholders and the general public. Input received through the consultation process was reviewed and assessed for applicability and, where appropriate, refinements to the alternatives were made.

For the purposes of this report, records of all forms of correspondence with the public and technical agencies relevant to the study are provided in **Appendix I**.

6.1. Notice of Study Commencement

Following the guidelines of the Municipal Class EA (October 2000, as amended in 2007 and 2011) a "Notice of Study Commencement" was provided at the outset of the study. This notice was advertised in the *Milton Champion* and the *Halton Compass* on September 23, 2010 and September 30, 2010. The "Notice of Study Commencement" was also mailed to property owners within the study area, all identified technical agencies and stakeholders that might have an interest in this study, including first nations. The letter notice contained information on the study, including the planning process being followed and study contacts, and invited stakeholders to join the Britannia Road Technical Agency Committee (TAC) and/or Stakeholder Advisory Group (SAG). Copies of the notice of study commencement, agency letter, fax back form, stakeholder package, and contact list are provided in Appendix I.

6.2. Technical Agency Committee

At the onset of the study, a list of technical agencies that were considered to have an interest in this study, including regional and local municipal departments, provincial ministries, federal departments, the local conservation authority, and various utility companies were invited to join the Britannia Road TAC.

The invitation to join the TAC was sent out as part of the Notice of Study Commencement (see Section 6.1). Details of the TAC meetings held as part of the study are summarized in the text below. All TAC correspondence is provided in Appendix I. For ease of review, details of the study team's consultation with Conservation Halton throughout the study have also been summarized in Section 6.7.

Technical Agency Committee Meeting #1

The first TAC meeting was held on December 10, 2010. The purpose of this meeting was to provide members an opportunity to meet the study team, review the study scope and discuss issues related to the study.

The meeting was conducted in two parts, including a site visit and a formal meeting at the Conservation Halton offices. In the field, meeting attendees visited several areas of interest to Conservation Halton such as watercourse crossings of 16 Mile Creek. As part of the formal meeting, the attendees discussed the requirements outlined in the October 19th Letter from Conservation Halton. Discussion items included, but are not limited to, the following:

- *Ontario Regulation 162/06*, which requires that a Permit be obtained from Conservation Halton prior to development, interference with wetlands or alterations to shorelines and watercourses.
- Natural heritage features within the study area; including regulated wetlands, endangered or threatened species habitat, areas of natural and scientific interest, wildlife habitat, significant valley lands, significant woodlands, and the Sixteen Mile Creek Valley ESA.
- Fish habitat drainage features and hydrologic connections within the study area.
- Groundwater impacts and infiltration.
- Stormwater management/drainage quality/quantity/erosion controls.

Technical Agency Committee Meeting #2

The second TAC meeting was held on June 30, 2011. The purpose of the meeting was to discuss the results of the evaluation of the alternative planning solutions, as well as the preliminary alternative design concepts, prior to the second Public Information Centre (PIC).

Items that were discussed by the meeting attendees included:

- Options for improvements to Britannia Road, specifically as they pertain to natural heritage;
- The project team's work plan to address the natural heritage component of study; and
- Requirements for access to private property.

Technical Agency Committee Meeting #3

The third TAC/CH meeting was held on December 9, 2011. The purpose of the meeting was to provide the members an update of the study and a summary of the fieldwork and analysis completed to date by the study team.

At the meeting, the study team presented summaries of the natural environment, fluvial geomorphology and stormwater management and drainage works undertaken. Discussion primarily focused on the methodologies used, existing conditions within the study area and preliminary recommendations.

6.3. Stakeholder Advisory Group

At the onset of the study, a list of stakeholders that might have an interest in this study was compiled, including landowners, business owners, and local church congregations. A stakeholder package was mailed to these stakeholders, inviting them to participate in the study as a member of the Stakeholder Advisory Group (SAG). The invitation to join the SAG was sent out as part of the Notice of Study Commencement (see Section 6.1).

A total of 3 SAG meetings were held with invited stakeholders during the study. These meetings were each held approximately 3 weeks prior to the Public Information Centres. All SAG correspondence is provided in Appendix I.

Stakeholder Advisory Group Meeting #1

The first SAG meeting was held on December 6, 2010 at Halton Region. The purpose of the meeting was to meet the group members, provide them with the study background and explain the Class EA process. Members were encouraged to provide any comments or information that they had with regards to the study.

Representatives from the following groups attended the first SAG meeting:

- Omagh Presbyterian Church
- Sernas Transtech on behalf of the Boyne Survey Secondary Plan and Land Owners Group
- Omagh Church of Christ
- TMIG (Milton Phase 3 Land Owners)
- Piper's Heath Golf Club
- Trinison Management Corp.

Issues that were raised by the attendees included:

- Impacts to unmarked graves at cemeteries
- Impacts to heritage buildings
- Parking and access at Omagh Church of Christ
- Stormwater drainage.

Stakeholder Advisory Group Meeting #2

The second SAG meeting was held on June 6, 2011. The purpose of the meeting was to discuss the results of the evaluation of the alternative planning solutions, as well as the preliminary alternative design concepts, prior to the second PIC. Representatives from the following groups attended the second SAG meeting:

- Omagh Presbyterian Church
- Sernas Transtech on behalf of the Boyne Survey Land Owners Group
- Omagh Church of Christ
- TMIG on behalf of the Milton Phase 3 Land Owners
- Trinison Management Corp.
- BA Group on behalf of Fieldgate
- Matson, McConnel Ltd. on behalf of Sundial Homes
- York Trafalgar Corp.

At the meeting, several items were discussed, including:

- Request for a 4-lane alternative through Omagh be considered;
- Concern over noise attenuation requirements;
- Concern over adverse effects that bypasses may have on the existing Fourth Line intersection.

Stakeholder Advisory Group Meeting #3

The third Stakeholder meeting was held on December 6, 2011. The purpose of the meeting was to present and discuss the preliminary preferred design. Members of the SAG were encouraged to provide comments or general information that they had with regards to the study and its findings.

Representatives from the following groups attended the third SAG meeting:

- Omagh Presbyterian Church
- Sernas Transtech on behalf of the Boyne Survey Land Owners Group
- Omagh Church of Christ
- Piper's Heath Golf Club
- Trinison Management Corp.
- MTE Consultants on behalf of Trinison Management Corp. and Orianna Glenn Homes
- BA Group on behalf of Fieldgate
- Sundial Homes.

In addition to the invited SAG members, two additional landowners also attended the meeting.

Comments provided by the meeting attendees are summarized as follows:

- Impacts to baseball diamond from Alternative 5C
- Timing of construction and phasing of improvements
- Uneven widening between Third Line and Omagh
- Future servicing needs
- Traffic analysis results
- Agricultural land access.

6.4. Public Information Centres

Invitations to attend the PICs were sent to all study area property owners and advertised in the local newspapers to ensure all interested members of the public were provided reasonable notice of the upcoming PICs. This list was kept up to date and modified throughout the study.

The PICs planned for this study provided an opportunity for the public to:

- Meet the Project Team
- Review the work done to date
- Ask questions about the Study
- Provide feedback and comment on the work done to date.

Due to the length of time the EA process was anticipated to take, and the subsequent timeframe that would occur between the two mandatory PICs, the project team decided to include a third PIC to "bridge the gap" between the first and last PIC. The first two PICs were conducted utilizing an open house format, where display boards were provided for the attendees to review, and members of the project team were on hand to answer questions. A third PIC was held to provide the public with an additional point of contact and included a formal presentation. Comment sheets were provided at all PICs, providing the public an opportunity to submit their comments on the project. Within this framework, members of the public were provided a variety of opportunities for learning, sharing, and responding during the Class EA process.

All feedback received from these PICs were utilized in the subsequent phases of the study including the evaluation of the various alternatives and the development of supporting mitigation measures.

Correspondence pertaining to the PICs, including notification materials, display material, and submitted comment sheets are provided in Appendix I.

Public Information Centre #1

The first PIC for the Britannia Road Transportation Corridor Improvements Class Environmental Assessment (EA) Study was held on Wednesday, January 26, 2011 from 7:00 p.m. to 9:00 p.m. at Our Lady of Victory School in Milton. The Britannia Road Class EA PIC was jointly held in the same facility as the Tremaine Road Study PIC, however separate displays were provided for each study. Local area residents, property and business owners, and agencies were invited to attend the first PIC via regular mail and newspaper advertisements in the *Halton Compass* and *Milton Champion* on January 13 and 20, 2011.

The purpose of the PIC was to provide stakeholders, agencies and interested members of the public an opportunity to meet the Project Team, review the study scope and discuss issues related to the study including alternative solutions, environmental considerations and preliminary evaluation criteria.

The PIC was set up as a "drop-in" style information centre in which participants were encouraged to view the boards on display and to address their questions and concerns to members of the project team.

Information displays presented at the PIC included the following:

- Welcome
- Purpose Of The Public Information Centre
- Study Area
- Study Organization
- The EA Process
- Purpose Of The EA Study
- Existing Conditions – Transportation
- Existing Conditions – Collision Analysis/Safety
- Existing Conditions – Natural Environment – Watercourses
- Existing Conditions – Natural Environment – Terrestrial
- Existing Conditions – Socio-Economic Environment
- Existing Conditions – Cultural Heritage
- Existing Conditions – Archaeological Assessment
- Future Conditions – Land Use
- Future Conditions – Transportation
- Problem/Opportunity Statement
- Alternative Solutions

- Evaluation Criteria
- Next Steps
- Thank You For Attending The First PIC.

Those attending the PIC were requested to sign an attendance booklet and were encouraged to provide their written comments on the material presented.

Attendance at the PIC included 50 individuals signing the attendance booklet. 7 written comments were submitted at the PIC and 4 written comments were received subsequent to the PIC by mail and email. In addition, throughout the PIC, a number of discussions were held between the project team and the attendees. Verbal comments or questions raised during these discussions were addressed during the PIC and all attendees were also encouraged to submit their written comments.

The main concerns raised at the PIC were related to the impacts to individual properties, not only in terms of acquisitions, but also impacts to property value.

In terms of traffic and safety issues, attendees indicated that existing traffic conditions were an issue, resulting in high accident rates and low levels of service, and they felt that any widening would result in increased speeds, traffic volumes and additional collisions along the corridor. It was conveyed to attendees that recent traffic volumes were higher than normal due to the road construction work occurring on Derry Road, which resulted in motorists utilizing Britannia Road to bypass construction delays on Derry Road.

Access to owner's driveways resulting from the increased volume and speed of traffic was also identified as a concern. Further, one attendee indicated that truck traffic (which generally avoids Britannia Road due to the high volumes and long delays) may return if Britannia is widened. Some attendees offered suggestions that they felt would alleviate these issues, including extending James Snow Parkway southerly and creating a bypass around both Omagh and Drumquin to reduce impacts to those communities.

Additional comments were received regarding potential impacts to the natural environment. Several attendees were concerned that an increase in traffic volumes would result in impacts to air and water quality. Concern was also raised regarding impacts to the Bobolink habitat as a result of improvements to the corridor.

<u>Public Information Centre #2</u>

The second PIC for the Britannia Road Transportation Corridor Improvements Class Environmental Assessment (EA) Study was held on Wednesday, June 8, 2011 from 7:00 p.m. to 9:00 p.m. at the Milton Sports Arena. As per the first PIC, local area residents, property and business owners, and agencies were invited to attend PIC #2 by notification through regular mail and newspaper advertisements in the *Halton Compass* and *Milton Champion* on May 26, 2011 and June 2, 2011.

The purpose of the second PIC was to provide stakeholders, agencies and interested members of the public an opportunity to meet the study team, provide a summary of the first PIC, present the preferred alternative solution and alternative design concepts, and to provide an update on the ongoing technical studies.

The PIC was set up as a "drop-in" style information centre in which participants were encouraged to view the boards on display and to address their questions and concerns to members of the project team.

Information displays presented at the PIC included the following:

- Welcome
- Purpose Of The Public Information Centre
- Study Area
- The EA Process
- Study Organization
- Purpose Of The EA Study
- Information Presented At PIC #1
- Key Comments – Stakeholder/Technical Agencies And Public Consultation
- Technical Studies (Ongoing)
- Future Conditions – Land Use
- Future (2031) Conditions – Transportation
- Alternative Solutions
- Evaluation Of Alternative Solutions
- Preliminary Preferred Solution
- Halton Region's Transportation Master Plan (Ongoing)
- Alternative Design Concepts
- Alternative Design Concept Considerations
- Typical Cross Sections
- Next Steps
- Thank You For Attending The Second PIC.

Attendance at the PIC included 35 individuals signing the attendance booklet. 6 written comments were submitted at the PIC, while 12 comments were received subsequent to the PIC via mail and email. In addition, throughout the PIC, a number of discussions were held between the project team and the attendees. Verbal comments or questions raised during these discussions were addressed during the PIC and attendees were also encouraged to submit comments.

Comments received at, and following the PIC included support for and objections against the recommended and alternative alignments through Omagh; support for the widening of Britannia Road, additional turn lanes at intersections, bicycle lanes and a grade separation at the CN rail crossing. Concern over impacts to Bobolink habitat was also brought forward at the PIC.

Public Information Centre #3

The third PIC for the study was held on Wednesday, December 14, 2011 from 7:00 p.m. to 9:00 p.m. at the Boyne Community Centre in Milton. The PIC began with a presentation to the attendees, followed by an open house session where attendees were encouraged to view the materials on display and to individually address their concerns to the members of the study team. Local area residents, property and business owners, and agencies were invited to attend by notice sent by regular mail and newspaper advertisements in the *Milton Champion* on December 1, 2011 and December 8, 2011.

The PIC was held to provide an opportunity for members of the public to review the study findings, provide additional comments on the design alternatives and discuss any questions or concerns with representatives from the study team.

Information displays presented at the PIC included the following:

- Welcome;
- Purpose Of The Public Information Centre;
- Study Area;
- Study Organization;
- The EA Process;
- Purpose Of The EA Study;
- Information Presented At Previous PICs;
- Key Comments – Stakeholder/Technical Agencies And Public Consultation;
- Technical Studies (Completed);
- Future Conditions – Land Use;
- Alternative Design Concept Considerations;
- Alternative Design Concept Considerations-Omagh;
- Alternative Design Concepts;
- Preliminary Evaluation Of Alternative Designs;
- Preliminary Preferred Design;
- Roadway Construction Staging;
- Next Steps;
- Thank You For Attending the Third PIC.

Attendance at the third PIC included 42 individuals signing the attendance booklet. 2 written comments were submitted at the PIC, while 8 written comments were subsequently received by mail and email. In addition, throughout the PIC, a number of discussions were held between the project team and the attendees. Verbal comments or questions raised during these discussions were addressed during the PIC and all attendees were also encouraged to submit their written comments.

Of the comments submitted (both verbal and written), the majority of the attendees indicated that they were in agreement with the study team's preferred design. Additional comments received at the meeting included support for shifting of the road alignment at the Omagh bypass further south, away from the Omagh community.

It should be noted that subsequent to the third Public Information Centre, a number of refinements were incorporated into the preferred design to reflect additional consultation with property owners and technical agencies. These refinements are summarized as follows:

- Lengthening of the proposed bridge structures over Sixteen Mile Creek to allow for improved road geometry.
- Shift in road alignment to the south to avoid impacting trees along the front of Omagh Presbyterian Church.
- Shift in road alignment at the Omagh bypass to the south to avoid impacting the existing baseball diamond and residence.
- Shift in road alignment to the north at Terra Greenhouses to minimize impacts to the existing parking lot and introduction of a new signalized intersection. The signalized intersection would connect with the school and park on the north side of roadway.
- Narrowing of boulevards in the area of the west woodlot to minimize impacts on natural features.
- Transition in cross section from 8th Line to Highway 407. The preferred design for this section of Britannia Road consists of 4 through lanes, a 4m median, no bike lanes, 2.5m multi-use trail and reduced boulevards. This provided for a controlled transition into and out of the HOV lanes at Eighth Line. Since the need for the accommodation of cycling and pedestrian facilities across the Highway 407 interchange structure along Britannia Road has not been established at this time, the need for these facilities at this location will be reviewed in conjunction with the City of Mississauga.

A full description of the Preferred Design for the subject portion of Britannia Road is provided in Section 7.0.

6.5. Meetings with Individual Omagh Stakeholders

Prior to the identification of a preliminary preferred design, the project team identified a number of stakeholders/property owners that would be significantly impacted by the two bypass options being considered for the Omagh community (alternatives 5B and 5C). These properties are located at the intersection of Britannia Road and Fourth Line, within the Omagh community.

A number of meetings were held with stakeholders in late 2011 in order to discuss the alternatives proposed for the Omagh community. Information from these meetings was ultimately used by the study team in determining the preferred alternative. Following the evaluation and selection of the preferred design, meetings were again held with the representatives of the landowners that would be affected by the selected preferred design. Details of these meetings are provided below.

Property Meetings #1 (October 24 to November 1, 2011)

The study team requested individual meetings with these stakeholders/property owners to discuss the design alternatives that were developed prior to the project team's selection of the recommended alignment. At the meetings, the project details were introduced to the stakeholders and the alternative alignments developed for the Community of Omagh were presented, including a north bypass, a south bypass and a central alignment. These alternatives were based on a 47m ROW and 6 lane cross section. Meetings were held between October 24, 2011 and November 1, 2011.

A summary of the concerns that were brought forward at these meetings, by location (i.e. quadrant) are provided as follows:

- Northwest Quadrant
    - The owner of the farm on the property situated north of Britannia Road, west of Fourth Line identified that alternative 5b would impact the farm to an extent that continuing farming operations would not be possible. The property owner expressed concern that the section of the proposed ROW west of the bypass would unduly impact his property and requested a that more balanced taking of property from both sides of the existing ROW be considered.

- Northeast Quadrant
    - The property situated north of Britannia Road, east of Fourth Line. At the meeting, the property owner's representative requested that the study team consider an alignment that included a section that went through the Omagh community for a portion of the alignment, then swing north or south to minimize impacts to their lands and the properties within Omagh.

- Southeast Quadrant

- The property situated south of Britannia Road, east of Fourth Line. Comments provided by the property owner's representative included:
  - Preserve the buildings in Omagh, given they currently have no official heritage designation.
  - Opposed to the bypass alternatives, stating they would sterilize developable land.
  - Consider a reduced ROW through the Omagh community.
  - Adjust the south bypass alternative to minimize property impacts and land sterilization.
  - Consider the impacts to the watercourse crossings and downstream in the evaluation of the alternatives.

- Southwest Quadrant
  - The property situated south of Britannia Road, west of Fourth Line. Comments provided by the property owner's representative included:
    - This property has not triggered the need for widening of Britannia Road, so it would be unfair if this property were impacted.
    - Concern that the lands north of Britannia have had various studies completed already, but the lands to the south have not. The lack of studies completed to the south would not allow for an accurate evaluation of the south alternative.
    - It would be possible to fairly compensate the north property owners, but not the south property owners, since the land to the north has been approved for development.
    - Drainage from the north would unduly impact this property.

Property Meetings #2 (December 5, 2011)

Following the selection of the preferred design concept (Alternative 5C), the study team met with the representatives of the southeast and southwest quadrants at Fourth Line to discuss the design alternatives developed. Meetings were held on December 5, 2011.

At these meetings, the southeast representative indicated that they would have no objection to the selection of Alternative 5C. The southwest representative indicated that they would not support the selection of alternative 5C, as they felt that the lands to the south have not been fully studied, and therefore the impacts to this decision could not be fully appreciated. It was advised that the appropriate investigations for the EA had been completed.

Although a south by-pass will impact the rural farm lands south of Britannia Road, the current farming of the lands could be maintained with little disruption. Any property requirements from landowners to accommodate future Britannia Road improvements would be acquired at fair market value through the Region's standard property acquisition process.

Property Meetings #3 (June 11 to August 13, 2013)

The study team met again with the representatives of the southeast and southwest quadrants at Fourth Line to discuss modifications that were made to the preferred road alignment (Alternate 5C) subsequent to the last meetings held in 2011, as well as the associated impacts to the respective properties. A meeting was also held with the owners of 5774 Fourth Line to review the proposed improvements and potential impacts to the property. These meetings were held between June 11 and August 13, 2013.

At the June 11, 2013 meeting, the southeast representative did not raise any specific concerns and inquired as to the timing of the property acquisition process. Any property requirements from landowners to accommodate future Britannia Road improvements would be acquired at fair market value through the Region's standard property acquisition process.

At the July 10, 2013 meeting with the owners of 5774 Fourth Line, an overview of the study project to date was provided and the location of the new roadway alignment was reviewed. The study team also discussed future servicing to the lands south of Britannia Road and that servicing would be available post 2021.

With the planned roadway improvements the edge of the new realigned roadway curb would be about 20m south of the existing property line where the garage is located, no property is required from the subject property to implement the realigned roadway. Noise mitigation to the property will be provided in the form of a noise barrier wall. Additional consultation with the home owner regarding the noise barrier wall will be undertaken during detail design.

At the August 13, 2013 meeting with the southwest property representatives, the property owner expressed concern over the location and property requirements for the south by-pass around the Omagh community. The Project Team discussed how the Technically Preferred Alternative for the by-pass was developed through consideration of existing and future conditions, overall traffic operations as well as the impacts of the by-pass on the social and natural environments within the study area. This included the impacts of adding a by-pass to the north of Omagh and following the existing ROW through the community as documented in Section 5.3 of the ESR.

6.6. Individual Property Owner Meetings

Property owners along the subject portion of Britannia Road whose properties were identified as being significantly impacted by the proposed improvements were contacted by the Region via mailed letter and were requested to meet with the study team to discuss the proposed improvements and the impacts to their respective properties.

Meeting invitation letters, minutes of each meeting and follow-up letters to those who did not respond to the Region's meeting request are provided in Appendix I.

6.7. Additional Consultation with Stakeholders & Technical Agencies

In addition to the meetings described above, additional consultation activities undertaken with various technical agencies and key stakeholders during the study are summarized below. All relevant correspondence with technical agencies and other key stakeholders is provided in Appendix I.

Conservation Halton

In addition to the TAC meetings held with CH, as described in Section 6.2, the study team consulted with CH throughout the study process. The following chronology highlights the significant consultation efforts between the study team and CH throughout the study:

1. September 23, 2010 – Notice of Study Commencement provided to CH.
2. October 19, 2010 (Letter from CH) – First letter from CH identified key issues and constraints as they pertain to CH's areas of concern, notably: Ontario Regulation 162/06 requirements, which requires that a permit be obtained from CH prior to development, interference with wetlands or alterations to shorelines and watercourses; natural heritage features within the study area, including endangered or threatened species, wildlife habitat, valleylands and woodlots; fish habitat; groundwater features; and Stormwater management/drainage. The letter requested that individual meetings be held between the study team and CH throughout the study.
3. December 10, 2010 (Meeting) - The first meeting with CH provided members of the project team an opportunity to review the study scope and discuss issues related to the study.

   The meeting was conducted in two parts, including a site visit and a formal meeting at the CH offices. In the field, meeting attendees visited several areas of interest to Conservation Halton such as watercourse crossings of 16 Mile Creek. As part of the formal meeting, the attendees discussed the requirements outlined in the October 19th Letter from Conservation Halton. Discussion items included, but are not limited to, the following:

- *Ontario Regulation 162/06*, which requires that a Permit be obtained from Conservation Halton prior to development, interference with wetlands or alterations to shorelines and watercourses.
- Natural heritage features within the study area; including regulated wetlands, endangered or threatened species habitat, areas of natural and scientific interest, wildlife habitat, significant valley lands, significant woodlands, and the Sixteen Mile Creek Valley ESA.
- Fish habitat drainage features and hydrologic connections within the study area.
- Groundwater impacts and infiltration.
- Stormwater management/drainage quality/quantity/erosion controls.

4. June 30, 2011 (Meeting) - The purpose of the meeting was to discuss the results of the evaluation of the alternative planning solutions, as well as the preliminary alternative design concepts, prior to the second Public Information Centre (PIC).

   Items that were discussed by the meeting attendees included:

   - Options for improvements to Britannia Road, specifically as they pertain to natural heritage;
   - The project team's work plan to address the natural heritage component of study; and
   - Requirements for access to private property.

5. December 9, 2011 (Meeting) - The meeting was held to provide CH an update of the study and a summary of the fieldwork and analysis completed to date by the study team.

   At the meeting, the study team presented summaries of the natural environment, fluvial geomorphology and stormwater management and drainage works undertaken. Discussion primarily focused on the methodologies used, existing conditions within the study area and preliminary recommendations.

6. February 3, 2012 (Letter from CH) – Letter provided comment on a meeting between CH and the study team; the study team's response to CH's previous comments; and the study team's summary of the hydrology/flooding within the study area; terrestrial & aquatic ecology; fluvial geomorphology; and hydraulic impacts of various bridge configurations.

7. October 1, 2012 (Meeting) – Discussion items included: drainage areas and impact on the hydrologic/hydraulic/culvert sizing analyses; model parameters; culvert sizing criteria and alignment requirements; detailed design requirements; impacts to the eastern woodlot and residential property; bobolink habitat and giant hogweed within the study area; and the need for Jefferson Salamander and Calling Amphibian Surveys.

8. October 25, 2012 (Letter from CH) – Purpose of the letter was to provide comments to the study team following CH's review of the October 1, 2012 meeting minutes, the draft *Hydraulic Analyses of Stream Crossings* and *Stormwater Management Alternatives Assessment*, *Fluvial Geomorphology Study* and *Terrestrial and Aquatic Resources* provided to CH by the study team.
9. January 22, 2013 (Meeting) – Purpose of the meeting was to discuss CH's comments as outlined in their October 25, 2012 letter. Key discussion items included: drainage area, flow and span requirements; updated hydraulic analysis results; bankfull width recommendations; stability analysis results; culvert substrate materials and alignments; Jefferson Salamander Survey permit application update; and CH's need for more detailed review of the eastern woodlot.
10. April 2, 2013 (Meeting) – Purpose of the meeting was to present the Britannia Road EA Stormwater Management Strategy and discuss the works being undertaken as part of the Boyne Area by the Town of Milton. An overview of the project was presented/discussed including the purpose of the study, proposed roadway cross section elements (including active transportation and HOV/BRT lanes) and roadway design plans and implementation timelines. In addition to the study team, the meeting was attended by members of CH, the Town of Milton, and AMEC.
11. April 5, 2013 (Letter from CH) - Purpose of the letter was to provide additional comments to the study team on the *Terrestrial and Aquatic Resources Report*, *Hydraulic Analyses of Stream Crossings and Stormwater Report*, and the *Fluvial Geomorphology Study* completed as part of the Class EA Study. Comments received from CH were incorporated into the study documentation as requested and a formal response was provided to CH.
12. May 2, 2013 (Site Visit) – Members of the study team and CH conducted a site visit to review the proposed alignment of Britannia Road and the potential impacts on two woodlands abutting the road. During the site visit, CH outlined their requirements for additional ecological investigations in support of the Class EA study.
13. September 27, 2013 (Draft ESR provided to CH) – The draft Britannia Road ESR was provided to CH for review and comment.
14. November 8, 2013 (Letter from CH) - Purpose of the letter was to provide comments on the draft ESR. Comments focused on a number of items within the body of the ESR and associated appendices, including but not limited to concerns over the road alignment and impacts on the significant woodlands, drainage impacts of the grade separation at the CN rail line, riparian plantings adjacent to the watercourses within the ROW, and additional commitments to be addressed during the subsequent detailed design phase of the study.

15. November 27, 2013 (Meeting) – Purpose of the meeting was to discuss CH's comments on the study recommendations, as outlined in their November 8, 2013 letter, and how they were addressed in the study documentation. Following the meeting, the study team provided CH with a formal response to CH's concerns.
16. January 8, 2014 (Letter from CH) – Letter stating CH's satisfaction that all of the comments included in their letter dated November 8, 2013 have been adequately addressed.
17. August 18, 2014 (Email from CH) – R.e. potential hydraulic impacts associated with revisions to the proposed CN railway crossing (i.e. change from road-under-rail to road-over-rail), CH confirmed that the hydraulic modelling already completed as part of the study was sufficient and that they would not be requiring any further refinement to the model to support the revised grade separation.
18. September 05, 2014 (Email from CH) – R.e. potential impacts to natural heritage resources stemming from revisions to the proposed CN railway crossing (i.e. change from road-under-rail to road-over-rail). CH indicated that they support the project team's added recommendations to revegetate the overpass slopes and the need for the design of the overpass to account for terrestrial wildlife movement to the east of the CN rail corridor.

