amec foster wheeler

Highway 407 Transitway Corridor Assessment within the Ninth Line Lands

Oct 12, 2016

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1. Executive Summary

The proposed Highway 407 Transitway extends through the Ninth Line Lands in the City of Mississauga, and is generally bounded by Highway 407 to the west, Ninth Line to the east, Highway 401 to the north and the Highway 407 and Ninth Line overpass to the south. In 2014, the City of Mississauga (City) and Regional Municipality of Peel (Region) initiated the Ninth Line Lands Study to establish a planning framework for the Ninth Line Lands and guide future growth and development. City and Region Official Plan amendments will be required to implement the study recommendations. As part of that process, a Scoped Subwatershed Study has been initiated in order to assess the constraints and opportunities within the Ninth Line Lands related to the terrestrial and aquatic ecology, stream system, and surface water and groundwater resources (quantity/quality).

During the course of the Ninth Line Lands Study, a major land use influence was identified related to the Ministry of Transportation (MTO) planning for a Transitway to be located through the Ninth Line Lands, in order to service GO and regional/ local commuter transit. MTO had earlier completed a Transitway corridor protection study in 1998, the limits of which extended from Highway 403 to Markham Road. The focus of that study was to establish the mainline Transitway alignment and assess station locations, parking facilities, access connections and associated facilities, with the objective of determining the general property requirements necessary to implement the Transitway. The 1998 Transitway corridor assessment recommended horizontal and vertical Transitway alignments and established a corresponding 30.0 m right-of-way (ROW). Approval to implement the ultimate Transitway will be pursued by the MTO through the Provincial Class Environmental Assessment (EA) Process for Provincial Transportation Facilities, the timing of which is yet to be confirmed.

Subsequent to the 1998 Transitway Corridor Assessment Study, the MTO completed the Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road which concluded in 2011. The Transitway design standards developed as part of the 2011 planning and preliminary design study have been adopted for the entire Transitway. Based on this and other Transitway studies undertaken since the 1998 Transitway Corridor Protection Study, the MTO is recommending a 60.0 m Transitway ROW width be considered along with a 14.0 m buffer to adjacent development.

It has been recognized that the planning of the Transitway and the future development within the Ninth Line Lands should be integrated. Understanding the interface between the proposed Ninth Line Lands grading, stormwater management, roadway design and municipal servicing, and the functional design of the Transitway, is considered critical to advancing an improved understanding of land use planning within the Ninth Line Lands. In order to better assess integration of the Transitway into the land use planning for the Ninth Line Lands, with the objective of optimizing potential development within the Ninth Line lands, the following assessments within the Ninth Line lands have been undertaken and documented under separate cover and are summarized herein:

- Assessment of stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains within the Ninth Line lands and integration of the stormwater management requirements with siting of the Transitway;
- Preliminary corridor width assessment for the proposed Highway 407 Transitway;
- Preliminary parking evaluation for the Transitway station facilities.

The Transitway was analyzed in five segments corresponding to reaches of the existing watercourses and floodplains that exhibit similar hydraulic characteristics. The currently approved HEC-RAS hydraulic model for the subject reach of the Sixteen Mile Creek through the Ninth Line Lands has been modified as part of the Scoped Subwatershed Study to update the floodline mapping through the Ninth Line Lands using the best available information. The majority of the Ninth Line lands, with the exception of the southern-most portion, contain watercourses regulated by Conservation Halton and thus have a Regulatory Floodplain associated with them. The Regional (Regulatory) Floodplain encompasses a large portion of the lands east of Highway 407 and

west of Ninth Line, as well as some existing residential lands east of Ninth Line.

The alternative alignments for the Transitway were evaluated based upon the following criteria, in order to determine preferred alignments:

- Preserve conveyance capacity and available freeboard along Highway 407 during Regional Storm event;
- Maintain available riparian storage;
- Minimize number of watercourse crossings;
- Specific/unique drainage requirements and opportunities to integrate stormwater management with requirements and systems for future development;
- Meet Transitway design standards;
- Minimize number of roadway grade separations; and,
- Provide compatibility with adjacent land use planning.

The preferred Transitway alignment developed as part of this study is considered to represent the optimal location for addressing the hydraulic criteria within the study area, while minimizing conflicts with existing infrastructure, and integrating the planning for the Transitway and associated parking facilities with the overall land use planning for the Ninth Line Lands. Moreover, the integrated planning for the Transitway and the Ninth Line Lands has provided opportunities to further increase potential developable area within the Ninth Line Lands. The Transitway has been sited to maintain existing and realigned watercourses between Highway 407 and the Transitway and eliminate requirements for equalization culverts across the Transitway.

The vertical profile for the Transitway was developed to meet the following design objectives:

- Maintain minimum freeboard of 0.3 m during Regional Storm event;
- Provide compatibility with existing underground utility infrastructure; and,
- Minimize the Transitway grading footprint and associated right-of-way width.

In keeping with efforts to maximize and support development within the Ninth Line lands, the required Transitway corridor widths were reviewed and tailored to accommodate the recommended Transitway alignments and rural design cross-section developed as part of this study. The proposed Transitway corridor width varies from 39 m to 90 m.

Options to maximize potential developable land east of the preferred Transitway alignment were reviewed. Improvements to the conveyance capacity at the railway crossing of the Sixteen Mile Creek Tributary west of Highway 407 and south of Britannia Road will reduce water surface elevations within the Ninth Line Lands; the effect of which extends through the reach of the upstream watercourse to more than mid-way between Britannia Road and Derry Road. The alteration to the Regional Floodplain would free up potential lands for unrestricted development in the southwest quadrant of the Ninth Line and Britannia Road intersection.

For the lands north of Britannia Road and south of the online pond, it is proposed to utilize the Transitway for permanent flood protection in the form of a Flood Protection Land Form (FPL). Draft criteria developed by TRCA in 2013 represent the most current standards for FPLs to permit formal alteration of the Regulatory Floodplain. If deemed a FPL, the preferred siting of the Transitway would formally alter the limit of the Regional Floodplain, and permit a combination of restricted and unrestricted development east of the Transitway on lands within the current Regional Floodplain and not permitted for future development. Such an approach is subject to further discussion with Conservation Halton. Finally, realignment of the existing watercourse north of Derry Road would permit formal alteration of the Regulatory Floodplain which would be contained between Highway 407 and the Transitway. Modification to the Regional Floodplain would free up lands east of the Transitway for unrestricted development.

The total land area within the Ninth Line lands is 350.1 hectares. The potential developable lands accommodated by the 1998 Transitway Corridor Protection Study design is 97.2 hectares. The potential developable lands accommodated by the Transitway design recommended as part of the current study is 109.0 hectares. The recommended Transitway alternative results in a net gain of 11.8 hectares. Improvements to potential developable area within the Ninth Line Lands are depicted in Figures 17 through 21.

Preliminary parking demand for station facilities within the Ninth Line lands were estimated and documented in the MTO 1998 Transitway Corridor Protection Study. The study recommended three at-grade parking facilities within the Ninth Line lands located in the southwest quadrant of the Ninth Line and Britannia Road intersection, northwest quadrant of the Ninth Line and Derry Road intersection, and the CPR Galt station at the CP rail crossing south of Highway 401. Discussions with MTO and Metrolinx confirmed that there are no plans to relocate the existing Lisgar station or add another station at the proposed CPR Galt station on Ninth Line. As such, the MTO will be removing plans for the CPR Galt station identified in the MTO 1998 Corridor Protection Study. The parking capacity proposed at the CPR Galt station will have to be reassigned to the Britannia station and Derry station parking facilities accordingly.

MTO also indicated that it is of the opinion that the overall forecasted parking demand of 2,415 spaces protected for in the 1998 Corridor Protection Study is outdated and highly underestimated. MTO indicated that a detailed analysis of parking demand will be undertaken as part of the MTO's future Highway 407 Transitway EA for this section of the Transitway. Given the anticipated timing of the EA and in order to facilitate completion of the current Corridor Protection Study, MTO recommends that a total of 2,800 spaces be protected for between the Britannia Road and Derry Road stations, with the potential to expand to a total of 4,000 spaces. Approximately 14.16 ha and 20.24 ha are required to accommodate the interim and ultimate at-grade parking capacities respectively.

Given property restrictions at the Britannia station/ parking facility (proximity to the floodplain to the west, Britannia Road to the north, the Ninth Line right-of-way to the east and the existing stormwater management system to the south) developed as part of the MTO 1998 Corridor Protection Study, expansion of the Britannia station would be limited to the extents of the private properties immediately north and south of the parking facility proposed in the MTO 1998 Corridor Protection Study. As such, a station/ parking facility was considered north of Britannia Road. Given grade differentials between the Transitway station and adjacent lands, including Ninth Line and Derry Road, at the Derry station/ parking facility developed as part of the MTO 1998 Corridor Protection Study, a station/ parking facility was considered north of proposed Derry station. A number of parking facility alternatives were developed and evaluated to meet the interim and ultimate parking capacities recommended by MTO. From a land use planning and station operational perspective, the Britannia station/ parking facility south of Britannia Road and the Derry station/ parking facility north of the location recommended in the MTO 1998 Corridor Protection Study are recommended to be carried forward as part of the land use planning assessment. Preliminary positioning of the parking facility will be refined as part of the land use planning assessment and ultimately finalized as part of the MTO Highway 407 Transitway environmental assessment.

Given concerns expressed by the City of Mississauga regarding the magnitude in the increase in parking demand requested by MTO and compatibility with land use planning, as it relates to associated land requirements for at-grade facilities and promotion of alternative modes of transportation to access the Transitway itself, implementation of parking structures to accommodate the future expansion were evaluated. The proposed expansion of 1,200 spaces from the interim to ultimate capacity could be accommodated by 5 parking levels either distributed between one or two parking structures. As part of the City's land use planning assessment, it was determined that the lands in the southwest quadrant of the Ninth Line and Britannia Road intersection, north of the 1998 station footprint, be retained for future use as mixed use development. As such, it is recommended that the Britannia station/ parking facility only include the additional lands south of the 1998 station footprint. Limiting expansion of the 1998 Britannia station/ parking facility to the south would preclude the installation of a parking structure at the Britannia station due to floodplain restrictions; all parking at the Britannia station would be at-grade. As such, the ultimate at-grade plan area of 20.24 ha could be reduced to 14.16 ha (parking structure contained within interim Derry station/ parking facility footprint) or 15.02 ha (single parking structure located outside the interim Derry station/ parking facility footprint). If the parking structure is ultimately provided and extended to six levels (maximum number of levels typically implemented by Metrolinx), the maximum parking capacity could be increased from 4,000 spaces to 4,130 and 4,300 depending on whether the parking structure is sited within or outside the 2,800 at-grade parking space foot print respectively.

It should be noted that the MTO does not endorse the use of parking structures at any future Transitway station, nor does MTO consider parking structures as part of their environmental assessment of Transitway parking facilities. Additional dialogue between the City and MTO will be required should the City want to pursue parking structures as a means of maximizing potential developable lands within the Ninth Line lands.

2. Introduction

2.1 Overview

The proposed Highway 407 Transitway extends through the Ninth Line Lands in the City of Mississauga (City), and is generally bounded by Highway 407 to the west, Ninth Line to the east, Highway 401 to the north and the Highway 407 and Ninth Line overpass to the south. In 2014, the City and Regional Municipality of Peel (Region) initiated the Ninth Line Lands Study to establish a planning framework for the Ninth Line Lands and guide future growth and development. As part of that process, a Scoped Subwatershed Study was initiated to assess the constraints and opportunities within the Ninth Line Lands related to the terrestrial and aquatic ecology, stream system, and surface water and groundwater resources (quantity/quality).

During the course of the Ninth Line Lands Study, a major land use influence was identified related to the Ministry of Transportation's (MTO) planning for a Transitway to be located through the Ninth Line Lands, in order to service GO and regional/ local commuter transit. MTO had earlier completed a preliminary Transitway corridor protection study in 1998, the limits of which extended from Highway 403 in the west to Markham Road in the east. The focus of that study was to establish the mainline Transitway alignment and assess station locations, parking facilities, access connections and associated facilities, with the objective of determining the general property requirements necessary to implement the Transitway. The 1998 Transitway corridor assessment recommended horizontal and vertical Transitway alignments and established a corresponding 30.0 m right-of-way (ROW). Approval to implement the ultimate Transitway will be pursued by the MTO through the Provincial Class Environmental Assessment (EA) Process for Provincial Transportation Facilities, the timing of which is yet to be confirmed.

Subsequent to the MTO 1998 Transitway Corridor Assessment Study, the MTO completed the Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road which concluded in 2011. The Transitway design standards developed as part of the 2011 planning and preliminary design study have been adopted for the entire Transitway. Based on this and other Transitway studies undertaken since the MTO 1998 Transitway Corridor Protection Study, the MTO is recommending a 60.0 m Transitway ROW width be considered along with a 14.0 m buffer to adjacent development.

Although the planning for the Transitway has not proceeded beyond that of a corridor protection study within the Ninth Line Lands, it has been recognized that the planning of the Transitway and the future development within the Ninth Line Lands should be integrated. Improved clarity would be gained from advancing the planning for the Transitway as part of the planning for the Ninth Line Lands concurrently. Understanding the interface between the proposed Ninth Line Lands grading, stormwater management, roadway design and municipal servicing, and the functional design of the Transitway, is considered critical to advancing an improved understanding of land use planning within the Ninth Line Lands.

In order to better assess integration of the Transitway into the land use planning for the Ninth Line Lands, with the objective of optimizing potential development within the Ninth Line lands, the following assessments within the Ninth Line lands have been undertaken and documented under separate cover, and are summarized herein:

- Assessment of stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains within the Ninth Line lands and integration of the stormwater management requirements with siting of the Transitway;
- Preliminary corridor width assessment for the proposed Transitway; and,
- Preliminary parking evaluation for the Transitway station facilities.

2.2 Relevant Reports and Standards

The following background information has been used in this assessment:

- Transitway Corridor Protection Study, Highway 407/ Parkway Belt West Corridor from Highway 403 to Markham Road, December 1998 (Ministry of Transportation Ontario – McCormick Rankin);
- Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road, 407 Transitway Design Standards, July 2011 (Ministry of Transportation – Delcan/ IBI);
- Ninth Line Lands Scoped Subwatershed Study Phase 1: Background Report Study Area Characterization (Amec Foster Wheeler et. al., January 2015 DRAFT);
- North 16 District 'Scoped' Subwatershed Study and Ninth Line District Floodplain Mapping (Philips Engineering Ltd., December 2004);
- 407 Transitway Corridor Protection Study, December 2005 (Ministry of Transportation Ontrio – EarthTech);
- 2013 Contour mapping for Ninth Line Lands (City of Mississauga);
- Watercourse Mapping (Conservation Halton);
- Ninth Line District Floodline Mapping (Philips Engineering Ltd., December 2004); and,
- HEC-RAS Hydraulic Model for 2004 Ninth Line District Floodline Mapping.

3. Transitway Assessment and Recommendations

3.1 Transitway Horizontal Alignment Assessment

Due to the high level nature of the MTO 1998 Corridor Protection Study, impacts to stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains were not analyzed and assessed. Upon completion of preliminary stormwater analysis as part of the current study, in particular assessment of watercourse conveyance and riparian storage, it became evident that alternative alignments needed to be considered to adequately address the stormwater criteria with emphasis also placed on optimizing potential development within the Ninth Line lands.

3.1.1 Hydraulic Model and Floodline Mapping

The currently approved HEC-RAS hydraulic model has been modified as part of the Scoped Subwatershed Study to update the floodline mapping through the Ninth Line Lands using the best available information. The cross-section geometry was obtained from the 2013 contour data provided by the City, and the flow data has been updated based upon the refined hydrologic modelling completed for the January 2015 Draft Scoped Subwatershed Study. In addition, the hydraulic structures and profile of the railway downstream of Highway 407 have been updated based upon the total station survey completed as part of the Scoped Subwatershed Study. The cross-section location plan and resulting Regional Storm (Regulatory) Floodplain are presented in the "Functional Assessment of Transitway Alternatives through Ninth Line Lands" report in Appendix A.

3.1.2 Baseline Hydraulic Assessment

The results from the updated HEC-RAS hydraulic model have been used to characterize the hydraulics through the study area with respect to freeboard and riparian storage for the purpose of evaluating the potential impacts of the various Transitway alternatives. This baseline characterization has specifically documented the freeboard and riparian storage within the Ninth Line Lands. Through this process, the following segments of the Ninth Line Lands have been considered to exhibit similar hydraulic characteristics:

Segment 1: Highway 403/407 Interchange to Highway 407 Crossing of the Sixteen Mile Creek East Tributary;

Segment 2: Highway 407 Crossing to Britannia Road;

Segment 3: Britannia Road to Outlet of Online Pond South of Derry Road;

Segment 4: Outlet of Online Pond South of Derry Road to Derry Road;

Segment 5: Upstream of Derry Road.

The results of the hydraulic analyses are presented and discussed in detail in the "Functional Assessment of Transitway Alternatives through Ninth Line Lands" report in Appendix A. Limits of the existing Regional Floodplain are detailed in Figures 1 to 4 and discussed below.

The watercourses within Segment 1 consist of headwater tributaries, and do not have a Regulatory Floodplain associated with them. Any proposed works would be required to address local capacity constraints within receiving infrastructure and systems, as well as addressing requirements for stormwater quality and quantity control.

LEGEND

EXISTING REGIONAL STORM FLOODLINE (2015)

EXISTING RIGHT OF WAY

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

EXISTING REGIONAL STORM FLOODLINE MAPPING

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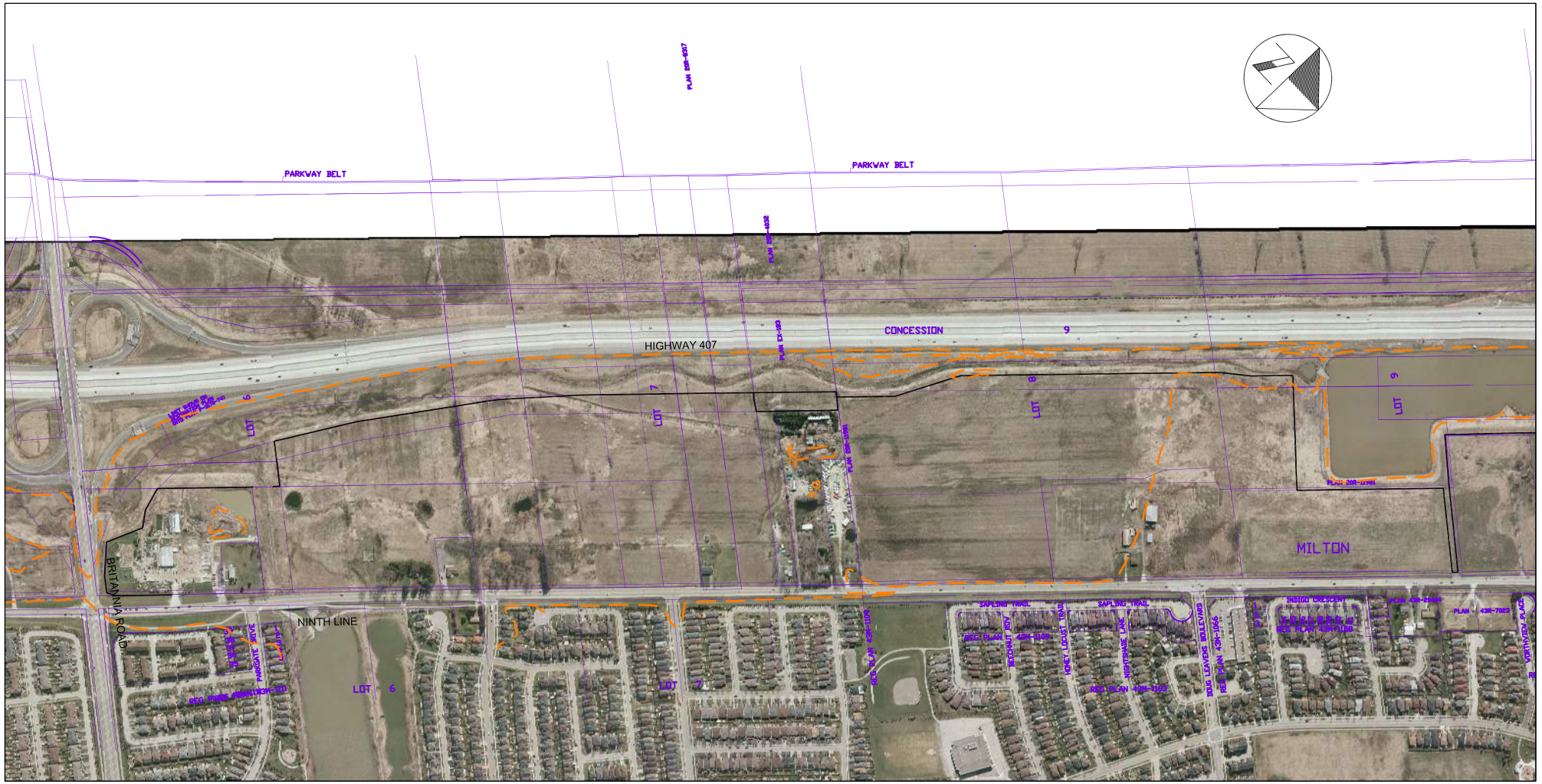
Scale

