7 PROJECT DESCRIPTION

The major features for the proposed roadway and active transportation improvements on Trafalgar Road between Steeles Avenue and 10 Side Road are described in **Section 7.1**. Potential environmental effects, mitigation measures, and commitments to future work along this section of the Trafalgar Road corridor are described in **Section 7.2**. The preliminary plan is provided in **Plates 1 to 38**.

This information should be reviewed in conjunction with **Chapter 5** of the ESR which describes the alternative designs. While refinements may occur during detailed design, any changes should not alter the intent of the recommended undertaking or its components. During detailed design, there will be further consultation with technical agencies, including, but not limited to, Conservation Halton, Ministry of Natural Resources and Forestry, Ministry of the Environment and Climate Change, Ministry of Transportation, Town of Halton Hills, utilities, and affected property owners.

The recommended undertaking for Trafalgar Road between Steeles Avenue and north of 10 Side Road includes the following:

- Widening of Trafalgar Road from 2 to 4 lanes to adjoin existing 4-lane section at Steeles Avenue, as well as the intersection at 5 Side Road
- Transforming from a rural roadway (i.e. ditches on both sides) to a semi-urban roadway (i.e. ditch on one side, curb on the other) from Steeles Avenue to Hornby Road, with a curb on the east side only and the west side remaining as rural. The east side of Trafalgar Road will be urbanized to minimize intrusion into the Coulson Tract
- Trafalgar Road will remain as a rural (i.e. ditches) corridor from Hornby Road to north of 10 Side Road on both sides of the corridor. The corridor will be urbanized (i.e. curbs) at intersections and localized areas to minimize direct impacts to adjacent property owners
- Active transportation facilities, include:
    - From Steeles Avenue to Hornby Road: 3.0 m bi-directional multi-use path on the east side, 1.8 m exclusive bike lane on the east side, 1.5 m paved shoulder on the west side available for use by cyclists
    - From Hornby Road to north of 10 Side Road: 3.0 m bi-directional multi-use path on the east side only and with 1.5 m paved shoulder in each direction
- Introduction of full illumination and enhanced streetscape features

7.1 Major Features

7.1.1 Design Criteria

Currently, Trafalgar Road is posted at 80 km/h between Steeles Avenue and 10 Side Road except on approach to signalized intersections. Once the improvements have been implemented, the posted speed limit on Trafalgar Road will remain at 80 km/h; this is consistent with Trafalgar Road's major Regional arterial road classification and its rural character. The geometric details are listed in **Table 7-1** for all new sections of road (excludes 5 Side Road and Steeles Avenue intersections).

Table 7-1: Trafalgar Road Design Criteria

	Existing Conditions	Design Standard	Proposed Standard
Design Speed	100 km/h	90 km/h	90 km/h
Posted Speed	80 km/h, 60 km/h at signalized intersections	80 km/h	80 km/h, 60 km/h at signalized intersections
No. of Lanes and Width	2 lanes @ 3.75 m	4 lanes @ 3.50 m	4 lanes @ 3.50 m
Shoulder treatment: Steeles Avenue to Hornby Road	3.0 m shoulder in each direction (combination of 0.8 – 1.2 m paved plus 1.2 – 1.8 m granular)	• 1.5 m paved shoulder in each direction	• 1.5 m paved shoulder* plus 1.0 m granular on west side of the road, curb on east side
Shoulder treatment: Hornby Road to North of 10 Side Road	3.0 m shoulder in each direction (combination of 0.8 – 1.2 m paved plus 1.2 – 1.8 m granular)	• 1.5 m paved shoulder in each direction	• 1.5 m paved shoulder* plus 1.0 m granular on both sides of the road
Provision for Pedestrians and Cyclists: Steeles Avenue to Hornby Road	• No sidewalks / multi-use path	• 3.0 m multi-use path east side	• 3.0 m multi-use path on east side • 1.8 m bike lane on east side of the road
Provision for Pedestrians and Cyclists: Hornby Road to North of 10 Side Road	• No sidewalks / multi-use path	• 3.0 m multi-use path east side • 1.5 m paved shoulder in each direction	• 3.0 m multi-use path east side • 1.5 m paved shoulder in each direction
Illumination	No illumination (except at signalized intersection)	Full illumination if warranted	Full illumination
Minimum Grade	0.11 %	0%	0.11 %
Maximum Grade	5.02 %	6-8%	5.02 %
Minimum Curve Radius	700 m	440 m	700 m
Minimum Stopping Sight Distance	157 – 205 m	157 – 205 m	157 – 205 m
Flush Median: Steeles Avenue to Hornby Road	N/A	Varies	2.0 m (Varies)
Flush Median: Hornby Road to North of 10 Side Road	N/A	Varies	3.25 m (Varies)
Minimum Crest Curve	K_{crest} = 47	K_{crest} = 45 – 80	K_{crest} = 47
Minimum Sag Curve	K_{sag} = 30	K_{sag} = 37 – 50	K_{sag} = 30
Basic Right-of-Way	Varies	47 m	47 m

*1.5 m paved shoulder available for use by cyclists

7.1.2 Horizontal Alignment

Trafalgar Road will be widened mainly along the existing centerline (i.e. to both the west and east sides) between Steeles Avenue and 10 Side Road, except at the 10 Side Road intersection where Trafalgar Road will be widened to the west in order to minimize impacts to adjacent properties (see **Chapter 5**). In localized areas where there are

existing constraints, the typical cross section will be modified to minimize impact to adjacent properties / features.

7.1.3 Profile

The proposed vertical profile is generally consistent with that of the existing Trafalgar Road profile in order to minimize property requirements. A preliminary geotechnical investigation was carried out by Thurber Engineering regarding pavement design and recommendations. A copy of the report is provided in **Appendix M**.

7.1.4 Typical Cross Sections

Exhibits 7-1 and **7-2** illustrate the typical proposed cross-sections for the Trafalgar Road corridor improvements between Steeles Avenue and 10 Side Road for all new sections of road (excludes 5 Side Road and Steeles Avenue intersections). The following summarizes the basic features of the cross-sections within the Study Area:

- Nominal 47 m right-of-way (varies locally near intersections and at constrained locations such as residential properties)
- 4 lanes (2 lanes in each direction)
- 2.0 m painted median to 3.25 m median turning lane
- 3.25 m right turn lane at Hornby Road
- Active transportation facilities are provided as follows:
    - From Steeles Avenue to Hornby Road: 3.0 m bi-directional multi-use path on the east side, 1.8 m exclusive bike lane on the east side, and 1.5 m paved shoulder on the west side available for use by cyclists
    - From Hornby Road to North of 10 Side Road: 3.0 m bi-directional multi-use path on the east side only, 1.5 m paved shoulder in each direction
    - In sections that are already at 4 lanes (e.g. at Steeles Avenue and at 5 Side Road), the multi-use path will be extended to connect to the intersection
- Through the 5 Side Road and Steeles Avenue intersections where 4 lanes already exist, the travel lanes will tie into the existing 4 lane sections

In areas where there are existing constraints from adjacent properties, the cross section has been modified to minimize or avoid impact to these features; for example, Ashgrove Cemetery, and properties with buildings in close proximity to the road right-of-way. Modification to the cross section in localized areas will be subject to further review during detailed design.

7.1.5 Intersections and Access

As a Regional road, Trafalgar Road will include left and right turn lanes at signalized intersections. Within the study limits, the following intersections (from south to north) are or will become signalized.

Existing Signalized Intersections	Proposed Signalized Intersections
Steeles Avenue (already at 4 lanes)	Hornby Road
5 Side Road (already at 4 lanes)	
10 Side Road	

Exhibit 7-1: Trafalgar Road Proposed Typical Cross Section - Steeles Avenue to Hornby Road

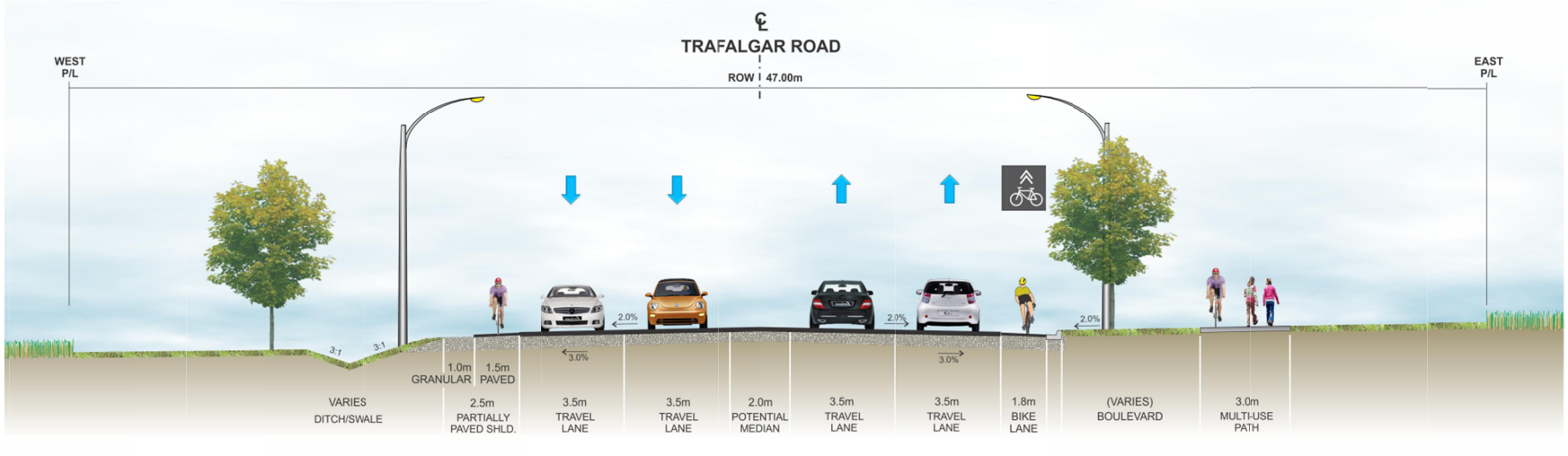


Exhibit 7-2: Trafalgar Road Proposed Typical Cross Section - Hornby Road to North of 10 Side Road

The existing channelized southbound access to Hornby Road from Trafalgar Road will be closed; Hornby Road will be converted to a cul-de-sac at this location. Access to Hornby Road from Trafalgar Road will be via a new signalized T-intersection at the existing Hornby Road / Trafalgar Road intersection.

There are a number of existing rural residential properties and farm operations with direct access to Trafalgar Road on both the east side and west side of the road. As Trafalgar Road is widened from 2 to 4 lanes between Steeles Avenue and north of 10 Side Road, a centre median will be provided to separate northbound and southbound traffic but will continue to allow full access by vehicles and farm equipment to properties on both sides of Trafalgar Road. This median will be reduced to 2.0 m through Coulson Tract to minimize intrusion.

Future access to Trafalgar Road will be subject to review and approval should any properties or currently vacant properties with no direct access to Trafalgar Road make applications for development / redevelopment.

7.1.6 Provisions for Active Transportation

Halton Region Council has approved 'in principal' the Active Transportation Master Plan (ATMP) which recommends Regional Walking and Cycling Networks to support and encourage people to walk and bike around Halton (as discussed in **Section 2.1.5**). The Halton Region ATMP was developed in consultation with the four local municipalities, including the Town of Halton Hills within the subject area. Consistent with the Active Transportation Master Plan, active transportation facilities within the Study Area are proposed as follows:

- From Steeles Avenue to Hornby Road: 3.0 m bi-directional multi-use path on the east side only, 1.8 m exclusive bike lane on the east side, 1.5 m paved shoulder on the west side
- From Hornby Road to North of 10 Side Road: 3.0 m bi-directional multi-use path on the east side only, with 1.5 m paved shoulder in each direction

For details regarding the Halton Region ATMP, please go to the website at: http://www.halton.ca/activetransportation. It should also be noted that between the completion of the EA Study and construction of improvements to the Trafalgar Road corridor between Steeles Avenue and north of 10 Side Road, there may be new trends in active transportation and the facilities being implemented may be updated at that time. The right-of-way protected through the EA Study (nominally 47 m right-of-way) will accommodate variations of active transportation facilities, as well as intersection treatments.

7.1.7 Drainage and Stormwater Management

7.1.7.1 Proposed Drainage Conditions

The overall drainage and stormwater management strategy is to improve upon the existing drainage conditions (i.e. no overtopping on Trafalgar Road under Regional storm events and all crossings meet freeboard requirements). Both quality and quantity control are to be provided. However, it is recognized that adjacent land uses may be

constrained through some sections of Trafalgar Road; therefore, one drainage area may be "over controlled" to compensate for the limited ability to control within the immediate drainage area of another section of Trafalgar Road.

Trafalgar Road is proposed to be widened to four lanes from Steeles Avenue to north of 10 Side Road. A 3 m wide multi-use path is provided on the east side through this section. The road configuration will be as follows:

- From Station 0+000 to 1+460 (approximately Steeles Avenue to Hornby Road), the road section consists of a semi-urban section, i.e. urban section on east side and rural on west side.
- From Station 1+460 to 6+240 (approximately Hornby Road to 10 Side Road), the roadway includes a rural-rural section and localized semi-urban sections at different stretches of the roadway to minimize property impacts.

The preferred alignment of Trafalgar Road is located inside the watershed of Sixteen Mile Creek between Steeles Avenue and 10 Side Road. The increase in pavement areas and the associated potential increase in pollutant loading to the receiving watercourses would result in negative effects such as reduced stream water quality, degraded aquatic habitat, flooding, and in-stream erosion, which necessitate provision of appropriate mitigation measures.

There are eight (8) culvert crossings on Trafalgar Road between Steeles Avenue and 10 Side Road. The culvert locations, drainage area ID numbers, and proposed conditions drainage mosaics are provided in **Exhibit 7-3 to Exhibit 7-9**. All the culvert locations within the study limits remain unchanged and there is no change in the drainage patterns; with the exception of Culvert C4.

Culvert C4 drains a small roadway area under existing conditions. This culvert will be eliminated under proposed conditions and runoff will be directed southerly toward SWM Pond N3. The pond will provide quantity control of the runoff and the Enhanced grassed swale (see description in **Section 7.1.7.7**) will provide quality treatment.

Within the roadway corridor, SWM facilities are provided in different locations, as required, to control the runoff from post-development to pre-development conditions. Enhanced grassed swales, bio-swales and oil-grit separators (OGSs) provided in different locations will facilitate the quality treatment of runoff.

Bio-swale is a bio-retention facility which stores, treats and infiltrates runoff. Bio-swale includes a filter bed which is a mixture of sands, fines and organic materials. It includes a mulch ground cover and plants adapted to the conditions of stormwater practice. These are also called bio-retention cells.

Enhanced grassed swale is the vegetated open channel with bottom width approximately 1.0 m or more and the channel velocity usually 0.50 m/s or less. It also treats and attenuates stormwater. Infiltration into the ground depends on the percolation rate of native soil since it does not include filter bed. Check dams are sometime used to lower the flow velocity.

Grassed swale includes regular grassed channel with smaller bottom width or even V-shape channel. There is no restriction in flow velocity. However, if channel velocity is significantly higher, riprap may be required to protect from channel erosion.

These SWM practices are described in **Section 7.1.7.7**.

From Steeles Avenue to 10 Side Road – Conservation Halton (CH) Jurisdiction:

Catchment areas from Steeles Avenue to 10 Side Road are located within the jurisdiction of CH as part of the Sixteen Mile Creek Subwatershed. The drainage areas are shown on **Exhibits 7-3 to 7-9**.

Runoff from Catchment 100 drains through Culvert C1. Roadway runoff will be directed to Enhanced grassed swales and bio-swales on the west side via storm laterals to provide quality treatment.

Catchment 105 was further separated into four (4) sub-catchments. Uncontrolled flows from Catchments 120, 125, and 130 are conveyed through Culverts C5, C6, and C7, respectively. Flows from these three (3) culverts combine and are routed through Catchment 105-0 before combining with flows from Catchment 105-0. Flows from Catchment 105-1 will be directed to Pond 2N (southwest quadrant of Trafalgar Road / Hornby Road), via grassed ditch and two pipe culverts, which will provide quality treatment and over-control of the flows. Flows from Catchment 105-2 drain to Enhanced grassed swales and bio-swales to provide quality treatment. Flows from Catchment 105-3 are directed to a linear facility Pond 2S to provide quantity control and quality treatment. The combined flows drain to Culvert C2.

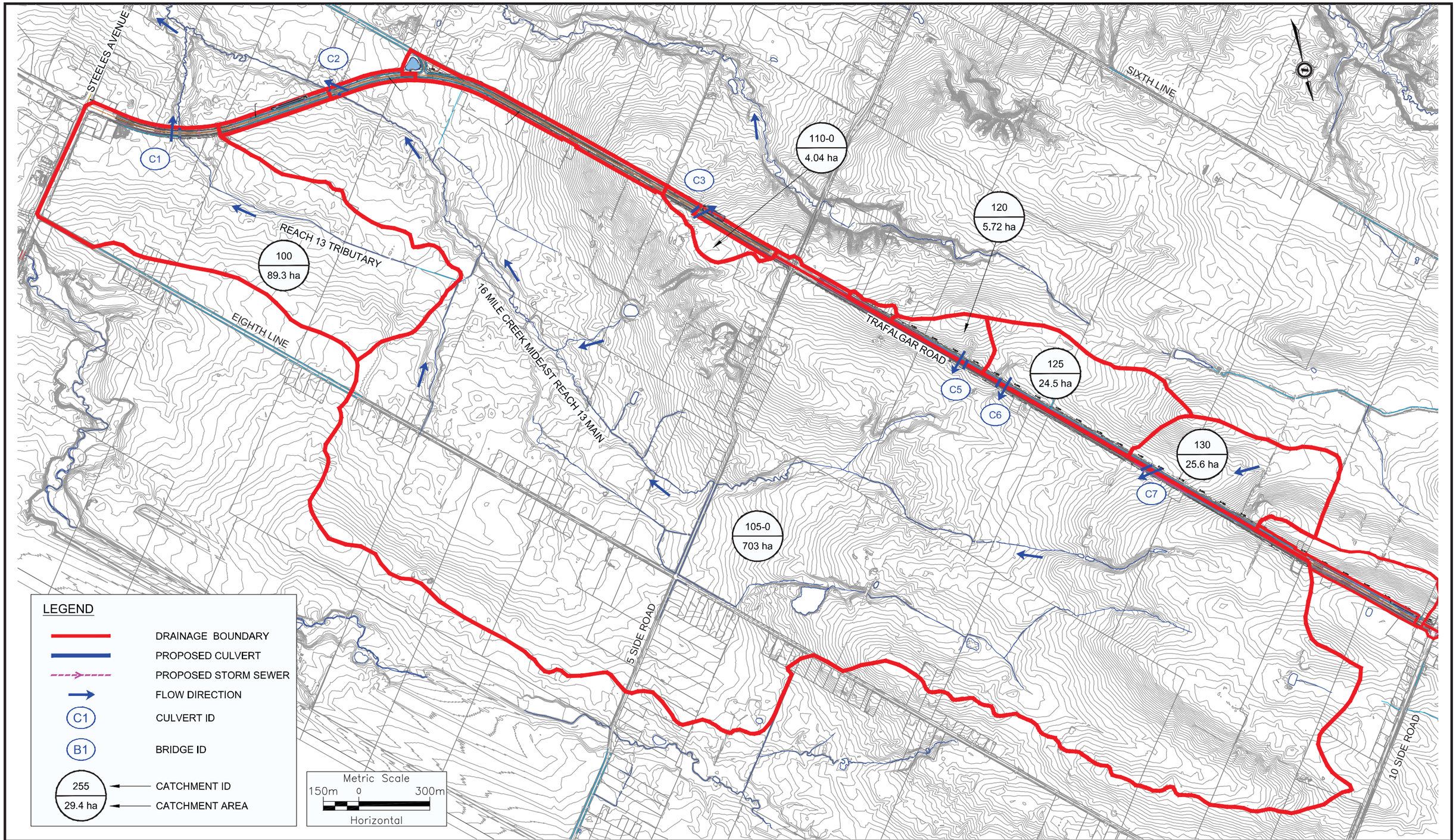
Catchment 110 was further separated into three (3) sub-catchments. Flows from Catchments 115, 110-2 and 110-1 are directed via flat-bottom grassed swales to SWM facility Pond 3N to provide quantity control. The flat-bottom grassed swales and bio-swales will provide water quality treatment. Outflows from Pond 3N and flows from Catchment 110-0 discharge to Culvert C3. In Catchment 110-1, storm laterals will be used to drain catchbasins to the west side ditch.