Ministry of Natural Resources

Throughout the study, the Ministry of Natural Resources (MNR) was consulted extensively on matters pertaining to natural heritage features within the study area. Specifically, the MNR provided considerable input on:

- Identified Species at Risk and associated habitat within the study area (e.g. Silver Shiner, Bobolink, Milkshake, Jefferson Salamander and Barn Swallow) and associated impact mitigation requirements
- Requirements under the *Endangered Species Act*
- Key natural features (e.g. Sixteen Mile Creek ANSI, Britannia Wetlands ANSI, Environmentally Significant Areas and wetlands)
- Additional commitments to the MNR during the detailed design phase of the study.

The MNR identified that Salamander surveys would not be required to be undertaken during the EA, as no vernal pools or wetlands are impacted within the right of way, and the woodland at the east end of the study area would not be impacted. It was also determined by the MNR that any Information Gathering Forms that would be required under the *Species at Risk Act* could be completed during the detailed design phase of the study. MNR was circulated the draft ESR for comment in September 2013.

All comments received from the MNR, particularly regarding existing conditions within the study area and impact mitigation requirements, have been incorporated into the study documentation.

CN Rail

Throughout the study, CN was consulted on several occasions to discuss the need for a grade separation at the CN Rail Line within the study area (Mile 38.72 on the Halton Subdivision). CN provided written correspondence and met with the study team on January 31, 2013 to discuss the EA project and the need for a grade separation at the CN tracks. The Region presented a preliminary subway (road under rail) design for CN to review. Minutes can be found in Appendix I.

The Region subsequently circulated the draft ESR to CN in September 2013 and comments were provided on October 25, 2013 (correspondence provided Appendix I). A meeting was held on December 17, 2013 to discuss the Region's preliminary preference for a subway design and CN's comments on the draft ESR. CN's comments on the proposed grade separation are summarized as follows:

- Mi. 38.72 Halton Subdivision is a main line; therefore project scheduling would be important.
- To ensure that their operations are not adversely affected, CN would require involvement throughout the design stages. Preliminary and final design drawings would require CN approval.
- Prior to CN approving the design, the Region will be required to enter into a Grade Separation Agreement with CN as well as to provide a Notice of Works as required under the *Railway Safety Act.*
- CN is a significant landowner in the two southern quadrants of Britannia Road. As such, they would require further review of its future land use of the property south of Britannia Road as part of the comments on the design of the structure. The proposed design of the grade separation will have to take into account CN's requirements.
- CN to advise on the ultimate right-of-way and the number of tracks to be protected for in the proposed grade separation.
- CN would accept a subway design if it were the only feasible option and would consider the preferred alternative.

On January 22, 2014 the Region, via email, confirmed with CN that a review of both grade separation options was undertaken and documented in the draft ESR circulated in September 2013. Based on the analysis, a subway design was initially preferred for the grade separation at the Mi 38.72 crossing. The evaluation considered adjacent future residential land uses, environmental considerations (impact on adjacent watercourses), ability to accommodate future road connections and the accommodation of active transportation infrastructure. The Region also committed to continued consultation with CN throughout the duration of the detailed design phase of the project.

On May 23, 2014 an additional meeting was held between CN representatives and Halton Region to further discuss the grade separation options at the Mi. 38.72 Crossing. CN

advised of their significant concerns regarding the continued operation and adverse impacts to the rail line if an underpass (road under rail) remained the preferred alternative. CN requested that the Region consider the significance of potential delays to railway speed and schedules, safety implications of the railway track diversion, safety concerns associated with the construction of the underpass structure and ongoing operation and maintenance considerations. CN requested that the Region update its evaluation criteria and re-evaluate the grade separation options.

The evaluation table was revised to include specific criteria to address CN concerns. Based on the results of the evaluation, including considerable consultation with technical agencies, the technically preferred alternative is an overpass structure (road over rail) with a commitment to ensure that aesthetics and the accommodation of active transportation are considered through the detailed design.

CP Rail

CP Rail provided input to the study team via email correspondence from October 29, 2013 to November 2, 2013 regarding the Ontario Hydro CP spur line located immediately west of Highway 407. According to CP Rail, this spur line is very infrequently used. The crossing is currently operating on a "stop and proceed" basis and they have no immediate plans to upgrade the crossing protection system. They did advise that they will reevaluate this in the future and advise if their plans/requirements change. It is recommended that the detailed design project team liaise with CP Rail when this final section of the Britannia Road widening is started.

Ministry of Transportation

A meeting was held with MTO on January 15, 2013 to discuss the Region's proposed transition from the widened Britannia Road with AT facilities to the existing Highway 407 interchange. The 4 lane (interim roadway design) and 6 lane (ultimate roadway design) plans were presented to the MTO along with their implementation timelines. Subsequent to the meeting the study team re-evaluated the transition and it was decided to terminate/commence the HOV lanes at the intersection of Britannia Road and Eighth Line (with transit priority signals), thus, the interim and ultimate design east of Eighth Line would only consist of 4 lanes. Given that Britannia Road is already four lanes at the MTO west ramp terminal no geometric improvements would be required.

At the meeting, the MTO requested a copy of the draft ESR for review as well as existing and future transportation volumes and analyses for the east end of the study area. This analysis was provided to MTO by letter dated March 4, 2013. MTO was also circulated the ESR in September 2013.

Ontario Realty Corporation / Infrastructure Ontario

Comments were received from Ontario Realty Corporation / Infrastructure Ontario (IO) via mailed correspondence on November 5th, 2010, February 8th, 2011 and July 13th, 2011.

Based on IO's review of information provided by the study team, it was identified that lands managed by Hydro One, on behalf of IO, are located within the study area and that they would be impacted by the proposed reconstruction works.

As the purchase of IO-managed lands or disposal of rights and responsibilities (e.g. easement) for IO-managed lands triggers the application of the MOI Class EA, the project report (ESR) has been completed in accordance with IO's specific Category B Class EA requirements, in addition to the Schedule C Municipal Class EA requirements. Section 10.0 of the ESR addresses how Infrastructure Ontario's Class EA requirements were addressed. As per IO's request, the draft ESR was provided to IO for their review prior to submittal for 30-day public review. IO advised that the ESR meets their requirements.

Town of Milton

Representatives from the Town of Milton provided relevant background reports and input into the study through project meetings with the study team and written correspondence at specific points during the study. Issues that were identified as particularly significant to the Town, and were subsequently addressed during the study, are identified as follows:

- Bypass of settlement areas near the Omagh Community
- Impacts of the proposed roadway corridor on Town properties
- Request for alternatives to be explored to maintain the existing Omagh baseball diamond to accommodate current and future recreational demands for the Town
- Support for access consolidation at the Terra Greenhouse & Halton District School Board property and driveway to Drumquin Park
- Reconfiguration of parking at the Boyne Community Centre
- Coordination with the ongoing Boyne Secondary Plan.

The Town was provided a copy of the draft ESR on September 27, 2013 for their review and comment. Subsequent comments received from the Town were incorporated into the study documentation, where feasible.

With respect to the Town's comments on bridge/culvert sizing requirements, future stormwater management pond / outlet locations and watercourse alignments/requirements, it was determined that these would be best addressed during the detailed design phase of the project, once the Boyne Secondary Plan Final FSEMS, CFC and SUS reports have been finalized and approved by Conservation Halton.

Ministry of the Environment

The Ministry of the Environment (MOE) was notified of the study and consultation activities throughout the duration of the Class EA and the draft ESR was provided in September 2013. A copy of the final report will be provided to the MOE for their file.

Correspondence from other Stakeholders

In addition to comments received from technical agencies, the study team received correspondence from members of the public, local business community and local developers, etc. Comments received from these stakeholders focused on a range of issues, including impacts to Species at Risk (e.g. Bobolink Habitat), impacts to property and developable land, as well as drainage impacts and stormwater management.

6.8. First Nations

A study notification letter was mailed to the Ministry of Aboriginal Affairs (MAA), Indian and Northern Affairs Canada (INAC) and the following First Nations on Dec 17, 2010:

- Alderville First Nation;
- Mississauga's of Scugog Island First Nation;
- Mississauga's of the New Credit First Nation;
- Hiawatha First Nation;
- Curve Lake First Nation;
- Mohawk Council of Akwesasne First Nation;
- Mohawks of the Bay of Quinte First Nation;
- Oneida Nation of the Thames First Nation;
- Six Nations Haudenosaunee First Nation;
- Six Nations of the Grand River;
- Wahte Mohawk Territory First Nation.

The purpose of the letter was to provide information about the project and to obtain their input. Feedback received indicated that the MAA is not aware of any First Nation land claims submitted to the Government of Ontario that will have an impact on this project. INAC's response indicated that there are no comprehensive First Nation land claims in the Town of Milton. First Nations were also invited to the study public information centres and a Notice of Study Completion, with a copy of the completed Stage 1 Archaeological Assessment report attached, was provided to the referenced First Nations on April 24, 2014.

Copies of correspondence received from First Nations, MAA and INAC is provided in Appendix I.

6.9. Notice of Study Completion

A Notice of Study Completion was placed in the *Milton Champion* on April 24, 2014 and May 1, 2014. The newspaper Notice of Study Completion identified main features of the preferred design, the Class EA process undertaken (including the "Part ll Order" request process), and details on the Environmental Study Report. Concurrent with the Notice of Study Completion, property owners within the study area, external agencies and other stakeholders were sent a final contact letter indicating that the ESR is available for review. The Notice of Study Completion is provided in Appendix I.

7.0 DESCRIPTION OF THE PREFERRED DESIGN

This section of the report identifies the key features of the preferred design that was developed for the subject portion of Britannia Road. Implementation of the preferred design will occur over a number of stages and includes interim (4-lane cross section) and ultimate (6-lane cross section) configurations. Implementation will be as follows:

1. Construct full 6-lane section from Tremaine Road to Regional Road 25
2. Construct interim 4-lane section from Regional Road 25 to Highway 407
3. Widen 4-lane section to 6-lanes from Regional Road 25 to Eighth Line
4. Convert outside lanes from Tremaine Road to Eighth Line to High Occupancy Vehicle (HOV) lanes by 2031

Additional details of the preferred design are provided in the preliminary plan and profile drawings. The following sections describe the various cross sections required for implementation of the preferred design.

7.1. Typical Cross Sections – Ultimate 6-Lane Configuration

The basic features of the typical cross section for Britannia Road were identified in the Halton Transportation Master Plan and are shown in **Figure 7-1**.

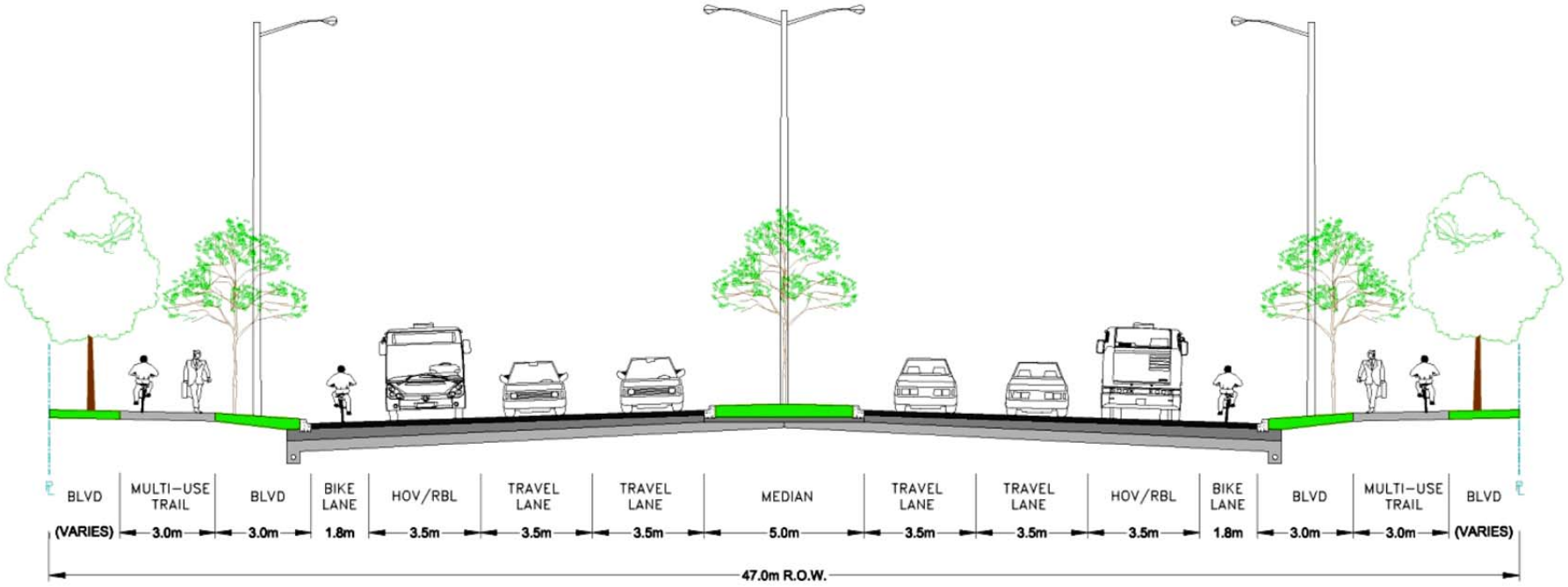
The typical cross section includes 6x3.5m through lanes, 1.8m dedicated bicycle lanes and 3.0m multi-use paths within a 47m ROW. The widths of the center median/two-way left-turn lane, as well as the width of the boulevards are approximately 5.0m and 2.5m respectively. In some highly constrained areas these were minimized in order to reduce impacts to existing features. The Region's ultimate vision for the corridor includes a continuous raised centre median for traffic operation, safety and urban design/aesthetic purposes. Recognizing the number of private accesses along the corridor, the preferred design has been developed with sections of two-way left turn lane, realigned driveways or median breaks in order to maintain existing vehicular movements at the driveways. This is an interim measure and, as the properties redevelop, these median openings will be eliminated.

The constrained areas in which the cross section was reduced to minimize impacts are detailed below.

<u>Approx. 690m East of Fifth Line to 370m West of Sixth Line</u>

This section of Britannia Road consists of relatively newer residential properties on either side of the existing ROW. At these properties the proposed ROW is approximately 36.5m. Since significant property would need to be acquired at these properties, and more than half of the existing front yards would be lost if the full 47m ROW was acquired, a reduced cross section was developed to minimize impacts (Over time, Halton Region may wish to

Figure 7-1: Typical Cross Section – Overall (47 Metre R.O.W.)



purchase these properties as they become available in order to provide the opportunity to implement the recommended 47m ROW cross section.)

In order to accommodate the reduced ROW width, the typical cross section was modified as follows:

- 4.0m two-way left-turn lane instead of 5.0m centre median;
- No boulevard, multi-use trail is curb face.

The typical cross section for this section of Britannia Road is shown in **Figure 7-2**.

Approx. 370m West of Sixth Line to 70m West of Sixth Line

This section of Britannia Road has a number of residential properties on the north side of the ROW. To provide continuity and minimize impacts to these properties, the 4.0m two-way left-turn lane was carried through, and the boulevard on the north side was eliminated. Along the south side, the 3.0m boulevard was restored.

The typical cross section for this section of Britannia Road is shown if **Figure 7-3**.

Eighth Line to Highway 407 Interchange

This section of Britannia Road has a woodlot located immediately north of Britannia Road on the west side of the CP railway corridor as well as a private residence on the south side. In order to mitigate impacts, the roadway cross section was modified to include 4 through lanes, a 4m median, no bike lanes, 2.5m multi-use trail and reduced boulevards. This cross section provides for a controlled transition into and out of the HOV lanes and in and out of the designated bicycle lanes at Eighth Line. Since the need for the accommodation of cycling and pedestrian facilities across the Highway 407 interchange structure along Britannia Road has not been established at this point, the need for these facilities at this location will be reviewed in conjunction with the City of Mississauga.

The typical cross section for this section of Britannia Road is shown in **Figure 7-4**.

Figure 7-2: Typical Cross Section - Approx. 690m East of Fifth Line to 370m West of Sixth Line (Constrained/Reduced 36.5m R.O.W.)

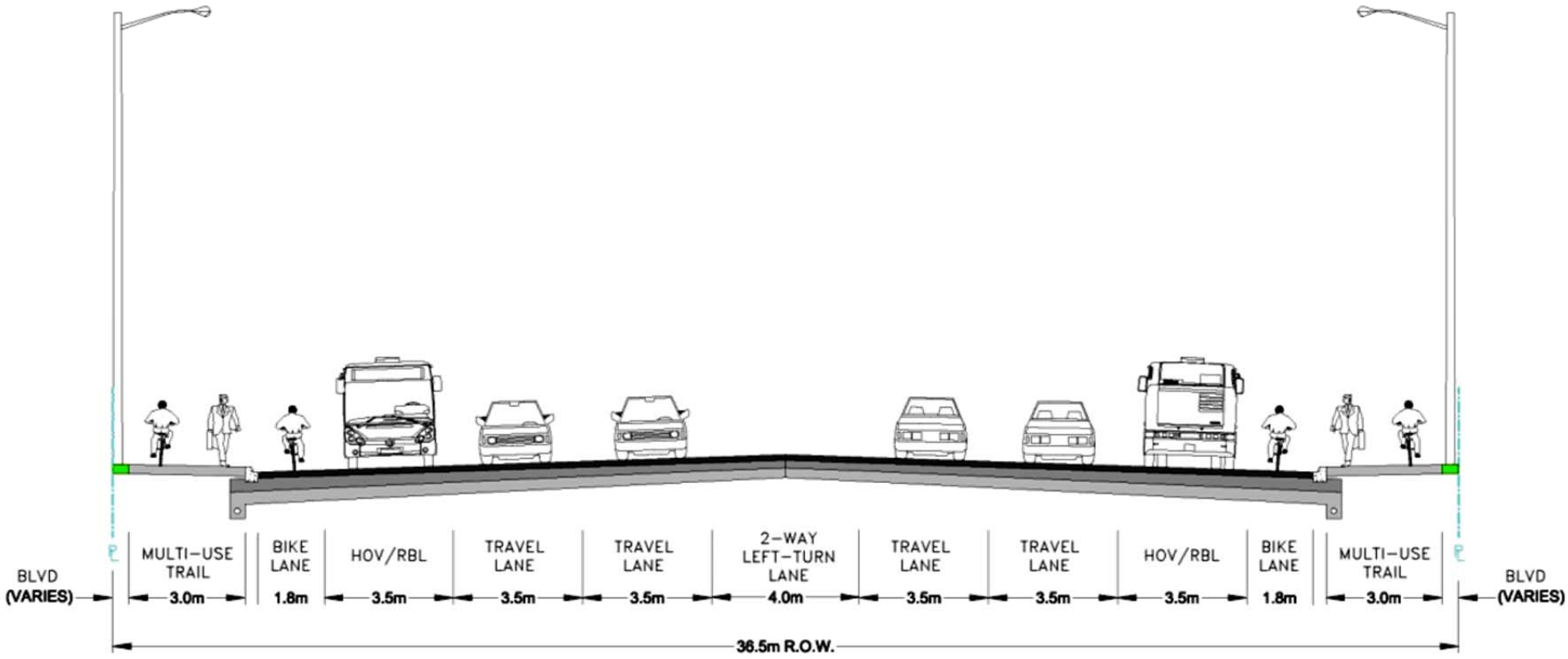


Figure 7-3: Typical Cross Section - Approx. 370m West of Sixth Line to 70m West of Sixth Line (Constrained/Reduced 40.8m R.O.W.)

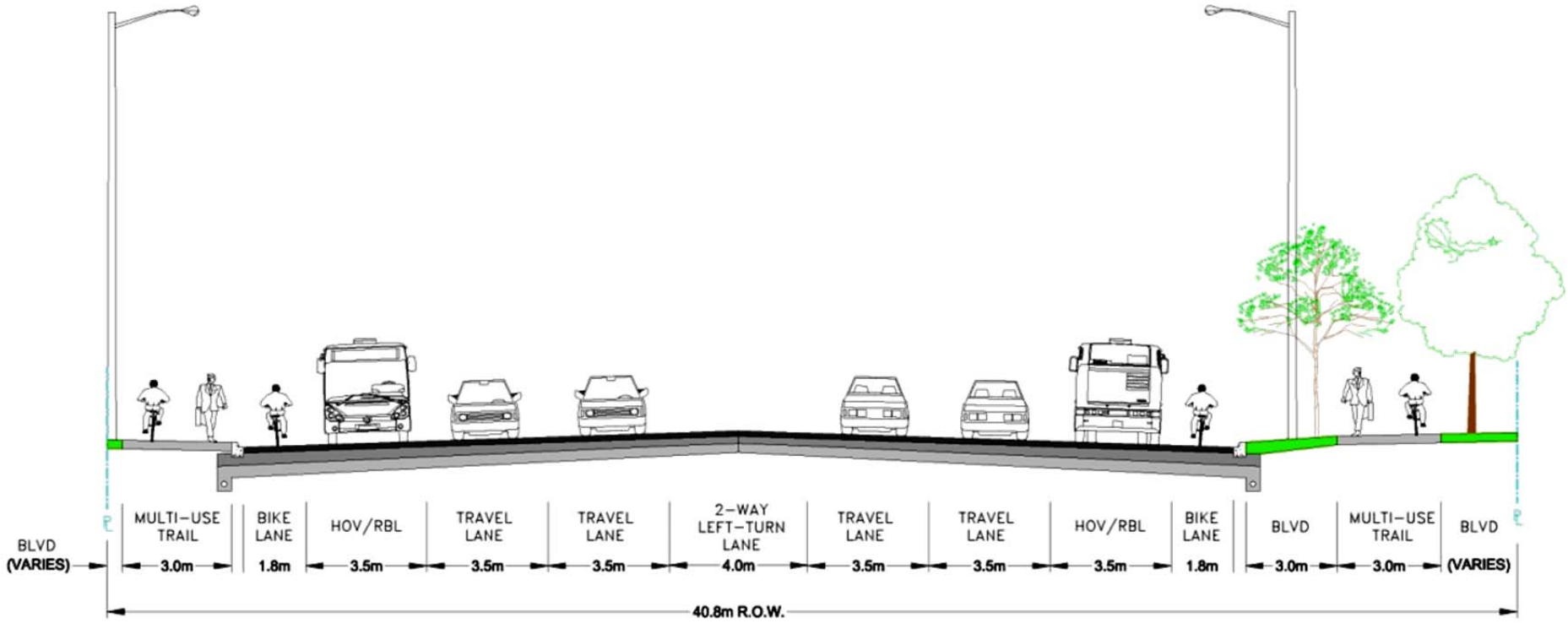
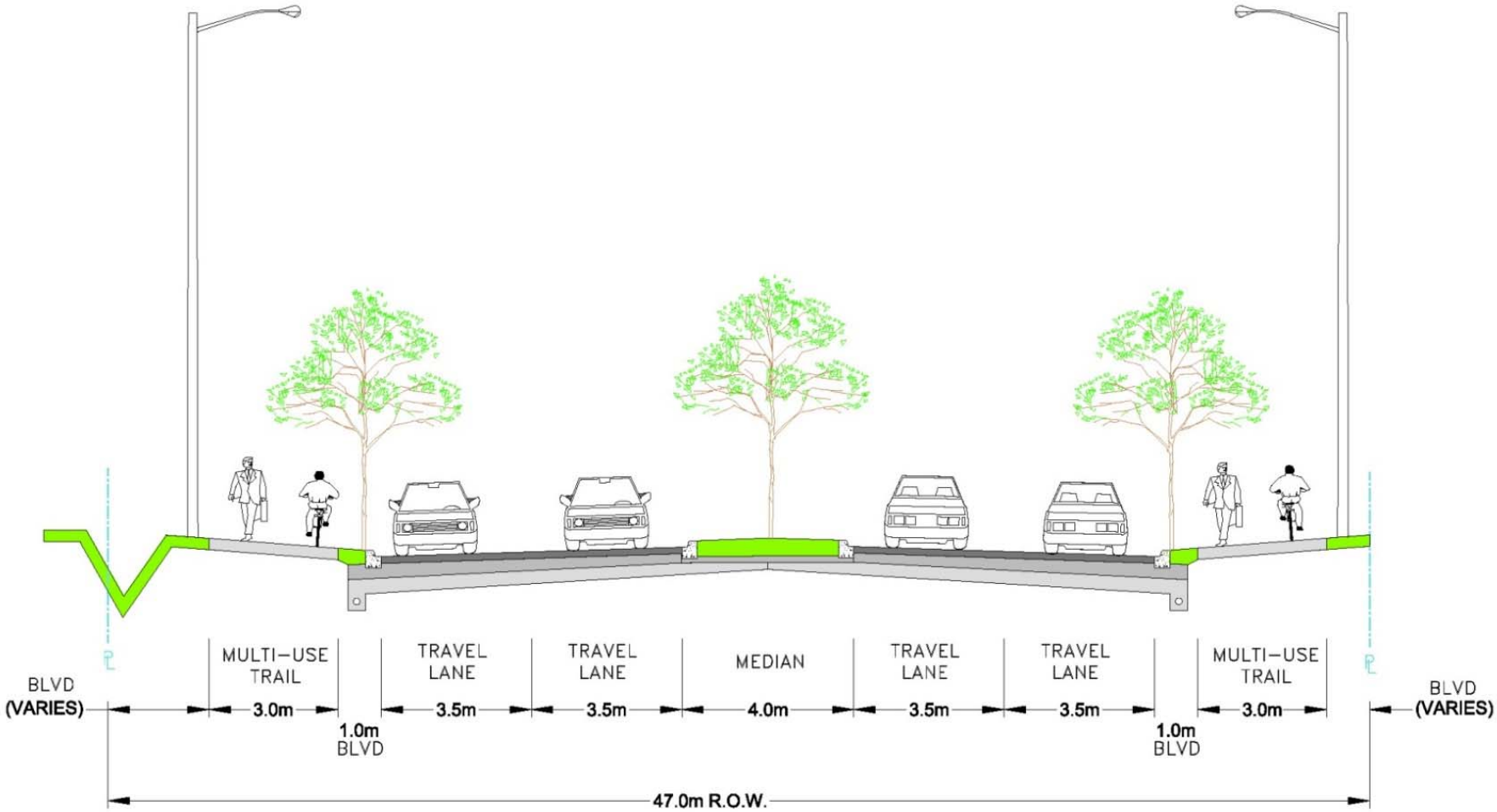


Figure 7-4: Typical Cross Section - Eighth Line to Highway 407 Interchange



7.2. Horizontal Alignment

The horizontal alignment of the roadway was designed to achieve a number of goals:

- Follow the existing ROW as closely as possible
- Minimize impacts to properties that would be significantly impacted by widening the ROW
- Minimize land fragmentation where the bypass is proposed
- Align with the existing or proposed road alignments at the study limits
- Meet the design criteria and design standards.

Based on these design goals, the proposed horizontal alignment generally follows the existing ROW alignment. At locations where the alignment shifts slightly to the north or south, simple curves with a minimum radius of 2650m and a minimum length of 150m were used to achieve the required deflections. At the Omagh bypass, where a larger deflection was required, spiral curves, with a curve radius of 180m and an A value of 110 were used with super elevations ranging from 4%-6%. During detailed design, refinements to the horizontal alignment may be required.

The preferred horizontal alignment is shown in the preliminary plan and profile drawings.

7.3. Vertical Alignment

The vertical alignment of the roadway was designed to achieve the following goals:

- Minimize the amount of grading on either side of the ROW,
- Minimize the amount of cut and fill required to construct the new road,
- Ensure overtopping requirements at watercourse crossings were met,
- Follow the existing vertical alignment as closely as possible,
- Align with the existing or proposed vertical alignments at the study limits, and
- Meet the design criteria and design standards.

Based on these design goals, the vertical alignment generally follows the existing road profile. At a number of watercourse crossings, the proposed profile needed to be raised higher in order to accommodate overtopping requirements. Grades varied between 0.5% and 5.5%, with parabolic curves utilized at all grade changes. During detailed design, refinements to the vertical alignment may be required.

The preferred vertical design (i.e. profile) is shown in the preliminary plan and profile drawings.