Figure No. 1



LEGEND

EXISTING REGIONAL STORM FLOODLINE (2015)

EXISTING RIGHT OF WAY

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

EXISTING REGIONAL STORM FLOODLINE MAPPING

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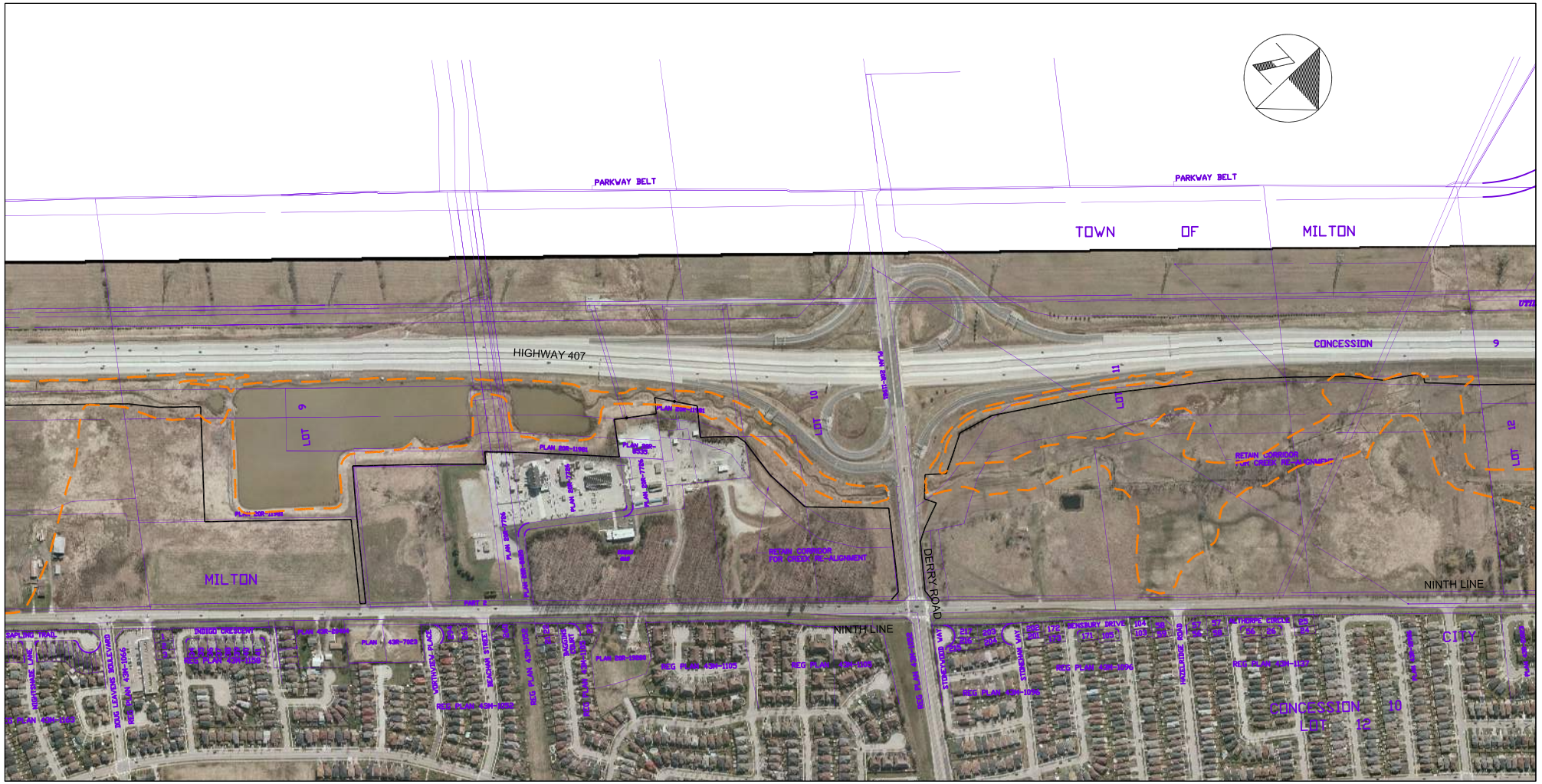
Scale

Figure No. 2



LEGEND

EXISTING REGIONAL STORM FLOODLINE (2015)

EXISTING RIGHT OF WAY

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

EXISTING REGIONAL STORM FLOODLINE MAPPING

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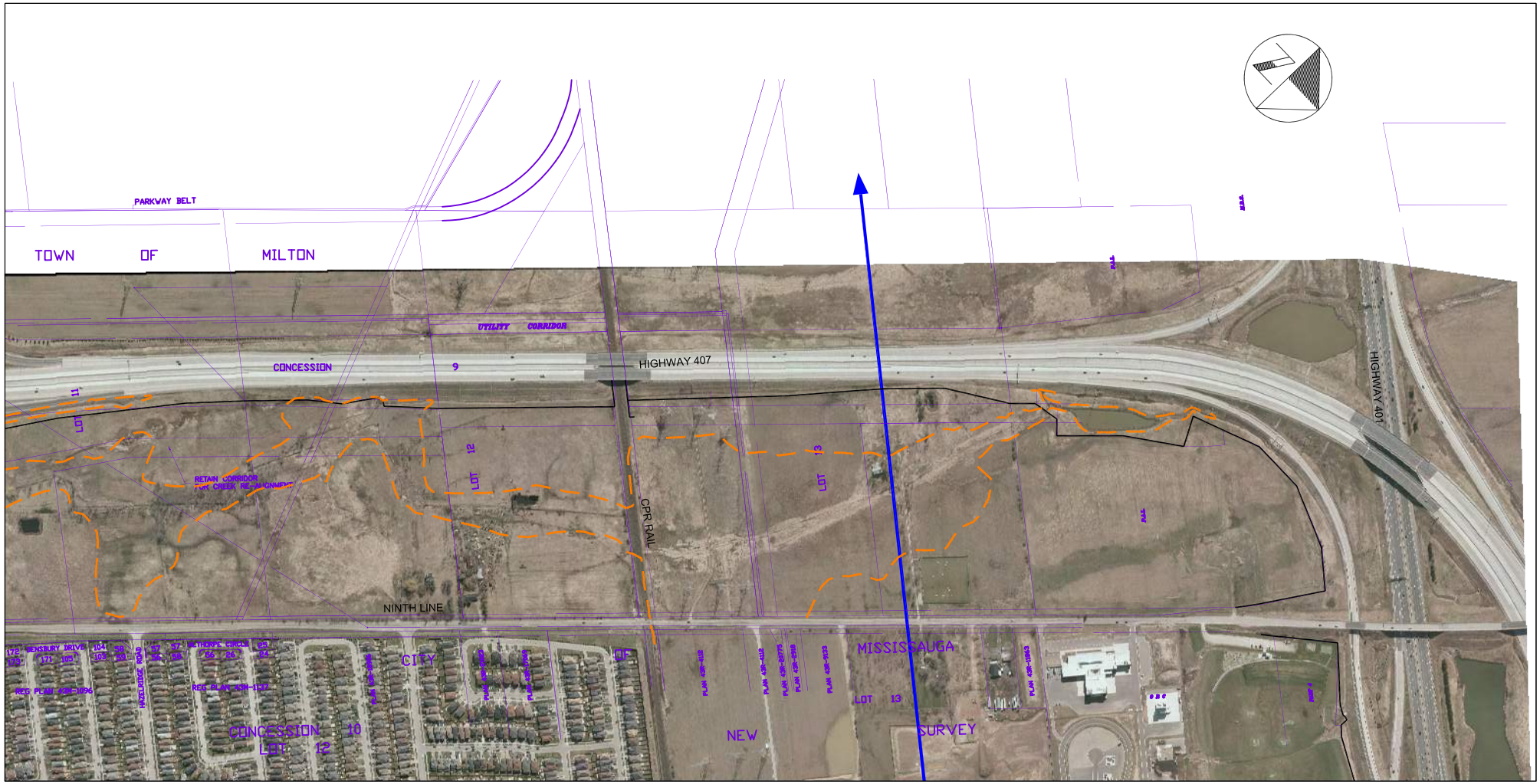
Scale

Figure No. 3



LEGEND

EXISTING REGIONAL STORM FLOODLINE (2015)

EXISTING RIGHT OF WAY

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

EXISTING REGIONAL STORM FLOODLINE MAPPING

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Scale

Figure No. 4

In general, the watercourse within Segments 2 through 4 consist of constructed natural channels providing aquatic habitat, which were implemented/ altered as part of Highway 407 construction and are localized toward the Highway 407. The watercourse within Segment 5 consists of an agricultural drainage feature which traverses the area approximately mid-way between Highway 407 and Ninth Line and was generally unaltered by the construction of Highway 407. A wetland feature is on-line to the watercourse, however to-date this feature has not been identified as a Provincially Significant Wetland.

The watercourses within Segments 2 through 5 are regulated by Conservation Halton and thus have a Regulatory Floodplain defined along their limits. The Regional (Regulatory) Floodplain within Segments 2 and 3 encompasses existing agricultural lands east of the watercourse, as well as some existing residential lands east of Ninth Line. The floodplain, watercourse and constructed wetland within these two segments provide substantial riparian storage, which was implemented in support of Highway 407 to offset the loss of riparian storage within upstream reaches resulting from the construction of the highway. Within portions of Segment 2, the Regional Storm Floodplain encompasses the east section of Highway 407, representing a flooding (i.e. negative freeboard) condition. The Regional Storm Floodplain within Segment 4 is contained within the limits of the online pond and the constructed watercourse, and does not encroach onto properties outside of the Highway 407 right-of-way. The riparian storage within this area is primarily attributed to the online pond, with limited riparian storage within the watercourse due to the confined nature of the floodplain. The Regional Storm floodplain within Segment 5 is localized toward the watercourse and generally does not encompass lands east of Ninth Line. A spill zone has been identified upstream of the railway, as a result of the limited capacity of the railway culvert. A stormwater management facility, constructed as part of the Highway 401/407 interchange, lies toward the upstream limit of the study area.

The MTO minimum 100 year storm event freeboard of 0.3 m is maintained along Highway 407 within the study limits under current conditions.

3.1.3 Alternative Transitway Horizontal Alignment Design Criteria

Design criteria for the Transitway was based on the Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road, 407 Transitway Design Standards, July 2011 (Ministry of Transportation – Delcan/ IBI).

The following design criteria was applied to the development of the Transitway horizontal alignment alternatives:

- Design speed 110 km/h;
- Minimum radii 525 m;
- Minimum spiral parameter 220 (mainline) and 130 (station approach); and,
- Minimum curve length 110 m.

3.1.4 Alternative Transitway Alignments

Given the foregoing, alternative Transitway alignments were developed to meet the following objectives with the intent of assessing impacts on development potential within the Ninth Line lands:

- Develop a Transitway alignment immediately adjacent to the existing Highway 407 ROW to the extent possible;
- Develop a Transitway alignment to accommodate required stormwater conveyance; and,
- Develop a Transitway alignment to accommodate floodplain riparian storage.

In light of the potential influence of the stormwater conveyance and riparian storage requirements on the Transitway alignment, alternative alignments were developed in conjunction with the hydraulic segments used in the base line assessment outlined in Section 3.1.2.

Based on the foregoing, the following alternative Transitway alignments were developed and assessed:

S1 – Based on 1998 Transitway Corridor Protection Study alignment

S2 – Based on 1998 Transitway Corridor Protection Study alignment;
S2A – Based on maintaining stormwater conveyance and riparian storage and upgrading the 1998 Transitway Corridor Protection Study alignment to meet the 2011 geometric design standards;
S2B – Based on maintaining the Transitway adjacent to the existing Highway 407 ROW;

S3 – Based on 1998 Transitway Corridor Protection Study alignment;
S3A – Based on maintaining stormwater conveyance; and,
S3B – Based on maintaining riparian storage.

S4 – Based on 1998 Transitway Corridor Protection Study alignment; and,
S4A – Based on modifying the 1998 Transitway Corridor Protection Study alignment to meet the 2011 geometric design standards;

S5 – Based on 1998 Transitway Corridor Protection Study alignment;
S5A – Based on maintaining stormwater conveyance;
S5B – Based on maintaining riparian storage; and,
S5C – Based on modifying the 1998 Transitway Corridor Protection Study alignment to meet the 2011 geometric design standards.

As a general statement, segments of the mainline Transitway horizontal alignment developed as part of the MTO 1998 Transportation Corridor Study utilize radii of 130 m to 250 m which are less than the 90 km/h minimum design radius of 340 m established as part of the 1998 Transportation Corridor Study. All alternative alignments to the MTO 1998 Transportation Corridor Study considered as part of the current study utilize the design criteria stipulated in Section 3.1.3.

3.1.5 Assessment Criteria

The alternative alignments for the Transitway were evaluated based upon the following criteria, in order to determine preferred alignments:

- Preserve conveyance capacity and available freeboard along Highway 407 during the Regional Storm event (no reduction where freeboard is less than 0.3 m, and 0.3 m minimum elsewhere);
- Maintain available riparian storage (no reduction preferred);
- Minimize number of watercourse crossings (minimum number of crossings preferred);
- Specific/unique drainage requirements and opportunities to integrate stormwater management with requirements and systems for future development;
- Meet Transitway design standards;
- Minimize number of Transitway road grade separations; and,
- Provide compatibility with adjacent land use planning.

3.1.6 Alternative Transitway Alignment Assessment

A tabular summary of the alternative assessment is presented in the "Functional Assessment of Transitway Alternatives through Ninth Line Lands" report in Appendix A.

The preferred alignment presented herein, and discussed in greater detail in Appendix A, is considered to represent the optimal location for addressing the hydraulic criteria within the study area, while minimizing conflicts with existing infrastructure, and integrating the planning for the Transitway and associated parking facilities with the overall land use planning for the Ninth Line Lands. Moreover, the integrated planning for the Transitway and the Ninth Line Lands has provided opportunities to further increase the potential developable area within the Ninth Line Lands, as well as reducing constraints associated with the planning and siting of the parking facilities for the Transitway. The recommended Transitway alignment is depicted in Figures 5 to 9.

3.1.6.1 Transitway Segment 1

The preferred Transitway alignment within Segment 1 generally follows the MTO 1998 Transitway Corridor Protection Study, as amended in the MTO 2005 407 West Transitway Corridor Protection Study, with geometric upgrades to meet the design criteria outlined in the MTO 2011 Highway 407 Transitway Planning and Preliminary Design Study.

The Transitway runs adjacent to the Highway 407 corridor and maximizes lands on the east side of the Transitway for development to the extent feasible. As mentioned above, the watercourses within Segment 1 do not have a Regulatory Floodplain associated with them. Any proposed works would be required to address local capacity constraints within receiving infrastructure and systems, as well as addressing requirements for stormwater quality and quantity control.

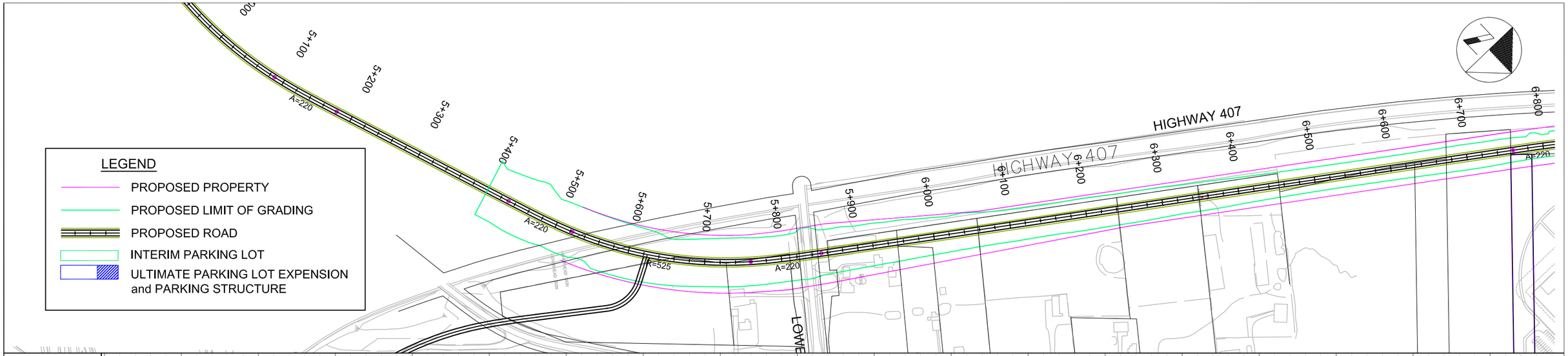
3.1.6.2 Transitway Segment 2

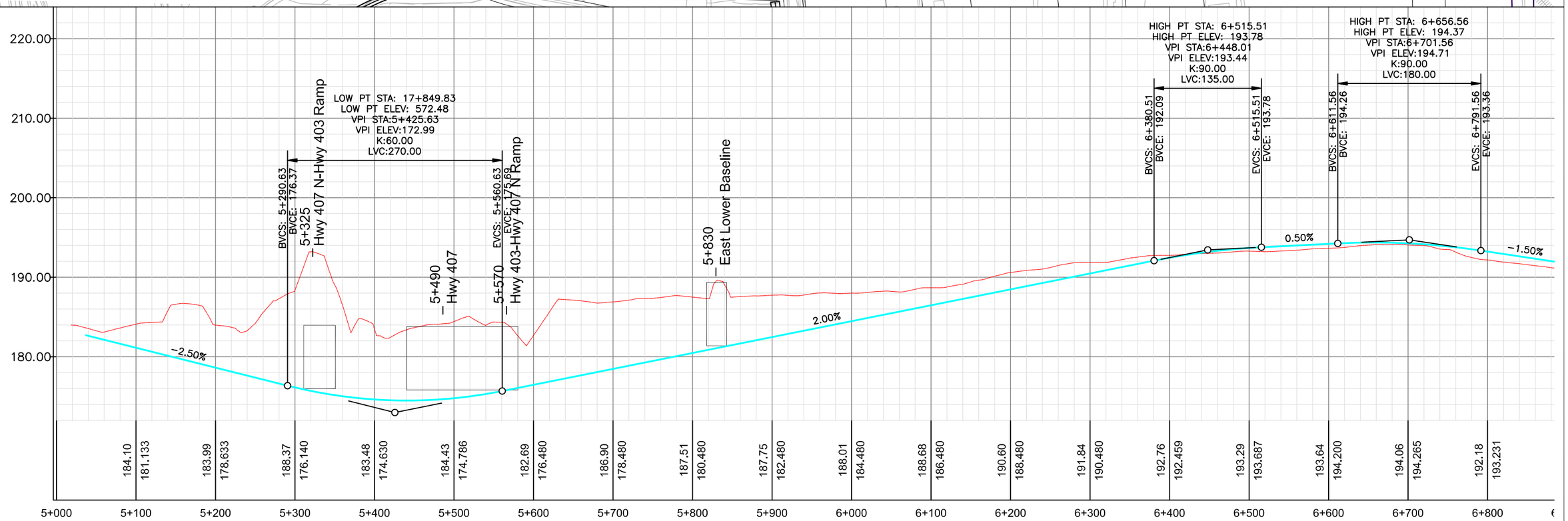
The recommended Transitway alignment within Segment 2 generally follows the MTO 1998 Transitway Corridor Protection Study, with geometric upgrades to meet the design criteria outlined in the MTO 2011 Highway 407 Transitway Planning and Preliminary Design Study.

The preferred Transitway alignment turns eastward away from the Highway 407 corridor in the vicinity of the Highway 407 Crossing of the Sixteen Mile Creek East Tributary to avoid impacts to the constructed natural channel implemented as part of Highway 407 construction and associated riparian storage, as well as the existing stormwater management ponds facilitating development east of Ninth Line. The Transitway alignment is sited to optimize use of existing landforms and minimize impacts to the existing natural channel.

The Regional FloodplainFloodplain extends east of the recommended Transitway alignment within Segment 2. Development within lands situated within the Regional Floodplain will be restricted and are subject to further discussion with Conservation Halton.