As mentioned above, flows from Catchments 120, 125 and 130 will discharge uncontrolled to the creek. Peak flow control will be accounted for by Pond 2N (see **Section 7.1.7.9** for pond descriptions). Quality treatment of runoff from these catchments will be addressed using Enhanced grassed swales and bio-swales.

Catchment 135 was further separated into two (2) sub-catchments. Flows from Catchment 135-1 are directed to Enhanced grassed swales and bio-swales on the west side via storm laterals to provide quality treatment and eventually to a vegetative dry, linear facility, Pond 8S, to provide quantity control and additional quality treatment. Outflows from Pond 8S combine with flows from Catchment 135-0 before discharging to Culvert C8.

7.1.7.2 Proposed Conditions Hydrologic Modelling

The proposed conditions drainage mosaics (**Exhibits 7-3 to 7-9**) vary slightly compared to the existing conditions drainage mosaics.



Halton REGION

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit
7-3

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Metric Scale
25m 0 50m
Horizontal

16 MILE CREEK MIDEAST REACH 13 MAIN

16 MILE CREEK MIDEAST REACH 13 TRIBUTARY

STEELES AVENUE

TRAFALGAR ROAD

BIO-SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

POND - 2S
GRASSED LINEAR DRY SWM FACILITY FOR QUANTITY AND QUALITY CONTROL
100-YEAR STORAGE VOLUME = 565 m³

ENHANCED GRASSED SWALES AND BIO-SWALE FOR QUALITY TREATMENT ON THE WEST SIDE

ENHANCED GRASSED SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

0+000 0+100 0+200 0+300 0+400 0+500 0+600 0+700 0+800 0+900 1+000 1+100

C1 C2

105-3 / 2.30 ha

105-0 / 703 ha

100 / 89.3 ha

Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit
7-4

POND – 2N
WET SWM FACILITY FOR QUANTITY AND QUALITY CONTROL
PERMANENT POOL VOLUME = 1160 m³
100–YEAR STORAGE VOLUME = 1890 m³

HORNBY ROAD

TRAFALGAR ROAD

1+500
1+600
1+700
1+800
1+900
2+000
2+100
2+200
2+300

675 mm DIAMETER CULVERT REQUIRED TO DIRECT RUNOFF TO SWM FACILITY

825 mm DIAMETER CULVERT REQUIRED TO DIRECT RUNOFF TO SWM FACILITY

105-1
6.42 ha

105-2
1.65 ha

1+300
1+200

BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

16 MILE CREEK MIDEAST REACH 13 MAIN

105-0
703 ha

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Metric Scale
25m 0 50m
Horizontal

Halton Region
MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit
7-5

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Metric Scale
25m 0 50m
Horizontal

POND – 3N
DRY SWM FACILITY FOR
QUANTITY CONTROL
100–YEAR STORAGE
VOLUME = 1290 m³

GRASSED SWALES FOR
QUALITY TREATMENT ON
THE WEST SIDE

ENHANCED GRASSED SWALES
AND BIO–SWALES FOR QUALITY
TREATMENT ON THE WEST SIDE

110-1
1.69 ha

110-2
0.90 ha

110-0
4.04 ha

105-0
703 ha

C3

TRAFALGAR ROAD

5 SIDE ROAD

2+400 2+500 2+600 2+700 2+800 2+900 3+000 3+100 3+200 3+300 3+400 3+500

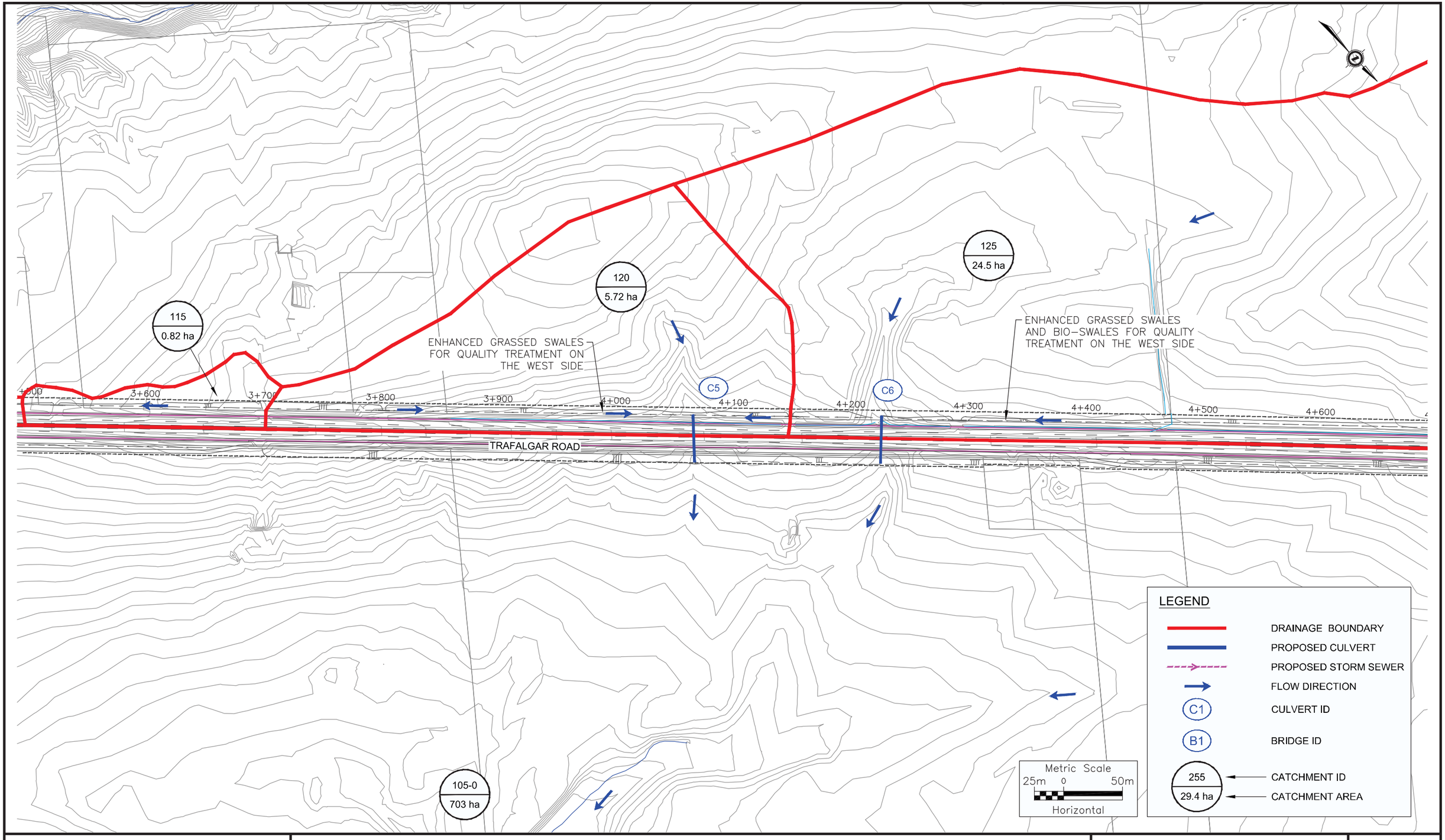
Halton REGION

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit
7-6



Halton Region

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit

7-7

125
24.5 ha

130
25.6 ha

135-0
9.3 ha

105-0
703 ha

ENHANCED GRASSED SWALES AND BIO-SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

4+700 4+800 4+900 C7 5+000 5+100 5+200 5+300 5+400 5+500 5+600 5+700 5+800

TRAFALGAR ROAD

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 CULVERT ID
- B1 BRIDGE ID
- 255 / 29.4 ha CATCHMENT ID / CATCHMENT AREA

Metric Scale
25m 0 50m
Horizontal

Halton Region

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TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit
7-8

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED CULVERT
- PROPOSED STORM SEWER
- FLOW DIRECTION
- C1 — CULVERT ID
- B1 — BRIDGE ID
- 255 / 29.4 ha — CATCHMENT ID / CATCHMENT AREA

Metric Scale
25m 0 50m
Horizontal

135-0
9.3 ha

140-0
28.0 ha

ENHANCED GRASSED SWALES AND BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

ENHANCED GRASSED SWALES AND BIO–SWALES FOR QUALITY TREATMENT ON THE WEST SIDE

5+900 6+000 6+100 6+200 C8 6+300 6+400 6+500 6+600 6+700 6+800 6+900 7+000

TRAFALGAR ROAD

See Trafalgar Road Class EA Study (Section 2) North of 10 Side Road to Highway 7

OGS

135-1
2.9 ha

140-1
1.30 ha

10 SIDE ROAD

POND – 8S
GRASSED LINEAR DRY SWM FACILITY
FOR QUANTITY AND QUALITY CONTROL
100–YEAR STORAGE VOLUME = 630 m^3

Halton REGION

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Proposed Conditions
Drainage Mosaic

Exhibit
7-9

A SWMHYMO hydrologic model was developed to estimate runoff from the roadway and external areas under proposed conditions, based on the 24-hour SCS storm distribution. The results of the hydrologic modelling are summarized in **Table 7-2**, which provides the proposed condition flows at each culvert.

The proposed hydrologic modelling schematics, hydrologic modelling parameters, and SWMHYMO summary output files are included in Appendix B of **Appendix J: Drainage and Stormwater Management Report**.

7.1.7.3 Comparison of Flows

As presented in **Table 7-2**, the comparison of peak flows are summarized as follows:

- Flows through Culvert C1 increases by less than 0.3% due to minor increase in imperviousness. No peak flow control is required.
- Uncontrolled flow at Culvert C2 increases significantly. Two SWM facilities are provided for peak flow control. The controlled flows are less than existing condition flows by up to 2%. No peak flow control will be provided in Catchments 120 (Culvert C5), 125 (Culvert C6) and 130 (Culvert C7), since these subcatchments drain to Culvert C2.
- Controlled flows through Culvert C3 decrease by up to 5% with the exception of the Regional Storm that increases by 29%. This can be reviewed during detailed design phase to provide addition control for the Regional Storm.
- Controlled flows through Culvert C8 decreases for all storm events.

7.1.7.4 Hydraulic Assessment

A hydraulic assessment was performed for the culverts between Steeles Avenue and 10 Side Road.

Hydraulic assessments of Culverts C1, and C2 were analyzed using the Hydraulic Engineering Center's River Analysis System modelling software (HEC-RAS). Bentley's CulvertMaster hydraulic model was used to analyze the hydraulic performance of the other culverts.

The design standards for the hydraulic assessment of culverts are based on the "MTO Highway Drainage Design Standards (HDDS) (February 2008)", discussed in **Appendix J Drainage and Stormwater Management Report**. The CulvertMaster hydraulic model was used to estimate headwater depth elevation and assess the hydraulic performance of each culvert within the study area. The CulvertMaster model was selected for the following reasons:

- Evaluates inlet and outlet controlled headwater depths;
- Simulates the hydraulic performance of culverts based on user-specified flows;
- Considers variable tailwater depths based on either outlet channel geometry or user specified depth discharge rating curves; and
- Incorporates an extensive database of standard culvert sizes, shapes and materials, and allows for the addition of custom culvert types and sizes.

Table 7-2: Peak Flow Comparison

Culvert ID / Node	Hydro ID	Drainage Area (ha)	Condition	24-hour SCS Storm Distribution Flows (m3/s)						Regional (Hazel)	Comments
				2-year	5-year	10-year	25-year	50-year	100-year		
C1	100	89.3	Existing	1.83	2.708	3.405	4.299	5.031	5.585	9.185	Negligible increases in flows; no peak flow control is required.
			Proposed (Uncontrolled)	1.835	2.713	3.41	4.304	5.035	5.589	9.185	
			Difference (Pr. Un. - Ex)	0.005	0.005	0.005	0.005	0.004	0.004	0.00	
			%	0.27%	0.18%	0.15%	0.12%	0.08%	0.07%	0.0%	
C2	505	770.6	Existing	7.209	10.926	13.925	17.815	21.033	23.482	55.203	Peak flow control is provided by wet Pond 2N and linear facility Pond 2S.
			Proposed (Uncontrolled)	8.092	12.107	15.315	19.451	22.852	25.433	56.684	
			Difference (Pr. Un. - Ex)	0.883	1.181	1.39	1.636	1.819	1.951	1.481	
			Proposed (Controlled)	7.063	10.734	13.702	17.555	20.742	23.167	54.748	
			Difference (Pr. Con. - Ex)	-0.146	-0.192	-0.223	-0.260	-0.291	-0.315	-0.455	
			%	-2.03%	-1.76%	-1.60%	-1.46%	-1.38%	-1.34%	-0.82%	
C3	110 515	5.73	Existing	0.246	0.364	0.457	0.574	0.670	0.741	0.761	Peak flow control is provided by dry Pond 3N.
			Proposed (Uncontrolled)	0.329	0.469	0.594	0.752	0.896	1.026	0.740	
			Difference (Pr. Un. - Ex)	0.083	0.105	0.137	0.178	0.226	0.285	-0.021	
			Proposed (Controlled)	0.244	0.346	0.447	0.572	0.668	0.741	0.982	
			Difference (Pr. Con. - Ex)	-0.002	-0.018	-0.010	-0.002	-0.002	0.000	0.221	
			%	-0.81%	-5.0%	-2.2%	-0.35%	-0.30%	0.00%	29%	
C4		Remove culvert in proposed conditions.									
C5	120	5.72	Existing	0.153	0.236	0.304	0.393	0.468	0.525	0.706	Subcatchment of C2. Peak flow
			Proposed (Uncontrolled)	0.173	0.262	0.335	0.430	0.509	0.569	0.722	

Culvert ID / Node	Hydro ID	Drainage Area (ha)	Condition	24-hour SCS Storm Distribution Flows (m3/s)						Regional (Hazel)	Comments
				2-year	5-year	10-year	25-year	50-year	100-year		
			Difference (Pr. Un. - Ex)	0.020	0.026	0.031	0.037	0.041	0.044	0.016	control provided at Culvert C2.
			%	13.07%	11.02%	10.20%	9.41%	8.76%	8.38%	2.27%	
C6	125	24.5	Existing	0.460	0.704	0.902	1.162	1.379	1.545	2.644	Subcatchment of C2. Peak flow control provided at Culvert C2.
			Proposed (Uncontrolled)	0.487	0.741	0.947	1.216	1.439	1.610	2.673	
			Difference (Pr. Un. - Ex)	0.027	0.037	0.045	0.054	0.060	0.065	0.029	
			%	5.87%	5.26%	4.99%	4.65%	4.35%	4.21%	1.10%	
C7	130	25.6	Existing	0.497	0.760	0.975	1.256	1.489	1.668	2.793	Subcatchment of C2. Peak flow control provided at Culvert C2.
			Proposed (Uncontrolled)	0.499	0.762	0.976	1.257	1.491	1.670	2.793	
			Difference (Pr. Un. - Ex)	0.002	0.002	0.001	0.001	0.002	0.002	0.000	
			%	0.40%	0.26%	0.10%	0.08%	0.13%	0.12%	0.00%	
C8	135 / 520	12.2	Existing	0.272	0.427	0.555	0.725	0.867	0.977	1.453	Peak flow control is provided by linear facility Pond 8S.
			Proposed (Uncontrolled)	0.328	0.504	0.648	0.837	0.994	1.114	1.500	
			Difference (Pr. Un. - Ex)	0.056	0.077	0.093	0.112	0.127	0.137	0.047	
			Proposed (Controlled)	0.271	0.420	0.545	0.706	0.858	0.976	1.428	
			Difference (Pr. Con. - Ex)	-0.001	-0.007	-0.010	-0.019	-0.009	-0.001	-0.025	
			%	-0.37%	-1.6%	-1.8%	-2.6%	-1.0%	-0.1%	-1.7%	

Under existing conditions, there are eight (8) crossing culverts between Steeles Avenue and 10 Side Road. Five (5) culverts are proposed to be replaced, one (a) culvert is proposed to be removed, and two (2) culverts are proposed to be extended. In addition, a third cell will be added at Culvert C2. These proposed changes are summarized in **Table 7-3**.

Table 7-3: Status of Crossing Structures from Existing to Proposed Conditions

Sixteen Mile Creek Watershed	
Culvert ID	**Status**
C1	Extend from 28.1 m to 36 m
C2	Extend from 36.4 m to 53.7 m and add 1 cell
C3	Replace
C4	Remove
C5	Replace
C6	Replace
C7	Replace
C8	Replace

In addition to the 8 crossing structures mentioned above, two (2) pipe culverts are required to direct the roadway runoff to Pond 2N at Hornby Road / Trafalgar Road.

7.1.7.5 Road Classification and Design Flow

Trafalgar Road will become a semi-urban road through some sections of the corridor and will remain rural in the remaining areas. According to the MTO HDDS for an urban arterial road, for structures with spans less than or equal to 6.0 m, the design flow is the 50-year storm flow; and for spans greater than 6.0 m, the design flow is the 100-year storm flow.

All culverts located on Trafalgar Road have spans of less than 6.0 m (except for Culvert C2); therefore, the design flow for the culverts is the 50-year flow.