7.4. Intersections

All of the intersections within the Britannia Road study area are designed to be signalized to accommodate the future travel demands as determined in the transportation analysis. In order to accommodate left turn movements, left turn lanes are included at all

intersections, with the storage lengths provided as recommended in the transportation analysis. Right-turn lanes will be protected for at all intersections. Sufficient ROW width is available at all intersections to accommodate the widening of the roadway for these auxiliary lanes. Tapers are provided as per the TAC design standards based on the design speed of the roadway at the intersection approaches.

A number of intersections have recently been improved; therefore the amount of reconstruction at these locations has been minimized in the preferred design in order to reduce construction costs. At Regional Road 25, James Snow Parkway and Trafalgar Road, the preferred design ties into the existing roadway configuration, generally just past the curve radii. Only the intersection and none of the approach roads needs to be reconstructed at these intersections.

At all other intersections, the preferred design includes a length of road design for the intersecting roads as they approach Britannia Road. This was done to provide a preliminary design for the approaches that satisfied the requirements identified in the transportation analysis, i.e. left turn lane storage length. The inclusion of these road sections in the detailed design phase of Britannia Road will need to be considered on a road by road basis, since it is anticipated that a number of these intersecting roads may be improved to an urban cross section as part of the development of the Boyne Secondary Plan area.

With the realignment of Britannia Road through Omagh, a new signalized intersection will be created at Fourth Line, south of the existing Fourth Line signalized intersection. Since the existing Britannia Road will be cul-de-sac'd at each end of the by-pass, the east-west traffic volumes along the existing alignment will be significantly reduced. Therefore the operation of the Fourth Line intersection should be further reviewed during the detailed design phase.

Future Boyne Secondary Plan Intersections

As identified in Section 4.8, 10 new intersections are proposed along the corridor as part of the Boyne Secondary Plan. The specific location and configuration of these intersections have yet to be determined. As such, they have not been included in the preliminary design.

7.5. Cyclist & Pedestrian Accommodations

Cyclists and pedestrians will be accommodated by way of 3.0m multi-use trails (can be used by both cyclists and pedestrians) and 1.8m on-road bike lanes (used by cyclists only). The bike lanes do not extend east of Eighth Line.

As the multi-use trails will be under the jurisdiction of the Town of Milton, the final configuration and alignment of the multi-use trails will be confirmed during detailed design through consultation with the Town.

7.6. Bridge / Culverts and Storm Drainage

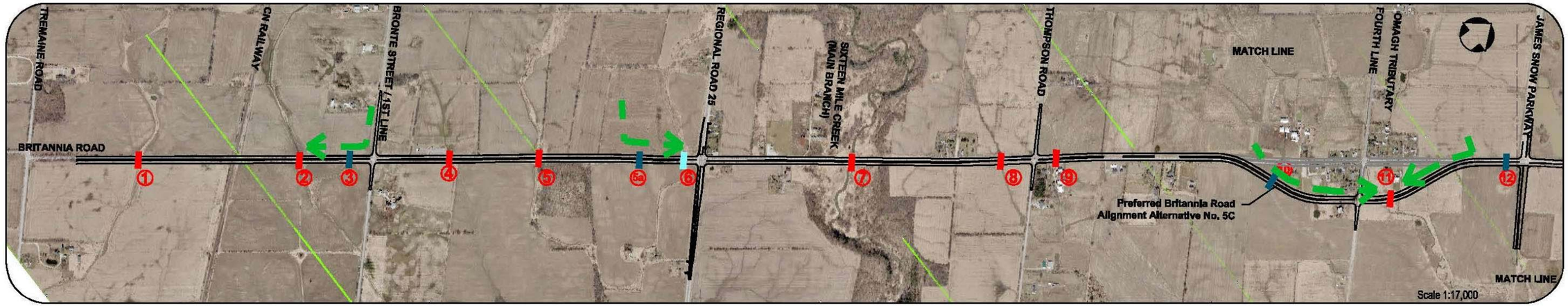
7.6.1. Drainage Measures and Crossing Details

Drainage and conveyance improvements at the stream crossing locations are required to meet conveyance, flooding and environmental targets for the subject portion of Britannia Road. Over the majority of the study area, the proposed roadway widening will require longer bridge/culvert structures than are currently in place. A minimum length of 47 metres was assumed for the future hydraulic structures beneath the widened 6-lane road. Given that most of the existing structures within this portion of the study area corridor do not meet the hydraulic capacity criteria (as shown in Table 4-8), most will require replacement with larger openings.

Figure 7-5 illustrates the recommended drainage measures at each of the study area stream crossings to be undertaken as part of the Britannia Road improvement works. As shown, new crossing structures are recommended at most stream crossing locations. Details of the proposed new hydraulic crossings, including crossing type and sizing requirements, performance details and flood impacts are outlined in **Tables 7-1, 7-2** and **7-3**, respectively. Additional details on each of the proposed bridge/culvert crossings (according to their classification as either permanent crossing structures, stormwater pond crossing structures, or optional temporary crossing structures) as well as additional guidance on minor structures associated with roadside ditches are provided in the *Hydraulic Analysis of Stream Crossing & Stormwater Management Alternatives Assessment* in Appendix C.

In general, as shown in Table 7-2 the proposed culverts can convey the 50-year storm with 1m of freeboard or more, and can convey the Regional storm flow without overtopping the road. As shown in Table 7-3, the proposed culvert would result in a decrease in flood levels.

Figure 7-5: Recommended Drainage Measures



LEGEND

- CROSSING No.
- EXISTING CULVERT STRUCTURE TO REMAIN (No.18)
- NEW HYDRAULIC CROSSING STRUCTURE
- OPTIONAL NEW HYDRAULIC CROSSING STRUCTURE (No.6)
- OPTIONAL TEMPORARY CULVERT STRUCTURE
- OPTIONAL TEMPORARY DIVERSION (DITCH, STM. SWR)

Table 7-1: Proposed Culvert / Bridge Crossing Structures

Structure / Stream Crossing No.	Station	Existing Crossing Structure						Proposed Crossing Structure												
										Minimum Span Requirements		Height Constraints			Proposed Structure						
		Structure Type	Existing Length (m)	Dia. (mm)	Span (mm)	Rise (mm)	Road Elevation (m)	Crossing Structure Classification (based on future drainage/SWM scenario)	Proposed Action	Bankfull Width (BFW) (m)	Minimum Span Criteria (2 x BFW) (mm)	Ex. Channel Elevation (m)	Proposed Centre Road Elevation (m)	Available Rise (m)	Structure Type	Proposed Length (m)	Span (mm)	Rise (mm)	Upstream Invert Elevation (m)	Downstream Invert Elevation (m)	Approx. Cover (m)
1	0 + 673	Concrete Box	7.2	-	2450	1200	183.70	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	2.4	4800	182.15	184.87	2.72	Conc. Box Open Footing	47	6000	1500	182.40	181.50	0.97
2	1 + 360	Steel Pipe Arch	10.8	-	1500	850	185.01	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	3.7	7400	183.77	186.56	2.79	Conc. Box Open Footing	47	7400	1400	183.85	183.65	1.31
3	1 + 556	Concrete Open Footing	17.8	-	5250	800	185.63	temporary (optional)	replace with larger opening to meet conveyance & flooding criteria*	Unregulated stream. No minimum span requirements.		184.54	186.30	1.76	Twin Conc. Box	47	3200	1000	184.58	184.30	0.72
4	2 + 000	C.S.P	11.7	420	-	-	186.29	SWM pond outlet	replace with larger opening to meet conveyance & flooding criteria	Unregulated stream. No minimum span requirements.		185.23	187.32	2.09	Conc. Box	47	4400	1000	185.58	184.62	0.74
5	2 + 358	Conc. Open Footing	18.9	-	2480	1220	184.49	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	3.8	7600	182.65	185.15	2.50	Conc. Box Open Footing	47	7600	1500	182.68	182.58	0.97
5a	2 + 814	C.S.P	12.9	400	-	-	184.06	temporary (optional)	replace with larger opening to meet conveyance & flooding criteria*	Unregulated stream. No minimum span requirements.		183.13	185.16	2.03	Conc. Box	47	2000	1000	183.39	182.72	0.77
6	2 + 964	Concrete Box (Twin)	33.9	-	2400 (twin)	1200	183.97	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	4.9	9,800	181.83	184.36	2.53	Conc. Box Open Footing	47	10,200	1200	182.15	182.00	1.01
7	3 + 658	Bridge	10.3	-	19800	3650	177.02	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	13.6	27,200	171.83	176.85	5.02	Bridge	47	30,000	4100	171.73	171.58	1.02
8	4 + 300	C.S.P	19	500	-	-	190.11	SWM pond outlet	replace with larger opening to meet conveyance & flooding criteria	Unregulated stream. No minimum span requirements.		188.44	190.00	1.56	Conc. Box	47	4500	1000	188.65	187.95	0.35
9	4 + 525	Concrete Box	17.5	-	3000	1200	188.94	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	2.1	4200	187.22	189.19	1.97	Twin Conc. Box Open Footing	47	4800	1200	187.41	186.81	0.58
10 Existing		Concrete Box	17.5	-	3000	1200	188.94	No change - existing culvert beneath current roadway to remain													
10 South By-Pass (Alternative 5C)	5 + 371	N/A	N/A	N/A	N/A	N/A	N/A	temporary (optional)	constructu new opening to meet conveyance & flooding criteria*	Unregulated stream. No minimum span requirements.		192.64	194.10	1.46	Conc. Box	59	4000	750	192.96	192.15	0.39
11 Existing		Conc. Open Footing	21.9	-	6000	1200	191.20	No change - existing culvert beneath current roadway to remain													
11 South By-Pass (Alternative 5C)	5 + 950	N/A	N/A	N/A	N/A	N/A	N/A	permanent	construct new structure to meet conveyance, flooding & environmental criteria	7	14,000	189.05	192.60	3.55	Conc. Box Open Footing	47	14,000	2600	189.05	189.00	0.95
12	6 + 472	C.S.P	24.4	800	-	-	193.07	temporary (optional)	replace with larger opening to meet conveyance & flooding criteria*	Unregulated stream. No minimum span requirements.		192.24	193.70	1.46	Conc. Box	47	3000	750	192.43	191.93	0.52
13	7 + 500	C.S.P	14.4	500	-	-	193.59	permanent	replace with larger opening to meet conveyance & flooding criteria	Unregulated stream. No minimum span requirements.		192.99	194.16	1.17	Conc. Box	47	2000	750	193.05	192.66	0.36
14	8 + 540	Conc. Open Footing	10.4	-	1850	1000	190.00	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	3.6	7200	188.66	190.45	1.79	Conc. Box Open Footing	47	7200	1000	188.85	188.45	0.60
15	9 + 821	Bridge	10.4	-	24400	4560	181.27	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	16	32,000	175.78	182.98	7.20	Bridge	47	32,000	4200	175.80	175.66	2.98
16	10 + 400	C.S.P	11.4	1200	-	-	186.42	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	1.3	2600	184.79	187.00	2.21	Conc. Box Open Footing	47	2600	1000	184.85	184.69	1.15
17	10 + 900	C.S.P	11.5	900	-	-	187.20	permanent	replace with larger opening to meet conveyance, flooding & environmental criteria	6.9	13,800	185.59	187.35	1.76	Conc. Box Open Footing	47	13,800	1000	185.80	185.20	0.55
18	12 + 182	Concrete Box (Twin)	47	-	3500 (twin)	2940	191.57	permanent	No change - existing culvert to remain												

* Note - for unregulated stream crossings 3, 5a, 10 and 12, consideration may also be given to smaller temporary culverts or temporary diversion of upstream drainage, until the upstream feature is eliminated as part of future urban development.

Table 7-2: Proposed Culvert/Bridge Performance

Structure / Stream Crossing No.	Drainage area (ha)	Existing Road Elevation (m)	Proposed Road Elevation (m)	50-yr Flow						100-yr Flow						Regional Storm Flow						Road Overtopped? (Yes/No)	Freeboard > 1 m for the 50-Yr Flow (for spans < 6m)? (Yes/No)	Freeboard > 1 m for the 100-Yr Flow (for spans > 6m)? (Yes/No)
				Flow (m3/s)	Flood Elevation (m)		Freeboard (m)			Flow (m3/s)	Flood Elevation (m)		Freeboard (m)			Flow (m3/s)	Flood Elevation (m)		Freeboard (m)					
					Existing	Proposed	Existing	Proposed	Change (m)		Existing	Proposed	Existing	Proposed	Change (m)		Existing	Proposed	Existing	Proposed	Change (m)			
1	167	183.70	184.87	5.21	183.46	183.12	0.24	1.75	1.51	6.08	183.60	183.20	0.10	1.67	1.57	21.00	184.52	184.42	-0.82	0.45	1.27	No	Yes	-
2	143.7	185.01	186.56	4.68	185.30	184.50	-0.29	2.06	2.35	5.42	185.36	184.55	-0.35	2.01	2.36	18.60	185.97	185.40	-0.96	1.16	2.12	No	-	Yes
3	70	185.63	186.30	2.28	185.53	185.17	0.10	1.13	1.03	2.64	185.61	185.22	0.02	1.08	1.06	9.06	186.22	186.11	-0.59	0.19	0.78	No	Yes	-
4	16.93	186.29	187.32	2.38	186.54	186.08	-0.25	1.24	1.49	2.97	186.58	186.13	-0.30	1.19	1.49	7.50	186.86	186.81	-0.58	0.51	1.09	No	Yes	-
5	163.7	184.49	185.15	1.68	183.32	183.07	1.17	2.08	0.91	1.97	183.40	183.12	1.09	2.03	0.94	17.06	185.21	184.79	-0.72	0.36	1.08	No	-	Yes
5a	16.15	184.06	185.16	0.17	183.79	183.55	0.27	1.61	1.34	0.19	183.82	183.56	0.24	1.60	1.36	1.68	184.21	184.11	-0.15	1.05	1.20	No	Yes	-
6	224.8	183.97	184.36	7.22	183.12	182.61	0.85	1.75	0.90	8.60	183.35	182.65	0.62	1.71	1.09	20.07	184.20	183.69	-0.23	0.67	0.90	No	-	Yes
7	12870	177.02	176.85	87.30	174.32	174.14	2.70	2.71	0.01	97.60	174.50	174.19	2.52	2.66	0.14	427.40	178.09	176.29	-1.07	0.56	1.63	No	-	Yes
8	36.22	190.11	190.00	1.47	190.27	189.00	-0.16	1.00	1.16	1.84	190.30	189.05	-0.19	0.95	1.14	4.03	190.47	189.34	-0.36	0.66	1.02	No	Yes	-
9	138	188.94	189.19	4.21	188.23	187.87	0.71	1.32	0.61	5.26	188.39	187.94	0.55	1.25	0.70	18.75	189.68	188.97	-0.74	0.22	0.96	No	Yes	-
10 South By-Pass (Alternative 5C)	12.56	N/A	194.10	0.27	193.18	193.09	N/A	1.01	N/A	0.31	193.25	193.10	N/A	1.00	N/A	0.97	193.62	193.25	N/A	0.85	N/A	No	Yes	-
11 South By-Pass (Alternative 5C)	303.18	N/A	192.60	5.40	190.16	190.10	N/A	2.50	N/A	6.46	190.23	190.18	N/A	2.42	N/A	20.50	190.79	190.78	N/A	1.82	N/A	No	-	Yes
12	4.7	193.07	193.70	0.08	192.51	192.51	0.56	1.19	0.63	0.10	192.54	192.52	0.53	1.18	0.65	0.32	192.81	192.61	0.26	1.09	0.83	No	Yes	-
13	6.9	193.59	194.16	0.12	193.35	193.15	0.24	1.01	0.77	0.15	193.40	193.19	0.19	0.97	0.78	0.47	193.64	193.35	-0.05	0.81	0.86	No	Yes	-
14	107	190.00	190.45	3.48	189.90	189.34	0.10	1.11	1.01	4.04	189.98	189.41	0.02	1.04	1.02	13.85	190.63	190.11	-0.63	0.34	0.97	No	-	Yes
15	14250	181.27	182.98	122.60	179.22	179.17	2.05	3.81	1.76	136.30	179.34	179.29	1.93	3.69	1.76	587.90	182.32	182.07	-1.05	0.91	1.96	No	-	Yes
16	40	186.42	187.00	0.78	185.57	185.29	0.85	1.71	0.86	1.02	185.72	185.37	0.70	1.63	0.93	4.86	186.65	186.54	-0.23	0.46	0.69	No	Yes	-
17	344	187.20	187.35	5.20	187.51	186.19	-0.31	1.16	1.47	6.51	187.56	186.24	-0.36	1.11	1.47	29.00	188.41	187.02	-1.21	0.33	1.54	No	-	Yes
18	136	191.57	191.57	1.81	187.61	187.61	3.96	3.96	0.00	2.24	187.67	187.67	3.90	3.90	0.00	11.54	188.46	188.46	3.11	3.11	0.00	No	Yes	-

Table 7-3: Flood Impacts of Proposed Culvert/Bridge Structures

Structure / Stream Crossiing No.	Proposed Crossing Structure						50-yr Flood Elevation (m)				100-yr Flood Elevation (m)				Regional Flood Elevation (m)			
	Proposed Action	Structure Type	Proposed Length (m)	Span (mm)	Rise (mm)	Proposed Road Elevation (m)	Existing	Proposed	Change	Impact?	Existing	Proposed	Change	Impact?	Existing (m)	Proposed (m)	Change (m)	Impact?
1	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	6000	1500	184.87	183.46	183.12	**-0.34**	**decrease**	183.60	183.20	**-0.40**	**decrease**	184.52	184.42	-0.10	**decrease**
2	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	7400	1400	186.56	185.30	184.50	**-0.80**	**decrease**	185.36	184.55	**-0.81**	**decrease**	185.97	185.40	-0.57	**decrease**
3	replace with larger opening to meet conveyance & flooding criteria*	Twin Conc. Box	47	3200	1000	186.30	185.53	185.17	**-0.36**	**decrease**	185.61	185.22	**-0.39**	**decrease**	186.22	186.11	-0.11	**decrease**
4	replace with larger opening to meet conveyance & flooding criteria	Conc. Box	47	4400	1000	187.32	186.54	186.08	**-0.46**	**decrease**	186.58	186.13	**-0.45**	**decrease**	186.86	186.81	-0.05	**decrease**
5	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	7600	1500	185.15	183.32	183.07	**-0.25**	**decrease**	183.40	183.12	**-0.28**	**decrease**	185.21	184.79	-0.42	**decrease**
5a	replace with larger opening to meet conveyance & flooding criteria*	Conc. Box	47	2000	1000	185.16	183.79	183.55	**-0.24**	**decrease**	183.82	183.56	**-0.26**	**decrease**	184.21	184.11	-0.10	**decrease**
6	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	10,200	1200	184.36	183.12	182.61	**-0.51**	**decrease**	183.35	182.65	**-0.70**	**decrease**	184.20	183.69	-0.51	**decrease**
7	replace with larger opening to meet conveyance, flooding & environmental criteria	Bridge	47	30,000	4100	176.85	174.32	174.14	**-0.18**	**decrease**	174.50	174.19	**-0.31**	**decrease**	178.09	176.29	-1.80	**decrease**
8	replace with larger opening to meet conveyance & flooding criteria	Conc. Box	47	4500	1000	190.00	190.27	189.00	**-1.27**	**decrease**	190.30	189.05	**-1.25**	**decrease**	190.47	189.34	-1.13	**decrease**
9	replace with larger opening to meet conveyance, flooding & environmental criteria	Twin Conc. Box Open Footing	47	4800	1200	189.19	188.23	187.87	**-0.36**	**decrease**	188.39	187.94	**-0.45**	**decrease**	189.68	188.97	-0.71	**decrease**
10 Alternative 5C	constructu new opening to meet conveyance & flooding criteria*	Conc. Box	59	4000	750	194.10	193.18	193.09	**-0.09**	**decrease**	193.25	193.10	**-0.15**	**decrease**	193.62	193.25	-0.37	**decrease**
11 Alternative 5C	construct new structure to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	14,000	2600	192.60	190.16	190.10	**-0.06**	**decrease**	190.23	190.18	**-0.05**	**decrease**	190.79	190.78	-0.01	**decrease**
12	replace with larger opening to meet conveyance & flooding criteria*	Conc. Box	47	3000	750	193.70	192.51	192.51	**0.00**	**-**	192.54	192.52	**-0.02**	**decrease**	192.81	192.61	-0.20	**decrease**
13	replace with larger opening to meet conveyance & flooding criteria	Conc. Box	47	2000	750	194.16	193.35	193.15	**-0.20**	**decrease**	193.40	193.19	**-0.21**	**decrease**	193.64	193.35	-0.29	**decrease**
14	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	7200	1000	190.45	189.90	189.34	**-0.56**	**decrease**	189.98	189.41	**-0.57**	**decrease**	190.63	190.11	-0.52	**decrease**
15	replace with larger opening to meet conveyance, flooding & environmental criteria	Bridge	47	32,000	4200	182.98	179.22	179.17	**-0.05**	**decrease**	179.34	179.29	**-0.05**	**decrease**	182.32	182.07	-0.25	**decrease**
16	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	2600	1000	187.00	185.57	185.29	**-0.28**	**decrease**	185.72	185.37	**-0.35**	**decrease**	186.65	186.54	-0.11	**decrease**
17	replace with larger opening to meet conveyance, flooding & environmental criteria	Conc. Box Open Footing	47	13,800	1000	187.35	187.51	186.19	**-1.32**	**decrease**	187.56	186.24	**-1.32**	**decrease**	188.41	187.02	-1.39	**decrease**
18	Existing culvert to remain						187.61	187.61	**0.00**	**-**	187.67	187.67	**0.00**	**-**	188.46	188.46	0.00	**-**

* Note - for unregulated stream crossings 3, 5a, 10 and 12, consideration may also be given to smaller temporary culverts or temporary diversion of upstream drainage, until the upstream feature is eliminated as part of future urban development.

7.6.2.Storm Water Management

A number of techniques to provide stormwater management control for the proposed Britannia Road improvements were reviewed. Recommended measures include stormwater management ponds and oil-grit separators.

Stormwater ponds utilize a permanent pool of water to remove pollutants from stromwater runoff and have been found to be efficient in reducing particulate matter such as suspended solids, organic nutrients, heavy metals and biological oxygen demand (BOD). A wet pond may also provide extended detention storage for erosion and flood control and can also enhance baseflow, thereby providing an opportunity to improve downstream aquatic habitat.

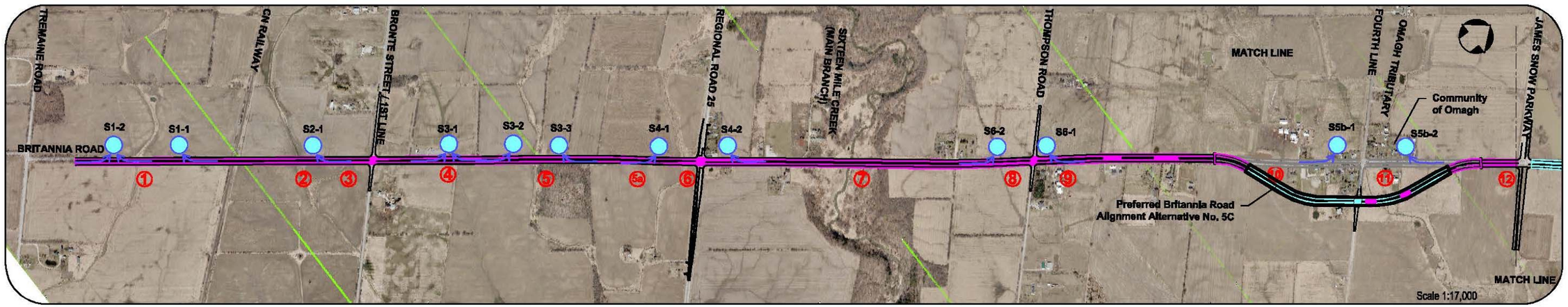
The use of stormwater ponds to treat runoff from roadways alone is often difficult due to limitations related to minimum drainage areas. However, a portion of the Britannia Road study reach is adjacent to the Boyne Secondary Planning Area where future urban development and associated stormwater ponds are planned. The proposed conceptual pond locations, as identified in the Boyne Survey FSEMS (AMEC 2011), include several ponds on the north side of Britannia Road. Therefore, to overcome the drainage area limitations for Britannia Road by itself, it is recommended that the future roadway drainage be combined into the larger adjacent Boyne stormwater pond catchments.

The planning and design of the Britannia Road storm sewer drainage system should therefore be undertaken in anticipation of future connections to the proposed stormwater management ponds within the Boyne Secondary Plan Area. As such, for the portion of Britannia Road that is adjacent to the Secondary Plan Area, the storm sewer system should be designed with outlets on the north side of the roadway. Further, sizing for future stormwater management ponds should include sufficient water quality and quantity storage to provide treatment for the future runoff from Britannia Road. In addition to Level 1 water quality control, it is recommended that design of future stormwater ponds also include measures to minimize thermal impacts (it is recommended that thermal mitigation be provided for all stormwater originating from the proposed Britannia Road). Potential techniques which would be incorporated into the designs include: bottom-draw outlet pipes; gravel trenches at the outfalls and shade plantings.

Oil-grit separators are recommended at the outlets from the storm sewer system for those segments of road which will not be serviced by future adjacent stormwater ponds. This would include the area east of James Snow Parkway as well as the south by-pass of Omagh. Devices within the study area should be sized to provide Level 1 water quality control.

The locations of the recommended stormwater management techniques for the proposed Britannia Road improvements, including the proposed stormwater management ponds and oil-grit separators, are illustrated in **Figure 7-6**.

Figure 7-6: Proposed Stormwater Management Concepts



7.6.3.Culvert Alignments

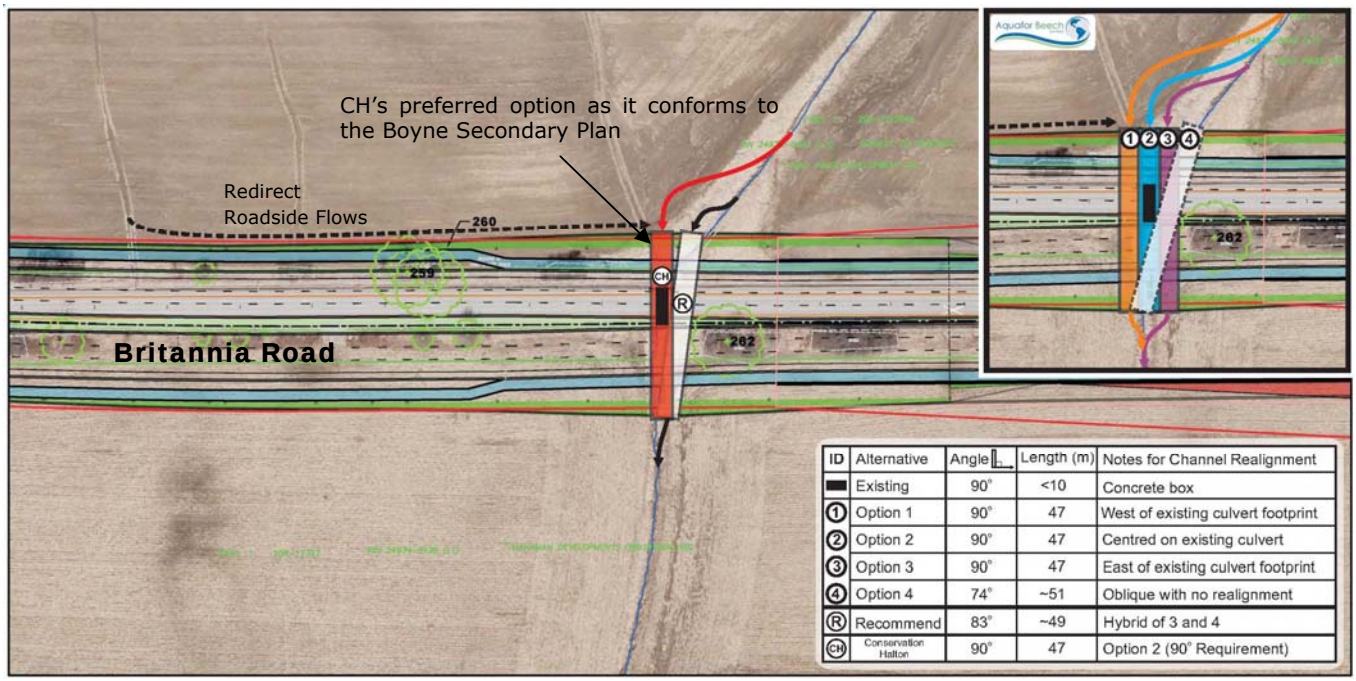
A number of alternative culvert alignments were considered for each watercourse crossing Britannia Road:

- Alignment Option 1 – culvert perpendicular to the roadway axis; west of the existing culvert footprint to facilitate construction where possible; and minimizing channel realignment on one side of the road where possible.
- Alignment Option 2 – culvert perpendicular to the roadway axis; more or less centred on the existing culvert footprint; and balancing channel realignments on both sides of the road where possible.
- Alignment Option 3 – culvert perpendicular to the roadway axis; east of the existing culvert footprint to facilitate construction where possible; and minimizing channel realignment on one side of the road where possible.
- Alignment Option 4 – culvert oblique to the roadway axis; and minimizing channel realignment on both sides of the road where possible.