Hydraulic analyses was completed to assess the potential benefits associated with improving the conveyance capacity at the railway crossing of the Sixteen Mile Creek Tributary west of Highway 407. The existing six (6) 2.0 m diameter pipe culverts at the railway were notionally replaced with a 25 m span bridge structure increasing the flow area from the current 18.9 m2 to approximately 62 m2. The restricted capacity of the existing culverts results in overtopping of the existing railway under the Regional Storm, however the proposed improvements would convey the peak flow from the Regional Storm below the railway with no overtopping. The proposed improvement would reduce the water surface elevations within the Ninth Line Lands by up to 0.64 m for the Regional Storm event and up to 1.68 m for the 100-year storm event; the impacts of which would extend through





HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

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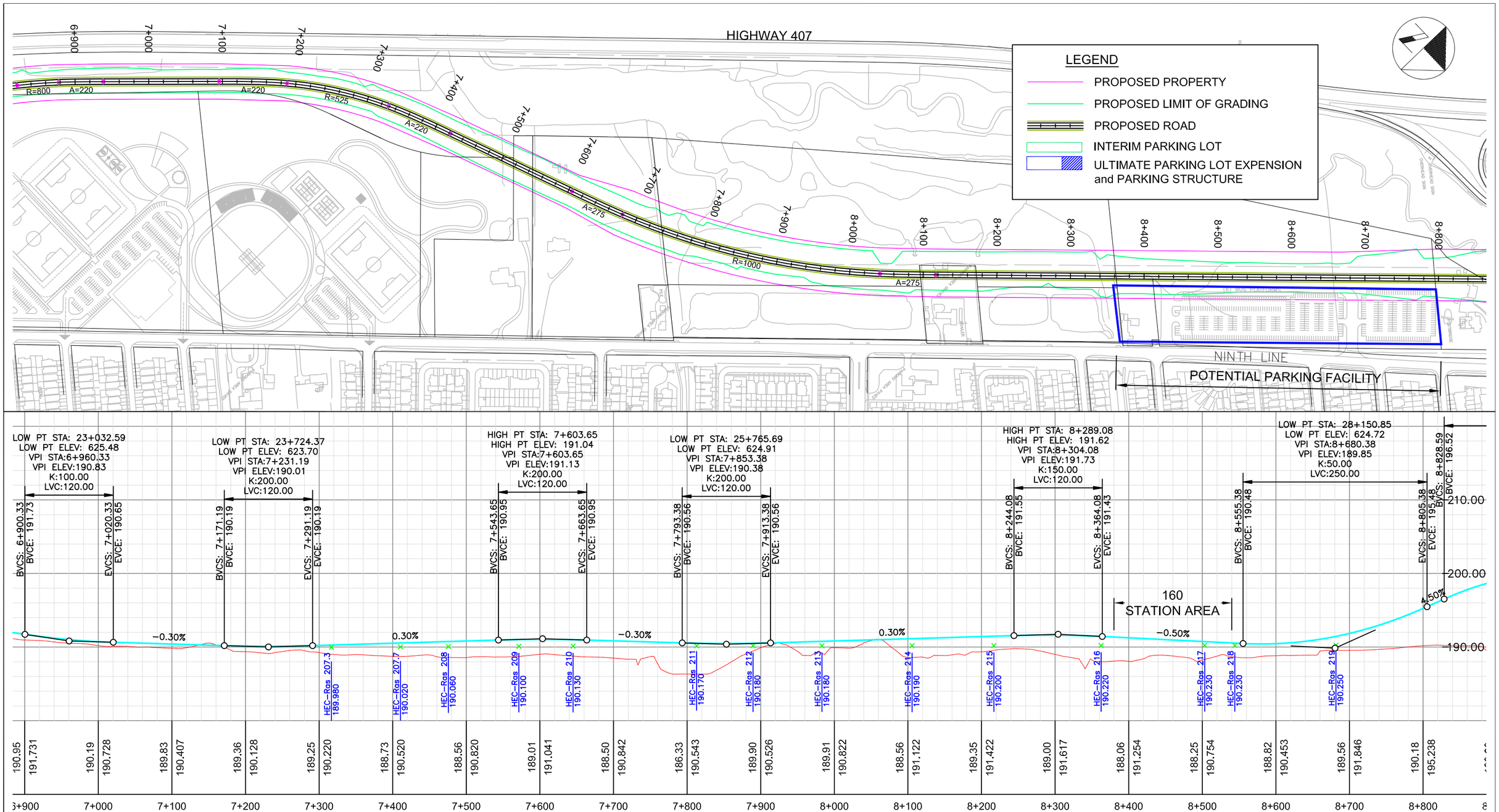
Scale 0 50 100 150 HOR.
0 5 10 15 VER.

Figure No. 5



HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

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Project No. TP114008

Scale 0 50 100 150 HOR.
0 5 10 15 VER.

Figure No. 6

LEGEND

- PROPOSED PROPERTY
- PROPOSED LIMIT OF GRADING
- PROPOSED ROAD
- INTERIM PARKING LOT
- ULTIMATE PARKING LOT EXPENSION and PARKING STRUCTURE

HIGHWAY 407

HIGHWAY 407

BRITANNIA ROAD

NINTH LINE

8+900 9+000 9+100 9+200 9+300 9+400 9+500 9+600 9+700 9+800 9+900 10+000 10+100 10+200 10+300 10+400 10+500 10+600 10+700 10+800 10+900

A=220 R=600 A=220 A=250 R=1000 A=250 A=220 R=525 A=220

HIGH PT STA: 8+986.09
HIGH PT ELEV: 200.07
VPI STA:8+986.09
VPI ELEV:203.61
K:35.00
LVC:315.00

LOW PT STA: 30+436.96
LOW PT ELEV: 633.72
VPI STA:9+214.19
VPI ELEV:193.35
K:30.00
LVC:126.00

EVCS: 9+143.59
EVCE: 196.52
BVCS: 9+151.19
BVCE: 196.18
EVCS: 9+277.19
EVCE: 193.16

LOW PT STA: 32+066.83
LOW PT ELEV: 629.05
VPI STA:9+788.97
VPI ELEV:191.62
K:150.00
LVC:120.00

BVCS: 9+728.97
BVCE: 191.80
EVCS: 9+848.97
EVCE: 191.92

HIGH PT STA: 10+098.91
HIGH PT ELEV: 192.98
VPI STA:10+083.91
VPI ELEV:193.10
K:150.00
LVC:120.00

BVCS: 10+023.91
BVCE: 192.80
EVCS: 10+143.91
EVCE: 192.92

LOW PT STA: 34+356.02
LOW PT ELEV: 629.85
VPI STA:10+499.21
VPI ELEV:191.85
K:100.00
LVC:115.00

BVCS: 10+441.71
BVCE: 192.02
EVCS: 10+556.71
EVCE: 192.34

4.50% −0.30% 0.50% −0.30% 0.85%

8+986 Britannia Road

HEC–Ros 225 191.520
HEC–Ros 226 191.530
HEC–Ros 227 191.530
HEC–Ros 228 191.530
HEC–Ros 229 191.540
HEC–Ros 230 191.590
HEC–Ros 231 191.670
HEC–Ros 232 191.770
HEC–Ros 233 191.940
HEC–Ros 234 193.080

220.00
210.00
200.00
190.00

185.38 199.007 192.23 200.038 189.56 198.212 193.39 194.381 188.59 193.088 189.01 192.788 189.75 192.488 190.11 192.188 190.19 191.888 190.14 191.756 190.04 192.176 190.00 192.676 190.35 192.983 191.13 192.748 190.70 192.448 190.78 192.148 191.02 192.017 191.33 192.707 192.44 193.557 193.37 194.407

9+900 9+000 9+100 9+200 9+300 9+400 9+500 9+600 9+700 9+800 9+900 10+000 10+100 10+200 10+300 10+400 10+500 10+600 10+700 10+800 10

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

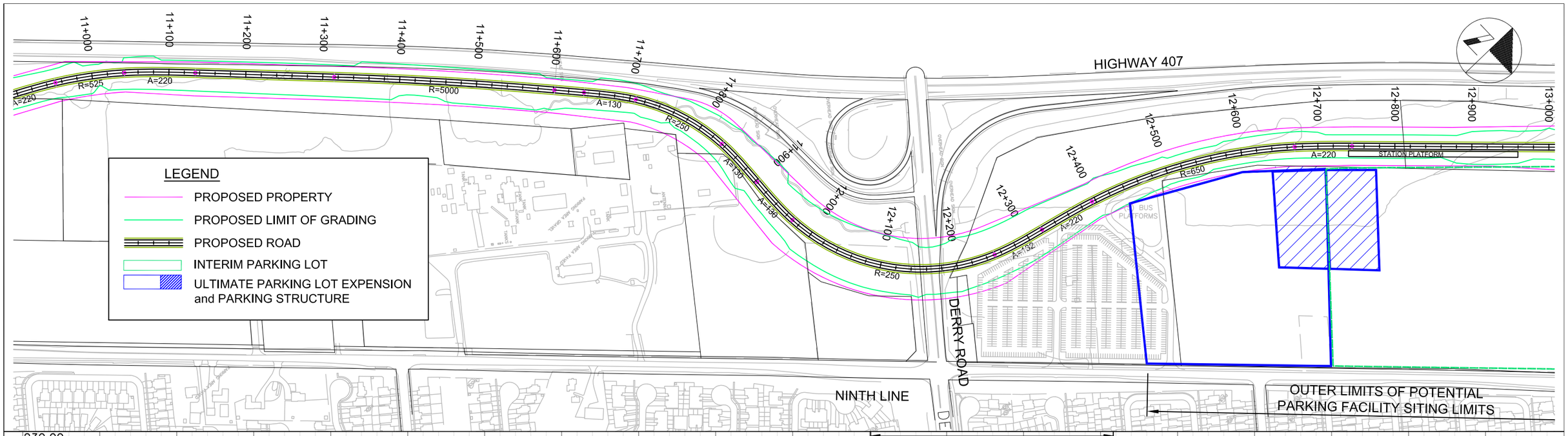
PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

amec foster wheeler

Project No. TP114008

Scale 0 50 100 150 HOR.
0 5 10 15 VER.

Figure No. 7



HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

PREFERRED TRANSITWAY ALIGNMENT PLAN & PROFILE

amec foster wheeler

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Scale 0 50 100 150 HOR.
0 5 10 15 VER.

Figure No. 8

HIGHWAY 407

HIGHWAY 407

HIGHWAY 401

CPR RAIL

NINTH LINE

NINTH LINE

13+100 13+200 13+300 13+400 13+500 13+600 13+700 13+800 13+900 14+000 14+100 14+200 14+300 14+400 14+500 14+600 14+700

A=220 R=525 A=220 A=220 R=525 A=220 A=220 R=525

LEGEND

- PROPOSED PROPERTY
- PROPOSED LIMIT OF GRADING
- PROPOSED ROAD
- INTERIM PARKING LOT
- ULTIMATE PARKING LOT EXPENSION and PARKING STRUCTURE

LOW PT STA: 42+611.65
LOW PT ELEV: 667.74
VPI STA:13+048.03
VPI ELEV:203.83
K:30.00
LVC:120.00

BVCS: 12+988.03
BVCE: 203.53

EVCS: 13+108.03
EVCE: 206.53

HIGH PT STA: 13+415.80
HIGH PT ELEV: 216.83
VPI STA:13+415.80
VPI ELEV:220.38
K:35.00
LVC:315.00

BVCS: 13+258.30
BVCE: 213.29

EVCS: 13+573.30
EVCE: 213.29

LOW PT STA: 45+107.69
LOW PT ELEV: 683.81
VPI STA:13+687.32
VPI ELEV:208.16
K:30.00
LVC:147.00

BVCS: 13+613.82
BVCE: 211.46

EVCS: 13+760.82
EVCE: 208.45

LOW PT STA: 45+943.43
LOW PT ELEV: 687.08
VPI STA:14+093.56
VPI ELEV:209.78
K:50.00
LVC:180.00

BVCS: 14+003.56
BVCE: 209.42

EVCS: 14+183.56
EVCE: 213.38

BVCS: 14+275.77
BVCE: 217.07

HIGH PT STA: 14+635.77
HIGH PT ELEV: 224.27
VPI STA:14+635.77
VPI ELEV:231.47
K:90.00
LVC:720.00

4.50% 4.50% 0.40% 4.00%

13+419 CPR Rail

14+650 Ninth Line

HEC-Ras 257 207.790

HEC-Ras 258 207.900

HEC-Ras 259 208.140

240.00 230.00 220.00 210.00 200.00

203.086 201.33 203.610 202.57 206.175 204.34 210.665 206.15 214.916 206.83 216.796 205.98 215.819 206.71 212.086 206.92 208.824 207.52 208.607 207.56 209.007 207.03 209.407 208.59 210.738 208.07 214.039 209.79 218.007 210.47 221.182 211.02 223.246 211.51 224.199 211.05 224.041 222.772

13+900 14+000 14+100 14+200 14+300 14+400 14+500 14+600 14+700 14+800

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

amec foster wheeler

Project No. TP114008

Scale 0 50 100 150 HOR.
0 5 10 15 VER.

Figure No. 9

the reach of the upstream watercourse to just downstream of the outlet of the online pond south of Derry Road. Furthermore, the proposed improvement would increase the freeboard along Highway 407 between the Highway 407 crossing and the outlet of the online pond south of Britannia Road, eliminate the existing negative freeboard (i.e. flooding) condition along Highway 407, achieving a minimum freeboard of 0.3 m along the entire length of Highway 407 under the Regional Storm, and would free up potential lands for unrestricted development in the southwest quadrant of the Ninth Line and Britannia Road intersection. Modifications to the Regional Floodplain associated with the railway crossing upgrades are depicted in Figures 11 and 12, along with proposed increases in unrestricted potential developable lands.

3.1.6.3 Transitway Segment 3

The recommended Transitway alignment within Segment 3 is proposed east of the MTO 1998 Transitway Corridor Protection Study to provide required stormwater conveyance and riparian storage. The existing riparian storage within this reach of watercourse could be maintained with some grading and re-contouring of the floodplain between the watercourse and the Transitway, without requiring equalization culverts to maintain access to the existing floodplain east of the Transitway.

Construction of the Transitway within Segment 3 provides a unique opportunity to provide flood protection for flood susceptible lands within the Ninth Line lands. The Transitway in of itself represents public infrastructure and is essentially a large engineered earthen berm with a roadway on top. As such the Transitway would separate and protect flood prone lands by creating a barrier between the watercourse and the flood susceptible lands. It should be noted that Provincial legislations do not recognize berms as permanent flood management works due to the potential for failure, hence despite "protecting" lands susceptible to flooding, MNRF would not recognize the berm as eliminating the flood risk permanently hence the Regulatory floodplain would continue to be in effect on those lands at risk, therefore there could be no development on the affected lands.

In recent years, various Conservation Authorities and the MNRF have considered opportunities for permanent flood protection in the form of "super berms" or Flood Protection Land Forms (FPL). Draft criteria developed by TRCA in 2013 represent the most current standards for structural requirements to formally alter the Regulatory Limit using FPLs. According to these criteria, structures which formally alter the Regulatory Limit are designated as landforms, and must fulfill certain requirements, including:

- Crest of landform must be at least 0.3 m above the Regulatory Water Level;
- Crest of landform must be at least 3 m in width;
- No buried infrastructure or pipes are permitted within or crossing the landform;
- Side slopes are to not to exceed 10 % toward the watercourse; and,
- Side slopes are to be between 1.5 % and 2.5 % on the side opposite the watercourse – local grades as steep as 5 % may be permitted, subject to Conservation Authority approval.

In addition to the foregoing criteria, there are various restrictions on the land uses permitted on the slopes of the landform. However, at the point where the landform matches existing grade on the slope opposite the watercourse, development would be considered removed from the Regulatory Limit and may proceed without restrictions.

The proposed landform cross section is depicted in Figure 10.

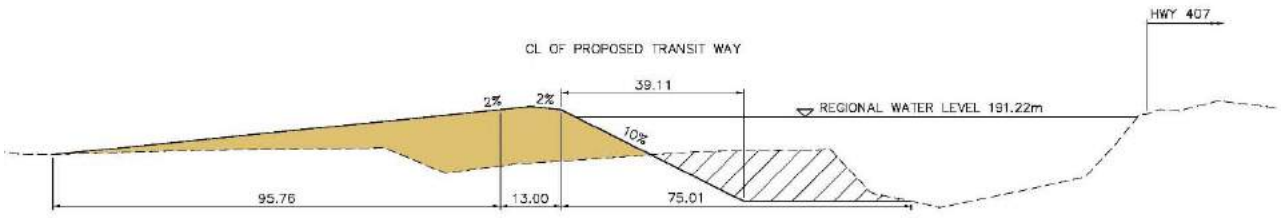


Figure 10 – Transitway Landform Cross-Section

The preferred Transitway alignment through Segment 3 was reviewed in order to determine the opportunity for potential developable land which would be permitted if the Transitway were constructed on top of a landform. For this assessment, cross-sections were developed to depict the Transitway atop the landform in accordance with the grading criteria provided above, and to approximate the footprint of the landform. It was determined that approximately 12.5 ha +/- would be removed from the Regulatory Floodplain, potentially allowing development to proceed unrestricted. In addition, and subject to Conservation Halton and MNRF approval, other land uses may be permitted on the slopes of the landform, primarily in the form of passive park land and open spaces. Buried infrastructure and pipes are not permitted within or crossing the landform. As such, the Transitway atop the landform would be required to provide a rural drainage system with swales and ditches promoting surface drainage.

Modifications to the Regulatory Floodplain and changes in potential developable lands are depicted in Figures 13 to 15.

LEGEND

- EXISTING REGIONAL STORM FLOODLINE (2015)
- PROPOSED REGIONAL STORM FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT RAILWAY CROSSING
- EXISTING RIGHT OF WAY
- EXISTING HIGHWAY 407 RIGHT OF WAY
- PROPOSED TRANSITWAY
- REGIONAL STORM FLOODPLAIN REMOVED

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

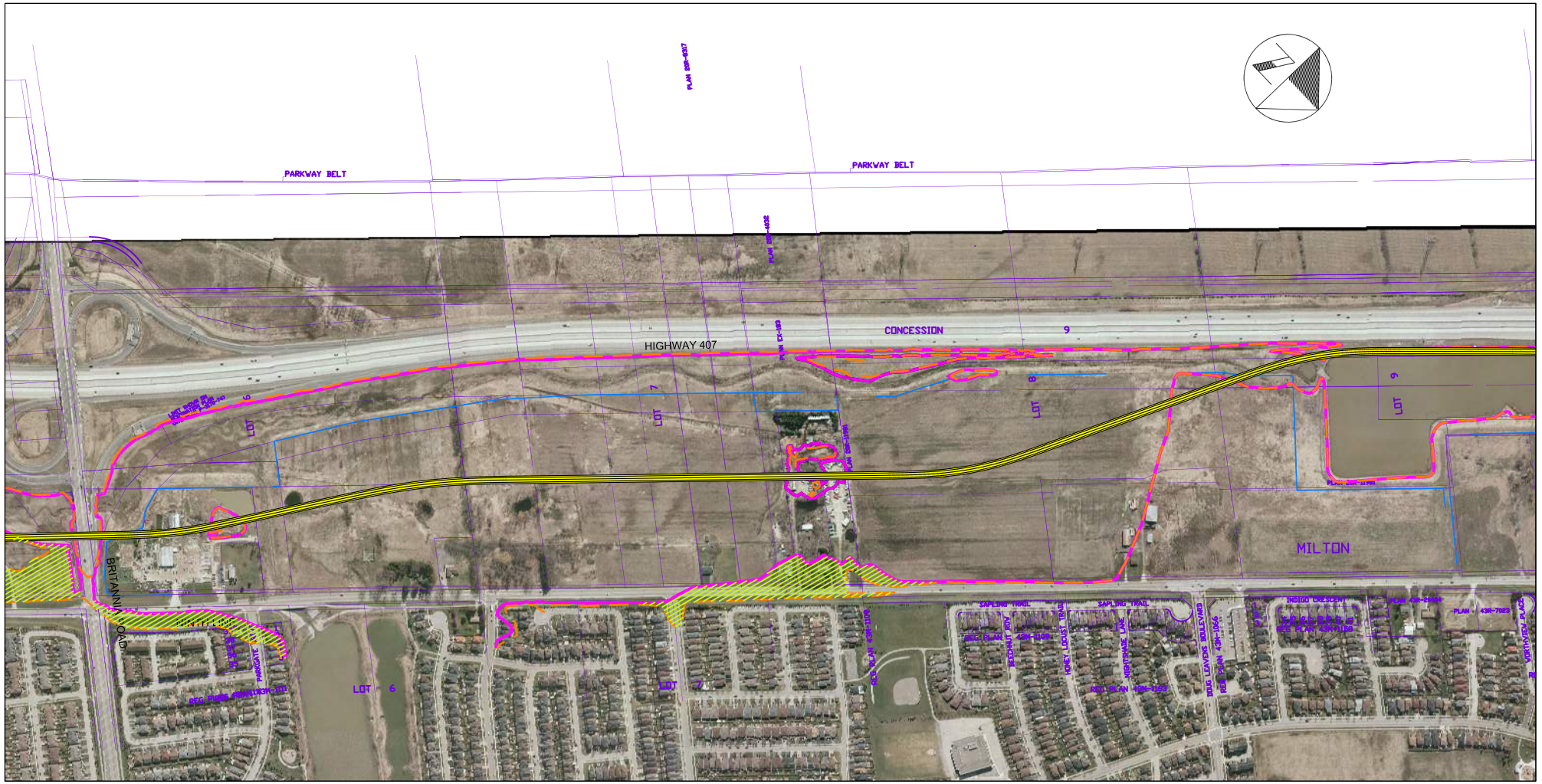
PROPOSED REGIONAL STORM FLOODLINE MAPPING WITH HYDRAULIC IMPROVEMENTS AT RAILWAY CROSSING

amec foster wheeler

Project No. TP114008

Scale

Figure No. 11



LEGEND

- EXISTING REGIONAL STORM FLOODLINE (2015)
- PROPOSED REGIONAL STORM FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT RAILWAY CROSSING
- EXISTING RIGHT OF WAY
- EXISTING HIGHWAY 407 RIGHT OF WAY
- PROPOSED TRANSITWAY
- REGIONAL STORM FLOODPLAIN REMOVED

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

PROPOSED REGIONAL STORM FLOODLINE MAPPING WITH HYDRAULIC IMPROVEMENTS AT RAILWAY CROSSING

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Project No. TP114008

Scale

Figure No. 12

3.1.6.4 Transitway Segment 4

Alternative Transitway alignments within Segment 4 are highly constrained by Highway 407 to the west, the Union Gas site, existing east-west oriented gas pipelines, property access required off of Ninth Line, and an existing woodlot in the southwest quadrant of the Derry Road and Ninth Line intersection. Under existing conditions, the floodplain through this area is confined to the limits of the online pond and the constructed watercourse, and does not encroach onto adjacent property, and the riparian storage is provided primarily by the online pond. Consequently, maintaining the alignment of the Transitway adjacent to Highway 407 in the vicinity of the online pond is considered to represent the optimal alignment for the roadway from the perspective of maintaining flood protection and riparian storage and minimizing environmental impacts. The Transitway alignment proposed in the MTO 1998 Transitway Corridor Protection Study utilizes sub-standard radii of 250 m to traverse around, as opposed to through, the Highway 407 and Derry Road interchange and requires a single grade separation at Derry Road. Given constraints outlined above south of Derry Road, implementation of the MTO 2011 Highway 407 Transitway Planning and Preliminary Design Study design criteria requires the Transitway to traverse through the Highway 407 and Derry Road interchange. Based upon preliminary grading assessments, it is anticipated that the resulting Transitway alignment would require four (4) grade separations with Derry Road and the associated Highway 407 interchange ramps, steep vertical Transitway grades and horizontal realignment of the interchange ramps to traverse over the ramps in the southeast quadrant of the interchange and under Derry Road and the ramp in the northeast quadrant of the interchange (similar to that being implemented at the Mississauga BRT crossing of Winston Churchill Boulevard). It is anticipated that a pumping station will be required at the underpass to drain low points in the vertical profile required to traverse the interchange.