It should be noted that while the Regional Storm is not the design storm being applied, Trafalgar Road is considered to be a critical transportation corridor within the Halton Region and it is the Region's policy that all regional arterial roads be designed as an emergency route such that it is flood free under Regional Storm conditions and can be relied upon by emergency services.

7.1.7.6 Hydraulic Modelling and Impact Assessments

The hydraulic performance of the existing structures was analyzed using HEC-RAS for Culverts C1 and C2. These are regulated watercourses and HEC-RAS models were available and provided by CH. For the remaining culvert crossings where HEC-RAS model are not available, CulvertMaster hydraulic model was used.

Culvert C1

Culvert C1 at Trafalgar Road Station 0+400 (north of Steeles Avenue) is located on Sixteen Mile Creek Mideast Reach 13 Tributary. The HEC-RAS model for this reach was provided by Conservation Halton. Two Sections 576 and 616.5, culvert size, inverts, road profile and flows were updated in the model.

Under existing conditions, Culvert C1 is a 28.1 m long concrete box culvert with a 3.05 m x 2.45 m opening. The road low point elevation for this crossing is 205.31 m. The available freeboard for the existing culvert is 3.01 m for the 50-year design flow, which meets the minimum requirement of 1.0 m. The 100-year and the Regional Storm flows do not overtop Trafalgar Road.

Under proposed conditions, Culvert C1 will be extended to approximately 36 m long maintaining the same 3.05 m x 2.45 m opening – see **Section 7.1.10**. The road low point elevation for this crossing is 205.38 m.

The available freeboard for the proposed culvert is 3.04 m for the 50-year design flow, which meets the minimum requirement of 1.0 m. The 100-year and the Regional Storm flows do not overtop Trafalgar Road. Immediately upstream of the culvert, the Regional Storm water level increased by 0.02 m, the 100-year water level increased by 0.03 m and 50-year water level increased by 0.04 m. These increases are considered small and are within modelling tolerance. There is no increase in water level for the other storm events.

Table 7-4 provides a comparison of the existing and proposed conditions HEC-RAS hydraulic modelling for Culvert C1.

Table 7-4: Comparison of HEC-RAS Modelling Results for Culvert C1

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
576	Regional	9.19	202.18	2.27	202.18	0.0	2.27
576	100-year	5.59	202.03	1.67	202.03	0.0	1.67
576	50-year	5.03	202.00	1.57	202.00	0.0	1.57
576	25-year	4.30	201.95	1.47	201.95	0.0	1.47
576	10-year	3.41	201.78	1.62	201.78	0.0	1.62
576	5-year	2.71	201.72	1.48	201.72	0.0	1.48
576	2-year	1.83	201.60	1.39	201.60	0.0	1.39
594.5		**Culvert C1**					
616.5	Regional	9.19	202.91	1.64	202.93	0.02	1.60
616.5	100-year	5.59	202.41	1.79	202.44	0.03	1.72
616.5	50-year	5.03	202.30	1.95	202.34	0.04	1.83
616.5	25-year	4.30	202.19	2.12	202.19	0.0	2.12

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
616.5	10-year	3.41	202.12	1.97	202.12	0.0	1.97
616.5	5-year	2.71	202.07	1.85	202.07	0.0	1.85
616.5	2-year	1.83	201.98	1.67	201.98	0.0	1.67
635.2526	Regional	9.19	203.21	1.97	203.21	0.0	1.97
635.2526	100-year	5.59	203.07	1.80	203.07	0.0	1.80
635.2526	50-year	5.03	203.04	1.77	203.04	0.0	1.77
635.2526	25-year	4.30	203.01	1.68	203.01	0.0	1.68
635.2526	10-year	3.41	202.96	1.63	202.96	0.0	1.63
635.2526	5-year	2.71	202.91	1.57	202.91	0.0	1.57
635.2526	2-year	1.83	202.83	1.47	202.83	0.0	1.47

Culvert C2

Culvert C2 at Trafalgar Road Station 1+080 is located on Sixteen Mile Creek Mideast Reach 13 Tributary. The HEC-RAS model for this reach was provided by Conservation Halton. Three Sections 2594.387, 2571 and 2510.996 were updated based on a current survey. In addition, the culvert size, culvert inverts, road profile and flows were updated in the model.

Under existing conditions, Culvert C2 is a 36.4 m long twin cell concrete box culvert with openings measuring 2.75 m x 2.25 m. The road low point elevation at this crossing is 203.03 m. The available freeboard for the existing culvert is 1.08 m for the 50-year design flow, which meets the minimum requirement of 1.0 m. The 100-year flow does not overtop Trafalgar Road; however, the Regional Storm flow overtops Trafalgar Road by 0.40 m.

Under proposed conditions, the existing twin cell culverts will be extended to approximately 53 m. A 3.0 m x 2.4 m open footing culvert (i.e. a third cell) will be added to provide additional capacity to avoid overtopping of Trafalgar Road under the Regional Storm flow condition. The road low point elevation at this crossing is 203.07 m. With the addition of one culvert, the total opening exceeds 6.0 m, and the design flow increases to the 100-year flow. The available freeboard is 1.30 m for the 100-year design flow which meets the minimum requirement of 1.0 m. The Regional Storm flow does not overtop Trafalgar Road, and the available freeboard for the Regional Storm flow is 0.37 m. The water levels on the upstream side are lower than the existing water levels for all storm events.

Table 7-5 provides a comparison of the existing and proposed conditions HEC-RAS hydraulic modelling for Culvert C2.

Table 7-5: Comparison of HEC-RAS Modelling Results for Culvert C2

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
2511.00	Regional	55.2	202.55	4.21	201.89	-0.66	2.9
2511.00	100-year	23.5	201.80	3.18	201.58	-0.22	1.48
2511.00	50-year	21.0	201.73	3.05	201.58	-0.15	1.33
2511.00	25-year	17.8	201.63	2.89	201.54	-0.09	1.16
2511.00	10-year	13.9	201.55	2.53	201.45	-0.1	0.96
2511.00	5-year	10.9	201.47	2.19	201.36	-0.11	0.8
2511.00	2-year	7.21	201.36	1.70	201.22	-0.14	0.59
594.50		**Culvert C2**					
2571.00	Regional	55.2	203.43	0.52	202.70	-0.73	2.12
2571.00	100-year	23.5	202.02	3.10	201.77	-0.25	1.46
2571.00	50-year	21.0	201.95	2.98	201.72	-0.23	1.34
2571.00	25-year	17.8	201.85	2.82	201.65	-0.20	1.2
2571.00	10-year	13.9	201.72	2.62	201.52	-0.20	1.02
2571.00	5-year	10.9	201.61	2.46	201.41	-0.20	0.86
2571.00	2-year	7.21	201.42	2.25	201.25	-0.17	0.65
2594.39	Regional	41.1	203.44	0.42	202.99	-0.45	0.63
2594.39	100-year	16.2	202.66	0.39	202.06	-0.60	1.68
2594.39	50-year	14.5	202.55	0.42	202.03	-0.52	1.66
2594.39	25-year	12.3	202.40	0.48	202.00	-0.40	1.61
2594.39	10-year	9.62	202.21	0.60	201.72	-0.49	2.41
2594.39	5-year	7.55	202.06	0.77	201.62	-0.44	2.29
2594.39	2-year	4.98	201.85	1.02	201.45	-0.40	2.11
2640.57	Regional	41.1	203.42	1.17	202.96	-0.46	1.84
2640.57	100-year	16.2	202.65	1.07	202.27	-0.38	2.04
2640.57	50-year	14.5	202.54	1.14	202.25	-0.29	1.89
2640.57	25-year	12.3	202.39	1.25	202.22	-0.17	1.72
2640.57	10-year	9.62	202.21	1.39	202.24	0.03	1.31
2640.57	5-year	7.55	202.10	1.37	202.13	0.03	1.29
2640.57	2-year	4.98	201.98	1.18	201.95	-0.03	1.23
2685.01	Regional	41.1	203.46	0.78	203.09	-0.37	1.29
2685.01	100-year	16.2	202.71	1.09	202.57	-0.14	1.55
2685.01	50-year	14.5	202.61	1.26	202.52	-0.09	1.6
2685.01	25-year	12.3	202.48	1.49	202.45	-0.03	1.61
2685.01	10-year	9.62	202.36	1.50	202.37	0.01	1.49

River Station	Storm Event	Existing Conditions			Proposed Conditions		
		Flow	Water Surface Elevation	Channel Velocity	Water Surface Elevation	Difference (Water Surface Elevation)	Channel Velocity
		(m^3/s)	(m)	(m/s)	(m)	(m)	(m/s)
2685.01	5-year	7.55	202.28	1.39	202.29	0.01	1.38
2685.01	2-year	4.98	202.15	1.17	202.14	-0.01	1.2
2740.57	Regional	41.1	203.45	1.71	203.06	-0.39	2.12
2740.57	100-year	16.2	202.76	1.68	202.73	-0.03	2.1
2740.57	50-year	14.5	202.70	1.63	202.70	0.00	2.04
2740.57	25-year	12.3	202.65	1.50	202.65	0.00	1.98
2740.57	10-year	9.62	202.57	1.34	202.57	0.00	1.83
2740.57	5-year	7.55	202.48	1.21	202.48	0.00	1.87
2740.57	2-year	4.98	202.33	1.03	202.33	0.00	1.81

Other Culverts

The CulvertMaster hydraulic model was used to determine the upstream headwater elevations (HWL) for Culverts C3, C5, C6 to C8. The input characteristics of the culverts include size, length, type, material and invert elevations. Culverts C3 to C8 are located within the Sixteen Mile Creek watershed.

Peak flows obtained from the 24-hour SCS storm distribution were used for the assessments. The hydraulic assessment was carried out for flows of the design storm, 100-year storm and Regional Storm (Hurricane Hazel). Tailwater elevations (TWL) were determined based on the downstream channel geometry of each culvert where a channel was present. Otherwise, a constant tailwater was used. The computed headwater elevations were compared to the road low point elevation to determine if freeboard was available. The CulvertMaster output files for both existing and proposed conditions assessments are included in Appendix D of **Appendix J Drainage and Stormwater Management Report.**

Existing Conditions Assessment

Although Trafalgar Road is a rural arterial road under existing condition, it will become a semi-urban arterial road under proposed conditions where the design storm flow is the 50-year flow. Therefore, the 50-year storm flow was considered as the design flow for the existing culverts, so that upstream water levels can be compared with the proposed conditions.

Table 7-6 provides the results of the existing conditions hydraulic assessments of the culverts located within the Sixteen Mile Creek watershed. The results show that:

- Culvert C3 does not meet the freeboard requirement for the 50-year design flow. The roadway is overtopped during the design, 100-year, and Regional Storm flows by 0.04 m, 0.05 m and 0.05 m, respectively.

- Culvert C4 will be eliminated under proposed conditions. No assessment was carried out.
- Culvert C5 meets all hydraulic requirements. The flows do not overtop Trafalgar Road during the 100-year and the Regional Storm flows. Due to poor conditions of the culvert, replacement of the culvert is recommended.
- Culvert C6 does not meet the freeboard requirement. The Regional Storm flow overtops Trafalgar Road by 0.14 m.
- Culvert C7 does not meet the freeboard criterion. The Regional Storm flow overtops Trafalgar Road by 0.09 m.
- Culvert C8 does not meet the freeboard requirement. The roadway is overtopped during the design, 100-year, and Regional Storm flows by 0.11 m, 0.12 m and 0.16 m, respectively.

Proposed Conditions Assessment

While undertaking the assessments to determine the sizes of the culverts under proposed conditions, the following guidelines were taken into consideration:

- No increase of upstream headwater elevations compared to the existing conditions;
- No overtopping of the roadway during the 100-year and the Regional Storm flows; and
- Consideration of geomorphic interest.

Table 7-7 provides the results of the proposed conditions hydraulic assessments of the culverts located within the Sixteen Mile Creek watershed. The results show that:

- Culvert C3 will be replaced by a 750 mm diameter concrete pipe. The culvert meets the freeboard requirement for the 50-year design flow and Trafalgar Road does not overtop during the Regional Storm flow.
- Culvert C5 will be replaced by a 600 mm diameter concrete pipe. The culvert meets the freeboard requirement for the 50-year design flow and the Regional Storm flow does not overtop the roadway.
- Culvert C6 will be replaced by a 975 mm diameter concrete pipe. The culvert meets the freeboard requirement for the 50-year design flow and the roadway does not overtop during the Regional Storm flow.
- Culvert C7 will be replaced by a 2130 mm x 1220 mm concrete box culvert which includes a 300 mm embedment. The culvert meets the freeboard requirement for the 50-year design flow and the Regional Storm flow does not overtop Trafalgar Road.
- Culvert C8 will be replaced by a 1530 mm x 1220 mm concrete box culvert which includes a 500 mm embedment due to cover constraint. The culvert will have a freeboard of 0.67 m for the 50-year design flow which does not meet the requirement; however, the culvert will have a 0.39 m freeboard during the Regional Storm flow. The culvert has cover constraints and a higher culvert would not be technically feasible; therefore, it is not proposed.

7.1.7.7 Stormwater Management

The preferred alignment of Trafalgar Road is located inside the watershed of Sixteen Mile Creek between Steeles Avenue and 10 Side Road. A list of stormwater best management

practices (BMPs) was screened, with consideration of the general advantages and disadvantages, experience, and practical feasibility for the site specific conditions.

It was determined at the start of the study that the "do nothing" alternative is not an acceptable course of action. The increase in pavement areas and the associated potential increase in pollutant loading to the receiving watercourses would result in negative effects such as reduced stream water quality, degraded aquatic habitat, flooding, and in-stream erosion, which necessitate provision of appropriate mitigation measures.

The MOECC has identified a broad range of stormwater management practices (SWMPs) that may be considered for the proposed roadway corridor. The recommended practices that can be implemented as part of this project are:

- Wet ponds providing quality treatment, quantity control and erosion control;
- Vegetative, dry linear facilities providing quantity control and a measure of quality treatment;
- Storage pipe systems providing quantity control;
- Enhanced vegetated grassed swales providing quality treatment;
- Special SWMPs such as oil and grit separators (OGSs) to provide quality treatment;
- LID measures such as bio-retention areas (bio-swales), tree pits, and infiltration galleries/trenches

Storage SWMP such as wet ponds, dry ponds, and linear SWM facilities, can be effective in providing combined quality treatment and/or quantity control where drainage areas are sufficient and land is available. Storage pipe systems can be effective for small drainage areas and in the case where land is not available. Vegetative SWMPs such as Enhanced grassed swales, bio-swales, etc. provide water quality treatment primarily by filtering out fine sediments and promoting infiltration, but can also be used to provide erosion control. Filtering of roadway pavement runoff can also be accomplished with vegetative embankments. Enhanced grassed swales are primarily designed to provide water quality control by limiting flow velocities and increasing the wetted perimeter, and can include grassed berms to detain water during small events and/or wider flat bottoms to increase storage and flow contact. Vegetative SWMPs can be readily applied to roads and highways, and are relatively inexpensive and particularly effective for small catchment areas. Infiltration measures such as bio-retention areas (bio-swales), tree pits, and infiltration galleries/trenches are effective for water balance and low impact development (LID) measures.

Within the study area, runoff from the proposed roadway will ultimately discharge to permanent watercourses via ditches and storm sewers. The roadway areas result in an increase in impervious area which eventually may result in an increase potential for erosion, flood risk, and water quality degradation along the receiving watercourses. Therefore, road runoff needs to be treated as far as possible both in terms of quantity and quality treatment before discharging into the receiving watercourses. Where appropriate, extension detention will be provided to reduce/mitigate the erosion impacts to the receiving watercourses during the detail design phase. Planting of native, non-rare species around the proposed SWM facilities will be reviewed during detailed design.

Table 7-6: Hydraulic Assessments of Existing Culverts located within Sixteen Mile Creek Watershed

Culvert ID	Size (mm)	Length (m)	Drainage Area (ha)	Type / Material	U/S Invert (m)	D/S Invert (m)	Road Low Point Elevation (m)	Ditch Spill Elevation (m)	Events	Flow (m3/s)	TWL (m)	Computed HWL (m)	HW/D	Freeboard (m)	Meets Requirements?		
															Freeboard	HW/D	Overtopping?
C3	500 mm diameter	21.7	5.7	Circular, CSP	233.260	232.210	234.710	n/a	50-year	0.670	232.20	234.75	2.98	-0.04	No	No	Overtopping
									100-year	0.741	232.19	234.76	n/a	-0.05	n/a	n/a	Overtopping
									Regional	0.761	232.19	234.76	n/a	-0.05	n/a	n/a	Overtopping
C4	600 mm diameter	18.5	0.81	Circular, CSP	244.060	244.020	245.440	n/a	This culvert will be eliminated under proposed conditions.								
C5	600 mm diameter	20.6	5.7	Circular, CSP	241.240	240.930	243.260	n/a	50-year	0.468	239.15	242.07	1.36	1.19	Yes	Yes	No
									100-year	0.525	239.16	242.24	n/a	1.02	n/a	n/a	No
									Regional	0.706	239.18	242.93	n/a	0.33	n/a	n/a	No
C6	900 mm diameter	23.3	24.5	Circular, CSP	241.070	240.420	243.300	243.210	50-year	1.379	240.23	242.41	1.46	0.89	No	Yes	No
									100-year	1.545	240.24	242.56	n/a	0.74	n/a	n/a	No
									Regional	2.644	240.29	243.44	n/a	-0.14	n/a	n/a	Overtopping
C7	1400 x 900	26.5	25.6	Arc CSP	245.390	245.270	246.820	246.530	50-year	1.489	245.50	246.37	1.01	0.45	No	Yes	No
									100-year	1.668	245.51	246.45	n/a	0.37	n/a	n/a	No
									Regional	2.793	245.56	246.91	n/a	-0.09	n/a	n/a	Overtopping
C8	600 mm diameter	21.0	12.2	Circular, CSP	253.590	253.520	254.510	n/a	50-year	0.867	253.79	254.62	1.70	-0.11	No	No	Overtopping
									100-year	0.977	253.79	254.63	n/a	-0.12	n/a	n/a	Overtopping
									Regional	1.453	253.79	254.67	n/a	-0.16	n/a	n/a	Overtopping

Note: U/S = Upstream D/S = Downstream TWL = Tailwater elevation HWL = Headwater elevation HW/D = Headwater to depth ratio

Table 7-7: Hydraulic Assessments of Proposed Culverts located within Sixteen Mile Creek Watershed

Culvert ID	Size (mm)	Length (m)	Drainage Area (ha)	Type / Material	U/S Invert (m)	D/S Invert (m)	Road Low Point Elevation (m)	Ditch Spill Elevation (m)	Events	Flow (m3/s)	TWL (m)	Computed HWL (m)	HW/D	Freeboard (m)	Meets Requirements?		
															Freeboard	HW/D	Overtopping?
C3	750 mm diameter	40.5	5.7	Circular, Concrete	233.000	232.210	234.840	n/a	50-year	0.668	232.19	233.84	1.10	1.00	Yes	Yes	No
									100-year	0.741	232.21	233.90	n/a	0.94	n/a	n/a	No
									Regional	0.982	232.23	234.11	n/a	0.73	n/a	n/a	No
C5	600 mm diameter	40.6	5.72	Circular, Concrete	241.240	240.930	243.370	n/a	50-year	0.809	239.15	242.05	1.33	1.32	Yes	Yes	No
									100-year	0.569	239.17	242.14	n/a	1.23	n/a	n/a	No
									Regional	0.722	239.18	242.49	n/a	0.88	n/a	n/a	No
C6	975 mm diameter	40.6	24.5	Circular, Concrete	241.070	240.420	243.420	243.210	50-year	1.439	240.22	242.25	1.21	1.17	Yes	Yes	No
									100-year	1.610	240.24	242.35	n/a	1.07	n/a	n/a	No
									Regional	2.670	240.29	243.39	n/a	0.03	n/a	n/a	No
C7	2130 x 1220 mm 300 mm embedded	50.8	25.6	Box, Concrete	245.400	245.250	246.870	246.530	50-year	1.491	245.48	245.87	0.73	1.00	Yes	Yes	No
									100-year	1.670	245.51	245.92	n/a	0.95	n/a	n/a	No
									Regional	2.790	245.56	246.21	n/a	0.66	n/a	n/a	No
C8	1530 x 1220 mm 500 mm embedded	40.6	12.2	Box, Concrete	253.450	253.350	254.730	n/a	50-year	0.858	253.79	254.06	0.88	0.67	No	Yes	No
									100-year	0.976	253.79	254.11	n/a	0.62	n/a	n/a	No
									Regional	1.430	253.79	254.34	n/a	0.39	n/a	n/a	No

Note: U/S = Upstream D/S = Downstream TWL = Tailwater elevation HWL = Headwater elevation HW/D = Headwater to depth ratio

7.1.7.8 Impact of Proposed Improvement of Road Corridor

The proposed improvements of Trafalgar Road include the widening from a 2 to 4 lane roadway with the provision of active transportation facilities with a combination of urban, rural, and semi-urban sections. The proposed roadway improvement will lead to an increase in impervious areas thereby increasing the peak flow rates. Several SWM facilities are proposed to address flows from the increased impervious areas.