Within the Boyne Survey Area for future development, a strong preference for culvert alignments perpendicular to the road (i.e., 90°) was indicated by Conservation Halton to minimize the culvert lengths and consequent impacts to aquatic habitat, in terms of enclosure lengths and fish passage concerns in particular. It was also suggested by Conservation Halton that perpendicular culverts have been assumed in development plans. The analysis completed as part of the EA study however, identified that minimal offsets of the channel on the north side due to oblique culvert alignments could easily be accommodated within the development restoration designs of relatively wide stream corridors. In subsequent discussion with the Project Team, CH has indicated their support for the Project Team's recommendations for watercourse crossing nos. 2, 3, 4, 5, 8, 14, 16 and 17. These items shall be given further consideration during detailed design. For the crossings with the Boyne Secondary Plan Area, the final design elements will be confirmed as discussed in Section 4.3.5.

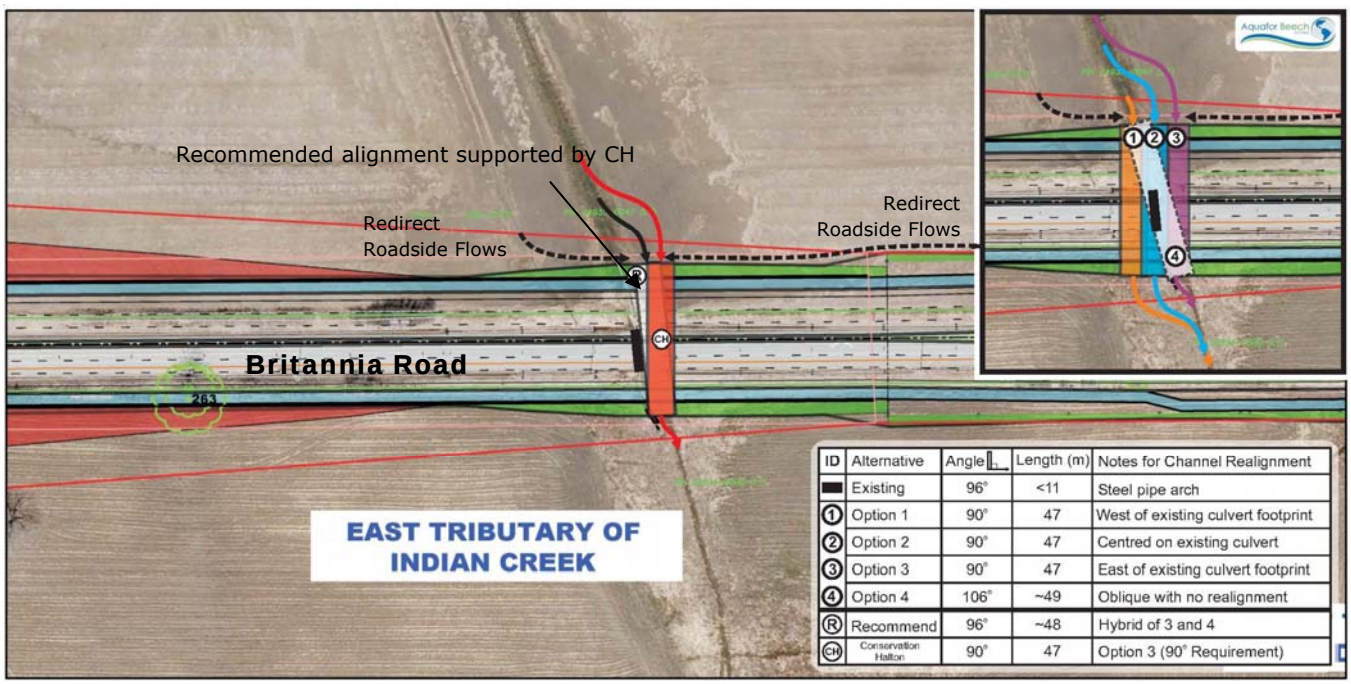
Figures 7-7 to **7-18** present the recommended culvert alignments (as well as the alternatives considered) for each crossing, excluding those crossings where a recommended alignment has not been made, or is not required. Further discussion of each watercourse crossing alignment, including those crossings where a recommended alignment has not been made, or is not required (i.e. watercourse crossing nos. 6, 7, 10, 13, 15 and 18), is provided in the *Fluvial Geomorphology Study* in Appendix D.

Figure 7-7: Recommended Culvert Alignments – Watercourse Crossing #1



ID	Alternative	Angle	Length (m)	Notes for Channel Realignment
	Existing	90°	<10	Concrete box
1	Option 1	90°	47	West of existing culvert footprint
2	Option 2	90°	47	Centred on existing culvert
3	Option 3	90°	47	East of existing culvert footprint
4	Option 4	74°	~51	Oblique with no realignment
R	Recommend	83°	~49	Hybrid of 3 and 4
CH	Conservation Halton	90°	47	Option 2 (90° Requirement)

Figure 7-8: Recommended Culvert Alignments – Watercourse Crossing #2



ID	Alternative	Angle	Length (m)	Notes for Channel Realignment
	Existing	96°	<11	Steel pipe arch
1	Option 1	90°	47	West of existing culvert footprint
2	Option 2	90°	47	Centred on existing culvert
3	Option 3	90°	47	East of existing culvert footprint
4	Option 4	106°	~49	Oblique with no realignment
R	Recommend	96°	~48	Hybrid of 3 and 4
CH	Conservation Halton	90°	47	Option 3 (90° Requirement)

Figure 7-9: Recommended Culvert Alignments – Watercourse Crossing #3

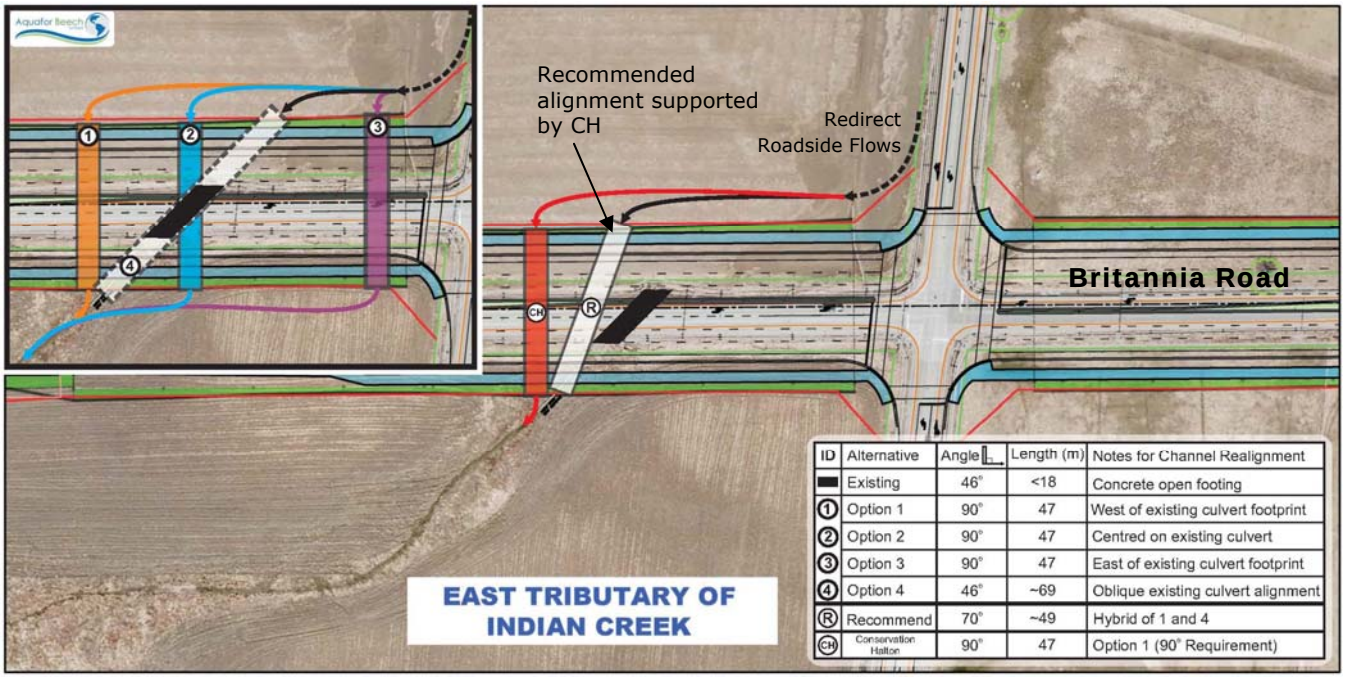


Figure 7-10: Recommended Culvert Alignments – Watercourse Crossing #4

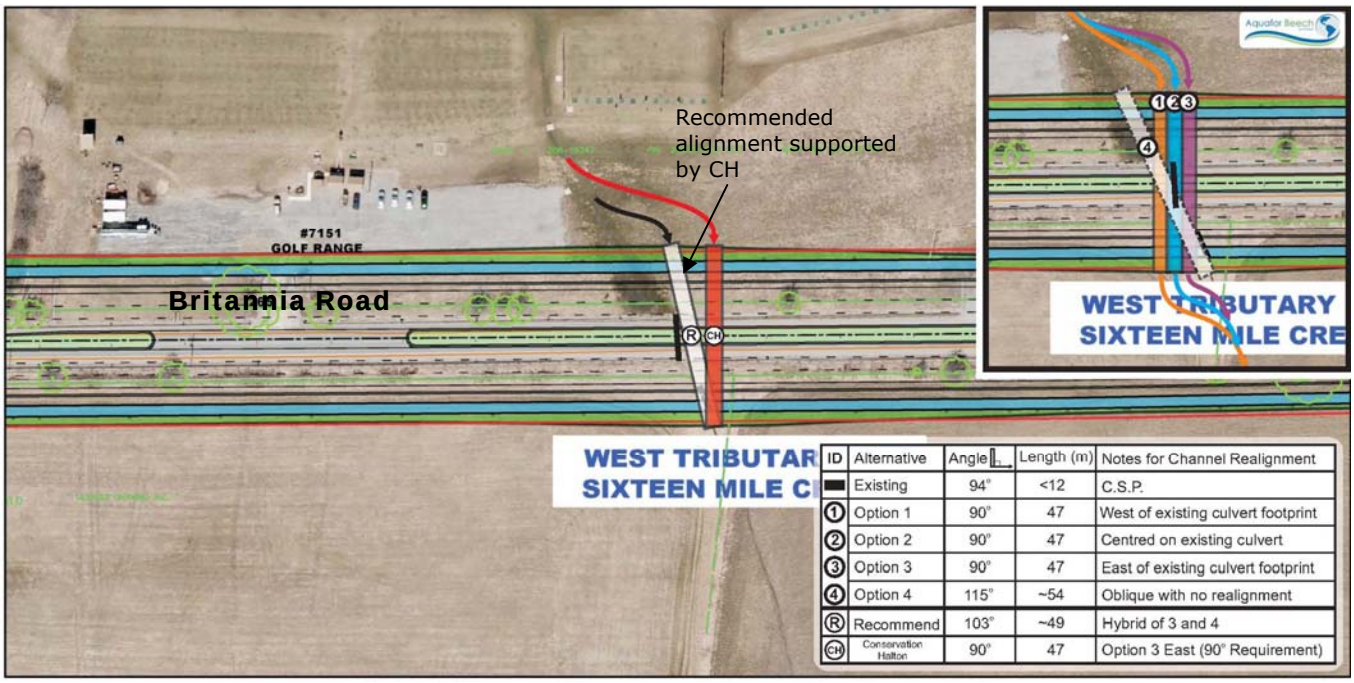


Figure 7-11: Recommended Culvert Alignments – Watercourse Crossing #5

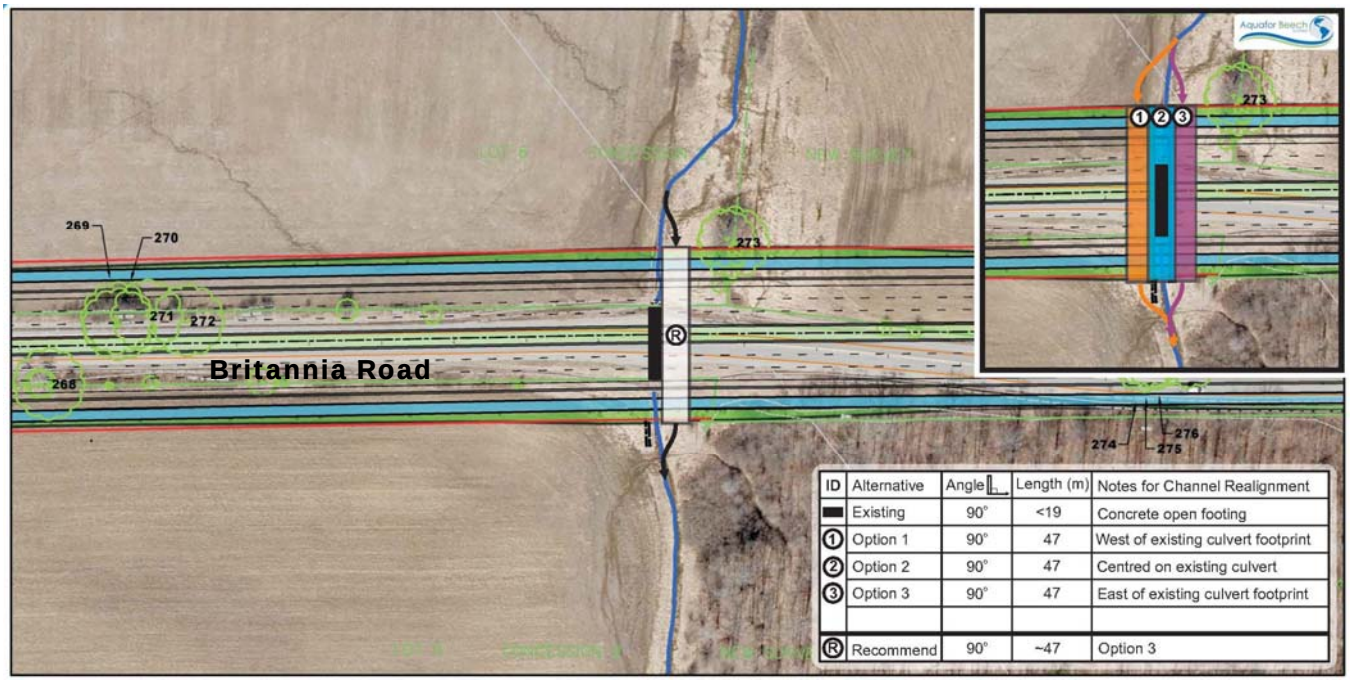


Figure 7-12: Recommended Culvert Alignments – Watercourse Crossing #8

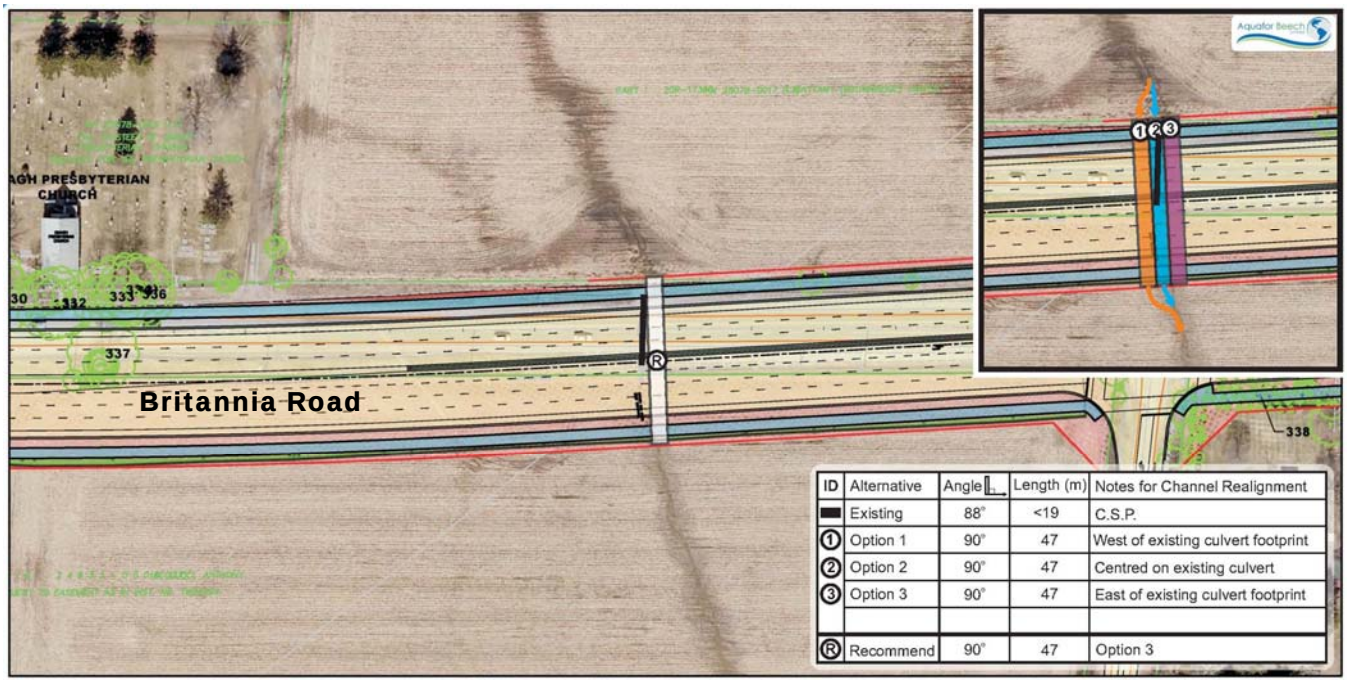
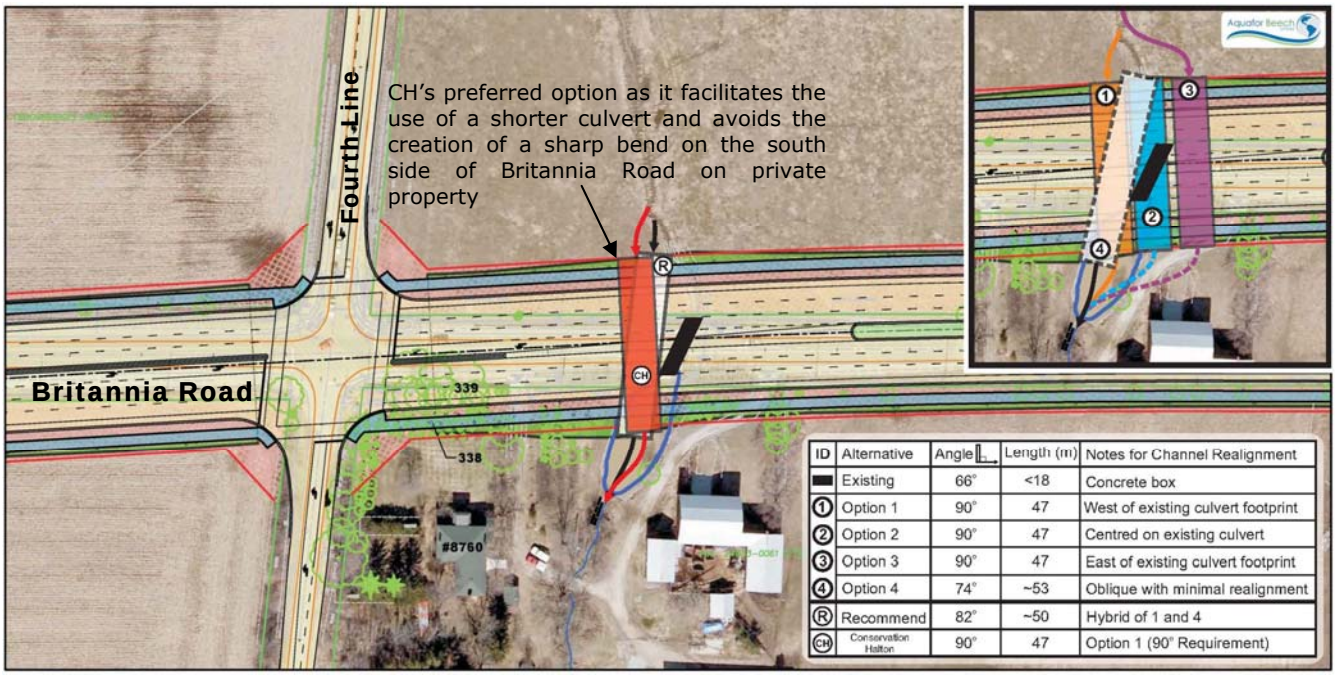
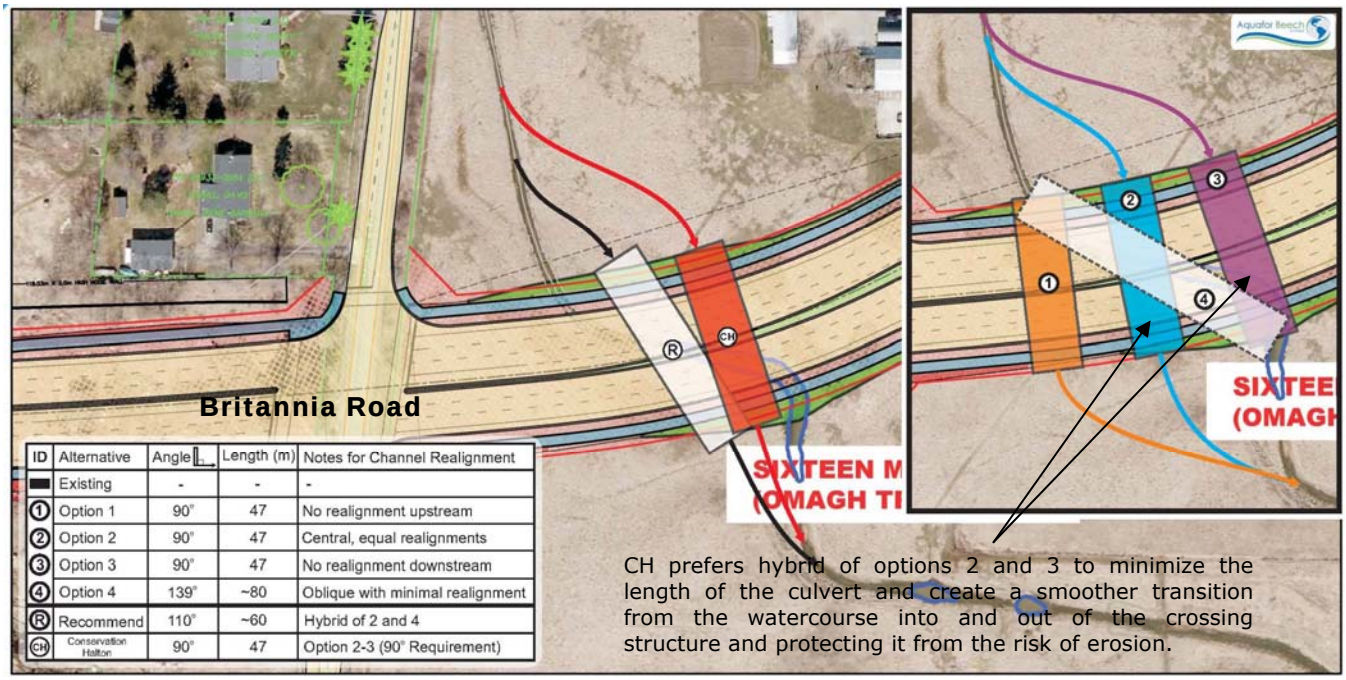


Figure 7-13: Recommended Culvert Alignments – Watercourse Crossing #9



ID	Alternative	Angle ∟	Length (m)	Notes for Channel Realignment
	Existing	66°	<18	Concrete box
1	Option 1	90°	47	West of existing culvert footprint
2	Option 2	90°	47	Centred on existing culvert
3	Option 3	90°	47	East of existing culvert footprint
4	Option 4	74°	~53	Oblique with minimal realignment
R	Recommend	82°	~50	Hybrid of 1 and 4
CH	Conservation Halton	90°	47	Option 1 (90° Requirement)

Figure 7-14: Recommended Culvert Alignments – Watercourse Crossing #11



ID	Alternative	Angle ∟	Length (m)	Notes for Channel Realignment
	Existing	-	-	-
1	Option 1	90°	47	No realignment upstream
2	Option 2	90°	47	Central, equal realignments
3	Option 3	90°	47	No realignment downstream
4	Option 4	139°	~80	Oblique with minimal realignment
R	Recommend	110°	~60	Hybrid of 2 and 4
CH	Conservation Halton	90°	47	Option 2-3 (90° Requirement)