Given the complexity of the design issues outlined above, further analysis of the alignment options in Segment 4 is required to establish a preferred alternative. It is recommended that the alignment assessment be completed as part of the future MTO Highway 407 Transitway EA, and that both alternatives be advanced for further consideration as part of the current corridor assessment.

3.1.6.5 Transitway Segment 5

The recommended Transitway alignment within Segment 5 is proposed east of the MTO 1998 Transitway Corridor Protection Study to provide required stormwater conveyance and riparian storage. The recommended Transitway alignment requires realignment of the existing watercourse to support both the Transitway and future development within the Ninth Line lands. The optimal location for the watercourse has been identified immediately east of Highway 407 and west of the Transitway, in order to maintain direct access between the Transitway station and associated parking facility, without requiring a watercourse crossing between the two facilities.

For planning purposes, a preliminary cross-section of the realigned watercourse corridor has been developed based upon the following criteria:

- 30 m minimum bottom width to address fluvial geomorphologic criteria for meander belt width;
- 15 m setback required on each side of the corridor based upon current requirements for hazard protection from Conservation Halton; and,
- 5 m side slopes on each side of the corridor for grading.

Based upon the foregoing criteria, a minimum planning corridor width of 70 m separating Highway 407 and the Transitway was applied to the recommended Transitway alignment. The 70 m separation was further increased to provide required riparian storage between the two facilities.

As noted above, the recommended Transitway alignment through Segment 5 has been established assuming a 15 m setback which would notionally be required from the top of bank of the realigned watercourse to Highway 407 and the Transitway, based upon current requirements of Conservation Halton. Further discussion with Conservation Halton will be required to confirm whether a reduced setback may be implemented due to the disturbed nature of the riparian corridor and the back slope of the adjacent roadways. Furthermore, the alignments would also need to consider requirements to accommodate or adjust the footprint of the existing stormwater management facility at the north limit of this area, as well as requirements for a replacement structure at the railway crossing of the realigned watercourse.

3.1.6.6 Transitway Land Use Impacts

As discussed above, the preferred alignment was developed to accommodate stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains within the Ninth Line lands, with the objective of maximizing potential developable lands within the corridor.

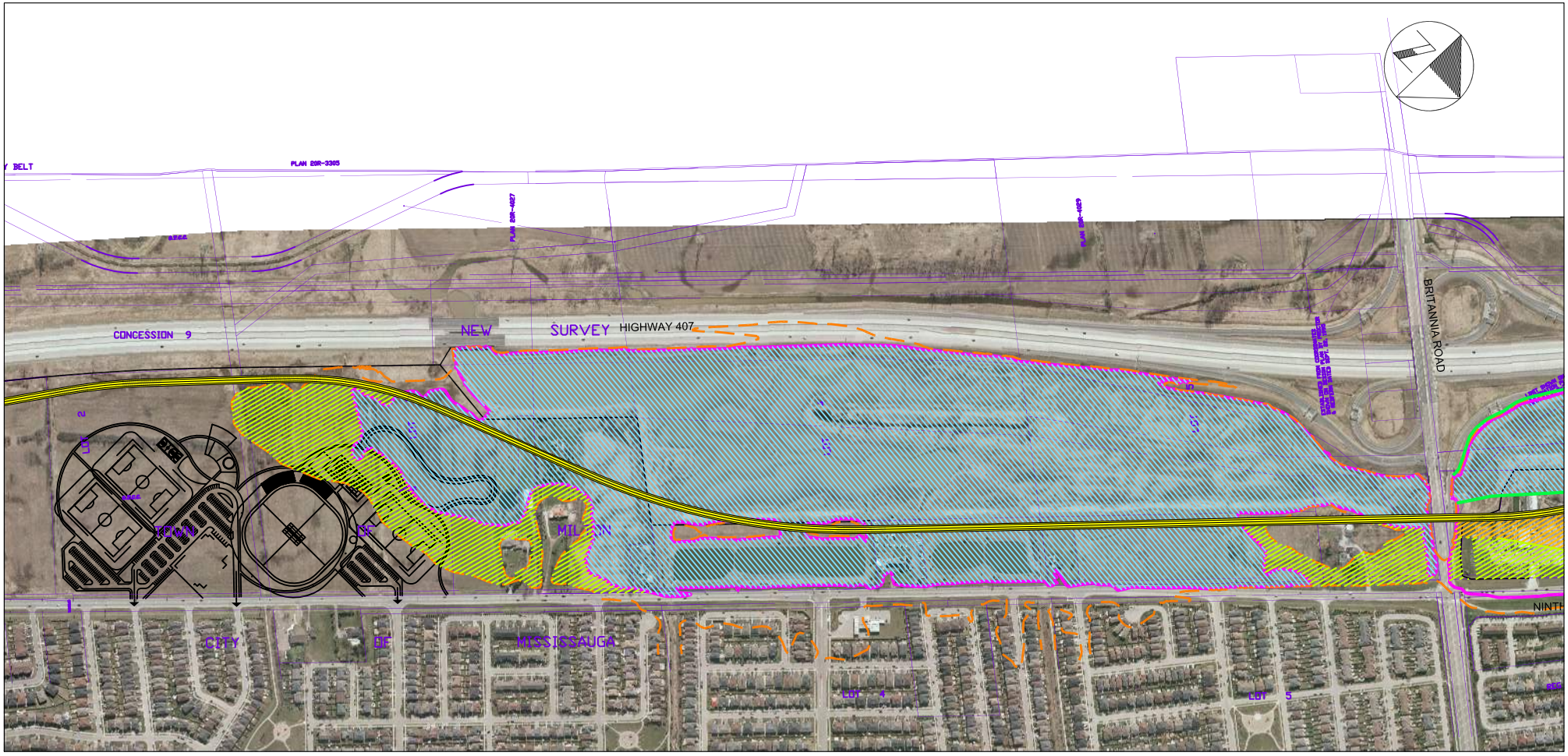
There is no Regional Floodplain associated with Segment 1 allowing for placement of the Transitway immediately east of the Highway 407 right-of-way, to the extent feasible, to minimize impacts on potential developable lands east of the Transitway.

Within Segment 2, the Transitway is predominately situated on existing landforms and has minimal impact on the Regional Floodplain which currently extends east of the recommended Transitway alignment and encompasses lands east of Ninth Line. Development within lands situated within the Regional Floodplain will be restricted and are subject to further discussion with Conservation Halton. As discussed above, improvements to the conveyance capacity at the railway crossing of the Sixteen Mile Creek Tributary west of Highway 407 will reduce water surface elevations within the Ninth Line Lands. The impacts to the Regional Floodplain would free up potential lands for unrestricted development in the southwest quadrant of the Ninth Line and Britannia Road intersection as detailed in Figure 13.

Within Segment 3, stormwater conveyance and riparian storage will be accommodated between Highway 407 and the Transitway. Currently, the majority of lands within Segment 3 are within the Regional Floodplain and future development within these lands is not permitted. As discussed in detail in Section 3.1.6.3, if the Transitway is deemed a FPL, restricted and unrestricted development would be permitted east of the Transitway on lands currently not permitted for future development. Such an approach would be subject to further discussion with Conservation Halton. The potential impact of the above on potential developable land is detailed in Figure 14.

Regardless of the Transitway alignment, development within Segment 4 is not feasible given existing constraints associated with Highway 407, Union Gas infrastructure, existing gas pipelines, and existing woodlot.

Similar to Segment 3, stormwater conveyance and riparian storage within Segment 5 will be accommodated between Highway 407 and the Transitway. Realignment of the existing watercourse would correspond to a redefining of the Regional Floodplain which would be contained between Highway 407 and the Transitway. Modification to the Regional Floodplain would free up lands east of the Transitway for unrestricted development. Impacts to the available potential developable lands is detailed in Figure 15.



LEGEND

- EXISTING REGIONAL STORM FLOODLINE (2015)
- PROPOSED REGIONAL STORM FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT RAILWAY CROSSING
- PROPOSED REGIONAL STORM FLOODLINE WITH FLOOD PROTECTION LANFORM
- PROPOSED REGIONAL STORM FLOODLINE WITH WATERCOURSE REALIGNMENT
- EXISTING RIGHT OF WAY
- PROPOSED TRANSITWAY
- REGIONAL STORM FLOODPLAIN REMOVED - POTENTIAL DEVELOPABLE AREA (RESTRICTED)
- REGIONAL STORM FLOODPLAIN REMOVED - POTENTIAL DEVELOPABLE AREA (UNRESTRICTED)
- REGIONAL STORM FLOODPLAIN RETAINED
- REGIONAL STORM FLOODPLAIN MODIFIED

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

PROPOSED REGIONAL STORM FLOODLINE MAPPING

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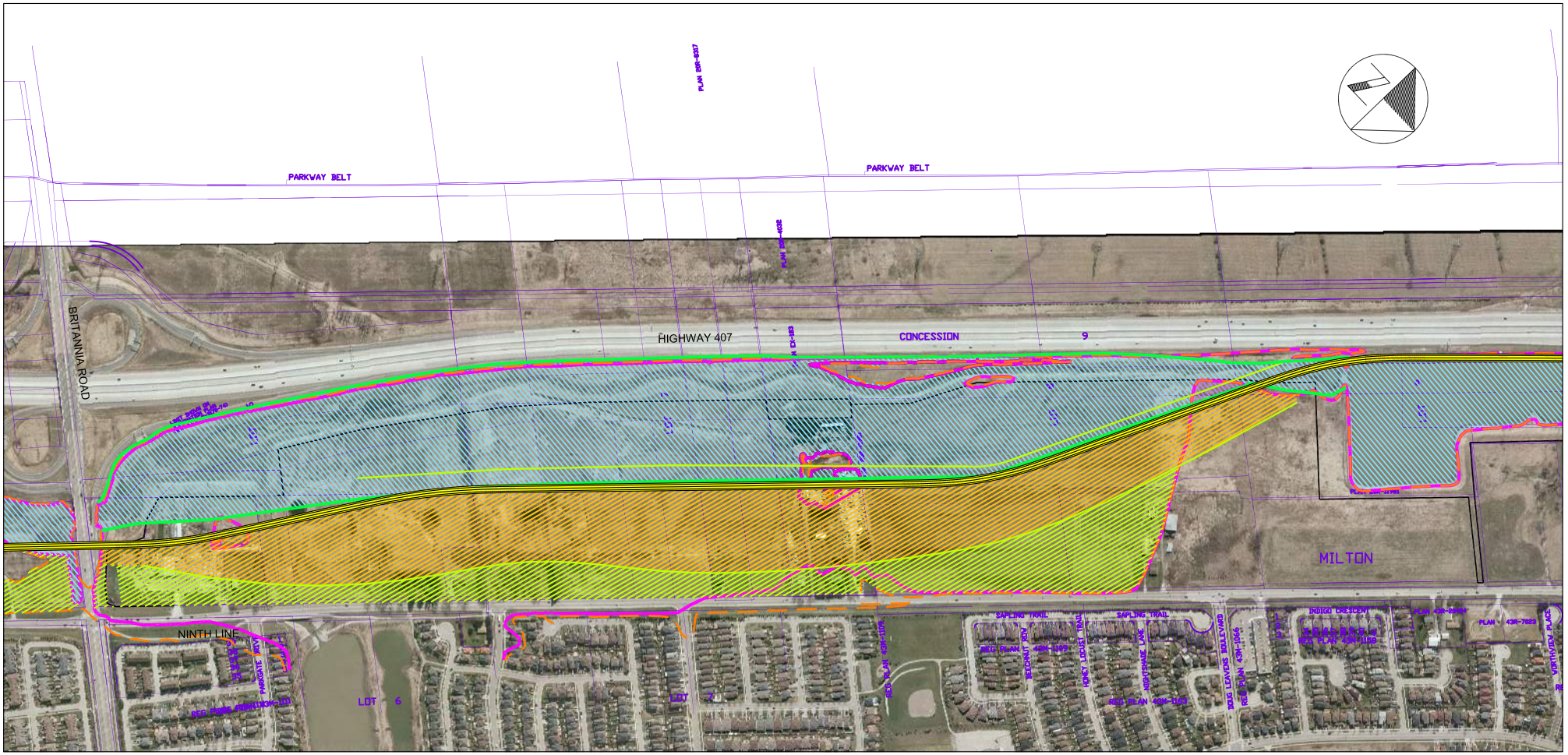
Scale 0 100 200 300

Figure No. 13



LEGEND

- EXISTING REGIONAL STORM FLOODLINE (2015)
- PROPOSED REGIONAL STORM FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT RAILWAY CROSSING
- PROPOSED REGIONAL STORM FLOODLINE WITH FLOOD PROTECTION LANFORM
- PROPOSED REGIONAL STORM FLOODLINE WITH WATERCOURSE REALIGNMENT
- EXISTING RIGHT OF WAY
- PROPOSED TRANSITWAY
- REGIONAL STORM FLOODPLAIN REMOVED - POTENTIAL DEVELOPABLE AREA (RESTRICTED)
- REGIONAL STORM FLOODPLAIN REMOVED - POTENTIAL DEVELOPABLE AREA (UNRESTRICTED)
- REGIONAL STORM FLOODPLAIN RETAINED
- REGIONAL STORM FLOODPLAIN MODIFIED

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

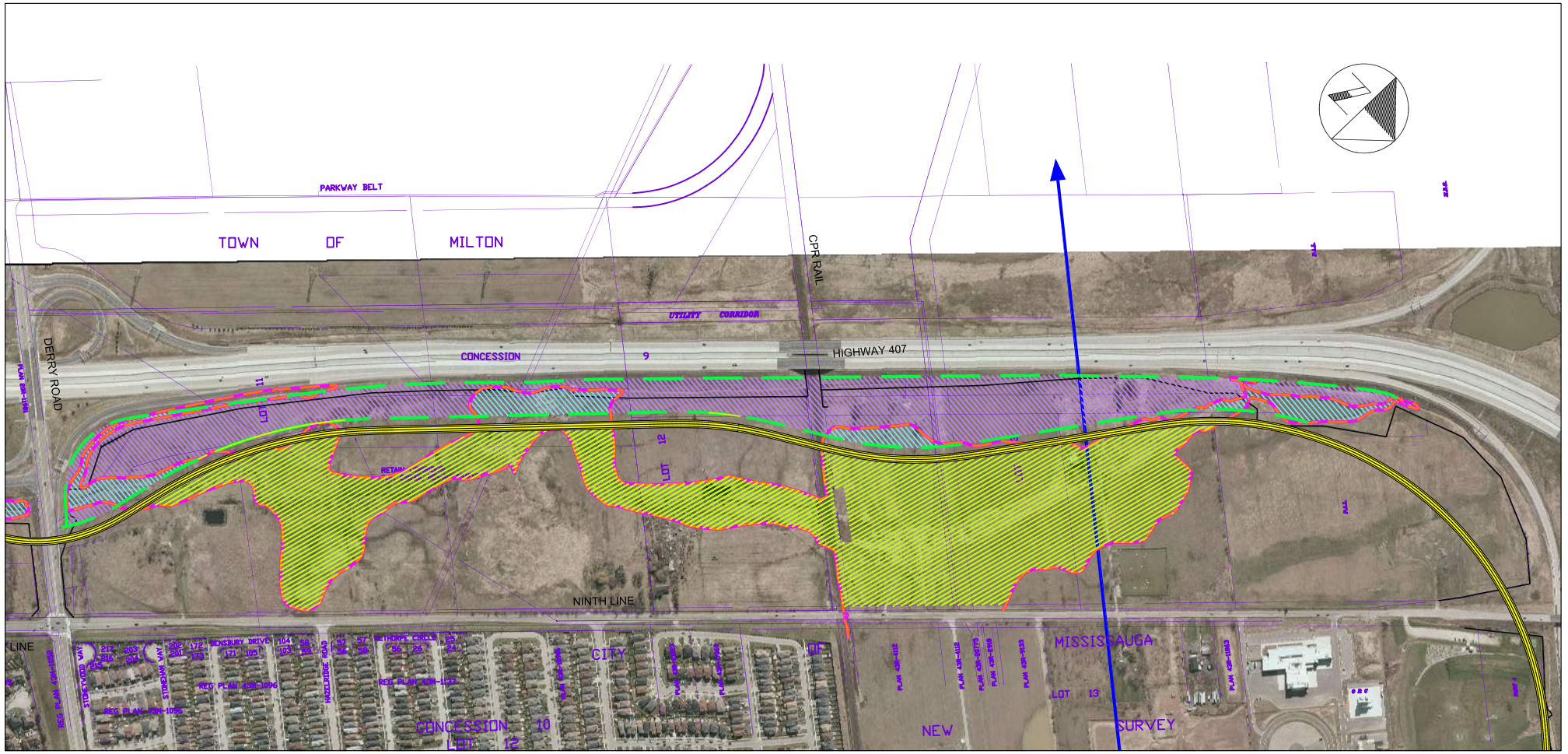
PROPOSED REGIONAL STORM FLOODLINE MAPPING

amec foster wheeler

Project No. TP114008

Scale 0 100 200 300

Figure No. 14



LEGEND

- EXISTING REGIONAL STORM FLOODLINE (2015)
- PROPOSED REGIONAL STORM FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT RAILWAY CROSSING
- PROPOSED REGIONAL STORM FLOODLINE WITH FLOOD PROTECTION LANFORM
- PROPOSED REGIONAL STORM FLOODLINE WITH WATERCOURSE REALIGNMENT
- EXISTING RIGHT OF WAY
- PROPOSED TRANSITWAY
- REGIONAL STORM FLOODPLAIN REMOVED - POTENTIAL DEVELOPABLE AREA (RESTRICTED)
- REGIONAL STORM FLOODPLAIN REMOVED - POTENTIAL DEVELOPABLE AREA (UNRESTRICTED)
- REGIONAL STORM FLOODPLAIN RETAINED
- REGIONAL STORM FLOODPLAIN MODIFIED

HIGHWAY 407 TRANSITWAY CORRIDOR
ASSESSMENT WITHIN THE NINTH LINE LANDS

PROPOSED REGIONAL STORM FLOODLINE MAPPING

amec foster wheeler

Project No. TP114008

Scale 0 100 200 300

Figure No. 15

3.2 Transitway Corridor Width Assessment

A 30.0 m right-of-way (ROW) was established as part of the MTO 1998 Transitway Corridor Protection Study within the Ninth Line lands. Subsequent to the 1998 Transitway Corridor Assessment Study, the MTO completed the Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road which concluded in 2011. The Transitway design standards developed as part of the 2011 study have been adopted by the MTO for the entire Transitway. Based on this and other Transitway studies undertaken since the 1998 Transitway Corridor Protection Study, the MTO is recommending protection for a 60.0 m Transitway ROW width along with a 14.0 m buffer to adjacent development.