Table 7-8 provides a comparison of impervious areas under existing and proposed conditions at each Node or point of interest due to the proposed road alignment. The table also shows the uncontrolled 100-year peak flow increases due to increase in impervious areas.

Table 7-8: Comparison of Impervious Areas

Node / Outlet	Existing Conditions			Proposed Conditions			Increase from Existing	
	Drainage Area (ha)	Impervious Area		Drainage Area (ha)	Impervious Area			
		Ha.	%		Ha.	%	Impervious Area	100-year Flow
Sixteen Mile Creek Watershed								
C1	89.3	3.16	3.5%	89.3	4.40	4.9%	1.4%	0.07%
C2	771	9.76	1.3%	769	15.7	2.0%	0.8%	8.30%
C3	5.73	0.80	14.0%	7.45	2.33	31.3%	17.3%	38.5%
C5	5.72	0.35	6.1%	5.72	0.65	11.4%	5.2%	7.70%
C6	24.5	0.50	2.0%	24.5	0.99	4.0%	2.0%	4.00%
C7	25.6	1.11	4.3%	25.6	1.57	6.1%	1.8%	0.10%
C8	12.2	1.29	10.6%	12.2	1.74	14.3%	3.7%	14.0%

C – Culvert

The table illustrates that there is significant increase in flows at Culverts C2, C3, C5, C6, and C8. Therefore, to reduce the impacts of sediment loading as well as increased peak flows to the receiving watercourses, storm water management measures are required for runoff quality and quantity control.

7.1.7.9 Proposed Stormwater Management Strategy

There are no planned future development adjacent to Trafalgar Road between Steeles Avenue and 10 Side Road. Therefore, stormwater management strategy is planned for the **ultimate conditions.**

Under this approach, a total of four (4) SWM facilities are proposed for the runoff quality and quantity control. There will be one (1) wet pond and three (3) grassed linear, dry SWM facilities. In addition, there will be Enhanced grassed swales and bio-swales to provide quality treatment as well as water balance. Oil and grit separators (OGSs) will be provided at two (2) locations where the roadway runoff is conveyed by storm sewers. The treatment goals for different SWM facilities are:

- SWM wet pond will provide quality treatment, quantity control and erosion control.
- Vegetative dry linear facility will provide peak flow control and quality control.
- Enhanced grassed swales, bio-swales and other grassed swales/ditch will provide quality treatment and water balance.
- OGSs will provide quality treatment.

Where feasible, a treatment train approach has been provided as per the MOECC guidelines.

Table 7-9 summarizes the details of the SWM component proposed for the Trafalgar Road corridor within the Sixteen Mile Creek watershed.

Table 7-9: Proposed SWM Components Within Sixteen Mile Creek Watershed (CH Jurisdiction)

Station		Length (m)	SWM Component	Purpose
From	To			
0+100	0+250	150	Enhanced grassed swale on west side	Quality control
0+250	0+400	150	Bio-swales on west side	Quality control and water balance
0+400	0+550	150	Enhanced grassed swale on west side	Quality control
0+600	0+850	250	Enhanced grassed swale on west side	Quality control
0+820	0+970	150	Grassed linear facility - Pond 2S	Quality and quantity control
0+970	1+050	80	Bio-swales on west side	Quality control and water balance
1+050	1+100	100	Grassed ditch on west side	Limited water quality control
1+100	1+360	260	Bio-swales on west side	Quality control and water balance
1+380	1+460	80	SWM wet facility - Pond 2N	Quality and quantity control
1+460	2+600	1140	Grassed ditch on both sides	Limited water quality control
2+780	2+880	100	Dry SWM facility – Pond 3N	Quantity control
2+880	3+100	220	Grassed ditch on west side	Limited water quality control
3+100	3+200	100	Bio-swales on west side	Quality control and water balance
3+200	3+500	300	Enhanced grassed swale on west side Grassed ditch on east side	Quality control
3+500	3+900	400	Grassed ditch on both sides	Limited water quality control
3+900	4+050	150	Enhanced grassed swale on west side Grassed ditch on east side	Quality control
4+050	4+300	250	Grassed ditch on both sides	Limited water quality control
4+300	4+500	200	Bio-swale on west side Grassed ditch on east side	Quality control and water balance
4+500	4+800	300	Enhanced grassed swale on west side Grassed ditch on east side	Quality control

Station		Length (m)	SWM Component	Purpose
From	To			
4+800	4+980	180	Grassed ditch on both sides	Limited water quality control
4+980	5+200	220	Bio-swale on west side Grassed ditch on east side	Quality control and water balance
5+200	5+700	500	Grassed ditch on both sides	Limited water quality control
5+700	5+950	250	Enhanced grassed swale on west side	Quality control
5+950	6+120	170	Bio-swales on west side	Quality control and water balance
6+120	6+300	180	Grassed linear facility – Pond 8S	Quality and quantity control

Where appropriate, extension detention /erosion control measures will be provided during detailed design. The possibility of other LID measures such as bio-retention areas (bio-swales), tree pits, infiltration galleries/trenches, etc. will be reviewed during the detail design phase. Consultation with Landscape Architect will be carried out to refine the LID options.

Table 7-10 summarizes the characteristics and overall performance of each SWM facility.

Table 7-10: Characteristics of Proposed SWM Facilities

Facility ID.	Type	Design Stage	Drainage Area	Permanent Pool [1]	Active Storage [2]	100-yr Peak Inflow	100-yr Peak Outflow	% Reduction in 100-yr Peak Flow
			(ha)	(m^3)	(m^3)	(m^3/s)	(m^3/s)	
2S	Grassed linear dry SWM facility	Ultimate	2.30	--	565	0.572	0.242	58%
2N	Wet SWM facility	Ultimate	6.42	1160	1890	1.345	1.105	18%
3N	Dry SWM facility	Ultimate	3.41	--	1290	0.98	0.218	78%
8S	Grassed linear dry SWM facility	Ultimate	2.90	--	630	0.728	0.503	31%

1) Permanent Pool is based on Table 3.2 of the MOECC Stormwater Planning and Design Manual.
2) Active Storage refers to the maximum volume used during the 100-year 24-hr SCS Storm.

The location of Enhanced grassed swales, bio-swales and other stormwater management BMPs are shown in **Exhibits 7-4 to 7-9**. The stage-discharge-storage information for each stormwater management facility is provided in Appendix F of **Appendix J Drainage and Stormwater Management Report**. Additional details for each SWM facility are provided in the following text.

Pond 2S:

- It is a grassed linear SWM facility located at Station 0+900 on the west side of Trafalgar Road.
- The facility will service 2.3 ha of the roadway (Catchment 105-3) from Station 0+580 to 0+960. The layout plan of this linear facility is shown in **Exhibit 7-4**.
- The pond will have 2.5:1 side slopes and a bottom elevation of 202.70 m. At the bottom of the facility, its size will be approximately 150 m long and 2.5 m wide. The 100-year storage volume for this pond will be approximately 565 m^3.
- Outflows from the SWM facility will discharge to the 80 m long Enhanced grassed swale and then ultimately to the downstream side of Culvert C2.
- The Enhanced grassed swale, vegetative linear facility and bio-swale in series provide a water quality treatment train.

Pond 2N:

- It is a wet SWM facility located at Station 1+400 on the west side of Trafalgar Road.
- The facility will service 6.42 ha of the roadway right-of-way (Catchment 105-1) from approximately Station 1+400 to 2+600. The layout plan of this facility is shown in **Exhibit 7-5**.
- The pond will have 3:1 side slopes from the bottom of the pond to the permanent pool level and 4:1 side slopes from permanent pool level to the top of the pond. The bottom elevation of the pond will be 202.00 m. The permanent pool volume of the pond will be 1160 m3 at an elevation of 203.80 m. The 100-year storage volume for this pond will be approximately 1890 m^3.
- Outflows from the SWM facility will discharge to the bio-swale followed by an Enhanced grassed swale and then ultimately to the downstream side of Culvert C2.
- The SWM wet pond, bio-swale and Enhanced grassed swale together will provide an Enhanced level of quality treatment of the runoff and maintaining a treatment train approach.

Pond 3N:

- It is a dry SWM facility located at Station 2+800 on the west side of Trafalgar Road.
- The facility will service 3.41 ha of the roadway (Catchments 110-1, 110-2 and 115) from approximately Station 2+800 to 3+700. The layout plan of this linear facility is shown in **Exhibit 7-6**.
- The pond will have 3:1 side slopes and a bottom elevation of 232.50 m. At the bottom of the facility, its size will be approximately 90 m long and 11 m wide. The 100-year storage volume for this pond will be approximately 1290 m^3.
- Before discharging into this SWM facility, roadway runoff will be conveyed by Enhanced grassed swale, bio-swale and flat bottom grassed ditch. Outflows from the SWM facility will discharge to the downstream side of Culvert C3.
- The Enhanced grassed swale, bio-swale, flat bottom grassed ditch and SWM facility together will provide quality treatment of the runoff and maintaining a treatment train approach.

Pond 8S:

- It is a grassed linear SWM facility located at Station 6+200 on the west side of Trafalgar Road.
- The facility will service 2.9 ha of the roadway corridor (Catchment 135-1) from approximately Station 5+500 to 6+250. The layout plan of this linear facility is shown in **Exhibit 7-9**.
- The pond will have 3:1 side slopes and a bottom elevation of 254.0 m. At the bottom of the facility, its size will be approximately 125 m long and 2.5 m wide. The 100-year storage volume for this pond will be approximately 630 m^3.
- Before discharging into this SWM facility, roadway runoff will be conveyed by Enhanced grassed swale and bio-swale. Outflows from the SWM facility will discharge to the upstream side of Culvert C8.
- The Enhanced grassed swale, bio-swale and vegetative linear facility maintain a treatment train to provide quality treatment of the runoff.

7.1.7.10 Water Balance and Low Impact Development Measures

For the water balance and low impact development (LID) measures the following steps were considered:

- Maximum exposure of roadway runoff into the pervious areas;
- Implementation of Enhanced grassed swales; and
- Implementation of bio-swales.

This will allow both quality treatment of the roadway runoff and infiltration into the ground to provide water balance requirement. **Table 7-9** list the locations where Enhanced grassed swales and bio-swales are proposed along the Trafalgar Road corridor. A comprehensive review of these water balance and LID measure will be carried out during the detailed design phase.

7.1.8 Fluvial Geomorphology

A fluvial geomorphic assessment was conducted to describe the existing conditions of the various watercourses within the study area, to assess the possible impacts of the proposed works on the watercourses and to provide preliminary design recommendations for the proposed watercourse crossings. A brief overview of the assessment is provided in this section.

Relevant background information was reviewed to provide context and fill any data gaps. This included available topographic data, drainage and hydraulic data from the drainage and stormwater management review completed as part of the Trafalgar Road EA Study, surficial geology mapping, project correspondence with technical agencies, relevant guidelines and relevant background reports.

Site visits were conducted on December 2 and 3, 2015 as well as on February 3, 2016. Existing reach characteristics are summarized in **Table 7-11**. Most of the watercourse crossings are headwater features with small drainage areas on the order of 1km^2 or less. These are typically swales or ditches with minimal ongoing geomorphic processes.

Within the study area between Steeles Avenue and north of 10 Side Road, the Sixteen Mile Creek Mideast Reach 13 Tributary (Culvert 1) is an intermittent channel with a drainage area of 0.89 km^2 and the Hornby Tributary to Middle Sixteen Mile Creek (Culvert C2), has a drainage area of 7.1km^2.

The detailed geomorphology assessment is provided in a separate report in **Appendix J Drainage and Stormwater Management Report**.

Table 7-11: Summary of Reach Characteristics (Sixteen Mile Creek Watershed)

Culvert No.	Drainage Area (km^2)	Bankfull Width (m)	Planform Geometry	Description
C1	0.89	1	Meandering	Small meandering channel upstream. Downstream, multiple flow paths through grassy area. Loose silt and clay bed.
C2	7.10	5	Straight	Bankfull width modified (over-widened). Channel previously straightened, straight planform persists. Cobble-gravel bed. Poorly developed bedforms, silt and alga-covered bed.

Culvert 1 will be extended. The existing culvert span is approximately three times the average channel bankfull width (where the channel is defined). The structure is well aligned with the defined channel upstream and is not impeding ongoing geomorphic processes. As such, culvert extension is considered. Minor tie in work may be required to connect the in-structure low flow channel through the culvert extension.

Culvert 2 will be extended and a third cell with an open footing will be added to the existing structure to provide additional hydraulic capacity. The existing crossing is located on a straight reach and is fairly well aligned with the existing channel planform. The total span of the three cells will be between one and two times the average channel width; however, it should be noted that the channel appears to be modified. The additional span will not increase erosion hazard over existing conditions, and may allow additional space for lateral adjustment were this to occur in the future. It should be noted that the existing channel planform, which is straight, has not notably changed since the culvert's construction in 1980. The channel may be realigned through the additional pen foot cell. Following realignment, the additional open foot cell will become the main flow path, which would allow sediment transport through the crossing. The existing two cells will remain closed-foot structures which would functions as high flow channels following realignment.

As noted above, minor realignment works may be required both upstream and downstream to convey the low flow through the third culvert cell. This would provide the opportunity to create several meters of additional channel length, and to improve bedforms by creating riffles and pools within the realignment footprint. Minor stabilization of the channel bed with appropriately sized substrate is recommended where the channel bed is locally scoured at the inlet of the eastern culvert cell. During detailed design, it should be considered to improve the angle at which the roadside ditch enters the creek from the northeast corner of the crossing; this may mitigate future bed scour at

the culvert inlet, and the removal of sediment from the western cell to increase culvert capacity should also be considered.

7.1.9 Hydrogeology

A hydrogeology assessment was conducted as part of the EA Study to broadly characterize the hydrogeological conditions in the overall study area between Steeles Avenue and Highway 7. A copy of the Hydrogeology Report can be found in **Appendix N**. The discussion in this section will focus on the section between Steeles Avenue and 10 Side Road.

The Ontario Water Resources Act states that the diversion of surface water or the extraction of groundwater in excess of 50,000 L/day requires a Permit to Take Water (PTTW) to be obtained from the MOECC. A Category 3 PTTW is expected to be required for this project for the construction of structural culverts. The dewatering of excavations shall be conducted to ensure that all discharges meet the Provincial Water Quality Objectives and comply with the Ontario Water Resources Act thresholds for water quality.

A door to door well survey within the study limits between Steeles Avenue and 10 Side Road will have to be performed. Groundwater monitoring points will have to be established near the municipal wells fields to monitor the effects of construction on the municipal and domestic water wells. Documentation of other permitted water takings will need to be evaluated and the effects considered as part of this door to door survey.

A suitable drinking water monitoring plan will need to be established, involving pre-construction baseline groundwater quantity and quality details at private wells and municipal wells. Monitoring of groundwater levels and water quality will be performed at the municipal and domestic wells during the construction period. The data will be analyzed to determine if any adverse trends regarding groundwater level and quality are observed.

Construction related impacts to domestic wells will be mitigated by notification (private well owner, Halton Region Water Services, Halton Region Health Unit, etc.), identifying the source/cause of the well issue, providing temporary water supplies to impacted well owners, and providing a solution to the well issue (e.g. drilling a new well, providing municipal water servicing, etc.)

The potential for soil and groundwater contamination near major intersections and adjacent to commercial properties should be evaluated. Dewatering discharge may need to be managed and/or treated during construction dewatering**.** A soil management plan may have to be developed to manage any potentially contaminated soil identified during construction, especially within Wellhead Protection Areas.

Contamination migration flow paths may potentially be modified during groundwater pumping in the shallow aquifer. Dewatering discharge may need to be managed and/or treated during construction dewatering.

During construction, the quality of surface water and groundwater between Steeles Avenue and 10 Side Road needs to be protected from loading of suspended solids into

watercourses, potential fuel leaks or falling construction debris caused from construction activities. Protection may be achieved through implementation of best management practices and the development of robust erosion and sediment control plans and monitoring and mitigation programs.

The depth to the groundwater table during wellfield pumping and non-pumping conditions will have to be confirmed to determine the need for temporary dewatering, and whether permanent dewatering is required in the distant future, should there be a change in the pumping conditions of the wellfields in the immediate area.

Wellhead Protection Area Policy and Monitoring Frameworks needs to be considered in the design and construction of the project within Wellhead Protection Areas.

The construction and/or decommissioning of wells will be carried out by a qualified and licensed well contractor, in accordance with Ontario Regulation 903, under the Ontario Water Resources Act, 1990, which governs well construction, maintenance and decommissioning.