Figure 7-15: Recommended Culvert Alignments – Watercourse Crossing #12

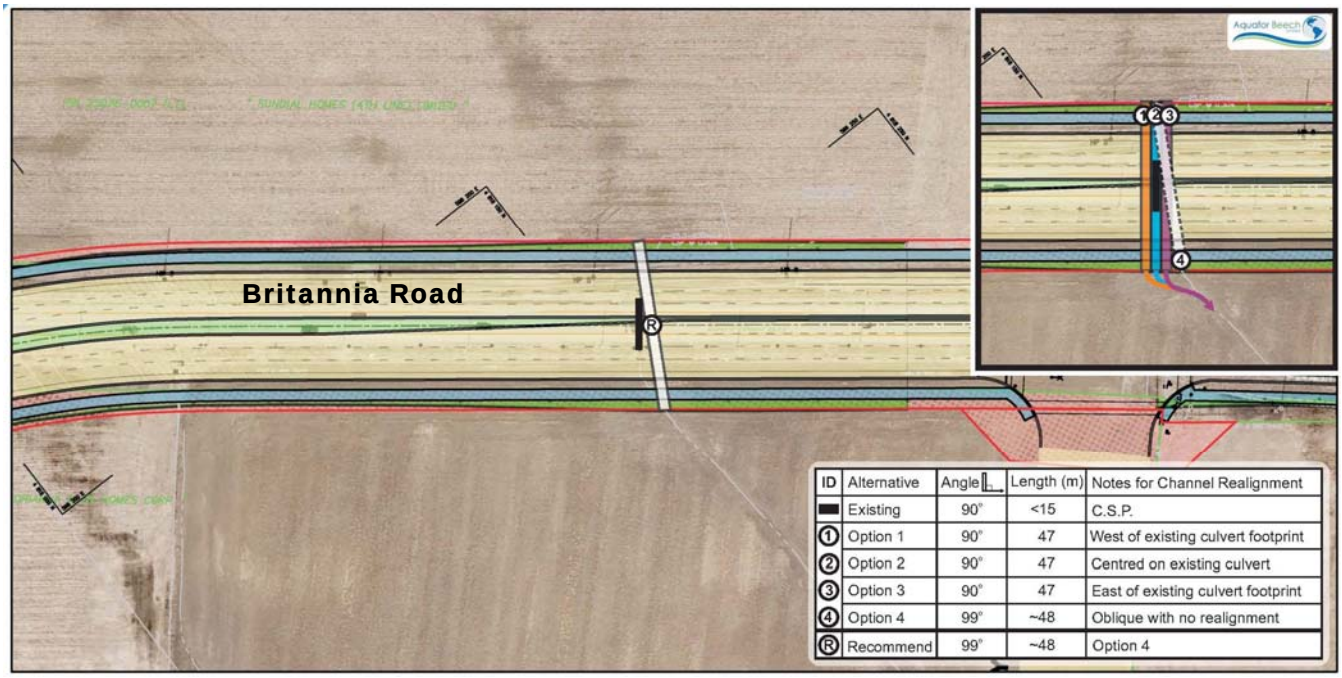


Figure 7-16: Recommended Culvert Alignments – Watercourse Crossing #14

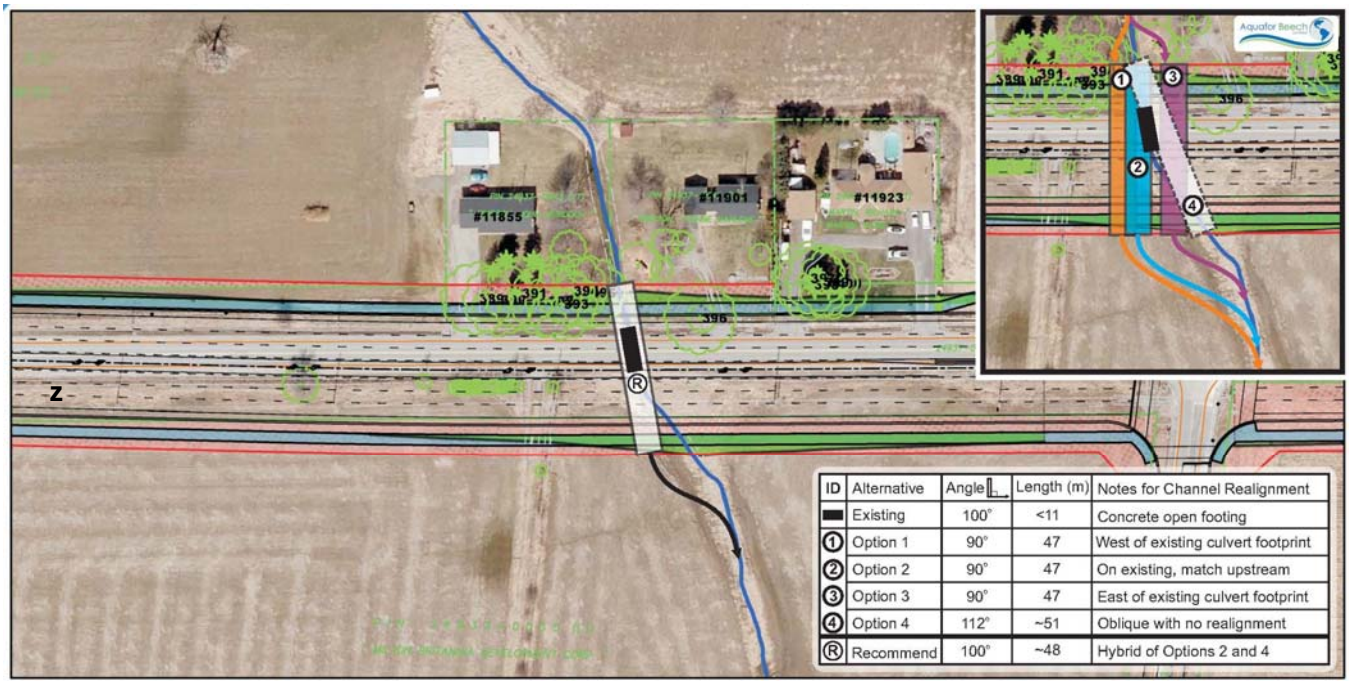


Figure 7-17: Recommended Culvert Alignments – Watercourse Crossing #16

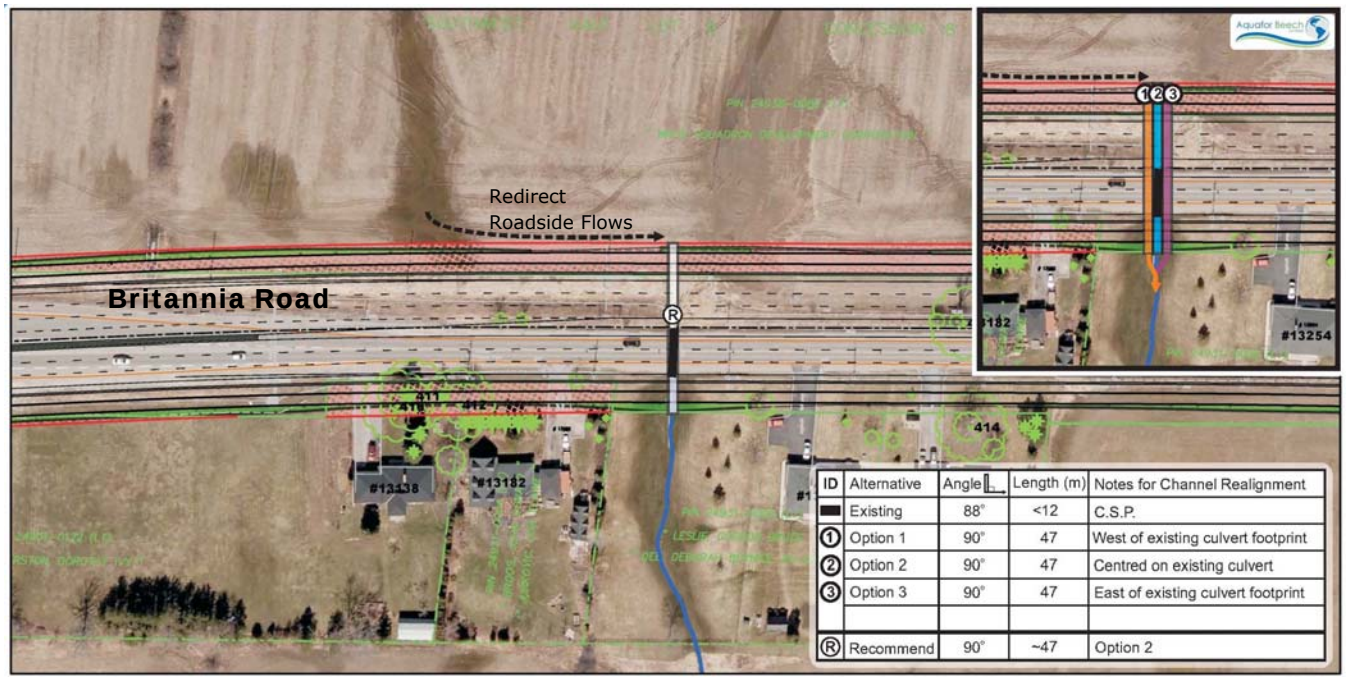
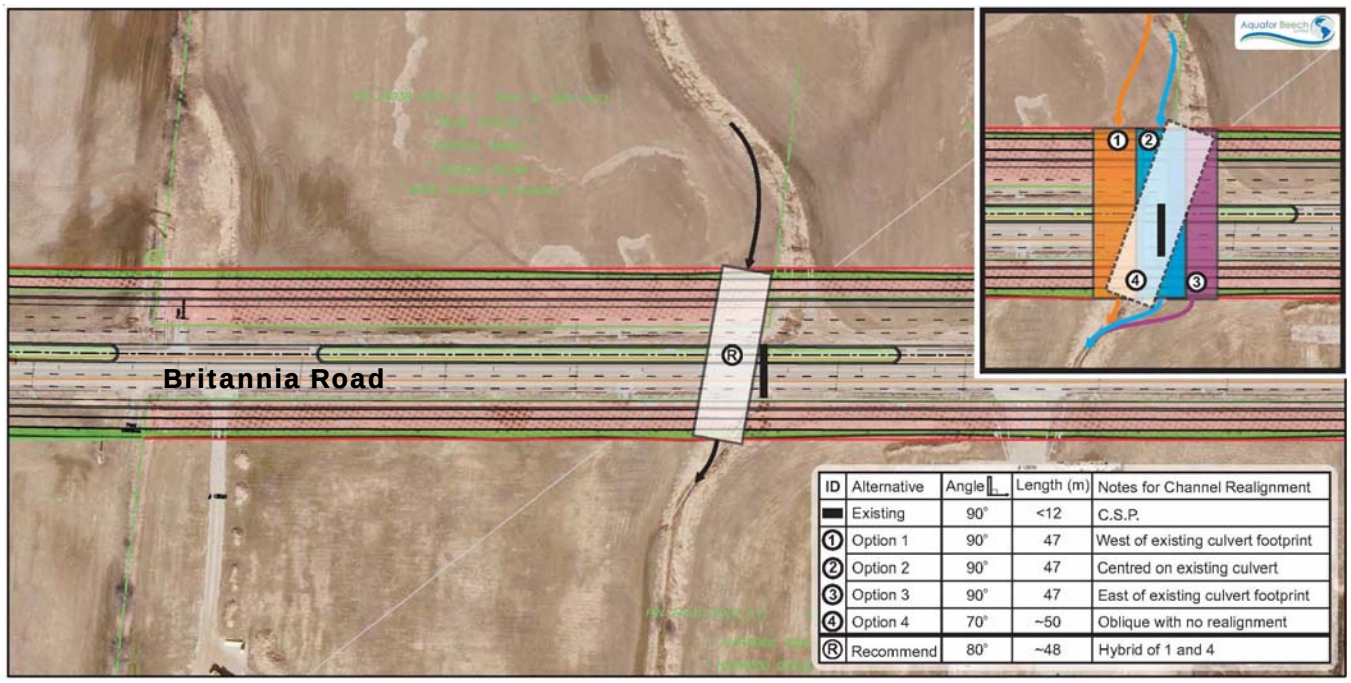


Figure 7-18: Recommended Culvert Alignments – Watercourse Crossing #17



7.6.4.CN Rail Grade Separation

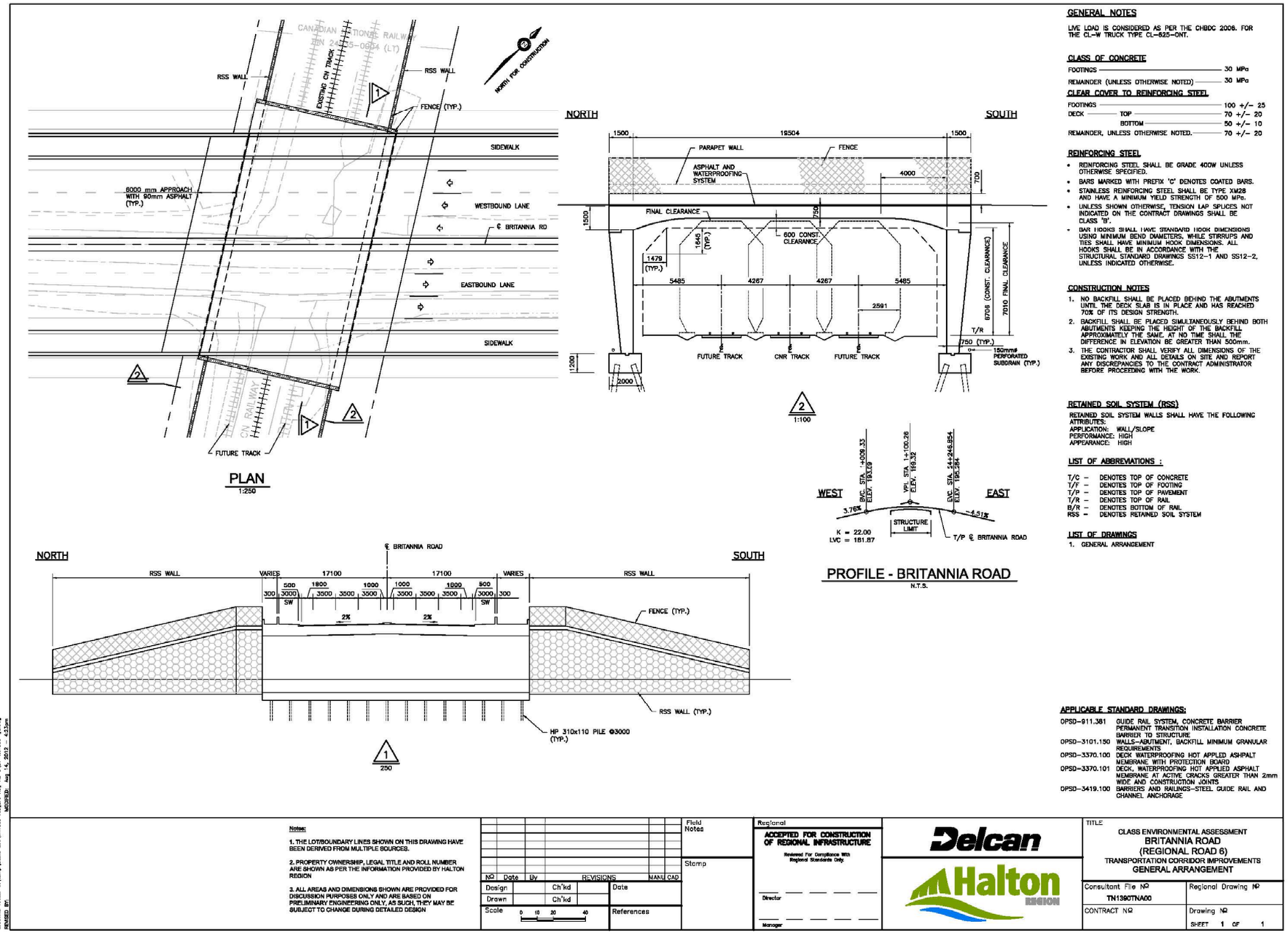
As identified in Section 5.4.3, an overpass (road over rail) between Tremaine Road and First Line was recommended to be carried forward as the preferred CN rail crossing. The approaches are approximately 350m long to allow for reasonable approach grades and vertical curves. A combination of retaining walls and side slopes at a ratio of 2:1 should be utilized for the approaches to both minimize property impacts and construction costs. The roadway cross-section over the structure will consist of the 6x3.5 m travel lanes, two on road 1.8m bicycle lanes and elevated 3.0m multi-use trails along both sides of the roadway A general arrangement drawing for the CN grade separation is provided in **Figure 7-19.**

The structure developed for the CNR grade separation shall include a rigid frame type bridge, featuring a 7.01 metre minimum vertical clearance. The structure has been currently designed with provision for two additional rail lines. The finalized structure rail cross-section will be completed during detailed design in cooperation with CN Rail.

In order to maintain traffic flows, the construction will be staged to include a roadway diversion to the north. An active railway protection system will need to be installed at the new at-grade crossing created by the diverted roadway. Once the structure is completed the roadway traffic will be transferred back onto Britannia Road and over the new structure. As per email correspondence with CN dated January 22, 2014, the Region is committed to continue to work with CN to finalize the detail design and staging.

As part of the grade separation temporary property easements will be required along the west and north side of the structure to allow for temporary roadway detours during the construction of the grade separation. **Figure 7-20** illustrates the approximate property and easement requirements. As the project moves into the detailed design phase the limits of these easements may require some adjustments based on comments and feedback from CN Rail.

Figure 7-19: General Arrangement Drawing for CN Grade Separation



GENERAL NOTES

LIVE LOAD IS CONSIDERED AS PER THE CHBDC 2006. FOR THE CL-W TRUCK TYPE CL-625-ONT.

CLASS OF CONCRETE

FOOTINGS — 30 MPa
REMAINDER (UNLESS OTHERWISE NOTED) — 30 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTINGS — 100 +/- 25
DECK — TOP — 70 +/- 20
BOTTOM — 50 +/- 10
REMAINDER, UNLESS OTHERWISE NOTED. — 70 +/- 20

REINFORCING STEEL

- REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
- BARS MARKED WITH PREFIX 'C' DENOTES COATED BARS.
- STAINLESS REINFORCING STEEL SHALL BE TYPE XM28 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa.
- UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS 'B'.
- BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS. WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, UNLESS INDICATED OTHERWISE.

CONSTRUCTION NOTES

1. NO BACKFILL SHALL BE PLACED BEHIND THE ABUTMENTS UNTIL THE DECK SLAB IS IN PLACE AND HAS REACHED 70% OF ITS DESIGN STRENGTH.
2. BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS OF THE EXISTING WORK AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING WITH THE WORK.

RETAINED SOIL SYSTEM (RSS)

RETAINED SOIL SYSTEM WALLS SHALL HAVE THE FOLLOWING ATTRIBUTES:
APPLICATION: WALL/SLOPE
PERFORMANCE: HIGH
APPEARANCE: HIGH

LIST OF ABBREVIATIONS :

T/C – DENOTES TOP OF CONCRETE
T/F – DENOTES TOP OF FOOTING
T/P – DENOTES TOP OF PAVEMENT
T/R – DENOTES TOP OF RAIL
B/R – DENOTES BOTTOM OF RAIL
RSS – DENOTES RETAINED SOIL SYSTEM

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT

APPLICABLE STANDARD DRAWINGS:

OPSD-911.381 GUIDE RAIL SYSTEM, CONCRETE BARRIER PERMANENT TRANSITION INSTALLATION CONCRETE BARRIER TO STRUCTURE
OPSD-3101.150 WALLS-ABUTMENT, BACKFILL MINIMUM GRANULAR REQUIREMENTS
OPSD-3370.100 DECK WATERPROOFING HOT APPLIED ASHPALT MEMBRANE WITH PROTECTION BOARD
OPSD-3370.101 DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS
OPSD-3419.100 BARRIERS AND RAILINGS-STEEL GUIDE RAIL AND CHANNEL ANCHORAGE

Notes:

1. THE LOT/BOUNDARY LINES SHOWN ON THIS DRAWING HAVE BEEN DERIVED FROM MULTIPLE SOURCES.
2. PROPERTY OWNERSHIP, LEGAL TITLE AND ROLL NUMBER ARE SHOWN AS PER THE INFORMATION PROVIDED BY HALTON REGION
3. ALL AREAS AND DIMENSIONS SHOWN ARE PROVIDED FOR DISCUSSION PURPOSES ONLY AND ARE BASED ON PRELIMINARY ENGINEERING ONLY, AS SUCH, THEY MAY BE SUBJECT TO CHANGE DURING DETAILED DESIGN

Field Notes
Stamp
NO | Date | By | REVISIONS | MANU CAD
Design | Ch'kd | Date
Drawn | Ch'kd
Scale | References

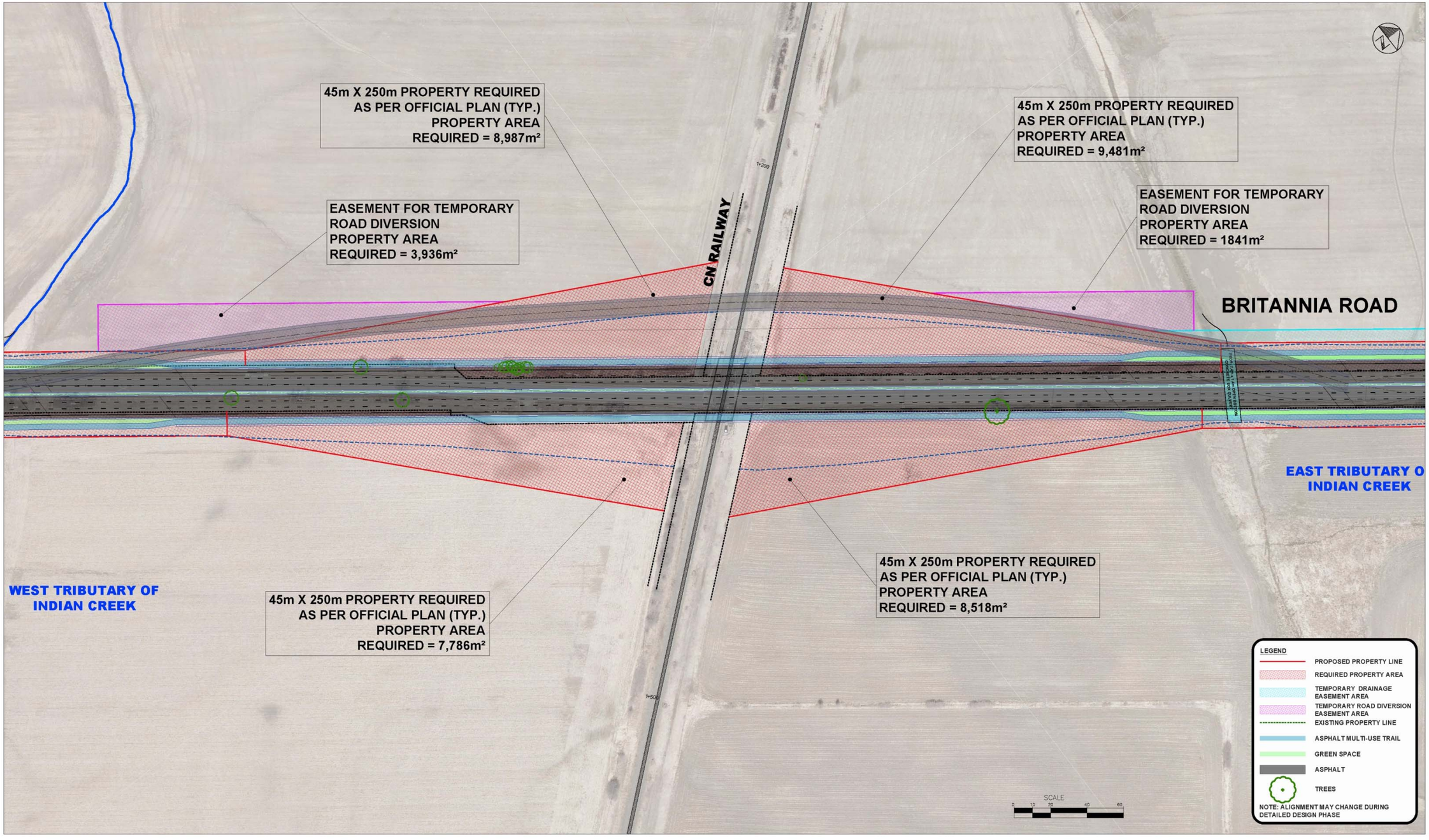
Regional
ACCEPTED FOR CONSTRUCTION OF REGIONAL INFRASTRUCTURE
Reviewed For Compliance With Regional Standards Only.
Director
Manager

Delcan
Halton REGION

TITLE
CLASS ENVIRONMENTAL ASSESSMENT
BRITANNIA ROAD
(REGIONAL ROAD 6)
TRANSPORTATION CORRIDOR IMPROVEMENTS
GENERAL ARRANGEMENT

Consultant File NO: TN1390TNA00
Regional Drawing NO:
CONTRACT NO:
Drawing NO:
SHEET 1 OF 1

Figure 7-20: Property and Easement Requirements Associated with CN Grade Separation



7.6.5.Bridge Structures

There are two existing bridge structures within the study limits, located at the main and east branches of Sixteen Mile Creek (crossing Nos. 7 and 15). These structures are unable to accommodate the additional lanes recommended for Britannia Road. Due to the age of the existing structures (approx. 50 years old), the degree of widening required (from 2 to 6 lanes, plus bike lanes) and required improvements to the vertical alignment, full replacement of these structures is required.

Since the bridge structures span branches of Sixteen Mile Creek, care must be taken during construction to avoid contaminating the valley lands or the watercourse. It should also be noted that replacement of the bridge structures could result in lengthy closures and complex detours. As such, opportunities to minimize closure durations and detour complexity should be explored during detailed design.

Summary details of the existing and proposed bridge structures, as well as anticipated detour routes during construction, are provided below.

16 Mile Creek Main Branch Structure

The existing structure is a rigid frame bridge with a span opening of 19.8 meters and a current roadway elevation of 177.02 at the bridge. The hydraulic investigation determined that the structure will not be overtopped during the Regional Storm and will be able to maintain 1 meter of freeboard during a 50 year storm in both existing and future widened conditions.

The proposed 16 Mile Creek West Branch bridge structure is to be comprised of a single span precast pre-stressed 2300 CPCI concrete box girder bridge with a cast-in-place concrete deck. The overall length of the bridge will be 54 m. The span will provide a soffit clearance of 2.79 m for the 100 year storm and accommodate a 30 m span, which is greater than 2 times the channel bankfull width as recommended in the fluvial geomorphology assessment. In order to minimize the overall length of the structure, retained soil system (RSS) wingwalls will be used to retain the roadway embankments. The overall width of the bridge will be 34.6 m and will accommodate the ultimate 6-lane configuration (even though only 4 lanes will be constructed initially, the bridge will be constructed to the ultimate 6 lane width) with a 1.8 m wide bike lane, a 3.0 m wide multi-use trail on both the east and west sides and a 2.0 m wide raised median.

Construction of the new bridge would occur as follows:

1. Construction of 10m wide south portion of new bridge,
2. Removal of existing bridge, and
3. Construction of remaining 24.6m width of new bridge.

The preliminary structural general arrangement drawing for this structure is provided in **Figure 7-21**.

16 Mile Creek East Branch Structure

The existing structure is a rigid frame bridge with a span opening of 24.4 metres and a current roadway elevation of 181.27 at the bridge. The hydraulic investigations concluded that the structure will be overtopped during the regional storm although it will pass the 50 year storm with over 1 metre of freeboard. In order to prevent overtopping of the bridge and roadway, as well as to improve the vertical geometry, the bridge will need to be raised to an elevation of 184.5, an increase of 3.23 meters.

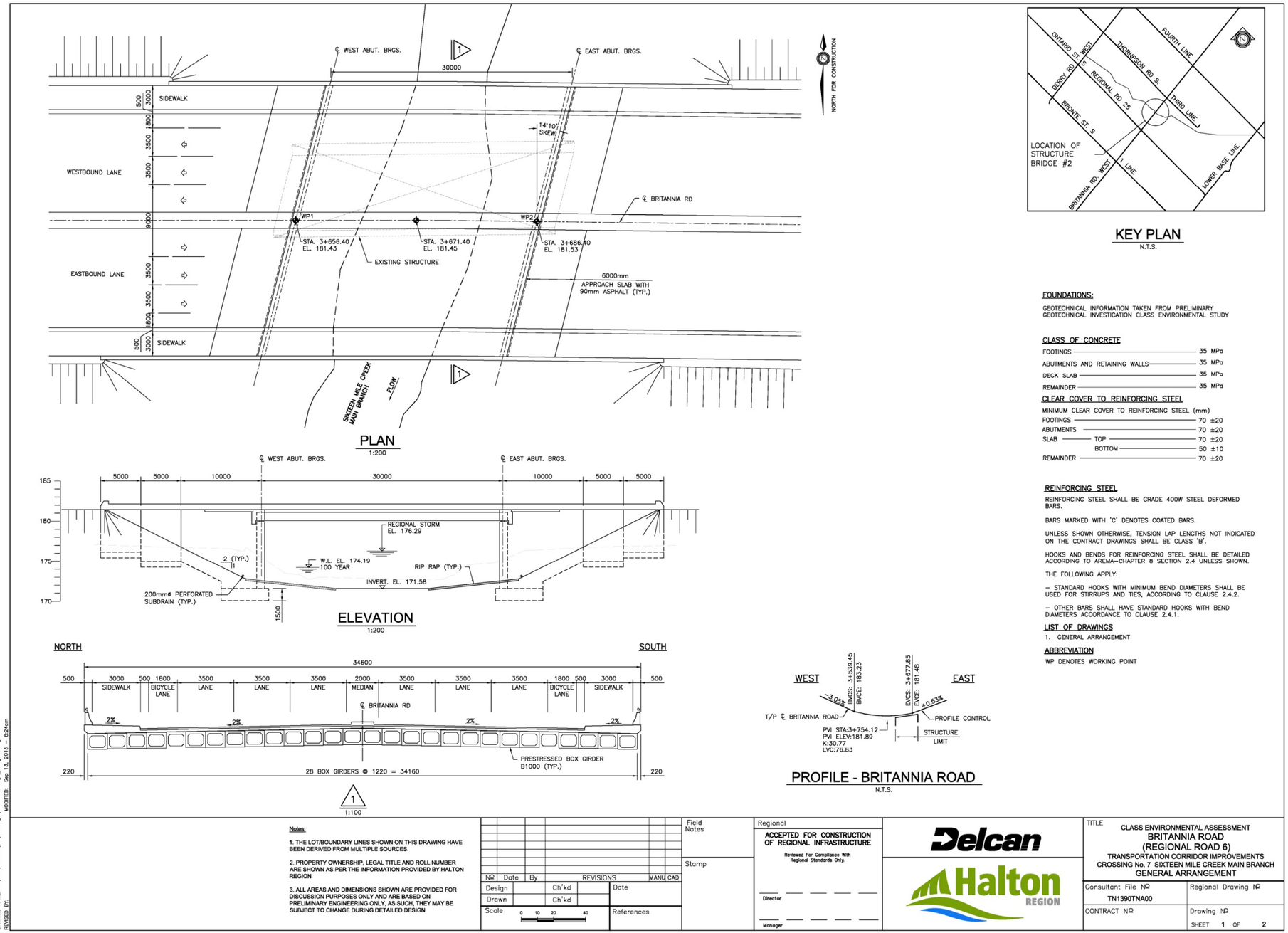
The proposed 16 Mile Creek East Branch bridge structure is to be comprised of a single span precast pre-stressed 2300 CPCI concrete 'I' girder bridge with a cast-in-place concrete deck. The overall length of the bridge will be 40 m. The span will provide a soffit clearance of 2.79 m for the 100 year storm and accommodate a 32 m span, which is 2 times the channel bankfull width as recommended in the fluvial geomorphology assessment. In order to minimize the overall length of the structure, retained soil system (RSS) wingwalls will be used to retain the roadway embankments. The overall width of the bridge will be 37.6 m and will accommodate the ultimate 6-lane configuration with a 1.8 m wide bike lane, a 3.0 m wide multi-use trail on both the east and west sides and a 5.0 m wide raised median area to accommodate a centre median and westbound left turn taper at the Trafalgar Road intersection.