In order to better assess integration of the Transitway into the land use planning for the Ninth Line Lands, with the objective of optimizing potential development within the Ninth Line lands, an assessment was undertaken to develop a vertical profile for the preferred Transitway horizontal alignment and refine the ROW requirements for the Transitway.

3.2.1 Design Criteria

Design criteria for the Transitway was based on the Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road, 407 Transitway Design Standards, July 2011 (Ministry of Transportation – Delcan/ IBI).

The following design criteria was applied to the development of the vertical alignment and assessment of required corridor widths:

Design Speed:

- Design speed 110 km/h

Cross-Section:

- Lanes widths 2x3.75 m
- Shoulder widths 2x2.25 m
- Rounding widths 2x1.00 m
- Granular side slopes 4:1
- Earth fore slope (cut) 4:1
- Earth fore slope (fill) 4:1 under 3.0m fill height and 2:1 above 3.0 m fill height
- Earth back slope (cut) 2:1
- Cut and fill ditch depths 0.50 m
- Flat-bottom ditch widths 1.00 m
- Tangent cross-falls 2.0 %
- Superelevation 6.0 % maximum

Vertical Profile:

- Minimum curve length 110.0 m

- Minimum crest-curve factor 90
- Minimum sag-curve factor 50
- Maximum/ Minimum grade (Station) 0.5 %
- Maximum grade (Transitway) 4.5 %
- Minimum grade (Transitway) 0.3 %
- Minimum vertical clearance (Structure) 5.0 m road structure and 7.0 m rail structure

The above criteria satisfies both bus and light rail transit design requirements.

3.2.2 Transitway Design Cross-Section

A rural design cross-section was developed in accordance with the above design criteria as depicted below in Figure 16 and applied to the assessment of grading requirements.

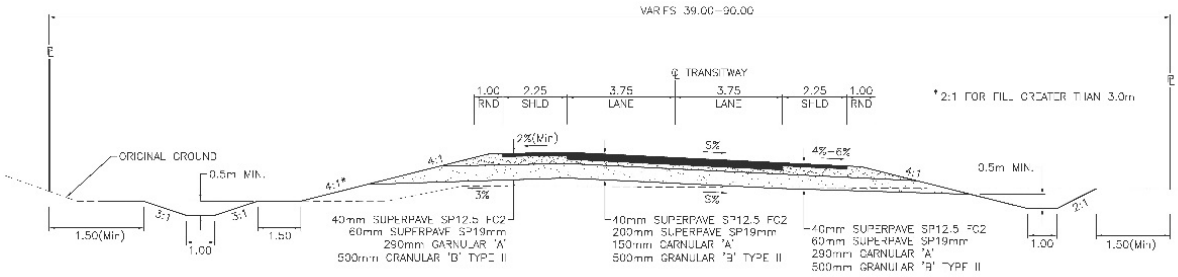


Figure 16 – Transitway Typical Design Cross-Section

3.2.3 Transitway Vertical Alignment

The vertical profile for the Transitway was developed in accordance with the above design criteria to meet the following design objectives:

- Maintain minimum freeboard of 0.3 m during Regional Storm event;
- Provide compatibility with existing underground utility infrastructure; and,
- Minimize the Transitway grading footprint and associated right-of-way width.

The Transitway crossing of Highway 407 and Lower Base Line Road at the southern limit of the study area are designed below grade to minimize impact to Highway 407 operations during construction. This is consistent with the MTO 1998 Transitway Corridor Protection Study, the MTO 2011 Highway 407 Transitway Planning and Preliminary Design, and direction received from MTO as part of the current study. All other Transitway crossings of roadways and railways are proposed to be above grade to minimize potential concerns with draining the low points along the Transitway resulting from implementation of required vertical clearances.

The steeper gradients occur at the approaches to the structure overpasses at the major crossing roads and CP Rail. The potential Transitway stations are located on tangent sections with a gradient of 0.5%.

The preferred Transitway vertical profile is depicted in figures 5 to 9.

3.2.4 Transitway Corridor Width

In keeping with efforts to maximize and support development within the Ninth Line lands, the required Transitway corridor widths were reviewed and tailored to accommodate the recommended Transitway alignments and design cross-section developed as part of this study.

The cross-section and vertical profile detailed in Sections 3.2.2 and 3.2.3 were applied to the assessment of the corridor width evaluation. As directed by MTO, retaining walls, other than standard installations off the proposed grade separation structures, were not applied to the evaluation of the required corridor width. The only exception to the above was south of Derry Road where proximity of the Transitway to Highway 407, the Enbridge property, and the watercourse is problematic and retaining/ bridge structures will likely have to be contemplated.

The proposed Transitway corridor widths vary from 39 m to 90 m and are not necessarily centred on the Transitway horizontal alignment to address localized Transitway grading requirements within the study limits. Transitions in corridor widths are generally developed over the lengths of the proposed horizontal spiral curves to maintain consistency within given segments of the Transitway.

A summary of the proposed corridor widths is provided in Table 3.1.

Table 3.1 – Summary of Transitway Corridor Widths

Stationing	Corridor Width Overall (m)	Corridor Width Lt Centreline (m)	Corridor Width Rt Centreline (m)
5+540 ~ 5+760	75	35	40
5+760 ~ 6+260	48-75	24-35	24-40
6+620 ~ 7+600	48	24	24
7+600 ~ 7+700	48-65	24-35	24-30
7+700 ~ 8+660	65	35	30
8+660 ~ 9+680	50-80	25-40	25-40
9+680 ~ 10+840	50	25	25
10+840 ~ 11+140	39-55	14-25	25-30
11+140 ~ 11+700	44	14	30
11+700 ~ 12+500	39-80	14-40	25-40
12+500 ~ 12+900	50	25	25
12+900 ~ 13+240	50-70	25-35	25-35
13+240 ~ 13+900	70	35	35
13+900 ~ 14+020	70-90	35-45	35-45
14+020 ~ 14+700	90	45	45

3.3 Transitway Station and Parking Facility Assessment

3.3.1 Transitway Parking Facility Demand

Preliminary parking demand for station facilities within the Ninth Line lands were estimated and documented in the MTO 1998 Transitway Corridor Protection Study. Daily parking demands were estimated for the demand year 2031 and are summarized in Table 3.2.

Table 3.2 – Summary of Parking Demand and Plan Areas (1998)

Station	**Forecasted Demand** (Spaces)	**Preliminary Parking Capacity Stated** (Spaces)	**Preliminary Parking Capacity Protected** (Spaces)	**Preliminary Plan Area Required** (Ha)	**Capacity Ratio Required** (Ha/Space)
Britannia	760	400	575	3.05	0.00530
Derry	380	800	925	4.07	0.00440
CPR Galt	290	500	915	5.10	0.00557
	* 1,430	** 1,700	*** 2,415	12.22	

The volumes stated above were obtained from the "Transitway Corridor Protection Study Highway 407/ Parkway Belt West Corridor from Highway 403 to Markham Road" Final Report dated December 1998 as specified below:
* Section 3.12 Transitway Station Parking Requirements, Page 3-43, Exhibit 3.12.1 Transitway Station Parking Requirements;
** Section 8.1.2 Details, Page 8-8 through 8-10
*** Based on plans provided in the report

It is noted that the MTO 1998 Transitway Corridor Protection Study report, as summarized in Table 3.2, includes discrepancies between the overall forecasted parking demands, stated parking capacity provided and the actual parking capacity accommodated in the preliminary layouts. The difference between the forecasted demand and the capacity of the preliminary layouts is 985 additional vehicles.

As per MTO correspondence dated March 30, 2015 (reference attached in Appendix C), Metrolinx confirmed that it has no plans to relocate the existing Lisgar station or add another station at the proposed CPR Galt station on Ninth Line. As such, it is our understanding that MTO will be removing plans for the CPR Galt station identified in the MTO 1998 Corridor Protection Study. As such, the parking capacity proposed at the CPR Galt station will have to be reassigned to the Britannia station and Derry station parking facilities accordingly.

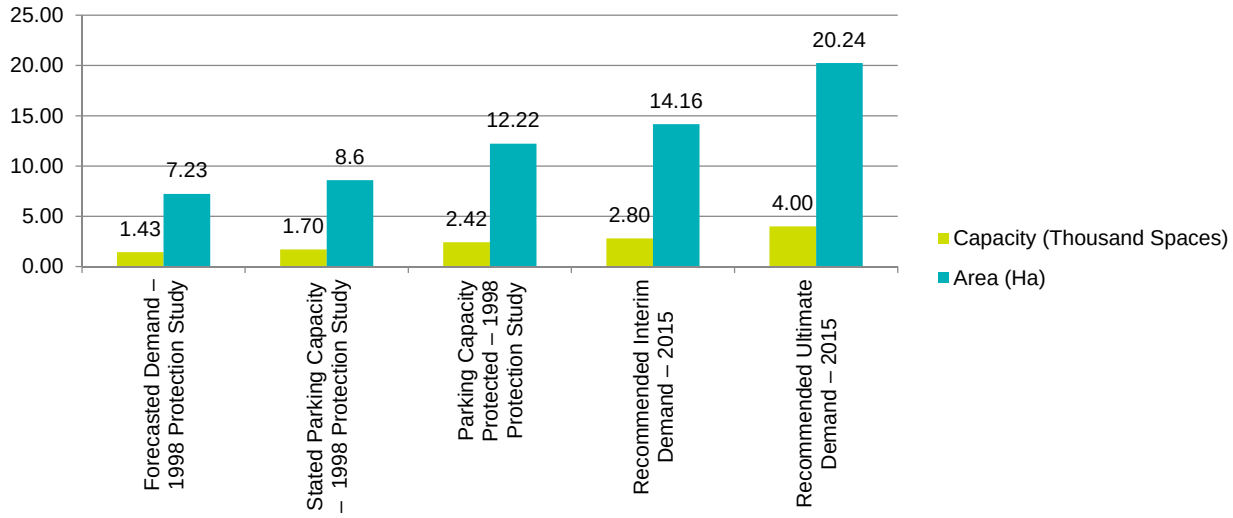
MTO also indicated that it is of the opinion that the overall forecasted parking demand determined in the 1998 Corridor Protection Study is outdated and highly underestimated. MTO indicated that a detailed analysis of parking demand will be undertaken as part of the future Highway 407 Transitway EA for this section of the Transitway. Given the anticipated timing of the EA and in order to facilitate completion of the current Corridor Protection Study, MTO recommends that a total of 2,800 at-grade spaces be protected for between the Britannia Road and Derry Road stations, with the potential to expand to a total of 4,000 at-grade spaces. MTO noted that land use designations will be reassessed following completion of the Transitway EA, should reductions in parking demand be recommended.

Table 3.3 summarizes the parking criteria in terms of parking facility capacity and at-grade plan area required to accommodate the 1998 Corridor Protection Study demands and currently proposed interim and ultimate capacities of 2,800 and 4,000. An average capacity ratio of 0.00506 ha/ space was established based on the preliminary layouts and corresponding capacity of the at-grade parking facilities developed as part of the MTO 1998 Corridor Protection Study and applied to the plan area estimate for the currently proposed interim and ultimate parking capacities.

Table 3.3 – Parking Facility Requirements

Parking Criteria	Capacity (Spaces)	Area (Ha)
Forecasted Demand – 1998 Protection Study	1,430	7.23
Stated Parking Capacity – 1998 Protection Study	1,700	8.60
Parking Capacity Protected – 1998 Protection Study	2,415	12.22
Recommended Interim Demand – 2015	2,800	14.16
Recommended Ultimate Demand – 2015	4,000	20.24

Chart 3.1 - Parking Facility Requirements



3.3.2 Transitway Parking Facility Alternatives

A number of Transitway parking facility alternatives were developed and assessed as documented in Appendix C. It should be noted that all layouts developed as part of the preliminary parking facility assessment are conceptual and are intended to establish plan area requirements for comparative purposes only. Station locations and configurations were refined subsequent to completion of the preliminary parking evaluation in Appendix C to coordinate with the land use concept being developed by the City as part of the Secondary Plan Study and are outlined in the following sections of the report. Further refinements may be considered, as required, to coordinate with development and finalization of the land use planning concept. Station locations and capacities are subject to final MTO approval as part of the MTO's future Transitway EA.

Given property restrictions at the preliminary location of the Britannia station (proximity to the floodplain to the west, Britannia Road to the north, the Ninth Line right-of-way to the east and the existing stormwater management system to the south) developed as part of the MTO 1998 Corridor Protection Study, expansion of the Britannia station would be limited to the extents of the private properties immediately north and south of the parking facility proposed in the MTO 1998 Corridor Protection Study.

The currently recommended parking demand of 4,000 spaces represents a 180% and 65% increase in the calculated demand and protected capacity identified in the MTO 1998 Corridor Protection Study respectively. The corresponding increases in plan area required to facilitate the increase in parking demand are 13.01 ha and 8.02 ha respectively, and significantly reduces the lands available for development in the Ninth Line lands. Furthermore, elimination of the CPR Galt Station will require reallocation of 915 parking spaces and represents a significant increase in the parking demand on the Britannia station and Derry station parking facilities. Given the limited ability to expand the Britannia station parking facility as recommended in the MTO 1998 Corridor Protection Study, the majority of the demand would need to be accommodated at the Derry Station parking facility. As such, a parking facility north of Britannia Road was assessed to improve functionality of the station and provide more evenly distributed parking capacity within the Ninth Line lands.

Given issues with grade differentials between the Transitway station proposed in the MTO 1998 Corridor Protection Study, and adjacent lands, including Ninth Line and Derry Road, a Derry Road station north of the 1998 recommendation was considered as part of this study.

3.3.3 Transitway Parking Structures

Given concerns expressed by the City regarding the magnitude in the increase in parking demand requested by MTO and compatibility with land use planning, as it relates to associated land requirements for at-grade facilities and promotion of alternative modes of transportation to access the Transitway itself, implementation of parking structures to accommodate the future expansion was evaluated.

The following design parameters were used in the assessment of the parking structures based on preliminary parking structure layout data for several GO parking structures provided by the City:

- Average length = 115 m
- Average width = 75 m
- Average plan area = 0.86 ha
- Average capacity = 250 vehicles/ level

The analysis assumed a minimum and maximum number of parking levels of two and six respectively per parking structure based on the parking structure data provided by the City. Each parking structure could accommodate a parking capacity ranging from 500 spaces to 1,500 spaces based on the implementation of two

or six parking levels respectively. The proposed expansion of 1,200 spaces from the interim to ultimate capacity could be accommodated by 5 parking levels either distributed between one or two structures.

It should be noted that the MTO does not endorse the use of parking structures at any future Transitway station, nor does MTO consider parking structures as part of their environmental assessment of Transitway parking facilities. Additional dialogue with the MTO will be required should the City want to pursue parking structures as a means of maximizing development within the Ninth Line lands.

3.3.4 Transit Parking Facility Recommendations

Given current uncertainties regarding parking capacity at the time of writing this memorandum, and subject to more detailed parking capacity analysis to be undertaken by MTO, it is recommended that an interim parking capacity of 2,800 spaces at-grade be accommodated within the Ninth Line land use concept.

Given issues with grade differentials between the Transitway station and adjacent lands, including Ninth Line and Derry Road, it is recommended that the Derry (North) location be carried forward as part of the land use concept assessment. The Derry (North) parking facility layout is depicted in Figures 8 to 9.

Both the Britannia (South) and Britannia (North) locations are recommended for consideration as part of the land use planning assessment being undertaken by the City. As part of the City's land use planning assessment, it was determined that the Britannia (South) location is preferred from a land use planning perspective; it was also concluded that the lands in the southwest quadrant of the Ninth Line and Britannia Road intersection, north of the 1998 station footprint, be retained for future use as mixed use development. As such, it is recommended that the Britannia Road (South) parking facility only include the additional lands south of the 1998 station footprint. Limiting expansion of the 1998 Britannia station/ parking facility to the south would preclude the installation of a parking structure at the Britannia station due to floodplain restrictions and all parking at the Britannia station would be at-grade. The Britannia (South) parking facility layout is depicted in Figures 6 to 7.

The following outlines the interim and ultimate requirements for the recommended parking facilities comprised of the Britannia (South) and Derry (North) station alternatives. Requirements for the station alternatives are summarized in Table 3.4 and Chart 3.2.

The interim parking capacity would be accommodated by Britannia (South) with 651 spaces and parking facility footprint of 3.24 ha and Derry (North) with 2,149 spaces and parking facility footprint of 10.92 ha. The overall parking facility footprint of 14.16 ha is required (Option 1 – Interim).

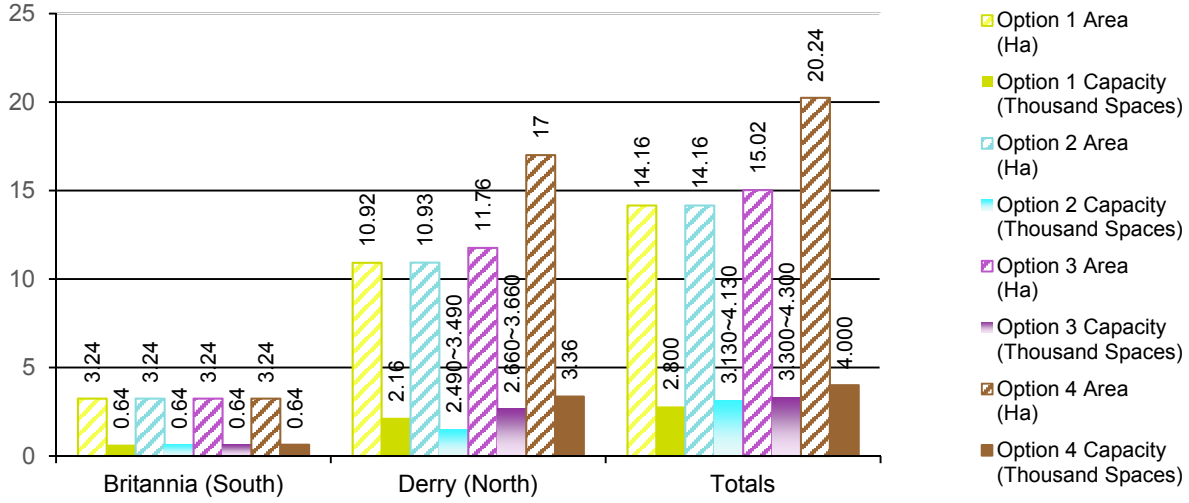
The land use planning concept should accommodate the following three potential options for expanding the interim parking capacity from 2,800 spaces to 4,000 spaces:

- An additional 1,200 spaces within one parking structure located within the limits of the Derry (North) interim at-grade parking footprint of 10.92 ha; thereby retaining the combined Britannia (South) and Derry (North) interim parking facility footprint of 14.16 ha (Option 2 – Ultimate);
- An additional 1,200 spaces within one parking structure located outside the limits of the Derry (North) interim parking facility footprint of 10.92 ha; thereby retaining the Britannia (South) parking facility footprint of 3.24 ha and increasing the Derry (North) parking facility footprint to 11.76 ha with a combined Britannia (South) and Derry (North) parking facility footprint of 15.02 ha (Option 3 – Ultimate); and,
- An additional 1,200 spaces at-grade at Derry (North) outside the limits of the Derry (North) interim parking facility footprint of 10.92 ha; thereby retaining the Britannia (South) parking facility footprint of 3.24 ha and increasing the Derry (North) parking facility footprint to 17.00 ha with a combined Britannia (South) and Derry (North) parking facility footprint of 20.24 ha (Option 4 Ultimate).

Table 3.4 – Parking Facility Alternatives

Station	Options							
	Option 1 Interim		Option 2 Ultimate		Option 3 Ultimate		Option 4 Ultimate	
	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)
Britannia (South)	3.24	640	3.24	640	3.24	640	3.24	640
Derry (North)	10.92	2,160	10.92	2,490 To 3,490	11.76	2,660 To 3,660	17.00	3,360
Totals	14.16	2,800	14.16	3,130 To 4,130	15.02	3,300 To 4,300	20.24	4,000

Chart 3.2 - Parking Facility requirements



Preliminary positioning of the parking facility will be refined as part of the land use planning assessment and ultimately finalized as part of the MTO Highway 407 Transitway environmental assessment.

The proposed expansion of 1,200 spaces from the interim to ultimate capacity could be accommodated by 5 parking levels. It should be noted that if the parking structure is ultimately provided and extended to six parking level each, the maximum parking capacity could be increased from 4,000 spaces to 4,130 and 4,300 for the parking structure alternatives within and outside the 2,800 at-grade parking footprint respectively.