7.1.10 Structural Culverts

Culvert C1

The reinforced concrete box culvert (Culvert C1) is located approximately 0.4 km north of Steeles Avenue on Trafalgar Road with a perpendicular alignment to Trafalgar Road and no existing head or wing walls. The culvert is 3.1 m wide by 2.4 m tall and approximately 28 m long with 250 mm thick walls and roof slab.

The existing box culvert is generally in good condition, with some wet cracks and efflorescence on the soffit and barrel walls. The watercourse flows from east to west and is heavily vegetated at the inlet and outlet. Overhead hydro wires are located to the east of the culvert. South of the structure street lighting is provided; however, there is no lighting to the north of the culvert. Additional information regarding the existing structure can be found in the inspection memo, in **Appendix I**.

At this culvert, the anticipated future cross section will carry two 3.50 m lanes and 1.50 m shoulders in each direction with a 3.0 m wide multiuse trail to the east. In order to accommodate the widening, the culvert will be extended by 5.0 m to the east and will require new headwalls as well as 3.0 m long wingwalls at each quadrant (total length of the culvert would be approximately 36 m. A pedestrian and cyclist guard rail is proposed above each headwall and wingwall in order to protect pedestrians from the potentially hazardous drop.

The Preliminary General Arrangement Drawing (GA) can be found in **Exhibit 7-10**.

Culvert C2

The twin cell reinforced concrete box culvert (Culvert C2) is located approximately 1.0 km north of Steeles Avenue on Trafalgar Road and is on a 43 degree skew with Trafalgar road. The existing culvert has no head or wingwalls and consists of two 3.1 m

wide by 2.4 m tall and approximately 25 m long with 280 mm thick walls and 300 mm thick roof slab.

The existing twin cell box culvert is generally in good condition, with some wet cracks, efflorescence, delaminated and spalled concrete in local areas. Additional information regarding the existing structure can be found in the inspection memo, in **Appendix I**.

At this location, the anticipated future cross section will carry two 3.50 m lanes and 1.5 m shoulders in each direction with a 3.0 m wide multiuse trail to the east. In order to accommodate the widening, the culvert will be extended to the east by 4.5 m and to the west by 10.4 m measured at the centre of the existing two culverts. Due to property restrictions and the skew severity, the end of the culvert extensions will have a 25 degree skew.

Hydraulic analysis warrants the addition of a third box (open footing culvert) immediately adjacent to the existing twin box structure in order to avoid overtopping of the road during a Regional Storm event. The additional proposed cell is approximately 53 m long with a 3.0 m span and 2.4 m rise with a 0.15 m lower invert for low flow and 0.30 m embedment. A new wingwall will be likely be required in the northwest and southeast quadrants to support the adjacent embankments. It should be noted that the new third cell may be constructed on either the north side or south side of the existing twin cell culvert; this will be confirmed during detailed design.

In addition to the modifications required to accommodate widening, the following proposed repairs are recommended:

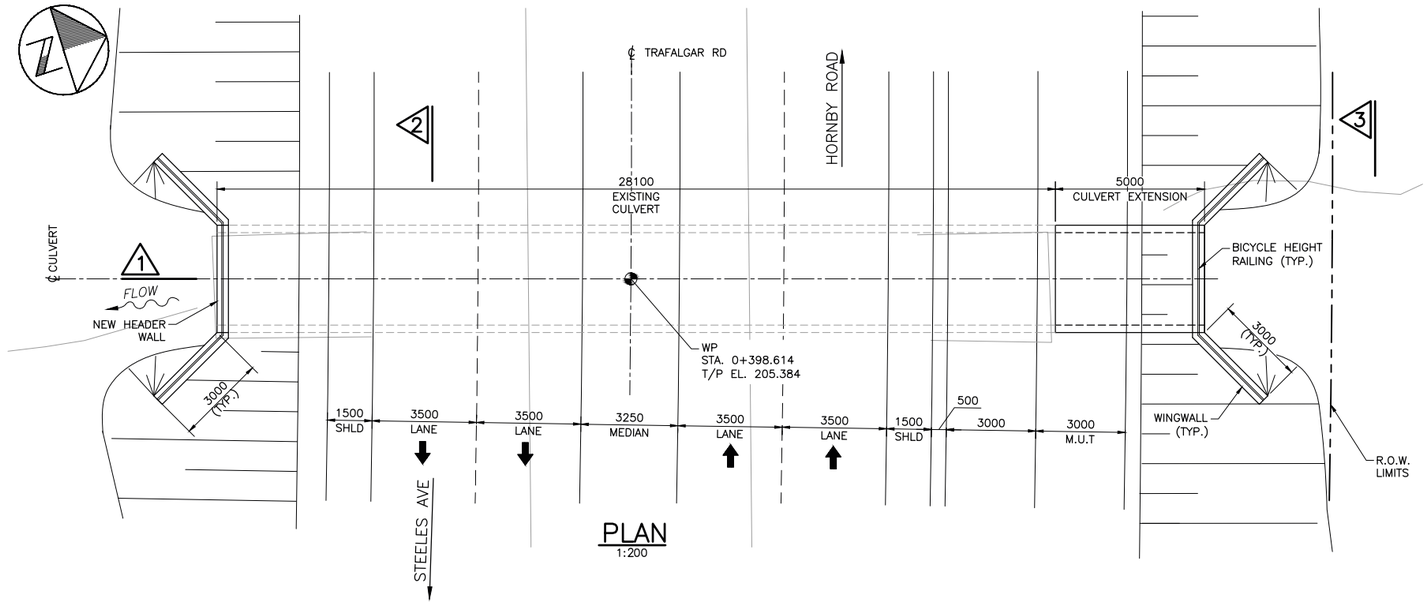
- removal of all delaminated and deteriorated concrete (including previous patches); and,
- local patch repairs and place additional steel reinforcement in areas when existing reinforcement is deteriorated.
- During detailed design, consideration could also be given to precast culvert to reduce the duration of the construction.

The Preliminary General Arrangement Drawing (GA) can be found in **Exhibit 7-11**.

7.1.11 Landscaping

A landscape can be defined as the aggregate of all of the visual elements found within a region or area. Each of these elements contributes to the over-arching character of a place, and can define it as distinctive or unique within a neighbourhood or region.

Currently, Trafalgar Road is a 2-lane rural roadway which functions as a major Regional Arterial road that supports the movement of goods and people. The character of Trafalgar Road between Steeles Avenue and north of 10 Side Road is largely rural with intermittent residential properties and farming operations. As Trafalgar Road is widened from 2 to 4 lanes, active transportation facilities such as multi-use path and bike lanes / paved shoulder and illumination will be provided to support all modes of transportation. The future landscaping should also be provided accordingly to complement these changes.



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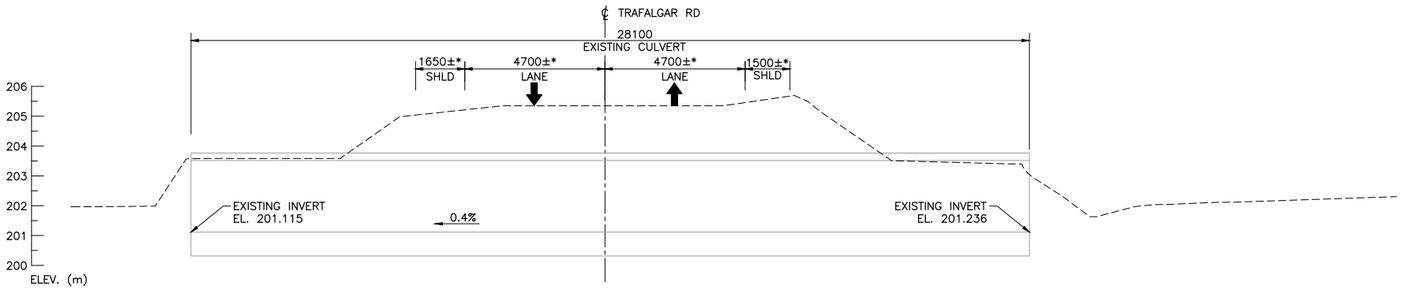

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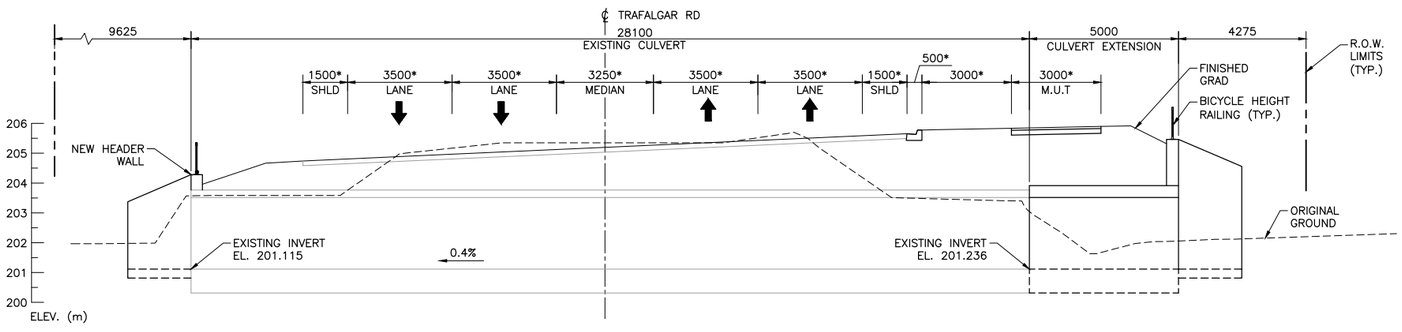

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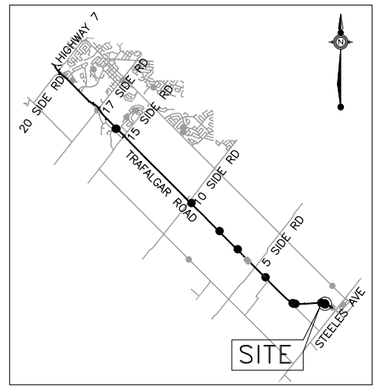
* DIMENSIONS ARE MEASURED PERPENDICULAR TO ℄ TRAFALGAR RD



KEY PLAN
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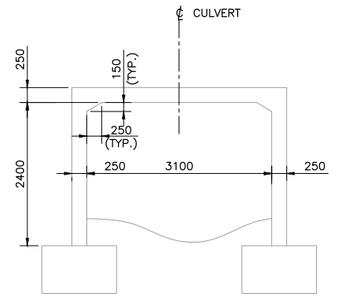

2 EXISTING
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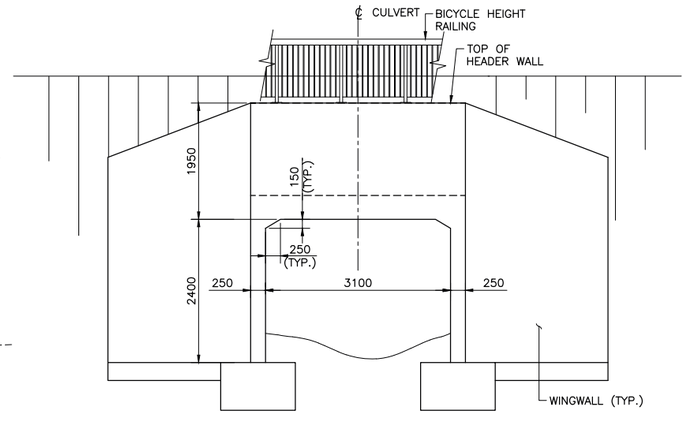
NOTES: DIMENSIONS ARE APPROXIMATE, BASED ON FIELD MEASUREMENT.



3 PROPOSED
1:100 (TO MATCH EXISTING)

CLASS OF CONCRETE:

CLASS OF CONCRETE TO BE 35 MPa

CLEAR COVER TO REINFORCING STEEL:

BOTTOM OF TOP SLAB	50±10mm
BOTTOM OF BOTTOM SLAB	100±25mm
REMAINDER	70±20mm

REINFORCING STEEL:

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.

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:

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.

BACKFILL SHALL BE GRANULAR 'B' AND SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF THE CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 300mm.

NO CONCRETE SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BY THE CONTRACT ADMINISTRATOR.

LIST OF ABBREVIATIONS:

U/S – DENOTES UP STREAM
D/S – DENOTES DOWN STREAM
T/C – DENOTES TOP OF CULVERT
T/F – DENOTES TOP OF FOOTING

LIST OF DRAWINGS:

1. PRELIMINARY GENERAL ARRANGEMENT

APPLICABLE STANDARD DRAWINGS:

OPSD 803.010	BACKFILL AND COVER FOR CONCRETE CULVERTS
OPSD 3121.150	WALLS RETAINING, BACKFILL MINIMUM GRANULAR REQUIREMENTS
OPSD 3190.100	WALLS RETAINING AND ABUTMENT WALL DRAIN
OPSD 3950.100	JOINTS CONCRETE EXPANSION AND CONSTRUCTION ON STRUCTURE

Halton REGION

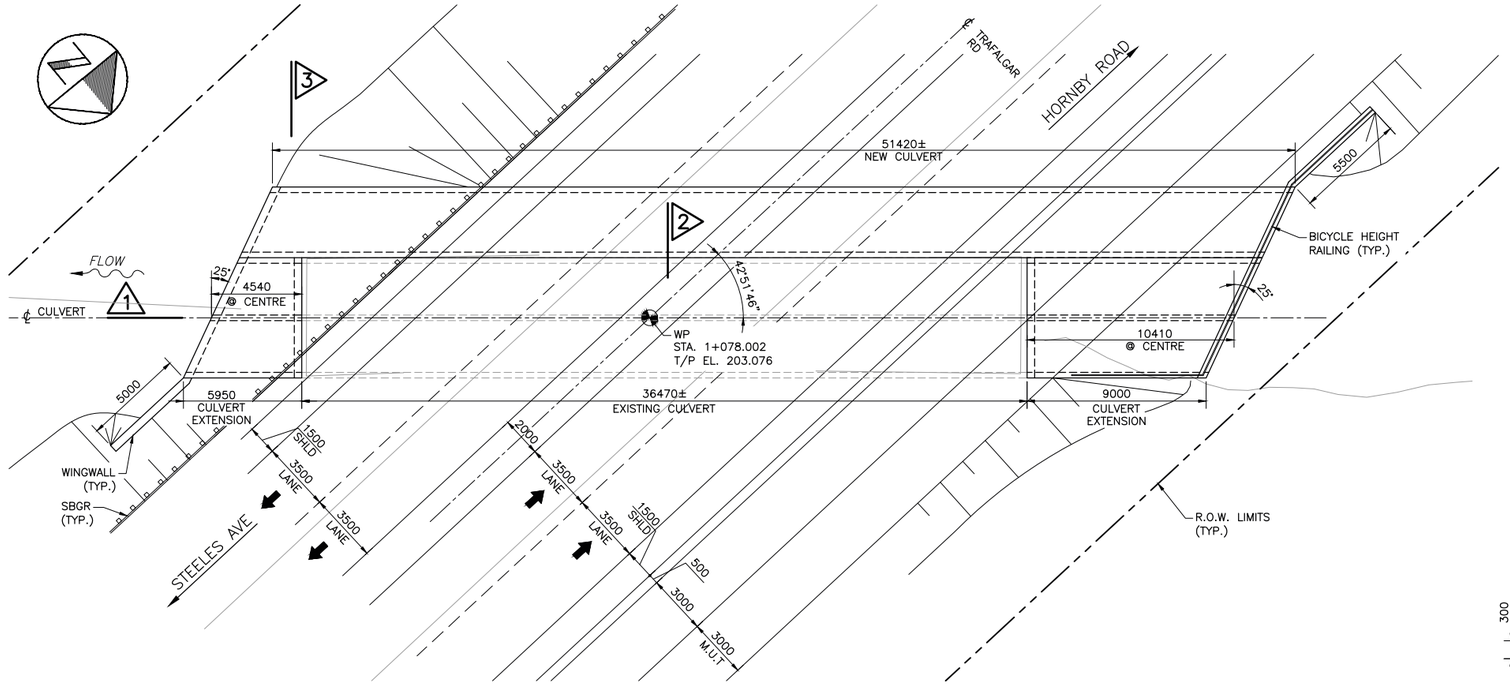
MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Preliminary General Arrangement
Trafalgar Road/Culvert Extension
400m North of Steeles Avenue
Culvert C1

Exhibit

7-10



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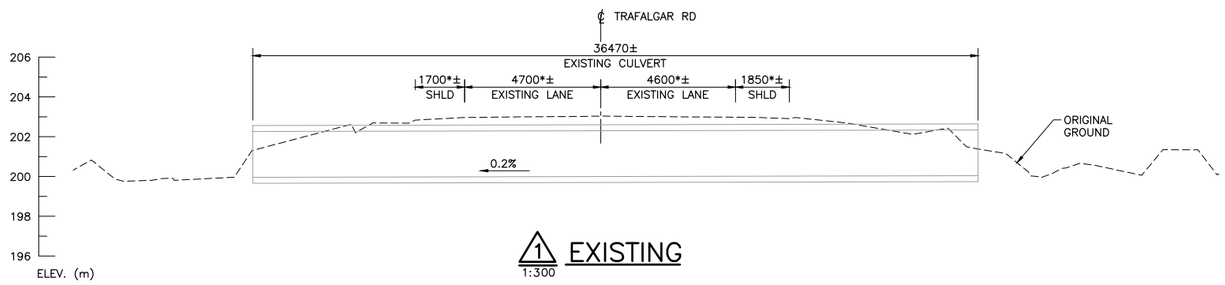

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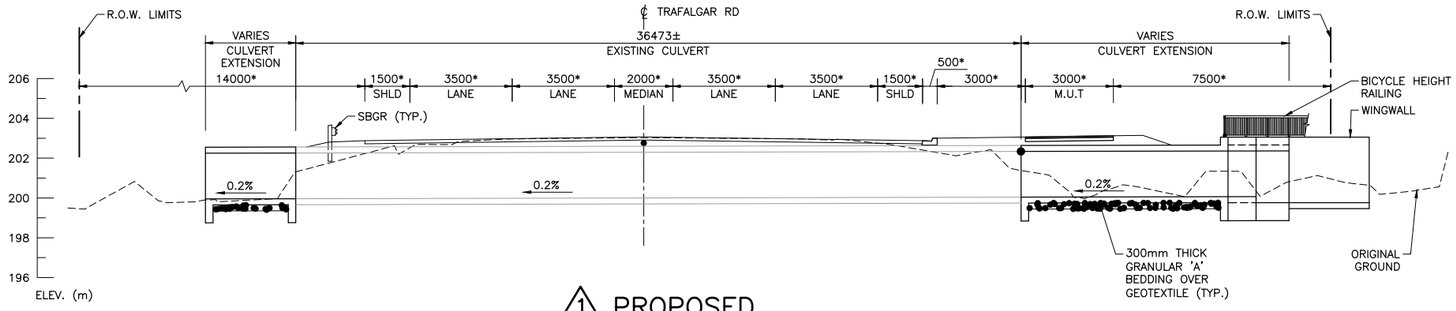

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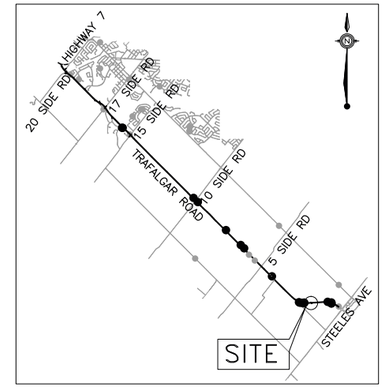
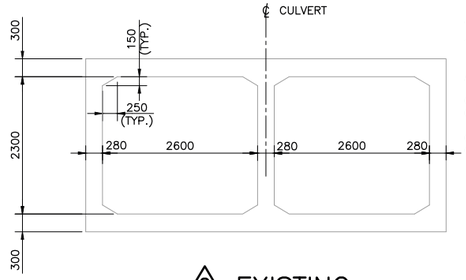
1:300

* DIMENSIONS ARE MEASURED PERPENDICULAR TO ℄ TRAFALGAR RD

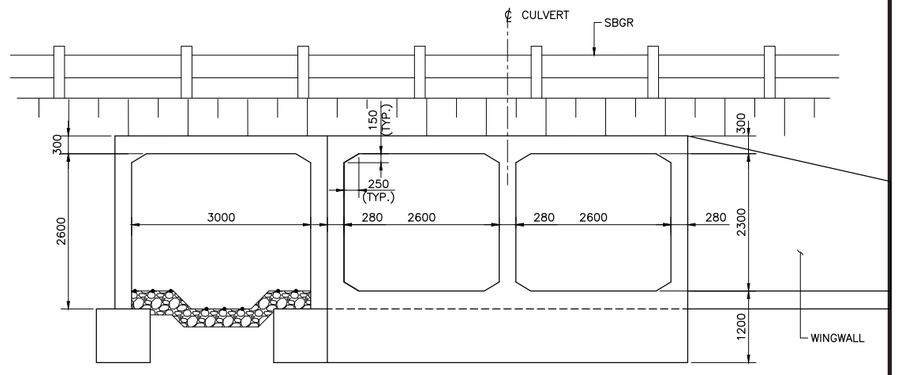


KEY PLAN
N.T.S.