Construction of the new bridge would occur as follows:

1. Construction of 10m wide south portion of new bridge,
2. Removal of existing bridge, and
3. Construction of remaining 24.6m width of new bridge.

The preliminary structural general arrangement drawing for this structure is provided in **Figure 7-22**.

Figure 7-21: General Arrangement Drawing for 16 Mile Creek Main Branch Structure



FOUNDATIONS:

GEOTECHNICAL INFORMATION TAKEN FROM PRELIMINARY GEOTECHNICAL INVESTICATION CLASS ENVIRONMENTAL STUDY

CLASS OF CONCRETE

FOOTINGS	35 MPa
ABUTMENTS AND RETAINING WALLS	35 MPa
DECK SLAB	35 MPa
REMAINDER	35 MPa

CLEAR COVER TO REINFORCING STEEL

MINIMUM CLEAR COVER TO REINFORCING STEEL (mm)

FOOTINGS		70 ±20
ABUTMENTS		70 ±20
SLAB	TOP	70 ±20
	BOTTOM	50 ±10
REMAINDER		70 ±20

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400W STEEL DEFORMED BARS.

BARS MARKED WITH 'C' DENOTES COATED BARS.

UNLESS SHOWN OTHERWISE, TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS 'B'.

HOOKS AND BENDS FOR REINFORCING STEEL SHALL BE DETAILED ACCORDING TO AREMA–CHAPTER 8 SECTION 2.4 UNLESS SHOWN.

THE FOLLOWING APPLY:

– STANDARD HOOKS WITH MINIMUM BEND DIAMETERS SHALL BE USED FOR STIRRUPS AND TIES, ACCORDING TO CLAUSE 2.4.2.

– OTHER BARS SHALL HAVE STANDARD HOOKS WITH BEND DIAMETERS ACCORDANCE TO CLAUSE 2.4.1.

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT

ABBREVIATION

WP DENOTES WORKING POINT

Notes:

1. THE LOT/BOUNDARY LINES SHOWN ON THIS DRAWING HAVE BEEN DERIVED FROM MULTIPLE SOURCES.

2. PROPERTY OWNERSHIP, LEGAL TITLE AND ROLL NUMBER ARE SHOWN AS PER THE INFORMATION PROVIDED BY HALTON REGION

3. ALL AREAS AND DIMENSIONS SHOWN ARE PROVIDED FOR DISCUSSION PURPOSES ONLY AND ARE BASED ON PRELIMINARY ENGINEERING ONLY, AS SUCH, THEY MAY BE SUBJECT TO CHANGE DURING DETAILED DESIGN

NO	Date	By	REVISIONS	MANU	CAD
Design			Ch'kd		Date
Drawn			Ch'kd		
Scale	0 10 20 40				References

Field Notes

Stamp

Regional

ACCEPTED FOR CONSTRUCTION OF REGIONAL INFRASTRUCTURE

Reviewed For Compliance With Regional Standards Only.

Director

Manager

Delcan

Halton REGION

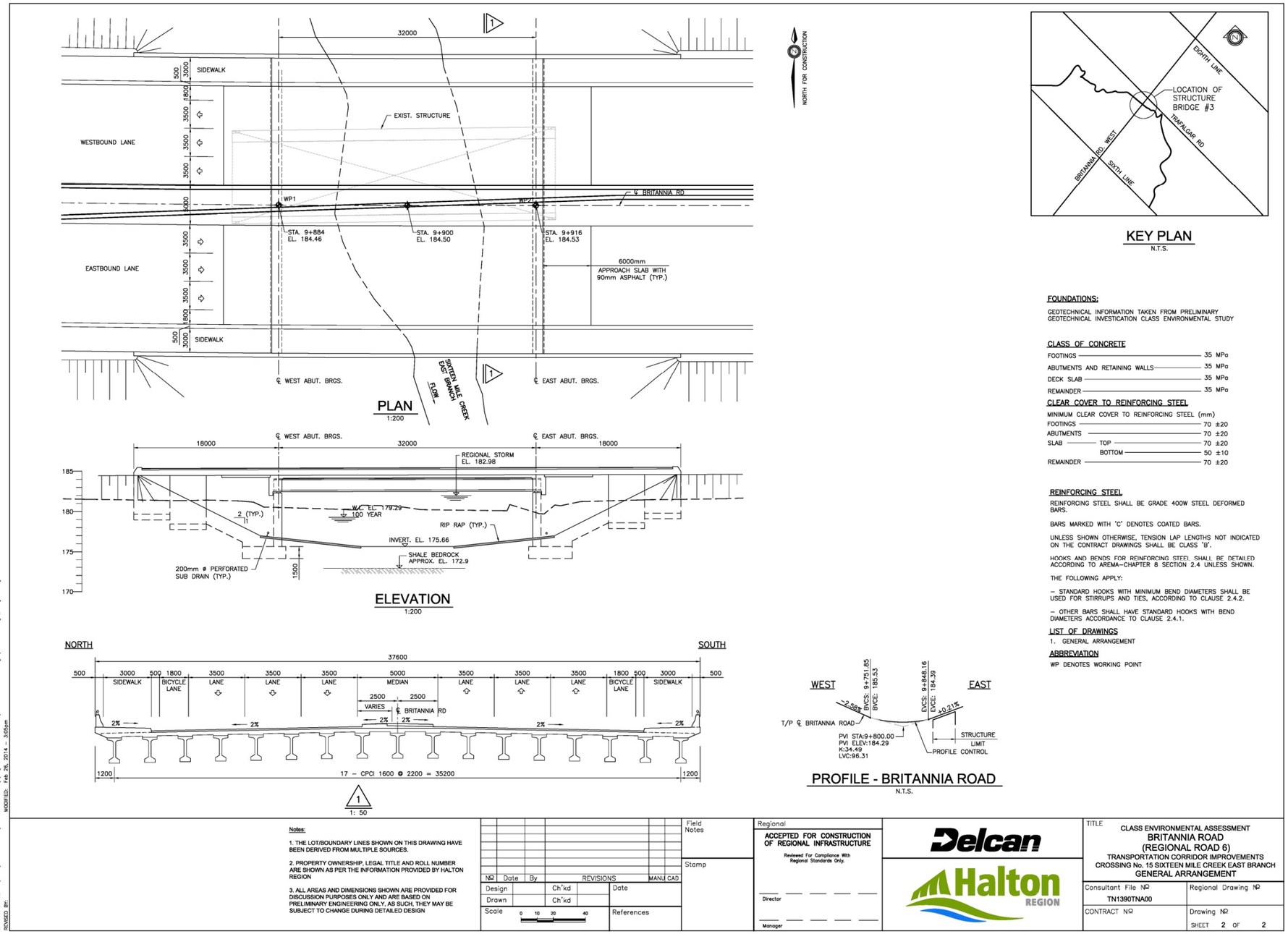
TITLE

CLASS ENVIRONMENTAL ASSESSMENT
BRITANNIA ROAD
(REGIONAL ROAD 6)
TRANSPORTATION CORRIDOR IMPROVEMENTS
CROSSING No. 7 SIXTEEN MILE CREEK MAIN BRANCH
GENERAL ARRANGEMENT

Consultant File № TN1390TNA00	Regional Drawing №
CONTRACT №	Drawing № SHEET 1 OF 2

DRAWING NAME: c:\TDR\TN1390\TN\Drawings\ST-TN1390-gp_bridge 2.dwg
MODIFIED: Sep 13, 2017 - 8:24am
REVISED BY:

Figure 7-22: General Arrangement Drawing for 16 Mile Creek East Branch Structure



7.6.6. Illumination

As per the typical cross section presented in Figure 7-1, roadway illumination is to include light standards along both sides of the road, and/or within the centre median. Poles and luminaires would be in accordance with Halton Region standards. Illumination design, light standard spacing and opportunities for sharing poles with Milton Hydro will be explored further during the detailed design phase of the project.

7.6.7. Landscaping

The landscape on either side of Britannia Road is generally characterized by active farms and agricultural fields dating to the nineteenth and early-twentieth centuries with intermittent residential and commercial properties. There are also two low lying woods within the corridor. Britannia Road intersects three historic settlements, including Boyne (at Regional Road 25), Drumquin (at Trafalgar Road), and the largest, Omagh (at Fourth Line), and crosses two branches of Sixteen Mile Creek.

With the introduction of the proposed roadway cross-section, changes in topography and the proposed urban development, the character of the corridor would change to an urban roadway. Where feasible, cultural vegetation should be protected and preserved, to enhance the scenic character of the transportation corridor and provide buffer, screening, and aesthetic value. Corridor landscape plantings along with intersection treatments, improved pedestrian and cycling facilities (including rest areas/nodes) will enhance the streetscape of the corridor.

The exposed woodlot edges along Britannia Road will have plantings incorporated to screen the woodlot edges from salt spray and light encroachment into the wetland. These plantings would include a dense screen of salt-tolerant evergreen vegetation. Riparian planting will be provided for the disturbed creek/culvert crossings along Britannia Road. The plantings will incorporate input from CH staff during Detail Design.

7.6.8. Utilities & Services

To accommodate the preferred design, all utility poles within the study area will need to be replaced in accordance with Halton Region standards. In addition, it is anticipated that most, if not all, buried utility plant will need to be relocated during the reconstruction of Britannia Road. Sufficient boulevard width has been provided, particularly in areas that have a recommended reduced cross section, for the installation of above ground utility lines. The exact location and depth of all existing and proposed utilities will need to be determined during the detailed design phase.

The provision of municipal services (i.e. watermains and sanitary sewers) along the subject portion of Britannia Road will be determined during the detailed design phase of the study, in consultation with the Town of Milton.

7.6.9. Construction Stages

Due to the size of the overall project, it would not be feasible to construct the entire preferred design at once. Implementation of the preferred design is to be completed in stages, with the initial construction occurring at the western limits. Construction of the entire project should be completed as several smaller projects, which would allow detailed design of the next stage to be completed during construction of the previous stage.

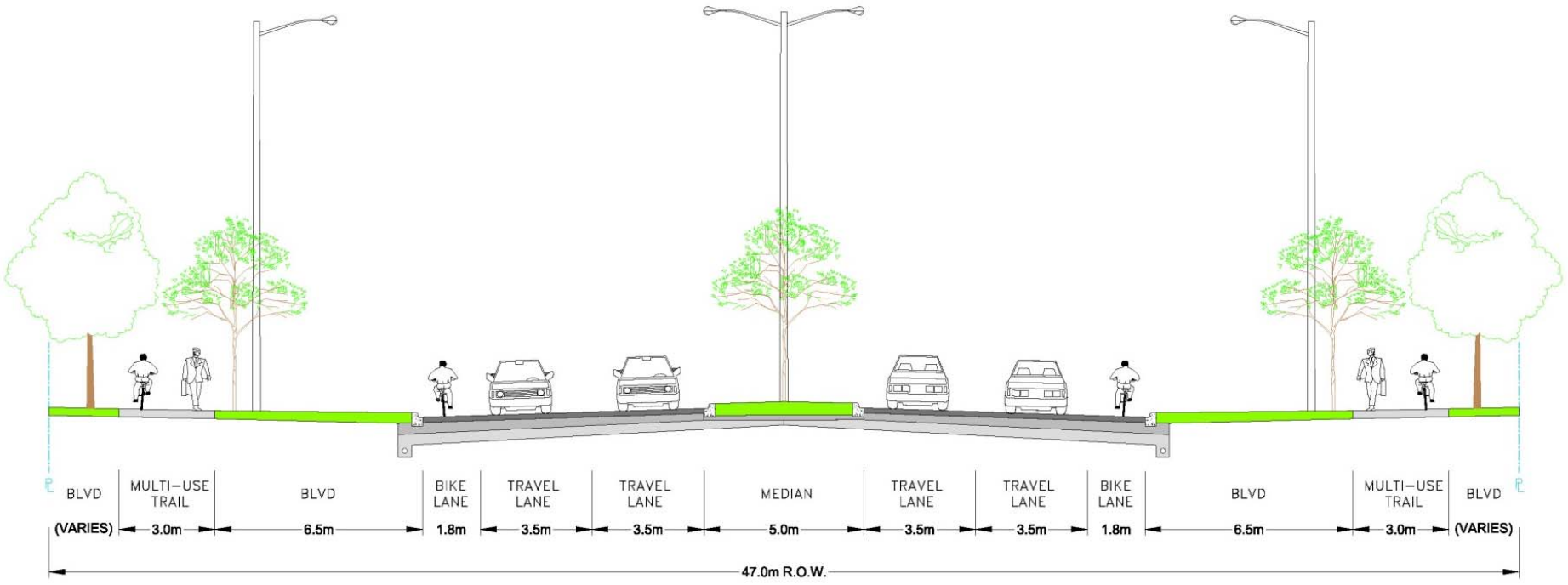
The recommended construction stages are as follows:

1. Tremaine Road to Regional Road 25 – widen from 2 to 6 lanes
2. Regional Road 25 to James Snow Parkway – widen from 2 to 4 lanes
3. James Snow Parkway to Trafalgar Road – widen from 2 to 4 lanes
4. Trafalgar Road to Highway 407 – widen from 2 to 4 lanes
5. Regional Road 25 to Highway 407 – widen from 4 to 6 lanes

Due to the importance of Britannia Road as an east-west corridor within the Region's transportation network, the traffic staging during each of the construction implementation phases should ensure that two travel lanes (one in each direction) are maintained for the duration of the construction period. Also, consideration should be given to the requirements of high trip generators (e.g. Terra Greenhouses) within the design staging plans.

In order to minimize throw-away costs when widening from 4 to 6 lanes, the multi-use trails, as well as streetlights, intersection signals, above ground utility lines, etc., should be constructed to their ultimate location. A typical 4-lane section is shown in **Figure 7-23**. The complete 4-lane design is provided in the preliminary plan and profile drawings.

Figure 7-23: Typical 4-Lane Cross Section



7.6.10. Preliminary Cost Estimates

The estimated project cost for implementing the Britannia Road improvements as detailed in the preferred design is estimated to be approximately $194 million, including property. The preliminary cost estimate is summarized in **Table 7-4** and is further broken down in **Appendix J**.

Table 7-4: Preliminary Cost Estimate Summary

Component	Cost (in $1,000,000)					
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Total
Construction Costs						
Roadworks and Drainage	12.2	12.7	12.9	8.4	24.5	70.7
Landscaping	0.3	0.4	0.4	0.2	1.0	2.3
Electrical	1.1	1.6	1.5	0.7	3.8	8.7
Structural	12.7	10.9	9.9	0.0	7.8	41.3
Utility Relocations	0.3	0.3	0.4	0.2	0.9	2.1
Subtotal	**26.6**	**25.9**	**25.1**	**9.5**	**38.0**	**125.1**
25% overhead and contingency	6.7	6.5	6.3	2.4	9.5	31.4
Subtotal	**33.3**	**32.4**	**31.4**	**11.9**	**47.5**	**156.5**
15% Engineering	5.0	4.9	4.7	1.8	7.1	23.5
Property Costs	4.1	4.6	4.0	1.2	0.0	13.9
Total	**42.4**	**41.9**	**40.1**	**14.9**	**54.6**	**193.9**

8.0 POTENTIAL IMPACTS, MITIGATION MEASURES & MONITORING

8.1. Transportation Environment

The proposed improvements to the subject portion of Britannia Road as described in Section 8.0 support the transportation goals and objectives of Halton Region and Town of Milton, as per the recommendations of the Region's Transportation Master Plan and the Town's secondary plans (e.g. Boyne Survey Secondary Plan).

The key benefits of the proposed improvements include:

- Providing suitable road network capacity to accommodate future development and growth in the area (including residential, commercial and institutional developments);
- Improving area roadway network flexibility to serve existing and future local land uses and provide opportunities for multi modal transportation choices, including provision for pedestrian and cyclists;
- Improving connectivity/capacity in the Britannia corridor to accommodate existing and future travel demands.

During construction, it is anticipated that road users travelling the subject portion of Britannia Road will experience delays in travel time. In order to minimize these delays:

- Construction will be staged to maintain two-way traffic flow during construction (one lane per direction). This may involve the use of detours and staged bridge construction.
- Emergency services shall be notified by the contractor of construction – related activities and schedule to minimize/avoid delays during emergencies. Traffic control plans give priority to emergency vehicles.
- Pedestrian access needs will be considered in the staging of construction.

8.2. Socio-economic Environment

8.2.1. Property Requirements

In order to accommodate the proposed 47m ROW, the purchase of a significant amount of property is required. As discussed earlier, one of the goals of the design of the horizontal alignment was to minimize property impacts, especially to residential, commercial and institutional properties. A preliminary summary of the property impacts associated with implementing the preferred design is provided **Table 8-1**. It should be noted that at intersections, additional property beyond the 47m ROW may be required to accommodate additional turning lanes, where requiored. Actual (i.e. detailed) property requirements will be determined during

the detailed design phase of the study. Due to the significant property requirements, Halton Region should initiate the negotiation of property as soon as possible. Property will be acquired through Halton Region Realty Service at fair market value.

Table 8-1: Property Impact Summary

Property Address	Property Required (ha)
7151 Britannia Road	1.03
North-East corner of Regional Road 25	0.03
South-East corner of Regional Road 25	0.02
8092 Britannia Road	0.02
8161 Britannia Road	0.06
Boyne Community Centre	0.11
8240 Britannia Road	0.48
8321 Britannia Road	0.08
8760 Britannia Road	0.28
9300 Britannia Road	0.12
9470 Britannia Road	0.12
10080 Britannia Road	1.99
6063 Fifth Line (Willis Family Fruit Farm)	0.42
11855 Britannia Road	0.04
11901 Britannia Road	0.04
12365 Britannia Road	0.07
Gro-Bark Organics	0.11
12478 Britannia Road	0.16
Drumquin Park	0.19
12800 Britannia Road (Terra Greenhouses)	0.19
12705 Britannia Road (Saint Nicolas Elementary School)	0.24
1008 Trafalgar Road/13138 Britannia Road	0.10
13182 Britannia Road	0.04
13520 Britannia Road	0.36
13670 Britannia Road	
13737 Britannia Road	0.14
13875 Britannia Road	0.39
14166 Britannia Road	0.04
14400 Britannia Road	0.01
Total Property Requirements	**6.88**

8.2.2. Property Access

Although access to residential and commercial properties adjacent to the Britannia Road corridor will be maintained as much as possible, it is anticipated that there could be some short-term access restrictions during construction.

The following requirements with respect to property access shall be met during construction:

- Access to all public and private land will be maintained.
- The contractor(s) shall not enter or occupy with crews, equipment or materials, any lands other than property owned by the Regional Municipality of Halton and easements shown on the Detailed Design Drawings, unless formal consent has been received from all affected parties.
- Property/business owners will be contacted during detailed design, to discuss their respective entrance impacts. Applicable mitigation strategies will be developed in consultation with property/business owners.

8.2.3. Noise

As per Section 4.1.2, a noise assessment was completed as part of the EA study to assess the impacts of the proposed road improvements on noise sensitive areas adjacent to the roadway corridor. Of the 63 receptor locations (NSAs) that were analyzed, noise mitigation is only warranted for the property on the north side of Britannia Road, immediately west of Fourth Line. This impact is considered significant and is mainly due to the shift in the Britannia Road alignment to bypass Omagh. To reduce the future noise impact, a sound barrier to reduce the daytime sound exposure, is recommended. The location, height and alignment will be finalized during detailed design.

It should be noted that providing noise mitigation for homes with direct frontage onto Britannia Road is not possible. Any sound barrier would need to be discontinuous at the driveways to retain access to the dwellings. These discontinuities would significantly impact the noise attenuation provided by any sound barrier.

Regarding construction impacts, construction noise is temporary noise and depends on the type of work required. The impact of construction noise depends on the type of equipment used, number of pieces of equipment, time and duration of operation and the proximity to noise sensitive receivers in question.

Britannia Road, along the extent of the project, is located in the Town of Milton. Therefore, the noise control by-law for the Town (By-law No. 16-84) applies. The following summarizes the applicable sections of the Town of Milton Noise Control By-law (No. 16-84) concerning construction noise:

3 q) *"Any noise that disturbs or is likely to disturb persons in any office, hospital or in any dwelling, hotel or other type of residence, or of any persons in the vicinity arising between the hours of 2100 hours of one day and 0700 hours of the next following day from an excavation, quarry or construction work whatsoever, including the erection, demolition, alteration or repair of any building."*

To help mitigate potential noise impacts during construction, the following recommendations are made:

- The noise control by-law for the Town of Milton (By-law No. 16-84) will be obeyed. Exemptions, where required, will be applied for through the municipality and should be included in the construction contract documents.
- General noise control measures will be referred to, or placed into construction contract documents. The following constraints addressing construction equipment operation and maintenance should be included in the construction contract documents:
    - Equipment shall be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffling systems, properly secured components and the lubrication of moving parts.
    - Idling of equipment shall be restricted to the minimum necessary to perform the specified work.

  Additional noise constraints may be included at the discretion of the Environmental Planner. They could include, for example, the siting of the contractor's yard.
- Any initial complaint from the public will require verification that the general noise control measures agreed to are in effect, any noise concerns will be investigated, and the contractor warned of any problems.
- Notwithstanding compliance with the "general noise control measures", a persistent complaint will require a contractor to comply with the MOE sound level criteria for construction equipment contained in the MOE Model Municipal Noise Control By-law. Subject to the results of field investigation, alternative noise control measures will be required, where these are reasonably available.

Further details on the analysis that was undertaken, as well as anticipated noise impacts associated with the preferred design, are provided in the *Environmental Noise Assessment* Report in Appendix A.

8.2.4. Air Quality

As part of the *Transportation Master Plan (2031) – The Road to Change*, the Region has developed air quality management initiatives to address air quality for its overall roadway system. The Region promotes air quality improvements as outlined in the TMP:

- The promotion of active transportation, transit and transportation demand management measures (e.g., car-pooling and High Occupancy Vehicle (HOV) lanes) to reduce vehicle kilometres travelled and minimize road traffic congestion;
- Increasing fuel efficiency in regional fleet management (e.g., alternative fuels, hybrid or electric vehicles);
- Implementing street sweeping and flushing, especially near construction and industrial activities to minimize re-suspension of road dust;
- Creating and promoting walkable and transit-supportive communities;
- Promoting on-street and off-street bicycle and walking trail networks in coordination with local Municipalities, particularly where public transit services are spatially or temporally inadequate;
- Promoting mixed-use higher density neighbourhoods (proximity to schools, public transit, amenities and recreational areas) which promotes alternative modes, healthy communities and reduced air pollution emissions;
- Undertaking design and maintenance of roadways that reduce air pollution, (e.g., wider paved shoulders (to reduce re-suspension of dust due to travelling vehicles) and appropriate street and shoulder flushing to reduce particulate matter emissions);
- Promote washing sand applied for de-icing, prior to application to reduce the fine particulate fraction of the sand (that will potentially become re-suspended) without reducing the effectiveness of its anti-skidding properties;
- Promoting tree planting across the Region as an effective means of removing airborne contaminants, particularly along significant transportation corridors;
- Maintaining and enhancing the Corporate lead-by-example model in the reduction of vehicle travel/emissions to reduce the air quality impacts from transportation sources; and
- Maintaining and enhancing health promotion to promote air quality education.

During construction, air quality can be degraded locally due to construction equipment and dust. The following measures are recommended to mitigate the effects of construction on air quality:

- Britannia Road and adjacent streets shall be swept and/or washed at the end of each work day and as required;
- Water and/or commercial dust suppressants approved by the Ministry of Environment (MOE) are to be used during construction to reduce dust emissions.
- All haul equipment shall use tarpaulins to cover loads of materials being delivered or removed from the construction site;
- Stockpiles of fine grained materials shall be covered with tarpaulins during dry and/or windy periods;
- All equipment shall have properly installed and functioning exhaust systems; and
- Burning of waste materials is prohibited onsite.

8.2.5. Transfer of Right-of-Way

Following construction, the sections of Britannia Road through Omagh that are not utilized as part of the new corridor will be transferred to the Town of Milton. The road would be transferred to the Town in a reasonable state of repair representing existing conditions. However, future negotiations/agreement would be required between the Region and Town.

In the interim, the Region will continue to maintain the existing Britannia Road and if development proceeds adjacent to the corridor prior to transfer of the road the Region will require dedication of the Regional right-of-way as per the Regional Official Plan or as identified in the Environmental Study Report.

8.3. Natural Environment

8.3.1. Terrestrial Resources

8.3.1.1. *Flora & Vegetation Communities*

The majority of the area to be affected by the road widening includes areas of active agriculture - primarily row crops with some hay and pasture fields. The proposed road alignment shifts away from and mitigates impacts within more sensitive natural heritage features such as woodlands and wetlands. Some impacts may occur at the location of the Main and East Branches of Sixteen Mile Creek which contain valley systems comprised of forested slopes and cultural meadow. A summary of impacts associated with widening Britannia Road at the Main and East Branches of Sixteen Mile Creek, accompanied by the preferred widening option, is provided below.

Main Branch of Sixteen Mile Creek

At the Main Branch of Sixteen Mile Creek, the proposed centreline of Britannia Road is approximately 3.2m south of the existing centreline. More importantly, the width of the required structure is approximately 34m as opposed to the 12m wide existing structure. As a result, the impacts will extend at least 16m on the south side of Britannia Road and 6m on the north side. Consequently, more vegetation will need to be removed from the forested slope on the south side of the road compared with the north side.

At the eastern extent of the main branch crossing, a dry-fresh sugar maple deciduous forest (north side) and dry-fresh hickory deciduous forest (south side) have developed upon the valley slope. The hickory deciduous forest is particularly noteworthy as it is provincially rare. An extensive cultural meadow has emerged on the terrace between the valley toe and the creek on both sides of Britannia Road. Scattered trees and shrubs throughout the meadow signify succession towards a future forest community. A silver maple swamp meanders along the west bank of the creek north of Britannia Road. The western valley slope is occupied by a dry-fresh sugar maple deciduous forest (north side) with the cultural meadow extending to the south. It is expected that the vegetation within ≤10 m meters of the edge of Britannia road will be removed from this woodland for the road widening. These communities are dominated by species fairly tolerant of human disturbance.

Within 100 metres of Britannia Road on the north side, there are five regionally uncommon and rare species present. Most of these species are well beyond the estimated zone of vegetation removal with the closest significant species to the road at approximately 20 metres.

It is not expected that the construction footprint will have significant impacts to the edge of the vegetation community south of Britannia Road, however, a detailed vegetation survey should be completed during detailed design to map the precise location of all regionally significant species so that all efforts can be made to avoid these individuals during construction.

Impacts to Silver Shiner habitat within the main branch of Sixteen Mile Creek may result from bridge construction. However, at this time the exact location of regulated Silver Shiner habitat is not known. At the detailed design phase, consultation with the MNR will aid in determining potential impacts and, if necessary, mitigation measures.

East Branch of Sixteen Mile Creek

At the East Branch of Sixteen Mile Creek the forested communities are within 5-10 m from the edge of the road. Therefore the road widening would require the removal of approximately 3-8 m of vegetation. Traveling from the east, a cultural thicket (north side) exists along the valley slope about 50 metres from Britannia road while another dry-fresh hickory deciduous forest occupies the south valley slope. Consistent with the main branch crossing, a cultural meadow has developed upon the creek terrace. Along the western valley slope, a dry-fresh sugar maple-ironwood deciduous forest has developed on the north side, and a dry-fresh white ash deciduous forest has developed on the south side.