It should be noted that the MTO does not endorse the use of parking structures at any future Transitway station, nor does MTO consider parking structures as part of their environmental assessment of Transitway parking facilities. Additional dialogue with the MTO will be required should the City of Mississauga want to pursue parking structures as a means of maximizing potential developable lands within the Ninth Line lands.

3.4 Summary of Recommendations

Given the foregoing, the recommended Transitway alignment meets the following objectives with the intent of assessing impacts on development potential within the Ninth Line lands:

- Develop a Transitway alignment immediately adjacent to the existing Highway 407 ROW to the extent possible;
- Develop a Transitway alignment to accommodate required stormwater conveyance; and,
- Develop a Transitway alignment to accommodate floodplain riparian storage.

Stormwater conveyance and riparian storage is maintained between the Transitway and Highway 407 to eliminate the requirement for equalization culverts and optimize potential developable lands within the Ninth Line lands.

The geometric design of the Transitway recommended in the 1998 Transitway Corridor Protection Study Design has been updated to satisfy the design criteria set forth in the 2011 Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road study undertaken by the Ministry of Transportation. The only exception is the horizontal alignment through the Highway 407 and Derry Road interchange, for which both the 1998 Transitway Corridor Protection Study (sub-standard based on 2011 design criteria) alignment and an alternative Transitway alignment based on the 2011 design criteria are recommended for further development and assessment given existing constraints in the vicinity of the interchange.

The total land area within the Ninth Line lands is 350.1 hectares. The potential developable lands accommodated by the 1998 Transitway Corridor Protection Study design is 97.2 hectares. The potential developable lands accommodated by the Transitway design recommended as part of the current study is 115.0 hectares. The recommended Transitway alternative results in a net gain of 17.8 hectares. Improvements to the potential developable area within the Ninth Line Lands are depicted in Figures 17 through 21.

Transitway stations are recommended in the southwest and northwest quadrant of the intersections of Ninth Line with Britannia Road and Derry Road respectively. The recommendations are based on the findings of this report in combination with land use planning input developed in parallel with the Highway 407 Transitway Corridor Assessment.

Parking facilities to accommodate MTO interim and ultimate parking capacities of 2,800 vehicles and 4,000 vehicles respectively, have been developed. Interim parking capacity will be accommodated entirely at-grade and at-grade and parking structure alternatives were developed for future consideration to expand the parking facilities to accommodate the ultimate capacities.

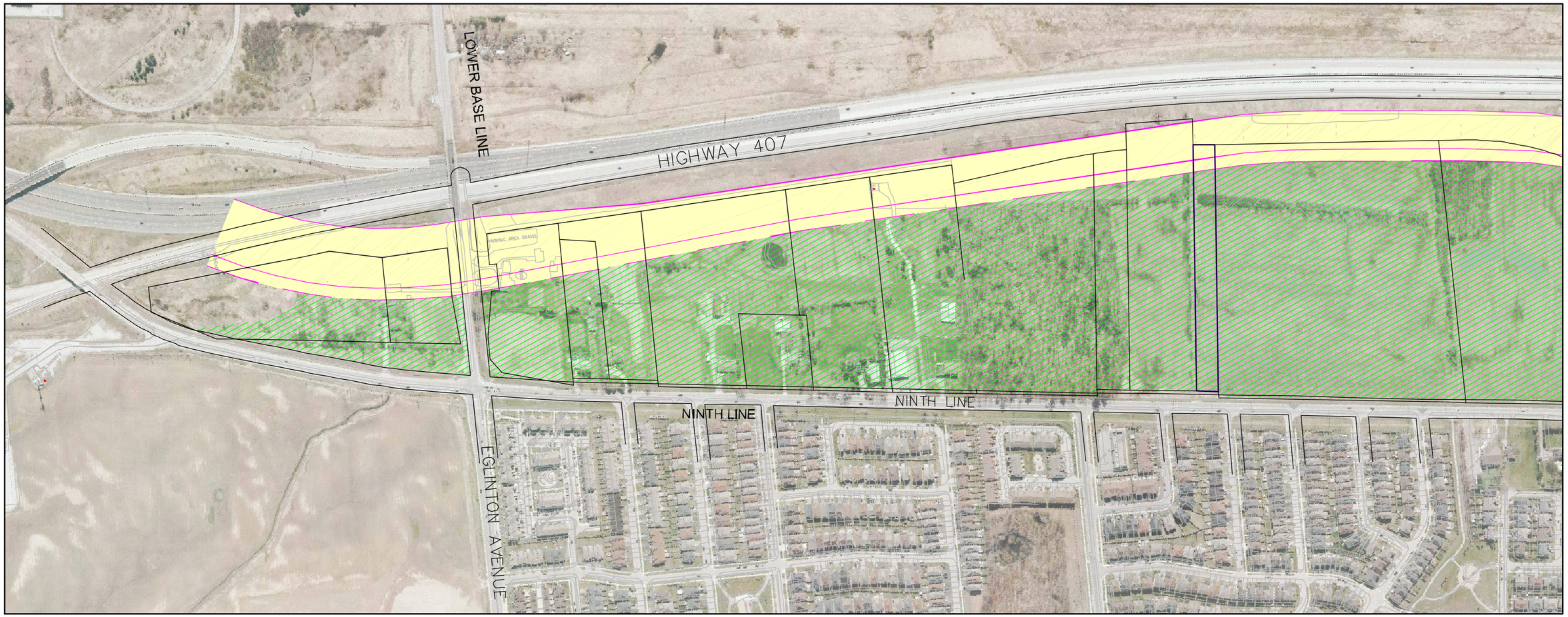
It should be noted that the MTO does not endorse the use of parking structures at any future Transitway station, nor does MTO consider parking structures as part of their environmental assessment of Transitway parking facilities. Additional dialogue with the MTO will be required should the City of Mississauga want to pursue parking structures as a means of maximizing potential developable lands within the Ninth Line lands.

Interim parking capacity will be accommodated by 640 spaces at the Britannia (South) station, corresponding to a parking facility footprint of 3.24 ha, and 2,160 spaces at the Derry station, corresponding to a parking facility footprint of 10.92 ha. The overall interim parking facility footprint is 14.16 ha.

The options to expand the capacity of the interim parking facilities to meet ultimate parking projections include:

- An additional 1,200 spaces within one parking structure located within the limits of the interim Derry station parking facility footprint with an overall Britannia (South) and Derry (North) parking facility footprint of 14.16 ha (Option 2 – Ultimate);

- An additional 1,200 spaces within one parking structure located outside the Derry (North) interim parking facility footprint with an overall Britannia (South) and Derry (North) parking facility footprint of 15.02 ha (Option 3 – Ultimate); and,
- An additional 1,200 at-grade spaces outside the Derry (North) interim parking facility footprint with and overall Britannia (South) and Derry (North) parking facility footprint of 20.24 ha (Option 4 Ultimate).



LEGEND

- Proposed Property
- Land Development Setback
- Existing Floodplain with Downstream Improvement
- Development Restriction Boundary
- Un-Developable Area
- Potential Developable Area
- Potential Developable Area (Restricted)
- Interim Parking Lot
- Ultimate Parking Lot Expension and Parking Structure

HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

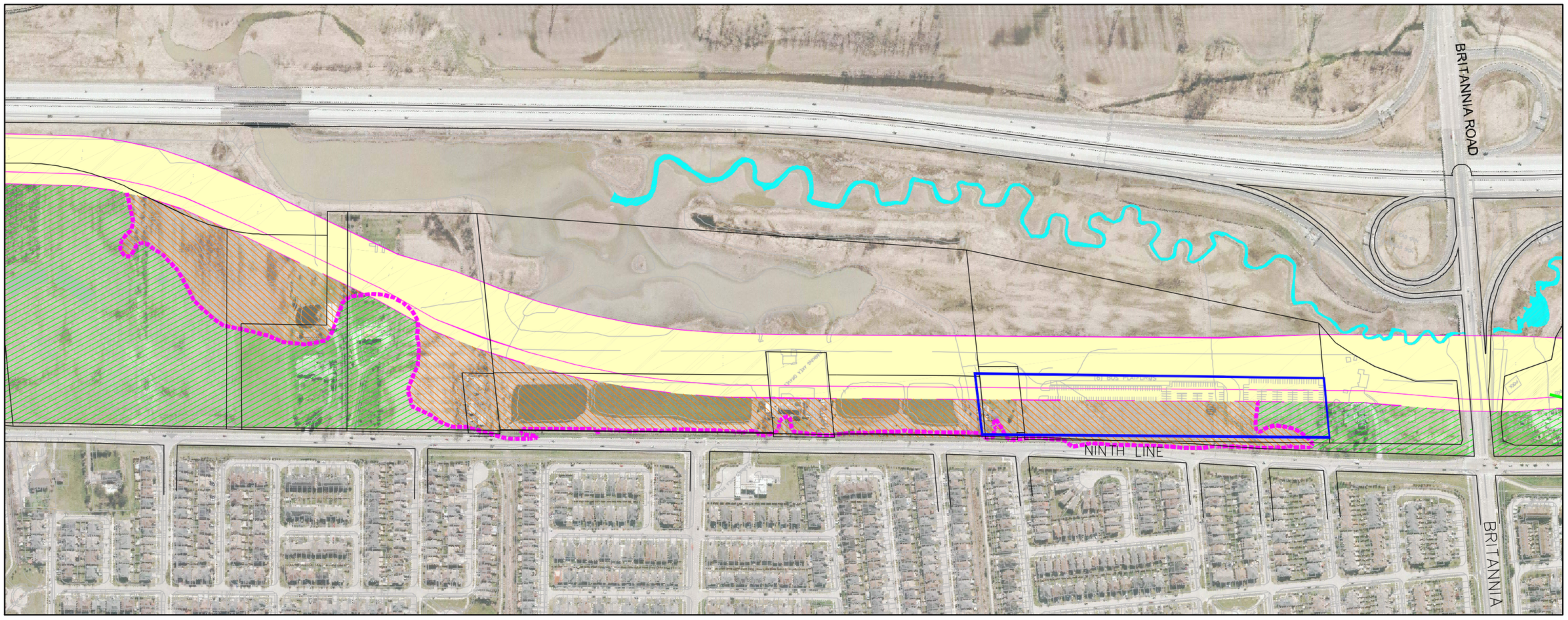
DEVELOPABLE LAND ASSESSMENT
2015 TRANSITWAY STUDY

amec foster wheeler

Project No. **TP114008**

Scale 0 50 100 150

Figure No. 17



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HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

DEVELOPABLE LAND ASSESSMENT
2015 TRANSITWAY STUDY

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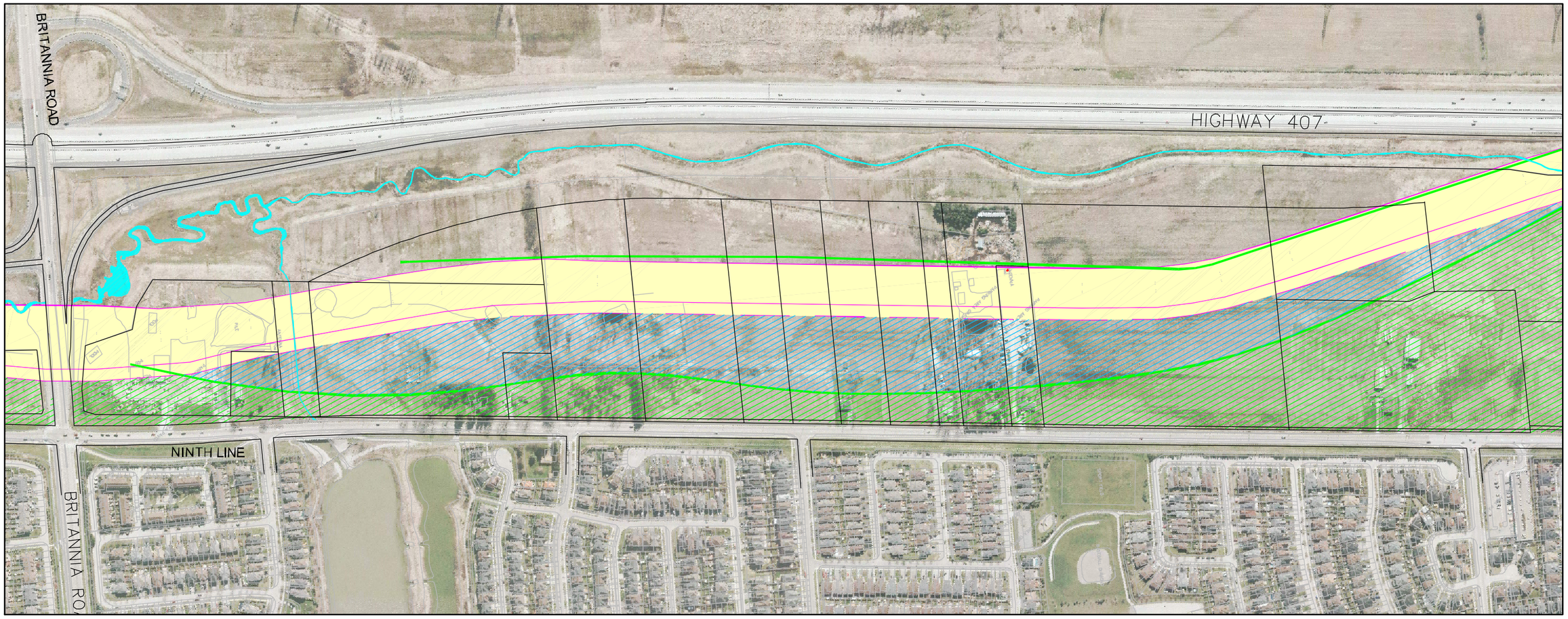
Scale 0 50 100 150

Figure No. 18



LEGEND

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HIGHWAY 407 TRANSITWAY CORRIDOR ASSESSMENT WITHIN THE NINTH LINE LANDS

DEVELOPABLE LAND ASSESSMENT
2015 TRANSITWAY STUDY

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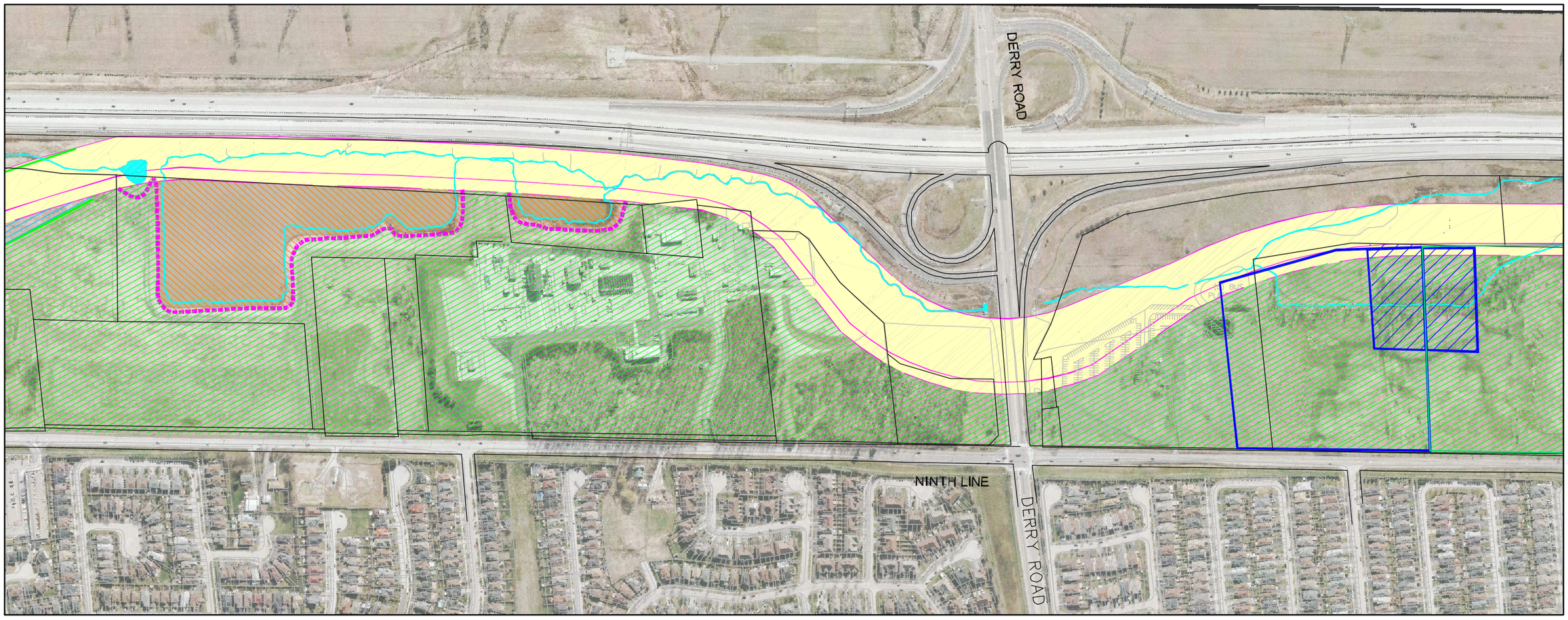
Figure No. 19



LEGEND

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HIGHWAY 407 TRANSITWAY CORRIDOR
ASSESSMENT WITHIN THE NINTH LINE LANDS

DEVELOPABLE LAND ASSESSMENT
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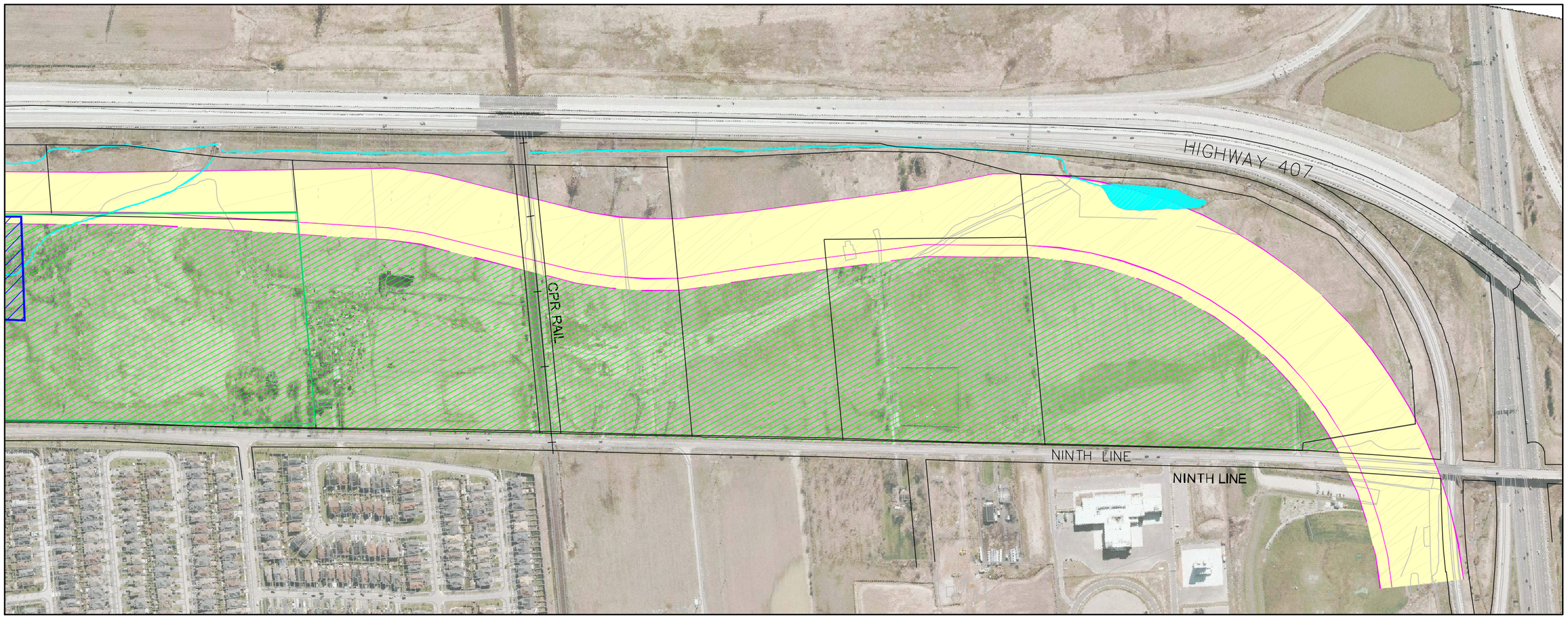
Scale 0 50 100 150

Figure No. 20



LEGEND

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HIGHWAY 407 TRANSITWAY CORRIDOR
ASSESSMENT WITHIN THE NINTH LINE LANDS

DEVELOPABLE LAND ASSESSMENT
2015 TRANSITWAY STUDY

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Scale 0 50 100 150

Figure No. 21

APPENDIX A

FUNCTIONAL ASSESSMENT OF
TRANSITWAY ALTERNATIVES THROUGH NINTH LINE LANDS

Functional Assessment of Transitway Alternatives through Ninth Line Lands

Prepared for:

The City of Mississauga

Prepared by:
Amec Foster Wheeler Environment & Infrastructure
3215 North Service Road
Burlington, ON L7N 3G2
(905) 335-2353

October 2015

Project No. TP114008

Functional Assessment of
Transitway Alternatives through Ninth Line Lands

Submitted to:

The City of Mississauga

Submitted by:

Amec Foster Wheeler Environment & Infrastructure
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October 2015

TP114008

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Amec Foster Wheeler Environment & Infrastructure is committed to achieving sustainability through balancing economic growth, social responsibility and environmental protection. Learn more at: http://amecfw.com/aboutus/sustainability.htm.