2 EXISTING
1:100

NOTES: DIMENSIONS ARE APPROXIMATE, BASED ON FIELD MEASUREMENT.



3 PROPOSED
1:100 (TO MATCH EXISTING)

CLASS OF CONCRETE:

CLASS OF CONCRETE TO BE 35 MPa

CLEAR COVER TO REINFORCING STEEL:

BOTTOM OF TOP SLAB	50±10mm
BOTTOM OF BOTTOM SLAB	100±25mm
REMAINDER	70±20mm

REINFORCING STEEL:

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.

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:

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.

BACKFILL SHALL BE GRANULAR 'B' AND SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF THE CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 300mm.

NO CONCRETE SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BY THE CONTRACT ADMINISTRATOR.

LIST OF ABBREVIATIONS:

U/S –	DENOTES UP STREAM
D/S –	DENOTES DOWN STREAM
T/C –	DENOTES TOP OF CULVERT
T/F –	DENOTES TOP OF FOOTING

LIST OF DRAWINGS:

1. PRELIMINARY GENERAL ARRANGEMENT

APPLICABLE STANDARD DRAWINGS:

OPSD 803.010	BACKFILL AND COVER FOR CONCRETE CULVERTS
OPSD 3121.150	WALLS RETAINING, BACKFILL MINIMUM GRANULAR REQUIREMENTS
OPSD 3190.100	WALLS RETAINING AND ABUTMENT WALL DRAIN
OPSD 3950.100	JOINTS CONCRETE EXPANSION AND CONSTRUCTION ON STRUCTURE

Halton REGION

MMM GROUP

TRAFALGAR ROAD CLASS EA STUDY (Section 1)
Steeles Avenue to North of 10 Side Road

Preliminary General Arrangement
Trafalgar Road/Culvert Extension
1000m North of Steeles Avenue
Culvert C2

Exhibit
7-11

The main natural environment features adjacent to Trafalgar Road in the study area between Steeles Avenue and north of 10 Side Road is the Coulson Tract (north of Steeles Avenue); this feature will be taken into consideration and the streetscape element should integrate with this feature. A detailed landscape plan will be developed based on the defining elements during subsequent detailed design.

Protection of Existing Vegetation

There are some natural environmental features along Trafalgar Road between Steeles Avenue and north of 10 Side Road; most notably the Coulson Tract woodland north of Steeles Avenue, which contribute to the cultural landscape value. The Conservation Halton's Landscaping Guidelines should be applied to the extent possible inside regulated areas.

Opportunities for Enhancements to Corridor Vegetation

In areas where enhanced vegetation will be provided, all enhancement plantings should be native, hardy, drought-tolerant species, salt resistant, and shall be restricted to the road right-of-way. Vegetation impacted in the easement areas should also be replaced. Planting layout will consider denser, more ornamental screenings at locations where residences are near the roadway.

A series of streetscape design techniques will be employed to balance the needs of motorized and non-motorized users.

Shape the driving experience:

- Add clear and consistent signage to assist navigation and caution about cyclists and use by farm equipment

Create comfortable non-motorized zones:

- Incorporate the multi-use path to serve as part of transportation circulation system and support multiple recreation opportunities

Landscape Plantings:

- Add street trees and ornamental grasses along the boulevard where space permits to provide a landscaped buffer and increase the year-round visual interest.
- Plant selection for enhancement and infill planting should provide seasonal interest (i.e. spring flowering, interesting bark for winter appeal, attractive fall colours). Particular attention should be paid to the growing conditions of these urban trees, giving consideration to continuous planting trenches and the use of structural soil technologies to improve tree health and survivability.
- Selection of proposed plantings should reflect changing climate conditions and therefore should consider resistance to drought, road salt and winter ice storms as these are becoming potentially more common. Plant materials currently at the southern limit of their natural range should be avoided.

Boulevard / Green Space:

Boulevards and the green space area within a rural section also play an important role in defining the streetscape. The boulevards / green space provide an element of continuity to the streetscape and also offer an area for street trees and other vegetation to grow, further enhancing the street, providing shading and separation of facilities. Maintaining street trees and other ornamental plantings within the boulevard / green space is a continuous challenge. Street trees within the boulevard / green space should also be planted with regularity along the length of the corridor where context permits. Within the boulevard / green space it is imperative that particular attention be paid to the growing conditions of the trees, again giving consideration to continuous planting trenches and the use of structural soil technologies to improve tree health and survivability.

Signage for recreational purposes should be considered for cyclists and pedestrians (e.g. connection to trail system, Coulson Tract, etc.) should be considered during the detailed design phase.

7.1.12 Utilities

There are a number of existing buried and aerial utilities located on either side along the corridor (varies), including watermain, sanitary sewer, gas main, hydro, and telecom. Existing hydro poles along the corridor will have to be relocated as a result of the proposed widening of Trafalgar Road. This will be pursued during detailed design in consultation with Halton Hills Hydro Inc., and Hydro One Networks Inc. Other utilities such as Bell, Cogeco, and Enbridge Gas may also be impacted as a result of the widening of Trafalgar Road. These utilities will be contacted during detailed design to confirm the conflicts and the extent of relocation required.

To service future Vision Georgetown area, Halton Region is anticipating the installation of watermain along Trafalgar Road between Steeles Avenue and 10 Side Road in the near future. The Region will coordinate the timing of the watermain construction with Trafalgar Road widening.

For any adjacent properties planned for development, provisions shall be made to install ducts or liners as part of the road reconstruction to facilitate future utility crossings of the Regional Road. Consultation with all utilities shall be undertaken during detailed design in order to coordinate this provision.

7.1.13 Illumination

It is proposed that Trafalgar Road be illuminated in accordance with Halton Region standards. A defining feature of any street is its illumination. This is not only because the quality of light provided can significantly enhance the night environment, but also because the form of the light standard can affect the character of a street during the day.

7.1.14 Property Requirements

The nominal proposed right-of-way for Trafalgar Road is 47 m between Steeles Avenue and north of 10 Side Road in accordance with the approved 2011 Halton Region Transportation Master Plan except in localized areas where there are existing constraints. The Region will be acquiring suitable property where land has not been

previously acquired. Additional property may be required at intersections to accommodate turning lanes, as well as for grading. The proposed property line is shown on **Plates 1 to 38**.

Property requirements, as shown in the red dash line on **Plates 1 to 38**, are preliminary only and subject to further review and confirmation during detailed design. The approximate property requirements for privately owned or publicly owned (provincial or municipal) properties are summarized in **Table 7-12** (properties are listed from south to north). A nominal 5 m temporary easement is shown beyond the proposed property line for construction purposes. The exact limit of the temporary easement will be confirmed during detailed design.

Table 7-12: Preliminary Property Requirements

Location	Preliminary Property Requirement (ha)	Location	Preliminary Property Requirement (ha)
8013 Trafalgar Road	0.04	8039 Trafalgar Road	0.01
13605 Steeles Avenue	0.06	13571 Steeles Avenue	0.05
13850 Steeles Avenue	0.18	8173 Trafalgar Road	0.06
8150 Trafalgar Road	0.21	8285 Hornby Road	0.02
8300 Trafalgar Road	0.02	8469 Trafalgar Road	0.25
8466 Trafalgar Road	0.08	8493 Trafalgar Road	0.24
8584 Trafalgar Road	0.18	8646 Trafalgar Road	0.37
8637 Trafalgar Road	0.09	8788 Trafalgar Road	0.38
8731 Trafalgar Road	0.16	8792 Trafalgar Road	0.39
8837 Trafalgar Road	0.03	13074 5 Side Road	0.11
8958 Trafalgar Road	0.06	12921 5 Side Road	0.16
9153 Trafalgar Road	0.51	9098 Trafalgar Road	0.02
9158 Trafalgar Road	0.19	9190 Trafalgar Road	0.07
9289 Trafalgar Road	0.37	9348 Trafalgar Road	0.51
9363 Trafalgar Road	0.02	9371 Trafalgar Road	0.03
9383 Trafalgar Road	0.07	9536 Trafalgar Road	0.52
9527 Trafalgar Road	0.47	9742 Trafalgar Road	0.30
9621 Trafalgar Road	0.03	9755 Trafalgar Road	0.56
9811 Trafalgar Road	0.23	9866 Trafalgar Road	0.38
9859 Trafalgar Road	0.04	9871 Trafalgar Road	0.29
Property located 300 m south of 10 Side Road on the east side of Trafalgar Road	0.13	Property located between 70 m and 150 m south of 10 Side Road on the east side of Trafalgar Road	0.05
9989 Trafalgar Road	0.01	12884 10 Side Road	0.002
9990 Trafalgar Road	0.19	12553 10 Side Road	0.31
10054 Trafalgar Road	0.04		

7.1.15 Preliminary Cost Estimate

A preliminary cost estimate (for construction) was prepared as part of this Class EA Study. The estimated roadway construction cost (excluding property cost) was estimated at approximately $ 29 M, including 25% engineering and 10% contingency costs. A breakdown of the cost estimate is shown in **Table 7-13**. The costs are preliminary; a detailed cost estimate will be prepared during detailed design.

Property cost is not included in the preliminary cost estimate. Affected property owners (**Section 7.1.14**) will be consulted individually during detailed design to address mitigation measures, property negotiation and to discuss project details. Property as required will be acquired at fair market value.

Table 7-13: Preliminary Cost Estimate

#	Item Description	Quantity	Unit	Estimated Price	Total
1.	Earth Excavation	160,000	m^3	$12.00	$ 1,920,000.00
2.	Hot Mix HL1 (40mm depth)	15,000	t	$90.00	$ 1,350,000.00
3.	Hot Mix HDBC (120mm depth)	35,000	t	$85.00	$ 2,975,000.00
4.	19mm Crusher Run Limestone (150mm)	60,000	t	$22.00	$ 1,320,000.00
5.	50mm Crusher Run Limestone (550mm)	200,000	t	$21.00	$ 4,200,000.00
6.	Concrete Curb and Gutter	5,000	m	$50.00	$ 250,000.00
7.	Concrete Sidewalk / Median	1,000	m^2	$50.00	$ 50,000.00
8.	Concrete Strip	2,000	m^2	$55.00	$ 110,000.00
9.	Asphalt Pathway	19,500	m^2	$30.00	$ 585,000.00
10.	Storm Sewer		L.S.		$ 1,000,000.00
11.	SWM Facilities / Oil Grit Separator		L.S.		$ 150,000.00
12.	Concrete Culverts				
	• Sta. 0+400		L.S.		$ 60,000.00
	• Sta. 1+080	80	m	$6,000.00	$ 480,000.00
	• Sta. 2+755	42	m	$1,000.00	$ 42,000.00
	• Sta. 4+068	40	m	$800.00	$ 32,000.00
	• Sta. 4+228	42	m	$1,200.00	$ 50,400.00
	• Sta. 4+950	48	m	$4,000.00	$ 192,000.00
	• Sta. 6+266	42	m	$3,500.00	$ 147,000.00
13.	Roadway Culverts	30	m	$600.00	$ 18,000.00
14.	Driveway Culverts	800	m	$150.00	$ 120,000.00
15.	Steel Beam Guide Rail	400	m	$150.00	$ 60,000.00
16.	Topsoil and Sod	30,000	m^2	$7.00	$ 210,000.00
17.	Cold Plane existing Pavement	50,000	m^2	$3.00	$ 150,000.00
18.	Removal of Curb and Gutter	300	m	$15.00	$ 4,500.00
19.	Clearing and Grubbing		L.S.		$ 150,000.00
20.	Landscaping		L.S.		$ 500,000.00
21.	Illumination				
	• Permanent		L.S.		$ 200,000.00
	• Temporary		L.S.		$ 80,000.00
22.	Traffic Signals				
	• Permanent	2	each	$200,000.00	$ 400,000.00
	• Temporary	1	each	$110,000.00	$ 110,000.00
23.	Maintenance of Traffic				
	• Traffic Control		L.S.		$ 150,000.00
	• Temporary Widening/Staging		L.S.		$ 400,000.00
24.	Miscellaneous (~15%)		L.S.		$ 2,624,100.00
	Subtotal (Construction)				**$ 20,090,000.00**
	Utility Relocation (est. by Consultant)				$ 2,000,000.00
	Contingency (10%)				$ 2,009,000.00
	Engineering (Detailed Design & CA) (25%)				$ 5,022,500.00
	TOTAL (excluding HST)				**$ 29,121,500.00**

7.2 Potential Environmental Effects, Mitigation Measures, and Commitments to Future Work

7.2.1 Natural Environment

The analysis of potential impacts arising from the planned improvements to Trafalgar Road was undertaken by assessing the details of the preferred road alignment (Alternative 1A) in relation to the known natural heritage features, functions, and species present within the study area.

Potential impacts are discussed in two categories:

- Direct Impacts – associated with the direct removal of natural features/habitats, caused by the actual "footprint" of the undertaking (e.g., clearing and grading, direct alteration of surface water features); and
- Indirect Impacts – associated with: 1) site alteration (e.g., alterations to surface water and groundwater quality/quantity, flow patterns); and 2) temporary disruption of features/habitats or displacement of species from active construction activities (e.g., impact to water quantity/quality, temporary physical disturbance, erosion, etc.).

The analysis of potential impacts (**Sections 7.2.1.1 to 7.2.1.3)**, recommended mitigation measures and the overall residual effect after mitigation **(Sections 7.2.1.4 to 7.2.1.6)** has been applied. The full report can be found in **Appendix E** Natural Heritage Report.

As the impact assessment was based on preliminary conceptual design details, potential impacts and recommended mitigation measures should be revisited at the detailed design phase of the project when detailed design is developed.

7.2.1.1 Vegetation – Impacts

Existing vegetation conditions within the Study Area are described in **Section 3.3.2.5**. The proposed works will occur within and immediately adjacent to the existing Trafalgar Road right-of-way, extending either to the edge of the right-of-way, or to the grading limits, as shown on **Plates 1 to 38**. The grading limits vary from being inside the right-of-way to extending slightly beyond it. Potential direct and indirect impacts to vegetation are summarized below.

7.2.1.1.1 Potential Direct Impacts

Minor vegetation removals are required to accommodate the proposed road widening and intersection improvements.

Individual Street/Urban Tree Removal

Individual tree removal is required to accommodate the widened roadway. No provincially or regionally significant species are anticipated to be impacted – this should be confirmed during detailed design.

Vegetation/Habitat Removals – Non-Natural Vegetated Areas

Minor removals of vegetation are required within the existing right-of-way. Vegetation affected is predominantly common, disturbance tolerant species and altered community types such as CUM1-1 (dry-moist old field meadow). Limited impact on wildlife and wildlife habitat anticipated.

Vegetation / Habitat Removals – Naturally Vegetated Areas

Overall, there will be limited removal of vegetation / habitat within the existing right-of-way and removals within existing adjacent natural communities/features. Minor encroachment into natural features is not anticipated to affect the form or function of the wetland and woodland features. The majority of each feature area is retained outside the alignment. Minor vegetation removals are not anticipated to affect significant flora or fauna species if recommended mitigation is implemented, although would require confirmation during detailed design.

One of the more prominent natural environment features between Steeles Avenue and 10 Side Road is Feature #2 (Coulson Tract Woods). The proposed limits of grading as a result of Trafalgar Road widening do not appear to encroach within the woodland feature, although some vegetation removal might be required at isolated locations (i.e. individual trees – to be confirmed at detailed design).

Wildlife using the existing right-of-way will be displaced to adjacent natural habitats. Potential disturbance during construction is discussed under 'Wildlife Disturbance' in **Section 7.2.1.2.2**.

7.2.1.1.2 Potential Indirect Impacts

Vegetation Disturbance

Vegetation clearing and other construction activities have the potential to inadvertently destroy, damage, and degrade adjacent vegetation through: use of construction equipment outside of the work zone; sedimentation; soil compaction; and spills.

Temporary drawdown of shallow groundwater levels from localized dewatering may be required at locations where groundwater levels are near the surface and excavation is required (e.g. works adjacent to wetland areas). This has potential to impact water levels in wetland areas supporting wetland vegetation if the drawdown is prolonged and recovery is slow. Any decrease in water levels is anticipated to be temporary and minor in nature, resulting in no permanent impacts to adjacent wetland vegetation.