All of the regionally significant species at this crossing are north of Britannia Road. There are four uncommon species within 100 metres of the road: speckled alder (*Alnus incana* ssp*. rugosa*), shining willow (*Salix lucida*), ditch stonecrop (*Penthorum sedoides*), and cow parsnip (*Heracleum lanatum*). Two rare species include hard-stemmed bulrush (*Scirpus acutus*) and American bur-reed (*Sparganium americanum*).

From a terrestrial ecology standpoint, it is not expected that the removal of 3-8 m of vegetation will have significant impacts to the edge of the vegetation community north of Britannia Road. The provincially rare hickory deciduous forest along the eastern valley slope to the south is offset from the present Britannia Road alignment by about 20 metres. As a result of road design modification, the total encroachment into the provincially significant FOD2-3 vegetation community has been reduced to 4.7 metres. Compensation plantings will be planted within the ROW in this area. The reduction of the woodland edge is not expected to have a significant impact on the ecological function of the woodlands due to their size and shape. Additionally, there are no regionally significant plants immediately south of Britannia Road. However, a detailed vegetation survey should be completed during detailed design to map the precise location of all regionally significant species so that all efforts can be made to avoid these individuals during construction.

Western and Eastern Woodlands

The preferred road alignment and accompanying sidewalk adjacent to the Western Woodland would generate a minor encroachment (i.e. a few metres) into the western corner of the woodland and marsh boundaries, and would therefore require minimal vegetation removal consisting of invasive tree species. The limits of construction on the south side of Britannia near the western woodland have been reduced to the extent possible while still maintaining road safety, and follow the staked dripline of the woodland with the exception of one area on the westernmost edge. This area contains exotic Manitoba maple (Acer negundo) trees; the staked dripline of the western corner of the woodland is exaggerated northward as a result

of the substantial northward lean of the maples. Impacts to exotic invasive species such as the Manitoba maples in the western woodland are not ecologically negative. Replacement of these trees with native species would result in a net benefit to the area. Furthermore, given that a sidewalk is planned along the Britannia Road boundaries of both woodlands, human encroachment (trampling, litter, etc.) and subsequent degradation is quite likely without measures aimed at mitigation (see Section 8.3.4.3). The total area of the meadow marsh will also be reduced as a result of the increased road footprint.

It should also be noted that breeding Western Chorus frogs were located on the western fringe of the Western Woodland, and Eastern Wood-Pewee was found to be a possible breeder. The road footprint will directly impact marsh habitat that does not contain direct breeding habitat for western chorus frog; areas of standing water suitable for breeding are present south of the proposed road alignment. Mitigation to account for the encroachment of the road footprint into wetland habitat is discussed in Section 8.3.1.3. As noted previously, eastern wood-pewee is generally tolerant of disturbance and development. Accordingly, the small amount of woodland edge removed as a result of road construction is not anticipated to have a significant effect on this species.

The preferred road alignment maintains the existing edge of the Eastern Woodland, and as such does not engender a reduction in overall area. Select root damage is foreseeable for mature trees growing on the woodland edge along the ditch in order to construct the multi-use trail. A limited number of select individual trees will likely need to be removed.

8.3.1.2. *Tree Survey*

Of the 221 trees surveyed within the new proposed property line, 170 are located within the proposed ROW and will have to be removed. There are four trees along the proposed alignment of Britannia Road that appear to be entirely outside of the new ROW (including both trunk and dripline). There are a further sixteen trees with trunks outside of the proposed ROW, but whose dripline extend into the new ROW. It is recommended that a Certified Arborist assess the retention status of these trees during the detail design phase, once the design drawings and method of utility installation has been finalized. All trees removed (170 plus those recommended for removal by a Certified Arborist) will be replaced at a ratio of 3:1 within the ROW, and will be concentrated near natural features (i.e. watercourses, wetlands, woodlands) wherever possible.

Additional details on the impacts to adjacent trees are provided in the *Terrestrial & Aquatic Resources Report* in Appendix B.

8.3.1.3. *Wetlands*

The wetland community (meadow marsh) located north of Britannia Road between Eighth Line and the significant woodland west of Highway 407 abuts the current alignment of the road. The construction footprint of the proposed road alignment will result in no more than 10 m of the southern edge of the wetland being removed from the current ROW. This is not expected to have a significant impact to the ecological function of the wetland.

The construction footprint of the proposed road alignment will also remove a portion of the meadow marsh community south of Britannia Road at crossing nos. 2 and 3 (Figure 3-5). At crossing no. 2 the proposed road alignment will result in no more than 7 m of wetland being removed and at crossing no. 3 no more than 5 m. The removal of 7 m and 5 m of wetland from crossing nos. 2 and 3, respectively, is not expected to have a significant impact on the ecological function of these wetlands.

Opportunities for wetland area compensation within the ROW are not recommended as the proximity to the road will likely be detrimental to the health of the wetland and the wildlife that use it (e.g. salt impacts, attracting wildlife to roads, etc). In an effort to minimize salt impacts to existing wetlands, it is recommended that native salt-tolerant woody vegetation be planted within the ROW in areas potentially affected by salt spray.

8.3.1.4. *Amphibians*

As a result of road mortality and noise disturbance (indirect impact), increasing traffic volumes have been shown to cause declines in amphibian population density. Wherever possible, the new Britannia Road alignment should avoid encroaching upon amphibian breeding ponds, particularly within the western monitoring station 11 (location provided in *Terrestrial and Aquatic Resources Report* in Appendix B). Additional mitigation measures to account for the encroachment of the road footprint into the Western Woodlot and associated wetland habitat are discussed in Section 8.3.4.3 and illustrated in Figure 10-1 in Section 10.1.

8.3.1.5. *Significant Species & Habitat*

Significant Flora

There are no species of flora designated as Provincially Significant that will be impacted by the proposed road works. Regarding the Regionally Significant flora species noted in Section 4.3.3.2, all are located within the cultural meadow communities of the East and Main Branches of Sixteen Mile Creek. Two of the species, hard-stemmed bulrush and American bur-reed, are outside of the proposed property line and therefore will not be directly impacted. The road widening is not

expected to be a significant impact to the habitat of the other regionally significant species nor their populations within these communities.

Significant Woodlands

Proposed improvements to Britannia Road will encroach less than 5m into the dry-fresh hickory deciduous forest (FOD2-3) associated with the Main and East Branches of Sixteen Mile creek, which is considered Regionally Significant. However, the reduction of the woodland edge is not expected to have a significant impact on the ecological function of the woodlands due to their size and shape. Specifically, these woodlands do not contain any interior forest (habitat that is at least 100 m from the edge of the woodland) that could be negatively affected by the creation of a new edge, and their status as regionally significant woodlands will not change. Recommended measures for tree preservation and protection where trees are in close proximity to the construction footprint of the road widening are provided in Section 8.3.4.4.

Direct impacts to the Western and Eastern Woodlands are discussed in Section 8.3.4.3.

Provincially Significant Fauna

Within the study area, Bobolink was recorded at locations adjacent to agricultural fields only. The road widening will remove no more than 10 m from the edge of these hay fields. Given the large size of these fields and the area of surrounding open habitat, it is not expected that there will be a significant impact to the amount of suitable habitat for bobolink. However, construction and road work may still require an *Information Gathering Form* (IGF) and a permit under Section 17(2)(c) of the *Endangered Species Act (2007)* to "damage or destroy" habitat for Bobolink.

Although Bobolink was recorded adjacent to agricultural fields only, the MNR may target natural meadows rather than hayfields for bobolink habitat. There are five locations containing natural meadow within the study area, however no bobolinks were recorded within the vicinity of these meadows.

Potential impacts to these communities as a result of road widening include:

1) Meadow Marsh (MAM) community south of crossing nos. 2 and 3: As this community extends south along the length of the watercourse at these crossings, the removal of no more than 7 m along the edge of these communities is not expected to be a significant impact to the amount of suitable habitat for bobolink.

2) Cultural Meadow (CUM) community to the north and south of crossing no. 7: As the bridge at this crossing will span 2 times the bankfull channel width, it is not expected that road widening will have a significant impact on this community or to the amount of suitable habitat for bobolink.
3) Cultural Meadow (CUM) community to the north and south of crossing no. 15: As the bridge at this crossing will span 2 times the bankfull channel width, it is not expected that road widening will have a significant impact on this community or to the amount of suitable habitat for bobolink.
4) Cultural Meadow (CUM) community south of Britannia Road between crossing nos. 16 and 17: Given the large size of this community and the area of surrounding open habitat, it is not expected that the removal of 5 m of cultural meadow community will be a significant impact to the amount of suitable habitat for bobolink.
5) Cultural Meadow (CUM) and Meadow Marsh (MAM) communities north of Britannia Road between Eighth Line and the CP Railway at the eastern end of the study area: Road widening will not impact the cultural meadow on the north-east corner of Eighth Line and Britannia Road, nor the cultural meadow community north of Britannia Road adjacent to the woodlot. The meadow marsh community within the woodlot will not be impacted. The removal of no more than 10 m of wetland from the edge of this community is not expected to have a significant impact to the ecological function of this wetland.

The breeding bird surveys also recorded Barn Swallow, but with no evidence of breeding. Breeding Barn Swallows, with nests, were observed at the concrete box culvert at crossing no. 5 during a field visit to the Western Woodland in May 2013. Suitable foraging habitat (i.e. open fields) is present north and south of crossing no. 5.

Given the large size of hayfields and the area of surrounding open habitat, it is not expected that removing no more than 10 m for Britannia Road widening will have a significant impact to the amount of suitable foraging habitat for Barn Swallow. Referring specifically to breeding habitat, anthropogenic structures with the potential to function as Barn Swallow nesting habitat present within the study area outside of Omagh are limited to culverts. The preferred Britannia Road alignment bypassing Omagh to the south will affect two barns south-east of the Britannia Road / Fourth Line intersection that may have the potential to function as Barn Swallow habitat. A more comprehensive survey will be required at Detail Design to confirm whether these barns, and culverts within the study area, are functioning as Barn Swallow nesting habitat. If so, construction and road work will require a permit under Section 17(2)(c) of the *Endangered Species Act* (2007) to "damage or destroy" habitat for Barn Swallow.

Any work associated with the proposed expansion of Britannia Road that would involve disturbance to the culvert running under Britannia Road, just to the west of the woodland at crossing no. 5, could potentially disturb nesting Barn Swallows if the nest is active at the time of work. The nests of this species not only receive protection from the Migratory Bird Convention Act (1994), but as a provincial and federal species at risk, Barn Swallow also receives 'Habitat Protection' under the Endangered Species Act (ESA) 2007. Removal or alteration of the culvert itself would result in a change to the suitable nesting habitat of this species, and therefore may require creation of new habitat under the ESA and Ontario-Regulation 176/13. An increase in the volume of road traffic as a result of the proposed road expansion would also increase mortality of Barn Swallows, which often collide with vehicles when they are found nesting or foraging close to roads. This is an existing impact that would be further exacerbated with an increase in the volume of road traffic.

Encroachment into the Western Woodland from the proposed road expansion would reduce the amount of available habitat for Eastern Wood-pewee, a federal Species-at-Risk (listed as Special Concern). It was notable that the singing male was heard calling from the width of the woodlot (east to west), but was entirely confined to the north end, within approximately 50m of Britannia Road West. As stated previously, the small amount of woodland edge removed as a result of road construction is not anticipated to have a significant effect on this species.

Significant Wildlife Habitat

The areas identified as potential significant wildlife habitat include the woodlands containing area sensitive species, grasslands and hay fields containing area sensitive species or species at risk in Ontario (e.g. Bobolink), wetlands associated with Crossing 5 south of Britannia Road (i.e. Western Chorus Frog habitat), and animal movement corridors in the valley systems of the Main and East Branches of Sixteen Mile Creek. The woodlands containing area sensitive species are going to be avoided by shifting the proposed road alignment away from the woodland. Therefore, there would be no direct impact to the habitat of area sensitive species in these woodlands. The valley corridors will still allow the same level of movement of wildlife and therefore the road widening would not be considered a negative impact. The reduction in the size of the hay fields containing bobolink and natural meadows that may contain suitable habitat will not reduce the area requirements for suitable breeding habitat of bobolink given the currently large size of these fields and surrounding open area. Therefore, there will not be a significant negative impact to the significant wildlife habitat associated with grasslands and hayfields where bobolinks were recorded as breeding.

8.3.1.6. *Indirect Impacts*

Indirect impacts associated with construction include road widening adjacent to woodlands and trees in hedgerows. There is the potential for damage to the tree roots which may negatively impact the health of the trees.

Transportation corridor improvements that increase the speed and volume of traffic can potentially lead to an increase in wildlife mortality. However, given the agricultural nature of the majority of the study area, this potential should be minimal. The majority of wildlife crossings most likely occur within the valley systems of the Main and East Branches of Sixteen Mile Creek, allowing wildlife to avoid traffic by crossing at the bridges beneath. Wildlife mortality due to an increase in vehicular traffic can also be mitigated by the addition of Wildlife Crossing Structures, discussed further in Section 8.3.4.5.

There is also evidence that an increase in road traffic can negatively reduce populations of woodland and grassland breeding. The reduction in density of bird populations is related to a reduced habitat quality, primarily as a result of traffic noise. As a result of the road widening and increase in traffic noise, there may be a negative impact to the breeding success of the grassland and woodland birds in the habitats adjacent to Britannia Road.

8.3.1.7. *Construction-related Impacts*

During construction there is the potential for erosion of exposed soil during rainfall events or periods of snow melt. Eroded sediment has the potential to move into the minor streams and the Main and West Branches of Sixteen Mile creek. An increase in sediment to a watercourse can impact fish habitat.

The removal of vegetation, specifically trees during the breeding bird season may have an impact on nesting species. Tree removal should be timed to avoid impacts to birds during the breeding bird season, generally from mid-May to mid-July. Similarly, construction activity adjacent to the hay fields can impact the breeding success of these species including any nesting bobolink. Construction activities proposed adjacent to the hay fields where bobolink are confirmed breeding or the natural meadows that contain potential breeding habitat should be planned to avoid the breeding season.

8.3.2. Aquatic

Potential direct and indirect impacts to the aquatic resources in the study area associated with the widening of Britannia road include:

- Construction during periods of sensitivity (e.g. spawning) to the resident fish community.

- Downstream sedimentation originating from the work area during and following construction may result in a reduction of quality instream habitat, increased turbidity and a reduction in productivity as benthic organisms and their habitats are buried.
- The addition of deleterious substances from the work areas into the watercourses as a result of construction activities.
- The removal of vegetation and riparian habitat that may occur as a result of construction and grading requirements could lead to eroded banks, reduced stream shading, a reduction in water quality and reduced quality of in-stream habitat.
- Increased road volume may lead to an increase in deleterious substances (i.e. salt, oil) entering the watercourse as a result of surface runoff.
- Increased culvert length potentially increases the amount of inhabitable habitat for fish while creating larger obstructions to fish migration.

The proposed work will require ROW replacements to the two existing span bridges over both the main and east branches of Sixteen Mile Creek as well as culvert replacements at each of the other watercourse crossings within the study area to accommodate the proposed 47 m ROW. The possibility of the proposed works at each watercourse resulting in a HADD (Harmful Alteration, Disruption or Destruction of fish habitat) will be determined during detail design, in consultation with Conservation Halton and/or the department of Fisheries and Oceans (DFO).

8.3.2.1. *Significant Species*

Silver Shiner habitat is present within the Main and East Branch of Sixteen Mile Creek. Construction and road work activities may require the completion of an Information Gathering Form (IGF) and a permit under section 17(2)(c) of the Endangered Species Act (2007) to "damage or destroy" habitat for Silver Shiner if works cannot be fully mitigated. The need for these permits will be at the discretion of the Ministry of Natural Resources and will be determined during detail design.

8.3.3. Utility Relocation

All utility relocation will occur within the proposed ROW, and therefore have negligible potential to adversely affect natural heritage features within the study area. Any utility relocation that occurs as a result of construction should not be placed within significant flora or fauna habitat. Utility relocation should avoid significant woodlands, valleylands, wetlands and wildlife habitat where possible, as well as fish habitat that includes a 15 m buffer on both sides of a watercourse.

8.3.4. Mitigation & Monitoring

Recommended mitigation measures to be implemented during the road work are discussed below. As noted in Section 4.3.5, the reports used in the EA analyses and subsequent identification of mitigation and monitoring measures within the Boyne Survey Secondary Plan Area are based on recommendations from draft versions of the *Boyne Survey Secondary Plan Area Functional Stormwater and Environmental Management Strategy (FSEMS)*, *Boyne Survey Secondary Plan Area Conceptual Fisheries Compensation Plan (CFCP)* and *Sixteen Mile Creek Areas 2 and 7 Subwatershed Update Study (SUS). As such, it is acknowledged that* further updates with respect to the mitigation measures identified in this report may be required at detail design, once the subject reports have been finalized and approved by Conservation Halton. Information contained in these final reports will need to be incorporated into the detailed design of the roadway corridor where appropriate.

8.3.4.1. *Terrestrial Resources*

Recommended mitigation measures to be implemented during the road work include:

- Erosion control fencing installed adjacent to watercourses to prevent erosion and silt deposition into a watercourse.
- All tree removals should be undertaken outside of the breeding bird season (early-May to mid-July).
- Construction adjacent to hayfields is not to be conducted during the breeding bird season (early-May to mid-July).
- Implementation of the *Tree Preservation and Protection Measures* recommended in Section 8.3.4.2.

Recommended monitoring to be implemented during and following the road widening work include:

- A qualified environmental inspector to conduct regular monitoring during road construction to ensure mitigation measures are implemented.
- A qualified arborist to monitor construction activities associated with roadside tree protection and in areas adjacent to the significant woodlands and forested slopes associated with the Main and East Branches of Sixteen Mile Creek.

8.3.4.2. *Tree Preservation & Protection*

The proposed road widening will result in the removal of trees in the new proposed property line of Britannia Road. There may be an opportunity to retain and preserve

trees outside of the proposed property line. Tree preservation and protection measures should be addressed in detail design. The following tree protection measures should be implemented:

- As part of the preservation of all trees in the significant woodlands and the forested slopes of the Main and East Branch of Sixteen Mile Creek, Type II erosion control fencing should be installed between the trees and the construction activity. Where possible the fencing should be placed one metre outside the drip line (canopy edge) to ensure tree root systems are fully protected from construction activities and soil compaction from machinery. This fencing should be installed prior to any grading or site clearing. The fencing should remain in place until all site work has been completed.
- Proper root pruning should be undertaken by a certified arborist if roots of retained trees are exposed by construction activities. Exposed roots should be covered with soil or mulch to the extent possible as soon as possible following damage in order to prevent further damage and desiccation.
- Within the woodlands there should be no:
    - dumping, stockpiling or storage of any materials;
    - parking or storage of any machinery or equipment;
    - disposal of waste, garbage, brush or stumps or any burning of materials or disposal of ashes; or
    - the use of any machinery without prior approval and written consent by the Region.
- Any accidental damage to vegetation that is to be retained should be brought to the Region's attention and examined by an arborist to recommend the appropriate treatment (e.g., pruning or sealing).
- It is recommended that opportunities for creating or enhancing some riparian plantings adjacent to intermittent, ephemeral, and permanently flowing watercourses within the ROW that adheres to the Tree-Canopy Replacement Policy on Regionally Owned Lands, as outlined in Regional Report No. LPS31-08, be considered at detailed design.
- Tree compensation plantings are to be planted within the ROW at the main Sixteen Mile Creek crossing south of Britannia Road, to help mitigate any impacts on the provincially rare hickory deciduous forest (FOD2-3).

8.3.4.3. *Significant Woodlands*

Given that a multi-use trail is planned along the Britannia Road boundaries of both woodlands, human encroachment (trampling, litter, etc.) and subsequent degradation of these woodlands is likely without measures aimed at mitigation. In order to protect these sensitive features, it is recommended that permanent chain-

link fencing be installed along the northern boundary of the Western Woodland and southern boundary of the Eastern Woodland to reduce pressures associated with human encroachment.

Furthermore, edge effects resulting from encroachment into the Western Woodland should be mitigated through an edge management plan determined at the detailed design stage. Per consultation with Conservation Halton, it is not recommended that area loss as a result of encroachments into the marsh at the western edge of the Western Woodland be mitigated through habitat creation in ROW. As part of the Boyne Subwatershed Study (presently ongoing), a 60m wide north-south corridor has been identified along the Creek. It is anticipated that future restoration efforts along the Creek will result in increased habitat for flora and fauna using wetlands in the vicinity. In the short term, it is recommended that a dense screen of salt-tolerant evergreen vegetation be planted along the interface between the marsh and the road edge in order to mitigate increased salt spray and light encroachment into the wetland.

MNR recommends that a qualified professional visit each of crossings along this stretch of Britannia Road at least one year prior to construction to determine the presence of Barn Swallow nests at the other watercourse crossings.

8.3.4.4. *Aquatic Resources*

Recommended mitigation measures to be implemented during the road work include:

1. In-stream works should be minimized as much as possible and constrained to periods that are least sensitive to the resident fish community. The fish community within the study area is generally that of a warmwater system, and therefore an in-water construction timing window of July 1st to March 31st should be implemented. However, due to the presence of Rainbow Trout and Chinook Salmon in the Main and East Branches of Sixteen Mile Creek, a cool/coldwater in-stream construction timing window of July 1st to September 15th should be imposed for crossing nos. 7 and 15 to ensure that disturbed areas are given adequate time to naturally stabilize prior to the end of the growing season, thereby helping to prevent the migration of sediment into the watercourse during the spring freshet. As the Main and East Branch of Sixteen Mile Creek is also occupied by Silver Shiner habitat, the MNR may apply the cool/cold water fisheries timing window to crossing nos. 10-14 and 16-18 following an assessment of the work required and the distance upstream of the confluence with the East Branch of Sixteen Mile Creek. This is to be discussed with the MNR during detail design.
2. Many of the tributary crossings within the study area represent seasonal or contributing fish habitat and were dry during the assessment. Consistent with

recommendations in the Conceptual Fisheries Compensation Plan (CFCP) for the Boyne Survey Area, all work within each watercourse of the study area should be undertaken during the typical dry season to avoid impacts to downstream aquatic habitat. In the case of permanent streams, all in-stream work should be completed in the dry by providing temporary conveyance measures to isolate channel flow from the construction area to the greatest extent possible. The water should then be drained from the work area only after a qualified fisheries biologist has removed any fish trapped within the isolated work area and placed them in suitable habitat downstream. All efforts should be made to avoid in-stream work.

3. When the watercourse is considered direct fish habitat (i.e. permanent or seasonal habitat) downstream of the crossing location, fish passage must be assured in crossing construction.
4. Standard construction mitigation procedures should be utilized. Consistent with recommendations in the CFCP, construction within a watercourse will require the preparation of a Sediment and Erosion control plan for each watercourse crossing, in accordance with Town of Milton and Conservation Halton Guidelines.
5. Construction access lanes and staging areas will be chosen appropriately during detail design when final design drawings/construction plans have been completed. Access lanes and staging areas will avoid riparian areas where possible. Where it is not possible to avoid damaging riparian areas, these areas will be re-planted upon completion of construction activities to resemble a pre-construction state. All vehicle and machine fuelling and maintenance will be carried out a minimum of 30 m from any watercourse to prevent the entry of deleterious substances (e.g. fuel, lubricant, oil) into the watercourse.
6. All culverts should be open-bottomed to preserve the natural creek substrate and avoid disturbing the stream bed. These structures pose the least risk to both terrestrial and aquatic species.
7. Stormwater management within the study area should attempt to replicate pre-construction flows within each watercourse.

Monitoring and maintenance should be conducted during and following construction to ensure that mitigating measures (e.g. sediment and erosion control measures) are providing the expected protection continuously throughout the construction period and additional mitigating measures are provided, if required, to address any unanticipated impacts that arise during construction. Monitoring should include periodic site visits and inspections throughout the course of the work. In the event that the mitigation measures are not providing the anticipated amount of

protection, all operations should be suspended until the cause is identified and corrected.

8.3.4.5. *Wildlife Crossing Structures*

The Functional Stormwater and Environmental Management Strategy (FSEMS) recommends Enhanced Wildlife Crossings at crossing nos. 1, 2, 5, 6, 7 and 11 (see Figure 3-5). Lands outside of the FSEMS study area (i.e. east of Fourth line to Highway 407) were reviewed to assess the need for wildlife crossing structures. In general, lands adjacent to Britannia Road consist of agricultural fields and there is limited potential for wildlife movement across Britannia Road. However, crossing nos. 15, 17 and 18 are associated with habitat that may function as wildlife crossing locations. Crossing no. 18 is a dual-cell culvert that has already been constructed and will not be altered as part of the proposed Britannia Road widening. Therefore, in addition to the Enhanced Wildlife Crossing locations reported in AMEC (2011b), it is further recommended that Enhanced Wildlife Crossings be placed at crossing nos. 15 and 17.

Table 8-2 shows the proposed culvert sizes for the above mentioned crossings. Consistent with recommendations within the Conceptual Fisheries Compensation Plan (CFCP) for the Boyne Survey Area (AMEC 2011a), the minimum span opening for these crossings should be at least twice the proposed bankfull width in order to maintain natural channel form. Therefore, the minimum available freeboard within each culvert for wildlife crossing will be half the bankfull width on either side of the channel (Table 8-2). Protective cover should be used within each freeboard and consist of strategically placed rock and gravel, as well as plantings where appropriate (AMEC 2011a).

Table 8-2: Minimum Available Freeboard for Enhanced Wildlife Crossings

Enhanced Wildlife Crossing	Culvert Size (m)	Maximum Bankfull Width (m)	Minimum Freeboard Available (m) (x2)
1	4.8	2.4	1.2
2	7.4	3.7	1.85
5	7.6	3.8	1.9
6	9.8	4.9	2.45
7	27.2	13.6	6.8
11	14.0	7.0	3.5
15	32.0	16.0	8.0
17	13.8	6.9	3.45

It should be noted that the culvert at crossing no. 6 was recently replaced in the summer of 2012 and the current structure (twin 2.4 metre concrete box culverts) does not meet the 2x bankfull requirement. The criteria used in the design of this new structure was based on the current configuration of Britannia Road as a rural arterial roadway and was not required to span a distance equal to twice the bankfull width. Therefore, this existing structure does not meet the environmental criteria applied to the improved roadway design. Halton Region may opt to simply extend the current structure using the current opening size rather than replace the new structure. Further evaluation would need to demonstrate that the extended structure does not negatively impact flood levels and provides a sufficient amount of freeboard for wildlife crossing. At this early planning stage, it is recommended that the culvert at crossing 6 be replaced to provide an opening of at least 9.8 metres to provide sufficient opportunity for wildlife crossing of Britannia Road.

In addition, it is recommended that the construction design of the overpass associated with the CN Rail line west of Bronte Road (between Aquatic crossings 1 and 2) consider incorporation of terrestrial wildlife crossing opportunities. Specifically, wildlife passage should be accommodated on the east side of the railway in order to be compatible with the Boyne Natural Heritage System. Design specifics would be determined during the detailed design phase.

An additional design consideration for the CN rail overpass includes using locally native meadow species to revegetate the slopes of the overpass to mitigate habitat loss of the area sensitive Savannah Sparrow, which was recorded in the adjacent meadow during breeding bird surveys.

8.4. Cultural Heritage Environment

8.4.1. Archaeological Resources

A Stage 1 Archaeological Assessment was conducted to determine the potential for impacting archaeological resources along Britannia Road from Tremaine Road to Highway 407. The assessment determined that 46 archaeological sites have been registered within 1 km of the study area. A review of the geography of the study area also suggested that it has potential for the identification of Aboriginal and historic archaeological remains. The property inspection determined that while the Britannia Road ROW is heavily disturbed, there was potential beyond the ROW limits throughout the length of the study corridor, and that there are two historic cemeteries located adjacent to the study area limits.

In light of the results of the background research and property inspection undertaken for the Stage 1 Archaeological Assessment of the Britannia Road corridor, the following recommendations have been made:

- The Britannia Road ROW does not retain archaeological potential due to extensive and deep land alterations that have severely damaged the integrity of any archaeological resources. Additional archaeological assessment is not required within the current ROW boundaries and the Britannia Road ROW can be cleared of further archaeological concern.