1.0 INTRODUCTION

The proposed Highway 407 Transitway extends through the Ninth Line Lands in the City of Mississauga, and is generally bounded by Highway 407 to the west, Ninth Line to the east, Highway 401 to the north and the Highway 407 and Ninth Line overpass to the south. In 2014, the City initiated the Ninth Line Lands Secondary Plan Study to establish a planning framework for the Ninth Line Lands and guide future growth and development. As part of that process, a Scoped Subwatershed Study has been initiated in order to assess the constraints and opportunities within the Ninth Line Lands related to the terrestrial and aquatic ecology, stream system, and surface water and groundwater resources (quantity/quality). During the course of the Secondary Plan Study and the Scoped Subwatershed Study, a major land use influence was identified related to the Ministry of Transportation (MTO) planning for a Transitway to be located through the Ninth Line Lands, in order to service GO and regional/ local commuter transit. MTO had earlier completed a preliminary Transitway corridor protection study in 1998, the limits of which extended from Highway 403 to Markham Road. The focus of that study was to establish the mainline Transitway alignment and assess station locations, parking facilities, access connections and associated facilities, with the objective of determining the general property requirements necessary to implement the Transitway. The 1998 Transitway corridor assessment recommended horizontal and vertical Transitway alignments and established a corresponding 30.0 m right-of-way (ROW). Approval to implement the ultimate Transitway will be pursued by the MTO through the Provincial Class Environmental Assessment Process for Provincial Transportation Facilities, the timing of which is yet to be confirmed.

Although the planning for the Transitway has not proceeded beyond that of a corridor protection study, it has been recognized that the planning of the Transitway and the future development within the Ninth Line Lands should be integrated. Improved clarity would be gained from advancing the planning for the Transitway as part of the planning for the Ninth Line Lands concurrently. Understanding the interface between the proposed Ninth Line Lands grading, stormwater management, roadway design and municipal servicing, and the functional design of the Transitway, is considered critical to advancing an improved understanding of land use planning within the Ninth Line Lands.

Due to the high level nature of the 1998 MTO Study, impacts to the floodplain (stormwater conveyance and riparian storage) within the Ninth Line lands was not specifically analyzed or assessed. As such, an assessment of Transitway alignment alternatives has been completed through the Ninth Line Lands to complement the 1998 MTO Study, and concurrently consider the overall stormwater management requirements within the Ninth Line Lands. This report has been prepared to summarize the findings and recommendations from that assessment.

Analyses of Transitway alignment alternatives as part of the current study has been limited to horizontal alignments only. Preliminary evaluation of vertical alignment requirements and corridor widths has been undertaken to-date, however further assessment of vertical profiles will be finalized as part of the next phase of the study and incorporate recommendations from this assessment. Based on Transitway studies undertaken since the 1998 Transitway corridor protection study, MTO is recommending a 60.0 m Transitway ROW width be considered along

with a 14.0 m buffer to adjacent development. In keeping with efforts to maximize and support development within the Ninth Line lands, the required Transitway corridor widths will be reviewed and tailored to accommodate the recommended Transitway alignments developed as part of this study.

2.0 BACKGROUND INFORMATION

The following background information has been used in this assessment:

- Transitway Corridor Protection Study, Highway 407/ Parkway Belt West Corridor from Highway 403 to Markham Road, December 1998 (Ministry of Transportation Ontario – McCormick Rankin);
- Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road, 407 Transitway Design Standards, July 2011 (Ministry of Transportation – Delcan/ IBI);
- Ninth Line Lands Scoped Subwatershed Study Phase 1: Background Report Study Area Characterization (Amec Foster Wheeler et. al., January 2015 DRAFT);
- North 16 District 'Scoped' Subwatershed Study and Ninth Line District Floodplain Mapping (Philips Engineering Ltd., December 2004);
- 2013 Contour mapping for Ninth Line Lands (City of Mississauga);
- Watercourse mapping (Conservation Halton);
- Ninth Line District Floodline Mapping (Philips Engineering Ltd., December 2004); and,
- HEC-RAS hydraulic model for 2004 Ninth Line District Floodline Mapping.

3.0 BASELINE ASSESSMENT

3.1 Hydraulic Model and Floodline Mapping Updates

The currently approved HEC-RAS hydraulic model through the Ninth Line Lands was originally developed in support of the 1996 Highway 407 Floodline Assessment, and subsequently updated as part of the 2004 'Scoped' Subwatershed Study and associated Ninth Line District Floodline Mapping. The updates included refinements to the hydraulic structures at the major arterial roadway crossings (i.e. Britannia Road and Derry Road) and at the railway crossing of the tributary based upon Total Station Survey information, as well as incorporating flows from the updated hydrologic analyses for the 2004 study.

The currently approved HEC-RAS hydraulic model has been modified as part of the Scoped Subwatershed Study to update the floodline mapping through the Ninth Line Lands using the best available information. The cross-section geometry has been obtained from the 2013 contour data provided by the City of Mississauga, and the flow data have been updated based upon the refined hydrologic modelling completed for the January 2015 Draft Scoped Subwatershed Study. In addition, the hydraulic structures and profile of the railway downstream of Highway 407 have been updated based upon the Total Station Survey completed as part of the Scoped Subwatershed Study. The cross-section location plan and resulting Regional Storm (Regulatory) Floodplain are presented in Drawing 1.

3.2 Baseline Assessment

The results from the updated HEC-RAS hydraulic model have been used to characterize the hydraulics through the study area with respect to freeboard and riparian storage for the purpose of evaluating the potential impacts of the various Transitway alternatives. This baseline characterization has specifically documented the freeboard and riparian storage within the Ninth Line Lands. Through this process, the following segments of the Ninth Line Lands have been considered to exhibit similar hydraulic characteristics:

Segment 1: Highway 403/407 Interchange to Highway 407 Crossing of the Sixteen Mile Creek East Tributary;
Segment 2: Highway 407 Crossing to Britannia Road;
Segment 3: Britannia Road to Outlet of Online Pond South of Derry Road;
Segment 4: Outlet of Online Pond South of Derry Road to Derry Road;
Segment 5: Upstream of Derry Road.

The results of the hydraulic analyses are presented in Table 3.1, and discussed in detail in the following sections.

Table 3.1:
Freeboard and Riparian Storage Assessment for Existing Conditions Through Ninth Line Area

Segment No. and Limits	HEC-RAS Section ID	Location	Edge of Travelled Way (m)	Water Surface Elevation		Freeboard		Regional Riparian Storage
				100-Year	Regional	100-Year	Regional	
				(m)	(m)	(m)	(m)	(m^3)
Segment 5 Upstream of Derry Road	259		214.04	207.70	207.92	6.3	6.1	67,190
	258		210.73	207.46	207.62	3.3	3.1	
	257		209.68	207.35	207.42	2.3	2.3	
	256		214.69	207.35	207.41	7.3	7.3	
	255.5		215.79	207.35	207.41	8.4	8.4	
	255	U/S Hudson Railway	216.27	207.34	207.41	8.9	8.9	
	254	D/S Hudson Railway	216.22	203.92	204.06	12.3	12.2	
	253		216.08	203.03	203.19	13.1	12.9	
	252.5		215.36	202.40	202.51	13.0	12.9	
	252		207.50	201.72	202.17	5.8	5.3	
	251		204.01	201.31	201.58	2.7	2.4	
	250		201.62	200.42	200.78	1.2	0.8	
	249		202.00	199.44	199.86	2.6	2.1	
	248.5		203.38	198.67	198.94	4.7	4.4	
	248	U/S of Derry Road W	204.98	197.76	198.54	7.2	6.4	
Segment 4 Outlet of Online Pond to Derry Road	247	D/S of Derry Road W	204.98	197.74	198.47	7.2	6.5	116,890
	246		203.86	197.65	198.35	6.2	5.5	
	245.5		200.49	197.25	197.95	3.2	2.5	
	245		198.49	196.79	197.45	1.7	1.0	
	244		197.79	195.49	196.00	2.3	1.8	
	243		197.56	195.38	195.92	2.2	1.6	
	242		197.23	195.37	195.90	1.9	1.3	
	241		197.26	195.11	195.53	2.1	1.7	
	240		197.12	195.05	195.48	2.1	1.6	
	239		197.08	195.04	195.47	2.0	1.6	
	238		196.86	195.04	195.47	1.8	1.4	

Table 3.1:
Freeboard and Riparian Storage Assessment for Existing Conditions Through Ninth Line Area

Segment No. and Limits	HEC-RAS Section ID	Location	Edge of Travelled Way (m)	Water Surface Elevation		Freeboard		Regional Riparian Storage
				100-Year	Regional	100-Year	Regional	
				(m)	(m)	(m)	(m)	(m^3)
	237		196.16	195.04	195.46	1.1	0.7	
	236	Outlet of Online Pond	195.85	194.85	195.16	1.0	0.7	
Segment 3 Britannia Road to Outlet of Online Pond	235	D/S of Online Pond	195.43	194.00	194.65	1.4	0.8	300,550
	234		194.19	192.89	193.04	1.3	1.2	
	233		192.79	191.26	191.60	1.5	1.2	
	232		192.09	191.04	191.38	1.1	0.7	
	231		191.85	190.91	191.30	0.9	0.5	
	230		191.78	190.67	191.20	1.1	0.6	
	229		192.29	190.13	191.16	2.2	1.1	
	228		192.34	189.93	191.15	2.4	1.2	
	227		192.00	189.71	191.15	2.3	0.8	
	226		191.82	189.68	191.14	2.1	0.7	
	225	Osprey Marsh	191.48	189.67	191.14	1.8	0.3	
	224		191.17	189.65	191.13	1.5	0.0	
	223	U/S of Britannia Road W	194.17	189.54	190.96	4.6	3.2	
Segment 2 Highway 407 Crossing to Britannia Road	222	D/S of Britannia Road W	196.48	189.49	190.04	7.0	6.4	744,000
	221		195.49	189.48	190.02	6.0	5.5	
	220		193.90	189.47	189.96	4.4	3.9	
	219		191.86	189.46	189.94	2.4	1.9	
	218		191.58	189.46	189.92	2.1	1.7	
	217		191.42	189.46	189.91	2.0	1.5	
	216		191.39	189.45	189.90	1.9	1.5	
	215		190.16	189.45	189.88	0.7	0.3	
	214		189.75	189.45	189.87	0.3	-0.1	
	213		189.80	189.45	189.86	0.4	-0.1	

Table 3.1:
Freeboard and Riparian Storage Assessment for Existing Conditions Through Ninth Line Area

Segment No. and Limits	HEC-RAS Section ID	Location	Edge of Travelled Way (m)	Water Surface Elevation		Freeboard		Regional Riparian Storage
				100-Year	Regional	100-Year	Regional	
				(m)	(m)	(m)	(m)	(m^3)
	212		189.89	189.45	189.86	0.4	0.0	
	211		190.34	189.45	189.85	0.9	0.5	
	210		191.22	189.44	189.82	1.8	1.4	
	209		191.86	189.44	189.79	2.4	2.1	
	208		192.20	189.43	189.76	2.8	2.4	
	207.7		192.26	189.43	189.73	2.8	2.5	
	207.3		192.29	189.42	189.70	2.9	2.6	
	207	U/S of Highway 407	192.29	189.42	189.67	2.9	2.6	

3.2.1 Segment 1 – Highway 407/403 Interchange to Highway 407 Crossing

This segment represents the southern limit of the study area. The watercourses in this area consist of headwater tributaries, and do not have a Regulatory Floodplain associated with them. Some urban development has occurred within this area, and the existing interchange of Highways 403 and 407 represents the most significant existing infrastructure in the area. Any proposed works would be required to address local capacity constraints within receiving infrastructure and systems, as well as addressing requirements for stormwater quality and quantity control.

3.2.2 Segment 2 – Highway 407 Crossing to Britannia Road

This segment of the study area encompasses works which were implemented in support of Highway 407. This area also includes isolated development west of Ninth Line, and existing stormwater management facilities which service existing development east of Ninth Line. The watercourse through this area is a constructed natural channel, which provides aquatic habitat. A constructed wetland is also located within the floodplain adjacent to the watercourse. The Regional Storm Floodplain in this area extends east of Ninth Line, and encompasses existing residential lands.

The 100 year freeboard along Highway 407 throughout this segment exceeds the 0.3 m minimum required by MTO. Limited freeboard during the Regional Storm event is currently provided along Highway 407 through the majority of this reach. In some areas, the Regional Storm Floodplain encompasses the east section of Highway 407, representing a flooding (i.e. negative freeboard) condition. The watercourse and wetland provide substantial riparian storage, which was implemented in support of Highway 407 to offset the loss of riparian storage within upstream reaches resulting from the construction of the highway.

3.2.3 Segment 3 – Britannia Road to Outlet of Online Pond South of Derry

This segment of the study area encompasses works which were implemented in support of Highway 407, as well as agricultural lands outside of the Highway 407 right-of-way. The watercourse through this area is a constructed natural channel providing aquatic habitat, which was implemented as part of Highway 407 and is localized toward the highway. The Regional Storm Floodplain in this area encompasses the existing agricultural lands east of the watercourse, as well as existing residential lands east of Ninth Line.

The 100 year freeboard along Highway 407 throughout this segment is generally above 1.0 m, with a minimum 100 year freeboard of 0.9 m. As such, the 100 year freeboard along Highway 407 exceeds the 0.3 m minimum required by MTO. Limited freeboard during the Regional Storm event is currently provided along Highway 407 through the majority of this reach, although the freeboard exceeds 0.3 m throughout this area. The floodplain, watercourse and wetland provide substantial riparian storage, which was implemented in support of Highway 407 to offset the loss of riparian storage within upstream reaches resulting from the construction of the highway.

3.2.4 Segment 4 – Outlet of Online Pond South of Derry to Derry Road

This segment of the study area encompasses works which were implemented in support of Highway 407, as well as Union Gas lands and associated underground utilities, and a woodlot. The online pond was constructed as part of the Highway 407, and the watercourse through this area is a constructed natural channel which provides aquatic habitat. The Union Gas site and a woodlot are located toward Ninth Line at the east limit of this segment. Toward the north limit of this area, the watercourse is constrained between the Highway 407 interchange at Derry Road and the Union Gas site. Utilities information indicates that west-east oriented pipelines traverse this area, between the online ponds.

The freeboard during both the 100 year and the Regional Storm events exceeds 1.0 m throughout this segment of the study area, and the floodplain is contained within the limits of the online pond and the constructed watercourse, and does not encroach onto properties outside of the Highway 407 right-of-way. The riparian storage within this area is primarily attributed to the online pond, with limited riparian storage within the watercourse due to the confined nature of the floodplain.

3.2.5 Segment 5 – Upstream of Derry Road

Upstream of Derry Road, the watercourse consists of an agricultural drainage feature which traverses the area approximately mid-way between Highway 407 and Ninth Line. The lands within this area include the Hydro Corridor and the CNR railway, as well as agricultural lands. A wetland feature is on-line to the watercourse, however this feature has not been identified as a Provincially Significant Wetland, and a stormwater management facility, constructed as part of the Highway 401/407 interchange, lies toward the upstream limit of the study area.

The Regional Storm floodplain along this reach of watercourse is localized toward the watercourse and generally does not encompass lands east of Ninth Line. A spill zone has been identified upstream of the railway, as a result of the limited capacity of the railway culvert. The 100 year and Regional Storm event freeboard along this watercourse reach exceeds 1.0 m, and this reach of watercourse provides limited riparian storage.

4.0 ALTERNATIVE ASSESSMENT

The 1998 Transitway Corridor Protection Study provided a preliminary alignment for the Transitway through the Ninth Line Lands. Due to the high level nature of the Corridor Protection Study, impacts to stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains were not analyzed and assessed as part of that study. An assessment of the Transitway alignment established in the 1998 Transitway Corridor Protection Study, plus other alignments and configurations, has been completed in order to develop a preliminary Transitway alignments that are compatible with the floodplain management requirements within the corridor and optimizes potential development opportunities within the Ninth Line Lands. The following section summarizes the alternatives evaluated, as well as the findings of the respective assessment.

4.1 Assessment Criteria

MTO staff has been pre-consulted in order to verify the assessment criteria for the Transitway, primarily related to hydraulic criteria (Correspondence is provided in Appendix A consultation).

The alternative alignments for the Transitway have been evaluated based upon the following criteria, in order to determine preferred alignments:

i) Preserve conveyance capacity and available freeboard along Highway 407 during Regional Storm event (no reduction where freeboard is less than 0.3 m, and 0.3 m minimum elsewhere);

ii) Maintain available riparian storage (no reduction preferred);

iii) Minimize number of watercourse crossings (minimum number of crossings preferred);

iv) Specific/unique drainage requirements and opportunities to integrate stormwater management with requirements and systems for future development;

v) Meet Transitway design standards;

vi) Minimize number of roadway grade separations; and,

vii) Provide compatibility with adjacent land use planning.

4.2 Development of Alternatives

The 1998 Transitway Corridor Protection Study provided a preliminary alignment for the Transitway which extends from Highway 403 to Markham Road including the Ninth Line lands. The focus of that study was to establish the mainline Transitway alignment and assess station locations, parking facilities, access connections and associated facilities, with the objective of determining the property requirements necessary to implement the Transitway. The objective of the current study is to review and refine the Transitway alignment established in the 1998 Study, and maximize potential development within the Ninth Line Lands. Alternative alignments initially developed as part of the current study focused on maintaining the Transitway alignment immediately east of the Highway 407 right-of-way (ROW) with the initial thought that the resulting alignment would minimize the Transitway corridor footprint and optimize development within the Ninth Line lands.

Due to the high level nature of the 1998 Corridor Protection Study, impacts to stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains were not analyzed and assessed. Upon completion of preliminary stormwater analysis as part of the current study, in particular assessment of watercourse conveyance and riparian storage, it became evident that alternative alignments needed to be considered to adequately address the stormwater criteria with emphasis also placed on optimizing potential development within the Ninth Line lands.

Given the foregoing, alternative Transitway alignments have been developed, where applicable, to meet the following objectives with the intent of assessing impacts on development potential within the Ninth Line lands:

- Develop a Transitway alignment immediately adjacent to the existing Highway 407 ROW to the extent possible;
- Develop a Transitway alignment to accommodate required stormwater conveyance; and ,
- Develop a Transitway alignment to accommodate floodplain riparian storage.

In light of the potential influence of the stormwater conveyance and riparian storage requirements on the Transitway alignment, alternative alignments were developed in conjunction with the following hydraulic segments used to analyze the stormwater management criteria as discussed in more detail under Section 3.2 of this report:

- Segment 1: Highway 403/407 Interchange to Highway 407 Crossing;
- Segment 2: Highway 407 Crossing to Britannia Road;
- Segment 3: Britannia Road to Outlet of Online Pond South of Derry Road;
- Segment 4: Outlet of Online Pond South of Derry Road to Derry Road; and,
- Segment 5: Upstream of Derry Road.

As a general statement, segments of the mainline Transitway horizontal alignment developed as part of the 1998 Transportation Corridor Study utilize radii of 130 m to 250 m which are less than the 90 km/h minimum design radius of 340 m established as part of the 1998 Transportation Corridor Study. All alternative alignments considered as part of the current study utilize a 110 km/h design speed and minimum radius of 525 m in accordance with the Transitway design standards outlined in the 2011 Highway 407 Transitway Planning and Preliminary Design Study.

Other factors influencing the development of the alternative Transitway alignments have included station locations and local access, presence of existing utilities, and existing natural features.

Based on the foregoing, the following alternative Transitway alignments have been developed for further assessment and evaluation:

S1 – Based on 1998 Transitway Corridor Protection Study alignment

S2 – Based on 1998 Transitway Corridor Protection Study alignment;
S2A – Based on maintaining stormwater conveyance and riparian storage and upgrading the 1998 Transitway Corridor Protection Study alignment to meet the 2011 geometric design standards;
S2B – Based on maintaining the Transitway adjacent to the existing Highway 407 ROW;

S3 – Based on 1998 Transitway Corridor Protection Study alignment;
S3A – Based on maintaining stormwater conveyance; and,
S3B – Based on maintaining riparian storage.

S4 – Based on 1998 Transitway Corridor Protection Study alignment; and,
S4A – Based on modifying the 1998 Transitway Corridor Protection Study alignment to meet the 2011 geometric design standards;

S5 – Based on 1998 Transitway Corridor Protection Study alignment;
S5A – Based on maintaining stormwater conveyance;
S5B – Based on maintaining riparian storage; and,
S5C – Based on modifying the 1998 Transitway Corridor Protection Study alignment to meet the 2011 geometric design standards.