Soil Compaction

Soil compaction also has potential to occur as a result of heavy machinery and the stockpiling of heavy materials and stripped soils. Soil compaction can greatly reduce the permeability of soils and affect their ability to retain water during rain/snow melt events. This may result in an increase in surface water run-off which will ultimately increase the erosion potential and the amount of sediment being transported into adjacent features. Soil compaction can prohibit roots from establishing in soil, preventing vegetation growth.

Construction Materials/Debris

Construction materials or vegetative debris from clearing that is stockpiled near a natural feature have potential to enter the feature if not properly contained.

Debris entering wetlands or woodlands has potential to smother and/or damage vegetation and impact water quality.

Erosion and Sedimentation

Vegetation clearing, grading, use of heavy machinery, and soil stockpiling all have the potential to increase erosion and sedimentation. Sediment-laden runoff has the potential to enter into adjacent natural features. Impacts include impaired surface water quality and the potential for vegetation dieback.

An Erosion and Sedimentation Control (ESC) plan will need to be prepared by qualified professionals. Construction inspectors should be trained and certified in ESC construction practices. ESC risk management should also include the phasing of stabilization efforts so that the establishment of groundcover is not left until the end of the project. These items should be incorporated into the construction contracts as special provisions.

7.2.1.2 Wildlife – Impacts

Existing wildlife habitats within the Study Area are described in **Section 3.3.2.6**. The proposed works will occur within and immediately adjacent to the existing Trafalgar Road right-of-way, extending either to the edge of the right-of-way, or to the grading limits, as shown on **Plates 1 to 38**. Potential direct and indirect impacts to wildlife are summarized below.

7.2.1.2.1 Potential Direct Impacts

Wildlife Passage

Candidate wildlife movement corridors have been identified at one location between Steeles Avenue and 10 Side Road.

Within the Coulson Tract Woods (Feature 2) - this crossing currently includes two box culverts (2.7 x 2.2 x 36.4 m) with an Openness Ratio (OR) of 0.16 for each cell. This currently provides adequate opportunity for movement by a variety of tolerant wildlife species. The proposed improvements will result in an extension of the two cells to 53.7 m, with some reduction in structure openness. An OR of 0.11 will continue to support passage of tolerant wildlife species. The addition of the new box culvert cell at 3 x 2.4 x 53.7 m will provide an OR of 0.13. Overall, the three cells together are anticipated to provide a collectively larger and more inviting location for passage and modifications are not anticipated to impact the function of the crossing.

7.2.1.2.2 Potential Indirect Impacts

Wildlife Disturbance During Construction

Increased disturbance caused by excessive noise, dust, vibrations, and proximity of human presence during construction may cause certain wildlife to abandon or avoid the area. Additionally, these disturbances may disrupt or discourage breeding birds from nesting within the vicinity.

However, these impacts are anticipated to be minimal and localized given the existing degree of anthropogenic disturbance, tolerance of species expected to use these habitats and small areas of proposed grading / works.

7.2.1.3 Watercourses and Fish Habitat – Impacts

Existing watercourse and fish habitat conditions within the Study Area are described in **Section 3.3.2.9**. This section summarizes the preliminary proposed works and associated implications at the various watercourses that support fish habitat (direct or indirect) along the Trafalgar Road study area between Steeles Avenue and 10 Side Road and their implications on fish and aquatic habitat. As noted, this impact assessment is preliminary and will be refined as required based on the detailed design. The proposed works and their associated impacts to fish and aquatic habitat are highlighted below.

7.2.1.3.1 Potential Direct Impacts

Fish Habitat Alteration and Serious Harm to Fish

The preferred alternative has the potential to impact three aquatic features crossing Trafalgar Road between Steeles Avenue and 10 Side Road. Impacts to aquatic features by the proposed works at watercourse crossings are limited to minor additional enclosure of features and minor removals of riparian vegetation associated with proposed culvert replacements with longer culverts, and extensions to two existing culverts. There are one intermittent and one permanent watercourse with proposed extensions to the existing culverts.

The one permanent watercourse with a proposed extension to the existing culvert is moderately sensitive supporting a coolwater fish community and contributing to Redside Dace habitat downstream.

Longer culvert lengths may impact watercourses by reducing allochthonous and solar inputs to contributing fish habitat and potentially interfering with groundwater input to the watercourses.

Details of potential direct impacts to each aquatic feature are as follows:

- Feature #1 (Intermittent watercourse). Enclosure of an additional 7.9 m of watercourse, resulting in reduced solar and allochthonous inputs.

- Feature #3 (Permanent watercourse). Enclosure of an additional 17.3 m of watercourse, resulting in reduced solar and allochthonous inputs. The addition of

a 3rd concrete culvert cell will ensure maintenance of natural flows and stream morphology in fish habitat up and downstream, but will also result in removal of riparian vegetation.

- Feature #7 (No fish habitat). No predicted impacts to fish habitat.

Alteration of Existing Surface Water Drainage Patterns

No alterations of existing surface water drainage patterns are anticipated. All existing water crossing structures and drainage features and functions will be retained (except for Culvert C4 as explained in **Section 7.1.7**). The increased opening size of all proposed culvert replacements will ensure maintenance of natural flows contributing to watercourses downstream.

7.2.1.3.2 Potential Indirect Impacts

Surface Water Quality Impairment

Potential indirect impacts to surface water quality are associated with all surface water drainage features, including fish habitat.

Sedimentation of a watercourse or wetland from construction activities (e.g., sediment laden runoff, dewatering discharge) can negatively impact surface water quality with increased turbidity and Total Suspended Solids (TSS) levels. Dewatering may be required at locations where groundwater levels are near surface and excavation is required (e.g. works adjacent to wetland areas). Dewatering requirements will be identified at detailed design.

Contaminant spills will result in the degradation of water quality. The degree and type of impact is dependent on the type and volume of contaminant released and how promptly and effectively the Spill Response Plan is initiated. Ultimately, a release of contaminant or 'spill' into a water body is considered a release of a 'deleterious substance'.

Alterations of surface water quality have potential to impact aquatic organisms. Under prolonged conditions where water quality remains at levels unacceptable for aquatic life, death of aquatic organisms may result.

Disruption to Fish and Fish Habitat

Potential indirect effects on fish and fish habitat include the following temporary impacts during construction:

- Temporary disturbance to bed and banks of watercourses by workers or equipment during construction
- Temporary disruption of fish passage during works
- Direct harm to fish caught within the work area of in-water works.
- Release of sediment into the watercourse from construction areas
- Potential spills of deleterious materials from machinery during construction
- Temporary disturbance to riparian vegetation during construction

- Temporary interruption may also be required at additional locations where groundwater levels are near surface and excavation is required (e.g. works adjacent to wetland areas).

Indirect effects may also occur during future operation / maintenance of the road way, including increased input of salt to watercourses during winter maintenance.

Soil Compaction

Soil compaction also has potential to occur as a result of heavy machinery and the stockpiling of heavy materials and stripped soils. Soil compaction can greatly reduce the permeability of soils and affect their ability to retain water during rain/snow melt events. This may result in an increase in surface water run-off which will ultimately increase the erosion potential and the amount of sediment being transported into adjacent features.

Construction Materials/Debris

Construction materials or vegetative debris from clearing that is stockpiled near a natural feature have potential to enter the feature if not properly contained.

Debris entering a water body has potential to: destroy or disturb fish habitat; disrupt flow patterns increasing risk for flooding or erosion and sedimentation; and impair water quality. The degree of impact on the water body is dependent on the type and amount of material entering the watercourse.

Erosion and sedimentation

Vegetation clearing, grading, use of heavy machinery, and soil stockpiling all have the potential to increase erosion and sedimentation. Sediment-laden runoff has the potential to enter into adjacent natural features. Impacts include impaired surface water quality and the potential for vegetation dieback.

Discharges to watercourses from temporary dewatering have potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly. Dewatering may be required at locations where groundwater levels are near surface and excavation is required (e.g. works adjacent to wetland areas). Dewatering requirements will be identified at detailed design. A PTTW from MOECC may be required. A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

7.2.1.4 Vegetation – Mitigation Measures

The following section outlines recommended mitigation measures to avoid or minimize effects to the local vegetation communities and their associated habitat functions.

7.2.1.4.1 Potential Direct Impacts

Vegetation/Habitat Removal

- Woodland trees and wetland areas are to be retained and protected, if feasible. Re-establish vegetation in the newly cleared/graded areas that are not to be

paved as soon as possible after disturbance. Native species are recommended for planting.

- Tree and vegetation protection is recommended for all trees and vegetation being retained. Tree protection should be outlined in a Tree Protection Plan (TPP) prepared at detailed design. Vegetation protection should be outlined on specification drawings in detailed design. Protection should be implemented to ensure encroachment within the adjacent natural features is restricted to the identified construction footprint. Vegetation clearing and road improvement construction activities **should be minimized or avoided during the general nesting period for Zone C2**[4] to avoid direct impacts to wildlife anticipated to use these areas. This timing window also covers off the breeding period of amphibians.
- Additional recommended mitigation measures to address indirect impacts that may occur during the construction phase are discussed under 'indirect impacts'.
- Any trees identified for removal as part of the detailed design should be surveyed for potential suitable bat habitat (i.e. cavity) prior to removal.

Net effects of these measures include the removal of disturbed vegetation within the existing right-of-way, the maintenance of the form and function of adjacent natural features, and the displacements of wildlife in the right-of-way to adjacent available habitats.

7.2.1.4.2 Potential Indirect Impacts

Vegetation Disturbance

- Install ESC silt fencing prior to any site grading to delineate the work zone and prevent direct damage to adjacent retained vegetation (i.e., mechanical damage, soil compaction). Leave fencing in place until construction is complete.
- Implement tree protection measures outlined in the Tree Protection Plan (TPP) (to be prepared at detailed design).
- A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Soil Compaction

- Control vehicle access routes and areas and limit equipment access
- Locate staging areas away from natural features (e.g., 30m)

No net effects are anticipated with proper implementation of these recommended mitigation measures.

[4] http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1

Construction Materials/Debris

- Stabilize construction debris (e.g., tarps) away from natural features
- Dispose of refuse and other material appropriately off-site
- Locate staging areas away from natural features (e.g., 30m)

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Erosion and sedimentation

- Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. Applicable measures include:
  - "Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear."
  - "Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practical, prune or top the vegetation instead of grubbing/uprooting."
  - "Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed."
  - "Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site."
  - "Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored."
  - "If replacement rock reinforcement/armoring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment."
  - "Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation."
  - "Remove all construction materials from site upon project completion."
  - "Minimize duration of in-water work."
  - "Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows."
- Eliminate potential from erosion and sedimentation by restricting access of works to limit of grading—achieved through clearly demarcating the limit of works through use of ESC structures such as silt fencing.
- A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

7.2.1.5 Wildlife – Mitigation Measures

The following section outlines recommended mitigation measures to avoid or minimize effects to local wildlife.

7.2.1.5.1 Potential Direct Impacts

Wildlife Passage

- The modified crossing at Coulson Tract Woods will continue to maintain wildlife passage.
- It is recommended that new replacement culverts be designed using most current wildlife passage design principles available at the time of detailed design.

7.2.1.5.2 Potential Indirect Impacts

Wildlife Disturbance During Construction

- Ensure that timing constraints are applied to avoid vegetation clearing (including grubbing) during the breeding bird season for tree nesting (approximately **April 1 to August 31**). It should be noted that occasionally bird species will precede or exceed the approximate breeding bird season window.
- **Wildlife exclusion fencing** should be installed temporarily to keep wildlife out of the construction zone, particularly in areas adjacent to natural habitat features e.g. fencing to prevent movement of amphibians and reptiles into the construction zone in areas adjacent to wetlands.
- In the event that an animal encountered during construction does not move from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities will stop and the Contract Administrator will be notified.

In the event that a SAR or possible SAR is found in the construction area, all construction that could potentially harm the animal will cease immediately and the Contract Administrator will be notified. The Contract Administrator will then contact the MNRF SAR Biologist for direction, as these animals are protected under the ESA (2007).

No net effects are anticipated with proper implementation of these recommended mitigation measures.

7.2.1.6 Watercourses and Fish Habitat – Mitigation Measures

The following standard and site specific mitigation measures will be implemented (where feasible) to protect fish and fish habitat at the watercourse crossings supporting fish habitat (directly or indirectly). These mitigation measures will be refined and augmented during detailed design once the details of the design and associated work requirements and potential impacts at each crossing are finalized.

7.2.1.6.1 Potential Direct Impacts

Fish Habitat Alteration and Serious Harm to Fish

- Adhere to standard coldwater timing window for in-water work of **October 1 to May 31** to protect the coldwater fishery. **No in-water work is to occur within this timeframe.**
- Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented.
- Eliminate potential for direct impacts to fish habitat by restricting access of works to limit of grading. This can be achieved through clearly demarcating the limit of works through use of ESC structures such as silt fencing. Implement standard best management practices when carrying out construction activities near water.
- All culvert extensions should ideally be replacements with open-bottom structures to minimize impacts to groundwater inputs. Through consultation with Conservation Halton during the EA Study, open-bottom culverts will be considered at locations where existing culverts with fluvial interest are being replaced.
- Culverts should be embedded into the existing invert of the watercourses by 10% to maintain natural flows and prevent barriers to potential seasonal movement of fish.
- Consider employing wingwalls to minimize required length extension of culverts and additional enclosure of watercourses.

Following design mitigation on all culvert extensions and replacements, impacts of these route alternatives would be limited to minor losses of riparian vegetation, allochthonous input and solar inputs to channel sections enclosed or covered by structure extensions.

With proper design, groundwater inputs to watercourses can be retained – this will be a priority during detailed design.

Alteration of Existing Surface Water Drainage Patterns

Alteration of existing surface water drainage patterns are to be mitigated through design considerations. All existing drainage features and functions will be maintained.

Existing surface water drainage patterns are to be maintained through design.

7.2.1.6.2 Potential Indirect Impacts

Surface Water Quality Impairment

- Implement an Erosion and Sediment Control (ESC) Plan to minimize risk of potential impacts from sedimentation. See 'Erosion and Sedimentation' under **Section 7.2.1.4.2**.
- Isolate in-water work areas, preventing sediment laden water or spills from entering the watercourse.

- Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. Applicable measures include[5]:
  - Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks.
  - Whenever possible, operate machinery on land above the high water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
  - Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.
  - Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
  - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
  - Plan activities near water to ensure that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse.
  - Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
  - Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish.
  - Manage water flowing onto the site, as well as water being pumped/diverted from the site such that sediment is filtered out prior to the water entering a waterbody.
- A Permit to Take Water (PTTW) from the Ministry of Environment and Climate Change (MOEE) may be required. A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Disruption to Fish and Fish Habitat

- Ensure DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. These include but are not limited to:
  - Time work in water to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.
  - Minimize duration of in-water work.

[5] Note that these measures should be applied anywhere where surface water has potential to be impacted (i.e. wetlands).

- Conduct instream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.
- Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation
- Design and plan activities and works in waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided.
- Undertake all instream activities in isolation of open or flowing water to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.
- Ensure that all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows.
- Retain a qualified environmental professional to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur on the site.
- Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish.
- Plan activities near water such that materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, or other chemicals do not enter the watercourse.
- Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
- Ensure that building material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish
- Develop and implement an Erosion and Sediment Control Plan for the site that minimizes risk of sedimentation of the waterbody during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear.
- Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practical, prune or top the vegetation instead of grubbing/uprooting.
- Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed.
- Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.
- Restore bed and banks of the waterbody to their original contour and gradient - if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restored.

  - If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
  - Remove all construction materials from site upon project completion.
  - Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds.
  - Whenever possible, operate machinery on land above the high water mark, on ice, or from a floating barge in a manner that minimizes disturbance to the banks and bed of the waterbody.
  - Limit machinery fording of the watercourse to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, construct a temporary crossing structure.
  - Use temporary crossing structures or other practices to cross streams or waterbodies with steep and highly erodible (e.g., dominated by organic materials and silts) banks and beds. For fording equipment without a temporary crossing structure, use stream bank and bed protection methods (e.g., swamp mats, pads) if minor rutting is likely to occur during fording.
  - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
- A mitigation and monitoring plan will be required to address any potential impacts from dewatering.

The potential for indirect negative effects on fish and fish habitat through construction activities occurring in close proximity will be mitigated through recommended best management practices.

Potential increase of salt input to watercourses may persist with future road maintenance; however, watercourses are already subject to salt inputs with winter maintenance of the existing roadway. Standards/requirements as per Halton Region's Salt Management Plan will be applied.

Soil Compaction

See 'Soil Compaction' under **Section 7.2.1.4.2**.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Construction Materials/Debris

See 'Construction Materials / Debris' under **Section 7.2.1.4.2**.

No net effects are anticipated with proper implementation of these recommended mitigation measures.

Erosion and sedimentation

Ensure that DFO 'Measures to Avoid Harm to Fish and Fish Habitat' are implemented. See 'Erosion and Sedimentation' under **Section 7.2.1.4.2**.

"No net effects are anticipated with proper implementation of these recommended mitigation measures.

7.2.2 Socio-Economic Environment

The proposed undertaking would:

- Maintain 2 through lanes of traffic during construction to minimize traffic delays;
- Provide for a future 4 lanes;
- Accommodate pedestrians and cyclists through provision of a multi-use path and on-street bike lanes / paved shoulders;
- Meet the Region's corridor "vision" and objectives for Trafalgar Road (i.e. a major arterial road which accommodates all modes of transportation, including active transportation, inter-regional travel, agricultural vehicles, and goods movement);
- Support future growth (e.g. Vision Georgetown) and travel demands in Halton Region

The following is a description of the social environmental effects (**Section 7.2.2.1** Property Impacts, **Section 7.2.2.2** Access, **Section 7.2.2.3** Pedestrians / Cyclists, **Section 7.2.2.4** Noise Analysis, and **Section 7.2.2.5** Air Quality), the proposed mitigation measures, and commitments to further address those effects.

7.2.2.1 Property Impacts

Proposed property impacts are shown in **Plates 1 to 38**. All adjacent and potentially impacted property owners were notified of the Class EA Study and invited to attend the Public Information Centres. The existing right-of-way for Trafalgar Road between Steeles Avenue and 10 Side Road is generally 30 m (it is wider approaching the Steeles Avenue intersection at 36 m), and the right-of-way for the proposed 4-lane Trafalgar Road is nominally 47 m (varies locally near intersections and areas of constraint).

As noted in **Section 7.1.2**, Trafalgar Road will be widened mainly along the centreline between Steeles Avenue and 10 Side Road. However, in areas where there are significant constraints, the widening will be shifted to the east or west or mitigated in constrained locations through modification to the typical cross section to minimize impact to adjacent properties / features.

Some properties will be directly impacted as a result of the widening of Trafalgar Road and meetings were held with the respective property owners to discuss the preliminary plan and associated property impacts. Affected property owners will be contacted again during detailed design to further address mitigation measures, property negotiation and to discuss project details and timing. Property required will be acquired at fair market value.