- The lands beyond the limits of the current Britannia Road ROW exhibit archaeological potential. If the proposed Britannia Road improvement project requires new lands beyond the current ROW limits then a Stage 2 Archaeological Assessment should be conducted on lands determined to have archaeological potential (see *Stage 1 Archaeological Assessment Report* in Appendix F). This work is to be completed in accordance with the MTC's 2011 *Standards and Guidelines for Consultant Archaeologists* in order to identify any archaeological remains that may be present.

- The selected roadway alignment avoids two cemeteries within the Britannia Road project corridor: Church of Christ (9850 Britannia Road) and Omagh Presbyterian Church (2077 Britannia Road). Nevertheless, in the event that the proposed project should impact these ROW lands, a Cemetery Investigation would be required in front of the two properties. This work would be completed in accordance with the MTC's 2011 Standards and Guidelines for Consultant Archaeologists and the Cemetery Act, to confirm the presence or absence of unmarked graves.

- In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Cultural Programs Unit of the Ministry of Tourism and Culture should be immediately notified.

8.4.2. Cultural Landscapes & Built Heritage Features

Proposed improvements to Britannia Road have the potential to affect cultural heritage resources in a variety of ways. Impacts can include direct impacts that result in the loss of resources through demolition, or the displacement of resources through relocation, and indirect impacts that result in the disruption of resources by introducing physical, visual, audible, or atmospheric elements that are not in keeping with the resources and/or their setting.

During the Class EA, alternative designs within the corridor were planned in a manner to avoid, where possible, any identified cultural heritage resources. That being said however, the preferred alignment and cross section developed for the Britannia Road corridor are anticipated to directly impact a number of cultural heritage resources. **Table 8-3** identifies the built heritage resources and cultural heritage landscapes to be impacted by the preferred design.

Table 8-3: Impacts to Built Heritage Resources (BHR) & Cultural Heritage Landscapes (CHL)

Feature	Type	Impact
BH 2	Residence	Some altering of the setting through encroachment.
BH 3	Bridge	Removal of existing bridge structure and construction of new bridge structure.
BHR 12	Residence	Some altering of the setting through encroachment.
BHR 15	Bridge	Removal of existing bridge structure and construction of new bridge structure.
CHL 7	Farmscape	Some altering of the setting through encroachment.
CHL 8	Roadscape	Intersection to be altered.
CHL 9	Garage & Residence	Garage removed as a part of Regional Road 25 reconstruction.
CHL 10	Historic Settlement	Garage (CHL 9) removed and road reconstructed as a part of Regional Road 25 reconstruction.
CHL 11	Farmscape	Displacement of the existing fence line near the access drive. Some altering of the setting through encroachment.
CHL 12	Farmscape	Displacement of the existing fence line and alteration of setting through encroachment. Land has been identified for future residential development.
CHL 14	Roadscape	Intersection to be altered.
CHL 15	Farmscape	Displacement of the existing fence line and alteration of setting through encroachment.
CHL 16	Farmscape	Displacement of the existing fence line, which includes decorative concrete corner posts and the removal of trees. Some altering of the setting through encroachment.
CHL 17	Farmscape	Displacement of the existing fence line and some altering of the setting through encroachment.
CHL 19	Remnant Farmscape	Altering of the setting through encroachment as well as displacement of the gravel access drive, line of established trees, small outbuilding, and decorative concrete corner post. Some to isolate the resource by

Feature	Type	Impact
		removing its access point and isolate the subject property from the heart of the historic settlement of Omagh.
CHL 20	Farmscape	Some altering of the setting through encroachment.
CHL 21	Farmscape	Some altering of the setting through encroachment.
CHL 22	Roadscape	Roadway to be altered.
CHL 23	Historic Settlement	Some altering of the setting through encroachment and isolation of the core of the historic settlement of Omagh from the surrounding agricultural landscape to the south.
CHL 24	Farmscape	Minor altering of the setting through encroachment and displacement of the existing fence line near the access drive, which includes older post-and-rail sections and concrete posts.
CHL 25	Farmscape	Some altering of the setting through encroachment.
CHL 26	Farmscape	Some altering of the setting through encroachment.
CHL 27	Roadscape	Intersection to be altered.
CHL 28	Roadscape	Intersection to be altered.
CHL 29	Historic Settlement	Minor alteration of the historic crossroads.
CHL 30	Remnant Farmscape	Some altering of the setting through encroachment.
CHL 31	Farmscape	Some altering of the setting through encroachment.
CHL 32	Roadscape	Some altering of the setting through encroachment.

Additional details on the heritage features identified within the study area, including descriptions and locations are provided in the *Cultural Heritage Assessment Report* in Appendix G.

Based on the cultural heritage assessment completed as part of the study, the following recommendations have been put forth to mitigate impacts to built heritage resources and cultural heritage landscapes within the study area:

- Completion of a resource-specific heritage impact assessment or documentation report for built heritage resources and cultural heritage landscapes identified as being impacted by the proposed works (see Table 8-2). In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken as necessary during detailed design.
- Encroachment of lands close to built heritage resources and cultural heritage landscapes should be avoided wherever possible.
- Wherever possible, landscaping with historic plant materials for berms or vegetative screens is recommended, and fence rows and hedge rows should be preserved where extant.

8.5. Bridge/Culverts and Storm Drainage

Details regarding recommendations for the watercourses crossing the subject portion of Britannia Road, including storm drainage requirements, are provided in Section 8.6 and further discussed in the *Hydraulic Analysis of Stream Crossings & Stormwater Management Alternatives Assessment* and *Fluvial Geomorphology Study* Reports provided in Appendices C and D, respectively. Discussion items include, but are not limited to: culvert sizing to improve drainage and fish passage opportunities; recommended substrate materials; velocity requirements and channel form enhancements; erosion control; proposed culvert alignments and storm water management recommendations.

8.6. Geotechnical

A detailed geotechnical investigation will be required to confirm the subsurface conditions and recommendations. This work should include:

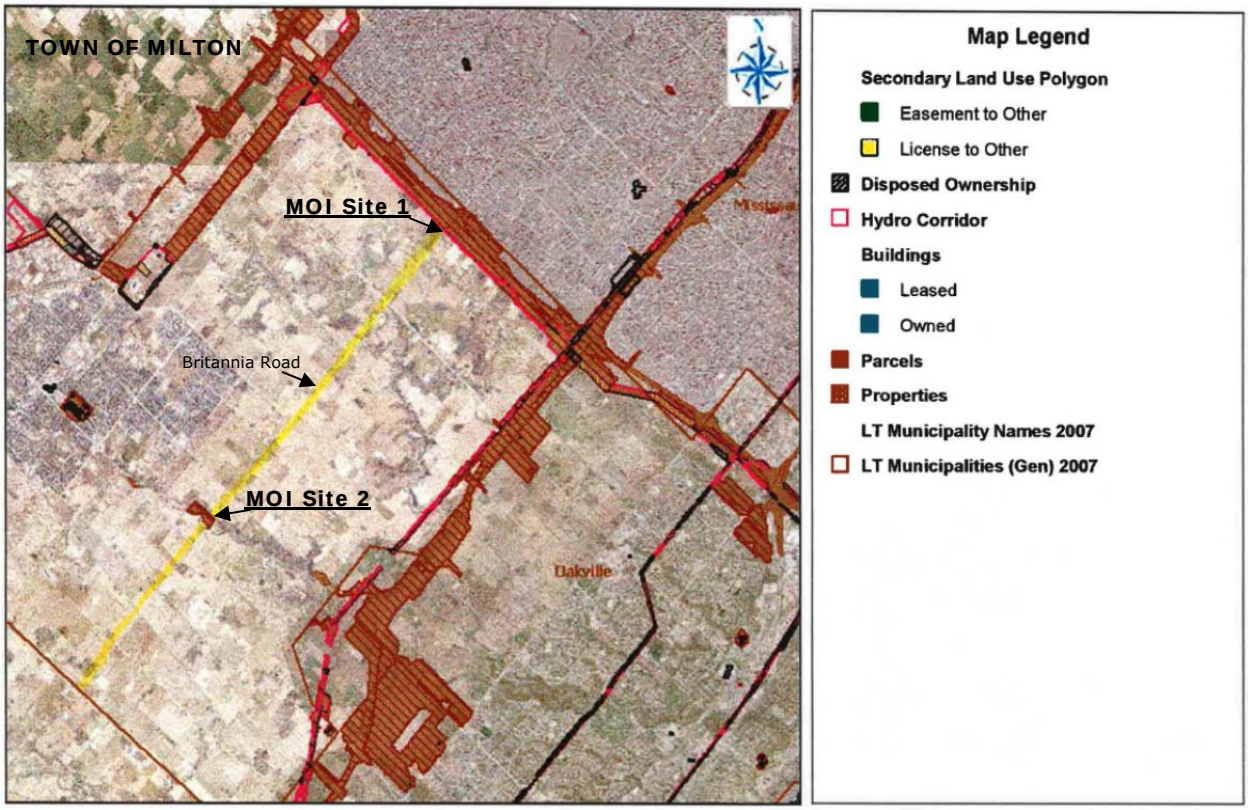
- Additional boreholes within the existing roadway pavement to confirm the preliminary pavement design recommendations, particularly if portions of the existing pavement structure will be incorporated into the widened roadway;
- Additional boreholes in the vicinity of Boreholes 12-16 and 12-20 to determine the limits of frost susceptible silt soils;
- Additional boreholes along proposed underground utility alignments, if applicable, when further details regarding the alignment and depth of these services are established;
- Additional boreholes and rock coring at the locations of the bridges, grade separation and culverts to confirm the preliminary recommendations for foundation design;
- Investigation at any additional structures defined during detailed design;

- Further assessment of dewatering requirements and the need for a Permit to Take Water (PTTW); and
- Chemical testing to evaluate excess material disposal.

9.0 INFRASTRUCTURE ONTARIO CLASS EA REQUIREMENTS

Implementing the recommendations identified in this ESR would require the relocation of a number of existing Hydro towers and the acquisition of Ministry of Infrastructure (MOI)-owned land (locations provided in **Figure 9-1**). These lands, adjacent to the Highway 407 southbound lanes in the east and along Sixteen Mile Creek Main Branch in the west, are controlled by Infrastructure Ontario (IO), which is responsible for managing the provincial government's real property. IO is required, by the MOE and the EA Act, to follow the MOI *Class EA Process for Realty Activities Other Than Electricity Projects (Approved 2004, Amended September 11, 2008)* prior to any activities on IO lands.

Figure 9-1: MOI-Owned Land



9.1. Seven Point Site Specific Analysis

As per *Figure 2.2 - Category Listing Matrix* of the MOI Class EA, the purchase of Hydro Corridor Lands within the study area can be considered a Category 'B' EA as the environmental effects and public concerns raised in the study have already been addressed through the completion of the Municipal Class EA (in accordance with Schedule 'C' requirements). In fulfilling the Municipal Class EA requirements, the requirements of the MOI's "7 point analysis" have been addressed. The MOI's 7

point analysis is summarized below. Where possible, Sections in the ESR covering the category items have been referenced.

Existing Land Use

Existing and proposed land use within the study area is discussed in Section 4.1.1 of the ESR.

With respect to the MOI-owned lands, land use adjacent to the roadway corridor for the eastern site (MOI Site 1 in Figure 10-1) is identified in the Town of Milton Zoning Bylaw as *Greenlands "A"* and *Agricultural* zones and in the Town's Official Plan as *Deferred and Appealed Area* and *Parkway Belt Plan Area*. MOI Site 2 to the west is identified as *Greenlands "A"*, *Open Space* and *Agricultural* zones. The Official Plan designates lands within this area as *Greenlands "A"*, *Environmentally Sensitive Area*, *Deferred and Appealed Area* and *Parkway Belt West Plan Area*.

Environmental Condition of the Property

A Phase 1 Site assessment was not completed as part of the Class EA study. In accordance with the requirements of the MOI Class EA, a Phase 1 ESA will need to be completed prior to the acquisition of the noted properties.

Environmentally Significant Areas

Issues pertaining to Environmentally Significant Areas identified within the overall study area and MOI-owned lands, as well as potential impacts and proposed mitigation measures, have been addressed as part of the Britannia Road Class EA Study. Details are provided in Sections 4.1, 8.3 and Appendix B of the ESR.

Distinctive Environmental Features

Distinctive environmental features identified within the overall study area and MOI-owned lands, as well as potential impacts and proposed mitigation measures, have been identified and addressed as part of the Britannia Road Class EA Study. Details are provided in Sections 4.1, 8.3 and Appendix B of the ESR.

Servicing Capacity of the Surrounding Infrastructure

The servicing capacity of the surrounding infrastructure (e.g. roads, drainage, etc.) within the study area and MOI-owned lands have been identified and addressed as part of the Britannia Road Class EA Study. Details are provided in Section 7.0, and Appendices C and J of the ESR.

Cultural Heritage Resources

Cultural Heritage Resources identified within the overall study area and MOI-owned lands, as well as impacts and proposed mitigation measures, have been identified and addressed as part of the Britannia Road Class EA Study. Details are provided in Sections 4.6 and 8.4, and Appendices F and G of the ESR.

Social and Economic Effects

The social and economic conditions within the overall study area and MOI-owned lands, as well as potential impacts and proposed mitigation measures, have been identified and addressed as part of the Britannia Road Class EA Study. Details are provided in Sections 4.1 and 8.2.

10.0 ADDITIONAL WORK, PERMITS & MONITORING

10.1. Detail Design Commitments

In accordance with the Schedule "C" Class EA requirements for the study, impacts to the environment, as defined in the EA Act, were minimized, where possible, through the evaluation process that was undertaken in identifying the preferred design. Potential impacts and proposed mitigation measures associated with implementing the preferred design for the subject portion of Britannia Road are discussed in Section 8.0.

In addition to incorporating all of the recommended mitigation and monitoring measures in Section 8.0, additional works that are required to be completed during the detail design phase of the project, prior to construction, are identified as follows:

- Transportation/Technical Requirements
  - Develop a traffic management plan to maintain vehicular access during construction.
  - Confirm posted speed limits along the corridor.
  - Confirm locations, configurations and cost of the proposed Boyne Secondary Plan intersections with Britannia Road.
  - Finalize grade separation and property requirements at the CN Halton Subdivision.
  - Identify and confirm active transportation links between the two cul de sacs and the bypass along the north side of Britannia Road through Omagh in consultation with the Town of Milton.

- Hydraulics and Stormwater Management Requirements
  - Confirm the storm drainage design within the Boyne Survey Secondary Plan Area for the Britannia Road improvements including bridge/culvert sizing requirements, future SWM pond outlets/locations and watercourse alignments/requirements based on recommendations from the Final *Boyne Survey Secondary Plan Area Functional Stormwater and Environmental Management Strategy (FSEMS)*, *Boyne Survey Secondary Plan Area Conceptual Fisheries Compensation Plan (CFCP)* and *Sixteen Mile Creek Areas 2 and 7 Subwatershed Update Study (SUS)*. The analysis conducted as part of the EA were completed using the best information available at the time while recognizing that further updates to the hydraulic, fluvial and SWM

analysis may be required at detail design to address any further updates in the above noted reports.

- Investigate options for the unregulated drainage features (i.e. crossing nos. 3, 5a, 10 and 12) which will ultimately be eliminated as part of the upstream Boyne development. Further details are provided in Section 4.1 of the *Hydraulic Analysis of Stream Crossing & Stormwater Management Alternatives Assessment* report in Appendix C.
- Confirm the preliminary recommendation to replace the existing twin concrete box culvert at Crossing No. 6. Further details are provided *Section 5.2.1* of the *Hydraulic Analysis of Stream Crossing & Stormwater Management Alternatives Assessment* report in Appendix C.
- Assess the proposed grading adjacent to the road and provide ditch inlets to the future storm sewer system, where required, to facilitate drainage at any low points, local depressions, or locations of poor drainage.
- Complete hydrogeological studies for the Sixteen Mile Creek East and Main Branch structures to determine the impacts from dewatering and interruptions to baseflow contributions during construction. This study should outline feasible mitigation measures to reduce interruption of groundwater to baseflow in the creek (if necessary) as well as potential impacts to the creek from dewatering during the construction stage of the project.

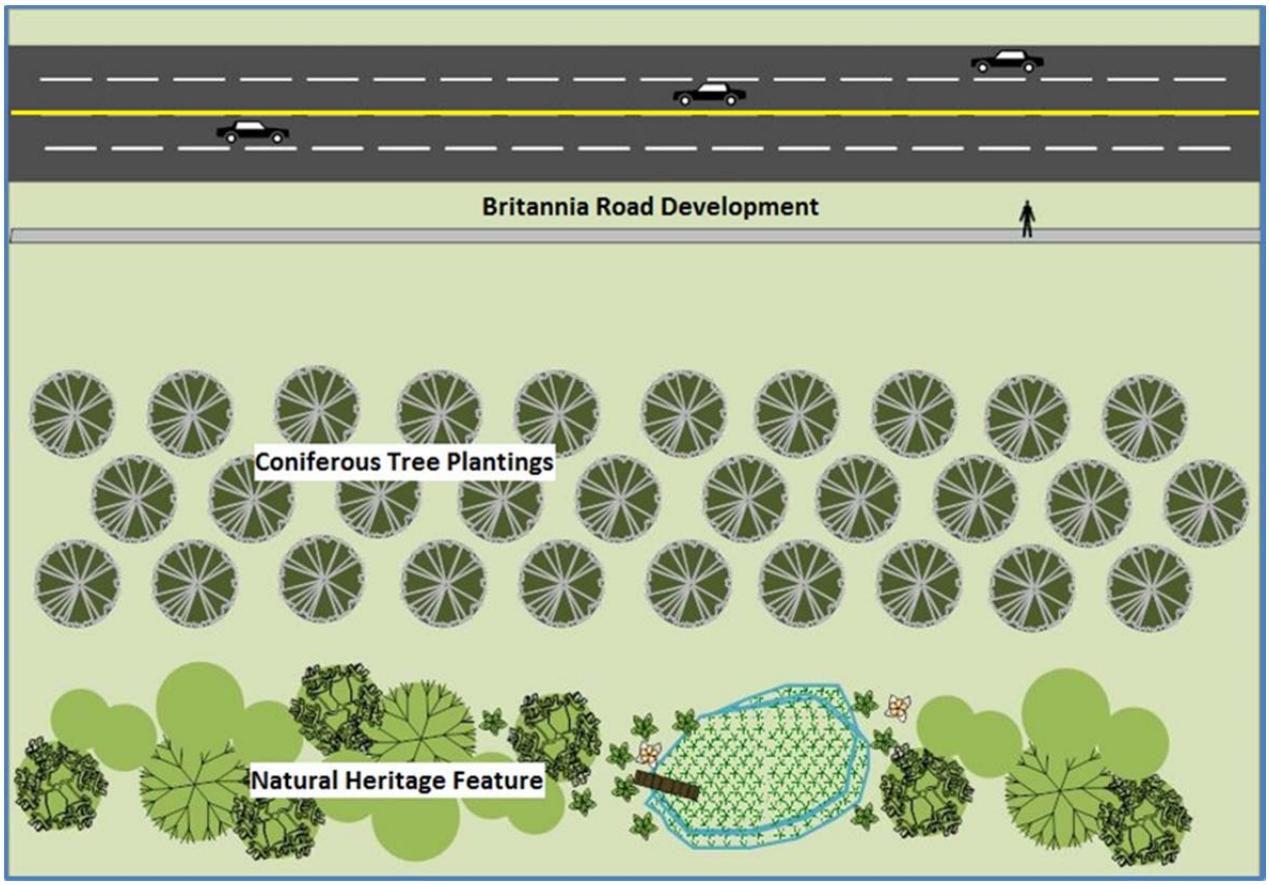
- Socio-Economic Requirements
  - Complete detailed property requirements and begin negotiations with affected property owners to purchase property required to implement the preferred design.
  - Commitments made to adjacent property owners, as documented in the records of consultation in the ESR shall be carried forward through further consultation with adjacent property owners.
  - Develop/finalize a landscaping plan for Britannia Road that includes aesthetic features such as roadside trees and vegetative plantings.

- Natural Environment Requirements
  - Complete an additional spring/summer vegetation inventory within the limits of disturbance to ensure that no species of conservation concern will be impacted by future works. This should include determining the precise location of all regionally significant species within the zone of

impact within the Main and East Branches of Sixteen Mile Creek so that all efforts can be made to avoid these individuals during construction.

- Retain a Certified Arborist to assess the retention status of the 16 trees with trunks located outside the proposed ROW but with driplines extending into the proposed ROW during detailed design.
- Undertake necessary tree preservation and protection measures.
- Design and installation of a multi-row salt-tolerant evergreen vegetation screen planted along the interface between the new road edge and the wetland (marsh) adjacent to the Western Woodland (conceptual diagram in **Figure 10-1**). These plantings will:
    - Increase forest cover and aid in compensating for tree removals within the project footprint;
    - Mitigate the effects of salt spray and traffic-related light and noise; and
    - Mitigate possible future tree cover loss as a result of the Emerald Ash Borer (Agrilus planipennis).
- Assess need for completion of an Information Gathering Form (IGF) and application under Section 17(2)(c) of the ESA for destruction of bobolink habitat with the Ministry of Natural Resources (MNR). This is to be completed early in the detailed design phase.
- Survey barns, culverts, and other suitable nesting structures, as applicable, and complete IGF at southern bypass within the Community of Omagh for possible Barn Swallow breeding. Complete 17(2)(c) permit if necessary for destruction of Barn Swallow breeding habitat.
- It is recommended the existing concrete box culvert at crossing no. 5 be replaced with a wider and longer concrete box culvert during a time when Barn Swallows are not using the nests (i.e. when the birds have migrated south). Consultation/registration with the MNR should take place at detailed design, at which point the specifics of culvert replacement will be determined.
- Choose appropriate construction access lanes and staging areas based on final design drawings/construction plans that will avoid riparian areas and have minimal impacts on terrestrial resources.
- Incorporate Enhanced Wildlife Crossing structures to the design of crossings 1, 2, 5, 6, 7, 11, 15 and 17; as well as the CN Rail overpass; following recommendations in Section 8.3.4.5.

Figure 10-1: Conceptual Vegetation Screen



- Assess need for completion of an IGF and application under Section 17(2)(c) of the ESA for destruction of silver shiner habitat within the East Branch of Sixteen Mile Creek with the MNR. To be completed early in the detailed design phase.
- Complete a Sediment and Erosion Control Plan for each watercourse crossing.
- Consult with CH and DFO for the possibility of creating a HADD during construction activities at watercourse crossings. If impacts to fish and fish habitat cannot be fully mitigated during construction, authorization under *Fisheries Act* may be required.
- Consider opportunities for creating or enhancing some riparian plantings adjacent to intermittent, ephemeral, and permanently flowing watercourses within the ROW that adheres to the Tree-Canopy Replacement Policy on Regionally Owned Lands, as outlined in Regional Report No. LPS31-08.

- Following an assessment of the work required and the distance upstream of the confluence, confirm cold water fisheries timing window for work on tributaries draining to the East Branch of Sixteen Mile Creek with the MNR.
- All culverts should be open-bottomed and utilize natural substrate. The stone sizing should be specified based on detailed hydraulic and geomorphic analyses (and further consultation with Conservation Halton).
- Confirm fish habitat status of the watercourses at crossings 3 and 8 (regulated by Conservation Halton).

- Cultural Heritage Requirements
  - Undertake a Stage 2 Archaeological Assessment in accordance with the recommendations of the Stage 1 Assessment.
  - Completion of a resource-specific heritage impact assessment or documentation report for built heritage resources and cultural heritage landscapes identified as being impacted by the proposed works (see Table 8-2) as per the recommendations of the *Cultural Heritage Assessment* Report in Appendix G.
  - Conduct heritage documentation activities for the 3 historical settlements that will be impacted by the proposed road widening, focusing on the changing landscape of the settlements.

10.2. Permits & Approvals

The permits and approvals that have been, and may be, required for this project are identified in **Table 10-1**.

Table 10-1: Permits and Approvals

Regulatory Agency	Legislation	Permit / Approval	Comments
Federal Government			
Fisheries and Oceans Canada (DFO)	Fisheries Act	Authorization for the Harmful Alteration, Disruption or Destruction of Fish Habitat	Will require preparation of a Fish Habitat Compensation and Mitigation Plan.
Provincial Government			
Ministry of the Environment	Ontario Environmental Assessment Act	Schedule 'C' Class EA (Municipal Engineer's Association Class EA)	Satisfactory completion of EA requirements is a prerequisite for obtaining most other approvals
	Ontario Water Resources Act	Permit to Take Water	Required if >50,000 L/d of surface or groundwater taken, includes temporary dewatering during construction
	Environmental Protection Act	Environmental Compliance Approval	Required prior to construction to ensure that the proposed works comply with MOE guidelines for the design of sanitary sewage systems, storm sewer systems and water systems
Ministry of Natural Resources	Endangered Species Act	Permit under Section 17(2)(c)	May be required due to potential for adverse effects on Silver Shiner. May also be required in the event of any predicted impacts on the crossing 5 culvert, which provides nesting habitat. *Silver Shiner is currently under assessment and could be added to Schedule 1 of the federal Species at Risk Act (SARA) as early as March 2014. If this is the case, a permit may be required under that legislation for crossings 7 and 15.*
	Fish and Wildlife Conservation Act	A License to Collect Fish for Scientific Purposes	Removal of fish during installation of cofferdams for culvert extensions
	Endangered Species Act	Permit under Section 17(2)(c)	May be required due to potential to damage or destroy habitat for Bobolink, which was recorded at locations adjacent to agricultural fields
	Endangered Species Act	Permit under Section 17(2)(c)	May be required due to potential to damage or destroy habitat for Barn Swallow (two barns south-east of the Britannia Road/Fourth Line intersection and the crossing 5 culvert, which provides nesting habitat).
Ministry of Tourism & Culture	Ontario Heritage Act	Section 48	It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest , and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*
	Ontario Heritage Act	Required under Environmental Assessment Act	'Environment', as defined in the EA Act includes: c) the social, economic and cultural conditions that influence the life of humans, or a community, and; d) any building, structure, machine or other device or thing made by humans.

Regulatory Agency	Legislation	Permit / Approval	Comments
Ministry of Labour	Construction Projects Regulation (O.Reg. 213/91)	Notice of Project	Required before construction commences
Ministry of Infrastructure	Ontario Environmental Assessment Act	Category "B" Class EA Process for Realty Activities Other Than Electricity Projects (Approved 2004, Amended September 11, 2008)	Required to be completed prior to acquisition of land from Infrastructure Ontario
Ministry of Transportation	Public Transportation and Highway Improvement Act	Encroachment Permit	Required if the proposed works are within the limits of a provincial highway right-of-way (Highway 407) and/or have the potential to interfere with the land within the limits of the highway or any structure forming a part of the highway.
Conservation Halton	Development and Interference with Wetlands and Alterations to Shorelines and Watercourses	Permit under Regulation ON. Reg.162/06	Permits are required for any site alteration or development within an area regulated under Ontario Regulation 162/06 CH permits will be required to support road widening and culvert modifications for all crossings within the study limits, with the exception of crossings 4, 5a, 10, 12, and 13. However, permits will not be required for the grading works associated with the optional redirection of flows within the unregulated portions of the channels north of Britannia Road, as per the Boyne Survey Secondary Plan Although one submission may be made to address multiple works within the regulated area, a separate permit will be required for works within the regulated area associated with each watercourse crossing, which could include the construction of new stormwater management outfalls, culvert replacements, grading, and relocation of utilities
Local and Regional Governments			
Town of Milton	Noise Control By-law (16-84)	Exemption	Required to allow construction works outside of normal hours (9 pm to 7 am) and on weekends
Town of Milton	Ontario Building Code	Building Permit	Required if temporary site trailers or other facilities are erected on-site
Halton Region	Tree Bylaw	Permit	Required to remove trees on town-owned property (i.e., within road right-of-way)

10.3. Monitoring During Construction

Mitigation measures identified in this report shall be written into the contract specifications. During construction, the contract administrator will ensure that full-time monitoring/inspection of the project works is undertaken to ensure that all environmental commitments identified in the Environmental Study Report are adhered to by the contract team. A qualified arborist shall be retained to monitor construction activities associated with roadside tree protection and in areas adjacent to the significant woodlands and forested slopes associated with the Main and East Branches of Sixteen Mile Creek.

Following completion of construction (i.e. post construction), a final inspection should be undertaken to ensure the effectiveness of the identified mitigation measures.