Property impacts are generally along the frontage of properties abutting Trafalgar Road and are listed in **Section 7.1.14**.

7.2.2.2 Access

As a Regional road, Trafalgar Road will include left and right turn lanes at all signalized intersections as listed in **Section 7.1.5**.

There are a number of existing rural residential properties and farm operations with direct access to Trafalgar Road on both the east and west side of the road. As Trafalgar Road is widened from 2 to 4 lanes between Steeles Avenue and north of 10 Side Road, a centre median will be provided to separate northbound and eastbound traffic but will continue to allow full access for vehicles and farm equipment to properties on both sides of Trafalgar Road.

Maintenance access to the Coulson Tract and to area farming land will continue to be provided based on current conditions or entrance locations (e.g. field entrances).

Future access to Trafalgar Road will be subject to review and approval should any properties or currently vacant properties with no direct access to Trafalgar Road make applications for development / redevelopment.

7.2.2.3 Pedestrians / Cyclists

As noted in **Section 7.1.6**, Halton Region is implementing an active transportation network in the Region to support and encourage people to walk and bike around Halton as outlined in the Halton Region Active Transportation Master Plan (ATMP). Active transportation facilities within the Study Area are proposed as follows:

- From Steeles Avenue to Hornby Road: 3.0 m bi-directional multi-use path on the east side, 1.8 m exclusive bike lane on the east side, and 1.5 m paved shoulder on the west side available for use by cyclists
- From Hornby Road to North of 10 Side Road: 3.0 m bi-directional multi-use path on the east side only, with 1.5 m paved shoulder in each direction
- In sections that are already at 4 lanes (e.g. at Steeles Avenue and at 5 Side Road), the multi-use path will be extended to connect to the intersection

In constrained areas, the width of the multi-use path will be confirmed during detailed design in consultation with adjacent land owners, and the Town of Halton Hills.

It was also noted that between the completion of the EA Study and construction of improvements to the Trafalgar Road corridor between Steeles Avenue and 10 Side Road, there may be new trends in active transportation and the facilities being implemented may be updated at that time. The right-of-way protected through the EA Study (nominally 47 m right-of-way) will be able to accommodate variations of active transportation facilities, as well as intersection treatments.

7.2.2.4 Noise Analysis

Based on the Ontario Ministry of Transportation (MTO)/Ministry of the Environment and Climate Change (MOECC) Noise Protocol, where an existing roadway is proposed to be modified / widened adjacent to a Noise Sensitive Area (NSA), MOECC requires that the future noise levels without the proposed improvements be compared to the future noise level with the proposed improvements. The assessment is completed at the Outdoor

Living Area (typically backyards) of each NSA. 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. If noise mitigation is provided, the objective is a minimum 5 dBA reduction. Mitigation will attempt to achieve levels as close to, or lower than, the objective level as is technically, economically and administratively feasible.

The noise assessment was undertaken based on a selection of several private residential homes in the vicinity of the Trafalgar Road corridor between Steeles Avenue and Highway 7. In total, 34 receiver locations located adjacent to Trafalgar Road were selected to represent the potential noise impact to noise sensitive areas in proximity to Trafalgar Road between Steeles Avenue and Highway 7. The noise analysis is provided in **Appendix K**, including a table of the selected receiver locations. Of the 34 receiver locations, Receivers 1 to 12 are located between Steeles Avenue and north of 10 Side Road.

Noise modelling was carried out for the following two scenarios:

i) future noise levels without improvements to Trafalgar Road (Year 2031 – see *Note* below)
ii) future noise levels with 4 lanes (+turning lanes) on Trafalgar Road (Year 2031)

Note - It should be noted that existing (2015) traffic volumes on Trafalgar Road were used to represent the future (2031) "without widening of Trafalgar Road" scenario. This approach is acceptable and it would yield a more conservative comparison between the future "with" and "without" improvements conditions.

Based on analysis using approved simulation techniques and software, the potential change in noise levels are predicted to be less than 5 dBA for all receiver locations between Steeles Avenue and north of 10 Side Road (i.e. Receivers 1 to 12) as a result of the proposed improvements to Trafalgar Road when compared to the "future without roadway improvements" condition. **Therefore, the consideration of noise mitigation is not warranted based on MTO/MOECC Noise Protocol.**

Receivers 3 to 12, which are properties adjacent to Trafalgar Road between Hornby Road and just north of 10 Side Road (see Exhibit in **Appendix K** Noise Analysis Report) are calculated to experience noise level at 60 dBA or higher under "future without improvements" or "future with improvements" scenarios. Therefore, they have been reviewed in light of the Halton Region's "Noise Abatement Policy for Regional Roads" to confirm whether they would qualify for mitigation under the Region's retrofit policy. Noise sensitive areas that qualify under the Region's retrofit policy must meet the following criteria:

- The residential area must be adjacent to a Regional Road.
- The residential areas must have reversed frontage lots or blocks including flanking units where their outdoor living areas are directly exposed to traffic noise. No barriers are considered under the policy for dwelling units that are of the direct frontage type.
- In addition, the minimum number of residences to be considered under this policy is 5 dwelling units and 50 linear meters of noise barrier.

Give the above, receivers 3 to 11 would not qualify for noise mitigation under the Region's policy as they all are direct frontage residences and have direct driveway access to Trafalgar Road; additionally all these receivers, as well as Receiver 12, are rural dwellings with less than 5 dwelling units and thus would not qualify for noise mitigation under the Region's Retrofit policy.

It should be noted that any future new residential subdivision developments along the Trafalgar Road corridor will have to carry out noise analyses in accordance with MOECC requirements as part of the development application process under the Planning Act. These studies would recommend the provision of outdoor and indoor noise attenuation measures and the inclusion of noise warning clauses on title of affected properties; these are outside the scope of the EA Study.

7.2.2.5 Air Quality

An air quality assessment was carried out as part of the Trafalgar Road Class EA Study with reference to the following applicable contaminant guidelines:

- Ministry of the Environment and Climate Change Ambient Air Quality Criteria
- Health Canada / Environment Canada Ambient Air Quality Objectives
- Canadian Council of Ministers of the Environment Canada Wide Standards

The Air Quality Assessment Report can be found in **Appendix L**. The potential effects of the proposed project infrastructure on local air quality were assessed (summarized in **Appendix L** – Table 32) and resulted in the following conclusions and recommendations:

- The maximum combined concentrations for the future build scenario were all below their respective Ministry of Environment and Climate Change (MOECC) guidelines or Canada Wide Standards (CWS), with the exception of PM_{10}, TSP, and annual benzene.
- Frequency Analysis determined that the project did not have additional exceedances of the PM_{10} guideline over the 5 year period. The TSP guideline was exceeded 2 additional days over the 5 year period. For TSP this equates to additional exceedances less than 1% of the time.
- Ambient annual benzene exceeded the relevant guideline without the roadway contribution. The contribution from the roadway was 1% of the maximum combined concentration.

Since there is a relatively small increase in the number of days above the MOECC guideline and CWS, mitigation measures are not warranted based on the air quality assessment.

7.2.3 Cultural Environment

7.2.3.1 Built Heritage Resources

A Cultural Heritage Impact Assessment was carried out and is included in **Appendix F**. A list of the Built Heritage Resources (BHR) and Cultural Heritage Landscape (CHL) features are listed in **Section 3.4**.

Based on the results of background data collection, field review, and a review of the preliminary plan, the proposed undertaking should not adversely affect cultural heritage resources. The following recommendations have been developed:

- Where limited encroachment on to BHRs and CHLs in the study corridor has been identified through grading and property acquisition, ensure that construction-related activities located in close proximity to identified heritage resources are suitably planned to conserve the resources and maintain appropriate vehicular access.
- The character and appearance of the Trafalgar Road corridor (CHL 3) will be changed permanently. As a record, during detailed design, a Photographic Documentation Report may be prepared for the cultural heritage landscape associated with Trafalgar Road and its context prior to any change in the study. The report should use historical mapping, 20th century and aerial photographs and current photographs to illustrate the development of the corridor.
- At BHR 10 (8637 Trafalgar Road), CHL 15 (8837 Trafalgar Road), CHL 18 (9156-9158 Trafalgar Road), CHL 19 (9289 Trafalgar Road), BHR 23 (9621 Trafalgar Road), and CHL 24 (9714 Trafalgar Road), remedial landscaping in the form of fencing and/or vegetation may be required (see **Section 7.1.11** Landscaping). Consultation with property owners will be conducted to determine the preferred approach. No further mitigation is anticipated.
- Potential impacts to the Ashgrove Cemetery (CHL 26) have been addressed through the preliminary design for the proposed widening. The road alignment will be widened to the east to avoid the cemetery and to avoid direct impacts to the property. During detailed design, consideration may be given to the provision of a pull off area for maintenance and visitor vehicles. Ensure fencing around the property is retained.

7.2.3.2 Archaeology Resources

As noted in **Section 3.4.23.6.2**, a Stage 1 archaeology assessment was carried out. The area within the right-of-way of Trafalgar Road between Steeles Avenue and north of 10 Side Road has been completely disturbed by the existing roadway, gravel shoulders, and ditching associated with roadway construction. Therefore, since the study corridor within the right-of-way is completely disturbed, no further assessment is required for these areas.

The Stage 1 archaeological assessment identified areas of archaeological potential outside of the current right-of-way. Given this, it is recommended to the Ministry of Tourism, Culture and Sport that any land that is outside of the right-of-way that will be impacted by future roadway construction will require Stage 2 archaeological assessment.

Details may be found in **Appendix G** – Stage 1 Archaeological Assessment.

7.2.4 Transportation

The proposed improvements on Trafalgar Road as described in **Chapter 7** support the transportation goals and objectives of Halton Region and Town of Halton Hills. All modes of transportation would be accommodated on Trafalgar Road as the roadway transforms

into a multi-modal corridor. The proposed undertaking supports Halton Region's Transportation Master Plan and Active Transportation Master Plan.

7.2.5 Source Water Protection and Hydrogeology

Source water protection is discussed in **Section 3.5** of the ESR, and hydrogeology assessment as part of the Trafalgar Road improvements are discussed in **Section 7.1.9**.

It should be noted that recent changes to regulations governing dewatering activities outlined in *Ontario Regulation 63/16: Registrations Under Part II.2 of the Act* – Water Taking also place restrictions on where dewatering effluent may be discharged within WHPAs. The requirements of this regulation shall be considered during the dewatering planning and execution stages.

Some of the policies noted in Section 3.5 and above may require preparation of a Risk Management Plan (RMP) outlining risk management measures that must be implemented to address significant drinking water threat (SDWT) activities. Separate RMPs may be required to address SDWT activities during the construction and post construction phases of the project. RMPs are to be established between the organization engaged in the SWDT activity and Halton Region's Risk Management Official (RMO).

7.2.6 Design and Construction Considerations

The mitigation of construction impacts will follow the *Environmental Construction Guidelines for Municipal Road, Sewage and Water Projects*, issued by the Municipal Engineers Association.

7.2.6.1 Potential Impacts during Construction

The following sections describe the potential environmental impacts during construction and proposed mitigating measures. The following potential adverse effects are identified:

- disruption/removal of existing vegetation
- construction noise and air quality
- disruption to vehicle traffic
- mud and dust during construction
- impacts to quality of well-water
- vibration

The mitigation and monitoring conditions included in the following sections indicate a commitment on the part of the Region to mitigate potential environmental impacts and undertake a monitoring program during and after construction.

During the detailed design stage and prior to construction, Halton Region will be responsible for obtaining approval from the Ministry of the Environment and Climate Change, as well as the Ministry of Natural Resources and Forestry for stormwater management. Permit approval will be required from Conservation Halton for all culvert installations, watercourse realignments, structures, site alteration, etc. within areas regulated pursuant to Ontario Regulation 162/06.

It is intended that the works proposed are executed in such a manner, which to the fullest possible extent, minimizes any adverse effects on the natural environment of the

project area. The Contractor will be responsible to ensure all his personnel are sufficiently instructed so that the work is carried out in a manner consistent with minimizing environmental impact. The Region will assign a qualified environmental inspector whose responsibility will be to ensure compliance with the environmental objectives.

7.2.6.2 Disposal of Excess Material

Surplus excavated material shall be removed to locations arranged by the Contractor. Prior to the disposal of any surplus excavated material, the Contractor will provide the Engineer with a sketch of the dumping site(s) showing access thereto. A written statement from the property owner(s) agreeing to allow the disposal of fill on the property must be approved by a Contract Administrator (CA). Furthermore, the placement of fill within any area associated with valleys, wetlands, shorelines and other hazardous lands that are regulated pursuant to Ontario Regulation 162/06 requires the written permission of Conservation Halton.

All approvals and permits will have to be obtained. Relevant MOECC policy frame work and best management practices should be referenced and applied where applicable.

Upon completion of the disposing, levelling and grading of surplus excavated material on any property, a written statement shall be obtained from the property owner(s) releasing the Contractor and Region from any claims and accepting the condition of the property as satisfactory.

7.2.6.3 Measures for Proper Tree Removal and Preservation of Residual Plant Communities

A Tree Protection Plan will be developed during detailed design. This plan will provide guidelines for protecting trees during construction, as well as minimizing soil compaction and making wise use of the removed timber resource. The plan should also include recommendations for during and post-construction maintenance including hazard tree monitoring, pruning, insect and disease control, aerating, watering and mulching.

7.2.6.4 Mud and Dust Control

The Contractor shall take such steps as may be required to prevent dust nuisance resulting from his operations. The Contractor shall be responsible for all dirt and mud that is tracked onto the roadways from vehicles entering or leaving the job site. The Contractor shall, upon request from the CA, immediately proceed with cleanup operations, or in the opinion of the CA, the Contractor has not or cannot sufficiently remove the mud from the road, the CA will proceed with the necessary clean up.

7.2.7 Monitoring and Maintenance

During construction, the Region will ensure that the environmental protection recommendations in the ESR and other subsequent agency approval conditions are complied with.

7.2.7.1 Detailed Design Commitments

Environmental concerns, anticipated impacts, and proposed mitigation measures as they relate to the project, have been described in **Chapter 7**. Many of the environmental concerns have been mitigated through the process by which the recommended design was selected, as described in the ESR. This section provides an additional list of standard commitments to be carried forward into Phase 5 of the Municipal Class EA process – Implementation Phase. These commitments have been developed through consultation with various agencies throughout the study process. It is recognized that certain decisions require specific agency input. Therefore, a key component of detailed design is refining and detailing the impact assessment and mitigation measures as the design is developed and refined, in consultation with the agency staff.

Conservation Halton, as well as the Ministry of Natural Resources and Forestry have been consulted throughout the Class EA process, and their comments and preliminary concerns have been integrated. For example, commitments to Conservation Halton may include but not limited to: Refinement and confirmation of drainage areas using latest DEM from CH and other sources (field survey), refinement of Hydrologic and Hydraulic model, if necessary, and submission to CH and refinement of LID options in consultation with Landscape Architect including the planting of native, non-rare species around the proposed SWM facilities.

Specific mitigation measures have been selected and committed to by Halton Region to address potential impacts as discussed throughout **Chapter 7**. It is recommended that these commitments, as presented in the ESR, become part of the contract package so that Contractors are aware of the requirements prior to tendering.

Monitoring of construction activities must ensure that all environmental standards and commitments for construction are met. Halton Region will work with Conservation Halton and other authorities, during detailed design and prior to the start of construction to ensure that the proposed works are acceptable and to obtain required permits.

Environmental monitoring will be combined with construction supervision to include periodic site visits and inspections throughout the course of the work.

7.2.8 Permit Requirements

Permits and approvals that may be required for this project are identified in **Table 7-14**:

Table 7-14: Permit Requirements

Regulatory Agency	Legislation	Permit/Approval	Comments
Federal			
Department of Fisheries and Oceans	Fisheries Act	Approval under the Fisheries Act	The requirement for review by DFO under the Fisheries Act will be determined at detailed design.

Regulatory Agency	Legislation	Permit/Approval	Comments
Provincial Government			
Ministry of the Environment and Climate Change	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[6]	Required if >50,000 L/d of surface or groundwater taken, includes temporary dewatering during construction
		Environmental Compliance Approval (ECA) for Industrial Sewage Works	Required if settling pond or other water treatment used during construction
	Environmental Protection Act	Environmental Compliance Approval	Storm water quality controls, including temporary facilities utilized during the project construction phase
		Environmental Compliance Approval	Construction and operation of water quality treatment facilities, including the proposed OGS And advanced filtration systems
Ministry of Natural Resources and Forestry	Endangered Species Act	Should a species or its habitat that is afforded protection under the ESA have potential to be negatively impacted, compliance under the Act must be demonstrated.	The requirement for completion of and IGF or activity registration will be determined at detailed design.
	Fish and Wildlife Act	A License to Collect Fish for Scientific Purposes	Removal of fish during installation of cofferdams for culvert extensions will also be determined at detailed design.
Ministry of Labour	Construction Projects Regulation (O.Reg. 213/91)	Notice of Project	Required before construction commences
Conservation Halton	Development, Interference with Wetlands & Alterations to Shorelines &	Permit	Will be required for any works occurring within a regulated area, this includes culvert extensions / replacements and widening of road

[6] Source Water Protection and hydrogeology are discussed in Sections 3.5 and 7.1.9 of the ESR. The Region recognizes potential delays associated with satisfying Source Water Protection policy requirements, namely the potential requirements to establish Risk Management Plans (RMPs) for construction and post construction activities. Note that RMPs would need to be finalized with the Risk Management Official prior to engaging in significant drinking water threat activities.

Regulatory Agency	Legislation	Permit/Approval	Comments
	Watercourses (O.Reg. 162/06)		
Halton Region / Town of Halton Hills			
Halton Region	Tree Bylaw	Permit	Required to remove trees on region-owned property(i.e., within road right-of- way)
Town of Halton Hills	Noise Control By- law (2010-0030)	Exemption	Required to allow construction works outside of normal hours (7 pm to 7 am) and on weekends
Town of Halton Hills	Ontario Building Code	Building Permit	Required if temporary site trailers or other facilities are erected on-site

8 MONITORING

During construction, the on-site Contract Administrator will ensure that implementation of mitigating measures and key design features are consistent with the contract and external commitments (e.g., permit conditions/requirements and EA commitments). In addition, the effectiveness of the environmental mitigating measures established during detailed design will be assessed to ensure that:

- Individual mitigation measures are providing the expected control and / or protection;
- Additional mitigation measures are provided, as required, for any unanticipated environmental problems that may develop during construction.

On-site construction administration staff will ensure that the environmental measures outlined in this report (Chapter 7) and further developed during detailed design are carried out. In an event that problems arise, appropriate agencies will be contacted to provide further input.

If the impacts of construction are different than anticipated, or if the method of construction is such that there are greater than anticipated impacts, the Contractor's methods of operation will be changed or modified to reduce those impacts.