The analysis of Transitway alignment alternatives has been limited to horizontal alignments only. The preliminary evaluation of vertical alignment requirements and corridor widths has been undertaken, however will be completed in greater detail as part of the next phase of the current study.

4.3 Assessment of Transitway Alignment Alternatives

As noted, the analysis of Transitway alignment alternatives has been limited to horizontal alignments only. Further evaluation of vertical alignments and corridor widths will be completed as part of the next phase of the current study.

The alternative assessment for the Transitway has been completed for the segments previously discussed, in order to evaluate each alternative in the context of the unique characteristics and constraints associated with each segment of the study area. The following summarizes the alternatives considered and the findings of this assessment.

4.3.1 Transitway Segment 1

Two (2) alternative alignments have been advanced for this segment of the Transitway, as depicted on Figure 1. Alternative 1 corresponds with the alignment advanced in the 1998 Transitway Corridor Protection Study and Alternative 1A upgrades the minimum horizontal radius to 525 m to meet the Transitway design standards outlined in the 2011 Highway 407 Transitway Planning and Preliminary Design Study.

Both Transitway alternatives are proposed to traverse the Highway 407 interchange as an underpass, hence a pumping station is anticipated to be required under either alternative in order to accommodate storm drainage.

4.3.2 Transitway Segment 2

Three (3) alternative alignments have been advanced for this segment of the Transitway, as depicted on Figure 2. Alignment Alternative 2 corresponds to the alignment advanced in the 1998 Transitway Corridor Protection Study, whereby the Transitway would not cross the existing watercourse and constructed wetland. Alignment Alternative 2 utilizes four (4) horizontal curves

with radii ranging from 130 m to 340 m. Alternative 2A generally coincides with the alignment advanced in the 1998 Transitway Corridor Protection Study, however has been modified to reduce the number of successive curves and upgrade the radii to meet the 110 km/h minimum radius of 525 m. Alignment Alternative 2B maintains the Transitway adjacent to the Highway 407 right-of-way.

Alignment Alternatives 2 and 2A require a single grade separation at Britannia Road. Alignment Alterative 2B would traverse the watercourse and pass through the Britannia Road interchange and would require five (5) grade separations with the watercourse, Britannia Road and the associated Highway 407 interchange ramps.

Detailed hydraulic analyses have been completed for Alignment Alternatives 2 and 2A, in order to assess the Transitway impacts on freeboard along Highway 407 and riparian storage within this area. A comparison of water surface elevations for each alignment alternative with respect to the existing condition is provided in Table 4.1. In addition, the results of the freeboard assessment are summarized in Table 4.2, and the results of the riparian storage assessment are presented in Table 4.3.

Table 4.1:
Comparison of Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 2

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
Existing (m)								
222	D/S of Britannia Road W	187.52	187.85	188.23	188.72	189.38	189.49	190.04
221		187.47	187.75	188.15	188.68	189.36	189.48	190.02
220		187.44	187.69	188.11	188.66	189.35	189.47	189.96
219		187.41	187.65	188.09	188.65	189.35	189.46	189.94
218		187.40	187.62	188.07	188.65	189.35	189.46	189.92
217		187.40	187.62	188.07	188.65	189.35	189.46	189.91
216		187.39	187.61	188.06	188.64	189.34	189.45	189.90
215		187.39	187.60	188.06	188.64	189.34	189.45	189.88
214		187.39	187.60	188.05	188.64	189.34	189.45	189.87
213		187.39	187.60	188.05	188.63	189.34	189.45	189.86
212		187.39	187.59	188.05	188.63	189.34	189.45	189.86
211		187.39	187.59	188.05	188.63	189.34	189.45	189.85
210		187.39	187.59	188.04	188.63	189.33	189.44	189.82
209		187.38	187.58	188.03	188.62	189.33	189.44	189.79
208		187.38	187.57	188.02	188.61	189.33	189.43	189.76
207.7		187.38	187.57	188.01	188.61	189.32	189.43	189.73
207.3		187.38	187.56	188.00	188.60	189.32	189.42	189.70
207	U/S of Highway 407	187.38	187.56	188.01	188.60	189.32	189.42	189.67
Proposed (m)								
222	D/S of Britannia Road W	187.53	187.85	188.23	188.72	189.38	189.50	190.06
221		187.47	187.75	188.16	188.69	189.36	189.48	190.02
220		187.44	187.69	188.11	188.67	189.36	189.47	189.97
219		187.41	187.65	188.09	188.65	189.35	189.46	189.95
218		187.40	187.63	188.08	188.65	189.35	189.46	189.93
217		187.40	187.62	188.07	188.65	189.35	189.46	189.93
216		187.39	187.61	188.07	188.64	189.35	189.46	189.92
215		187.39	187.60	188.06	188.64	189.34	189.45	189.90
214		187.39	187.60	188.06	188.64	189.34	189.45	189.89
213		187.39	187.60	188.05	188.64	189.34	189.45	189.88
212		187.39	187.60	188.05	188.63	189.34	189.45	189.88
211		187.39	187.59	188.05	188.63	189.34	189.45	189.87
210		187.39	187.59	188.04	188.63	189.33	189.44	189.83
209		187.38	187.58	188.03	188.62	189.33	189.44	189.80

Table 4.1:
Comparison of Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 2

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
208		187.38	187.57	188.02	188.61	189.33	189.43	189.76
207.7		187.38	187.57	188.02	188.61	189.32	189.43	189.72
207.3		187.38	187.56	188.00	188.60	189.32	189.42	189.68
207	U/S of Highway 407	187.38	187.56	188.01	188.60	189.32	189.42	189.67
Difference (m)								
222	D/S of Britannia Road W	0.01	0	0	0	0	0.01	0.02
221		0	0	0.01	0.01	0	0	0
220		0	0	0	0.01	0.01	0	0.01
219		0	0	0	0	0	0	0.01
218		0	0.01	0.01	0	0	0	0.01
217		0	0	0	0	0	0	0.02
216		0	0	0.01	0	0.01	0.01	0.02
215		0	0	0	0	0	0	0.02
214		0	0	0.01	0	0	0	0.02
213		0	0	0	0.01	0	0	0.02
212		0	0.01	0	0	0	0	0.02
211		0	0	0	0	0	0	0.02
210		0	0	0	0	0	0	0.01
209		0	0	0	0	0	0	0.01
208		0	0	0	0	0	0	0
207.7		0	0	0.01	0	0	0	-0.01
207.3		0	0	0	0	0	0	-0.02
207	U/S of Highway 407	0	0	0	0	0	0	0

Table 4.2: Freeboard Assessment for Proposed Conditions Through Ninth Line Area Section 2					
HEC-RAS Section ID	Location	Scenario/Alignment			
		Existing Without Transitway		Transitway Alignment Alternative 2/2A	
		100-Year	Regional	100-Year	Regional
222	D/S of Britannia Road W	7.0	6.4	7.0	6.4
221		6.0	5.5	6.0	5.5
220		4.4	3.9	4.4	3.9
219		2.4	1.9	2.4	1.9
218		2.1	1.7	2.1	1.7
217		2.0	1.5	2.0	1.5
216		1.9	1.5	1.9	1.5
215		0.7	0.3	0.7	0.3
214		0.3	-0.1	0.3	-0.1
213		0.4	-0.1	0.4	-0.1
212		0.4	0.0	0.4	0.0
211		0.9	0.5	0.9	0.5
210		1.8	1.4	1.8	1.4
209		2.4	2.1	2.4	2.1
208		2.8	2.4	2.8	2.4
207.7		2.8	2.5	2.8	2.5
207.3		2.9	2.6	2.9	2.6
207	U/S of Highway 407	2.9	2.6	2.9	2.6

Table 4.3: Riparian Storage Assessment for Alignment Alternatives 2 & 2A Through Ninth Line Area Section 2	
Scenario	Riparian Storage (m^3)
Existing Without Transitway	744,000
Transitway Alignment as per 1998 Study	707,220

The results presented in Table 4.1 indicate Transitway Alignment Alternatives 2 and 2A would not increase existing 2 through 100-year water surface elevations through this reach, and would marginally increase (≤ 2 cm) Regional Stormwater surface elevations. Therefore, the available freeboard along Highway 407 would remain relatively unchanged from existing condition during the 100-year and Regional Storm events, as presented in Table 4.2.

It is anticipated that these impacts could potentially be mitigated through the replacement of the downstream railway crossing with a larger span structure, hence freeboard would not be reduced below existing levels. The results in Table 4.3 further indicate that the riparian storage through this reach would be slightly less than the existing riparian storage, due to the separation of the lands on the east side of the Transitway from the riparian storage zone on the west side of the Transitway. Compensation for the loss of riparian storage could be achieved through grading and

excavation toward the south limit of the riparian storage zone to expand the footprint of the riparian storage zone and increase the available storage.

Although not analyzed in detail, it is anticipated that the hydraulic impacts associated with Alternative 2B would similarly be minor, and any impacts could likewise be mitigated. Nevertheless, recognizing that the hydraulic impacts associated with Alignment Alternatives 2 and 2A can be mitigated, as well as the lack of hydraulic structures (i.e. bridges/culverts) required to implement, compared to the structures required for Alternative 2B, both Alignment Alternatives 2 and 2A have been advanced for further consideration in this segment and Alternative 2B has been screened from further consideration.

4.3.3 Transitway Segment 3

The alternative alignments for this segment of the Transitway are depicted in Figure 3. Alignment Alternative 3 corresponds to the alignment advanced in the 1998 Transitway Corridor Protection Study, which would site the Transitway on the east side of the existing constructed watercourse. Alignment Alternative 3A represents the alignment required to maintain the required conveyance and freeboard along Highway 407 at existing levels during the Regional Storm event. Alignment Alternative 3B represents the alignment required to maintain existing riparian storage along this reach, between the Transitway and Highway 407; this alternative includes grading of the floodplain west of the Transitway to maintain riparian storage.

Hydraulic analyses have been completed along the reach of open watercourse between the Transitway and Highway 407 for each of the three alternatives to determine the hydraulic freeboard and riparian storage during the 100-year and Regional Storm events.

A comparison of water surface elevations for each alignment alternative with respect to the existing condition is provided in Table 4.4 and differences in water surface elevations for 2 through 100-year and Regional storm events, as compared to the existing water surface elevations are provided in Table 4.5. In addition, the results of the freeboard assessment are presented in Table 4.6, and the results of the riparian storage assessment are presented in Table 4.7.

Table 4.4: Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 3

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
Existing								
235	D/S of Online Pond	193.71	193.83	193.89	193.93	193.97	194.00	194.65
234		192.17	192.34	192.54	192.66	192.78	192.89	193.04
233		190.99	191.12	191.18	191.22	191.25	191.26	191.60
232		190.63	190.78	190.91	190.95	191.00	191.04	191.38
231		190.31	190.52	190.70	190.79	190.86	190.91	191.30
230		190.03	190.26	190.44	190.55	190.62	190.67	191.20
229		189.47	189.68	189.86	189.97	190.05	190.13	191.16
228		189.23	189.42	189.61	189.71	189.81	189.93	191.15
227		188.72	188.84	188.94	189.11	189.55	189.71	191.15
226		188.20	188.38	188.66	189.00	189.53	189.68	191.14
225	Osprey Marsh	187.91	188.24	188.57	188.96	189.52	189.67	191.14
224		187.82	188.18	188.53	188.93	189.50	189.65	191.13
223	U/S of Britannia Road W	187.62	187.97	188.33	188.78	189.41	189.54	190.96
Alternative 3								
235	D/S of Online Pond	193.71	193.85	193.96	194.04	194.11	194.18	194.65
234		192.17	192.28	192.39	192.46	192.53	192.59	193.04
233		191.00	191.19	191.38	191.51	191.63	191.73	192.31
232		190.63	190.82	191.02	191.15	191.27	191.39	192.07
231		190.31	190.53	190.73	190.86	190.98	191.09	191.83
230		190.03	190.27	190.47	190.61	190.73	190.84	191.66
229		189.47	189.68	189.87	190.00	190.12	190.24	191.36
228		189.23	189.42	189.61	189.71	189.84	189.97	191.26
227		188.72	188.84	188.94	189.11	189.56	189.72	191.20
226		188.20	188.38	188.66	189.00	189.53	189.69	191.18
225	Osprey Marsh	187.91	188.24	188.58	188.96	189.51	189.67	191.17
224		187.82	188.18	188.53	188.93	189.50	189.65	191.15
223	U/S of Britannia Road W	187.62	187.97	188.34	188.79	189.41	189.54	190.88
Alternative 3A								
235	D/S of Online Pond	193.71	193.85	193.96	194.02	194.08	194.18	194.65
234		192.17	192.28	192.39	192.50	192.60	192.59	193.04

Table 4.4: Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 3

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
233		191.00	191.19	191.36	191.46	191.55	191.62	191.99
232		190.63	190.82	191.01	191.13	191.21	191.29	191.76
231		190.31	190.52	190.72	190.85	190.95	191.03	191.55
230		190.03	190.26	190.45	190.58	190.68	190.76	191.41
229		189.47	189.68	189.86	189.98	190.09	190.19	191.25
228		189.23	189.42	189.61	189.71	189.83	189.96	191.22
227		188.72	188.84	188.94	189.11	189.56	189.72	191.19
226		188.20	188.38	188.66	189.00	189.53	189.69	191.18
225	Osprey Marsh	187.91	188.24	188.58	188.96	189.51	189.67	191.17
224		187.82	188.18	188.53	188.93	189.50	189.65	191.15
223	U/S of Britannia Road W	187.62	187.97	188.34	188.79	189.41	189.54	190.88
Alternative 3B								
235	D/S of Online Pond	193.71	193.85	193.96	194.04	194.02	194.08	194.52
234		192.17	192.28	192.39	192.46	192.59	192.62	192.78
233		190.96	191.07	191.15	191.18	191.22	191.27	191.64
232		190.63	190.68	190.77	190.84	190.91	190.97	191.47
231		190.31	190.48	190.65	190.72	190.79	190.84	191.37
230		190.03	190.31	190.52	190.56	190.67	190.70	191.29
229		189.47	189.57	189.70	189.80	189.77	189.84	191.24
228		189.21	189.35	189.40	189.38	189.57	189.73	191.23
227		188.77	188.69	188.83	189.00	189.54	189.71	191.23
226		188.05	188.27	188.61	188.99	189.54	189.70	191.23
225	Osprey Marsh	187.86	188.24	188.60	188.98	189.54	189.70	191.22
224		187.80	188.20	188.56	188.95	189.52	189.68	191.19
223	U/S of Britannia Road W	187.62	187.97	188.34	188.79	189.41	189.54	190.88

Table 4.5: Differences in Water Surface Elevations for Proposed Conditions Through Ninth Line Area Section 3								
HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
Alternative 3								
235	D/S of Online Pond	0.00	0.02	0.07	0.11	0.14	0.18	0.00
234		0.00	-0.06	-0.15	-0.20	-0.25	-0.30	0.00
233		0.01	0.07	0.20	0.29	0.38	0.47	0.71
232		0.00	0.04	0.11	0.20	0.27	0.35	0.69
231		0.00	0.01	0.03	0.07	0.12	0.18	0.53
230		0.00	0.01	0.03	0.06	0.11	0.17	0.46
229		0.00	0.00	0.01	0.03	0.07	0.11	0.20
228		0.00	0.00	0.00	0.00	0.03	0.04	0.11
227		0.00	0.00	0.00	0.00	0.01	0.01	0.05
226		0.00	0.00	0.00	0.00	0.00	0.01	0.04
225	Osprey Marsh	0.00	0.00	0.01	0.00	-0.01	0.00	0.03
224		0.00	0.00	0.00	0.00	0.00	0.00	0.02
223	U/S of Britannia Road W	0.00	0.00	0.01	0.01	0.00	0.00	-0.08
Alternative 3A								
235	D/S of Online Pond	0.00	0.02	0.07	0.09	0.11	0.18	0.00
234		0.00	-0.06	-0.15	-0.16	-0.18	-0.30	0.00
233		0.01	0.07	0.18	0.24	0.30	0.36	0.39
232		0.00	0.04	0.10	0.18	0.21	0.25	0.38
231		0.00	0.00	0.02	0.06	0.09	0.12	0.25
230		0.00	0.00	0.01	0.03	0.06	0.09	0.21
229		0.00	0.00	0.00	0.01	0.04	0.06	0.09
228		0.00	0.00	0.00	0.00	0.02	0.03	0.07
227		0.00	0.00	0.00	0.00	0.01	0.01	0.04
226		0.00	0.00	0.00	0.00	0.00	0.01	0.04
225	Osprey Marsh	0.00	0.00	0.01	0.00	-0.01	0.00	0.03
224		0.00	0.00	0.00	0.00	0.00	0.00	0.02
223	U/S of Britannia Road W	0.00	0.00	0.01	0.01	0.00	0.00	-0.08
Alternative 3B								
235	D/S of Online Pond	0.00	0.02	0.07	0.11	0.05	0.08	-0.13

Table 4.5: Differences in Water Surface Elevations for Proposed Conditions Through Ninth Line Area Section 3

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
234		0.00	-0.06	-0.15	-0.20	-0.19	-0.27	-0.26
233		-0.03	-0.05	-0.03	-0.04	-0.03	0.01	0.04
232		0.00	-0.10	-0.14	-0.11	-0.09	-0.07	0.09
231		0.00	-0.04	-0.05	-0.07	-0.07	-0.07	0.07
230		0.00	0.05	0.08	0.01	0.05	0.03	0.09
229		0.00	-0.11	-0.16	-0.17	-0.28	-0.29	0.08
228		-0.02	-0.07	-0.21	-0.33	-0.24	-0.20	0.08
227		0.05	-0.15	-0.11	-0.11	-0.01	0.00	0.08
226		-0.15	-0.11	-0.05	-0.01	0.01	0.02	0.09
225	Osprey Marsh	-0.05	0.00	0.03	0.02	0.02	0.03	0.08
224		-0.02	0.02	0.03	0.02	0.02	0.03	0.06
223	U/S of Britannia Road W	0.00	0.00	0.01	0.01	0.00	0.00	-0.08

Table 4.6: Freeboard Assessment for Proposed Conditions Through Ninth Line Area Section 3

HEC-RAS Section ID	Location	Scenario/Alignment							
		Existing Without Transitway		Transitway Alignment 3		Transitway Alignment 3A		Transitway Alignment 3B	
		100-Year	Regional	100-Year	Regional	100-Year	Regional	100-Year	Regional
235	D/S of Online Pond	1.4	0.8	1.3	0.8	1.3	0.8	1.3	0.9
234		1.3	1.2	1.6	1.2	1.6	1.2	1.6	1.4
233		1.5	1.2	1.1	0.5	1.2	0.8	1.5	1.2
232		1.1	0.7	0.7	0.0	0.8	0.3	1.1	0.6
231		0.9	0.5	0.8	0.0	0.8	0.3	1.0	0.5
230		1.1	0.6	0.9	0.1	1.0	0.4	1.1	0.5
229		2.2	1.1	2.0	0.9	2.1	1.0	2.4	1.0
228		2.4	1.2	2.4	1.1	2.4	1.1	2.6	1.1
227		2.3	0.8	2.3	0.8	2.3	0.8	2.3	0.8
226		2.1	0.7	2.1	0.6	2.1	0.6	2.1	0.6
225	Osprey Marsh	1.8	0.3	1.8	0.3	1.8	0.3	1.8	0.3
224		1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0
223	U/S of Britannia Road W	4.6	3.2	4.6	3.3	4.6	3.3	4.6	3.3

Table 4.7: Riparian Storage Assessment for Proposed Conditions Through Ninth Line Area Section 3

Scenario	Riparian Storage (m^3)
Existing Without Transitway	300,550
Transitway Alignment as per MRC	300,550[1.]
Transitway Alignment 3A	300,550[1.]
Transitway Alignment 3B	294,230[2.]

NOTE: [1.] Equalization culverts under the transitway would be required in order to maintain access to adjacent floodplain and satisfy requirements to maintain existing riparian storage.
[2.] Grading of floodplain between watercourse and transitway would be required in order to satisfy requirements to maintain existing riparian storage.

The differences in water surface elevations presented in Tables 4.4 and 4.5 indicate that Alignment Alternative 3 advanced in the 1998 Transitway Corridor Protection Study would generally increase water surface elevations compared to existing conditions for 2 to 100 year and Regional Storm events, with greater increase (10 – 70 cm) for Cross Sections 233 and 229 during larger storm events (>25-year events). The results in Tables 4.6 and 4.7 indicate that Alignment Alternative 3 would reduce both the freeboard and riparian storage through this reach compared to existing conditions. While equalization culverts can be implemented in order to access the floodplain east of the Transitway to maintain storage, Alignment Alternative 3 would result in a zero freeboard (i.e. flooding) condition along Highway 407. Consequently, this alternative has been screened from further consideration, due to the resulting freeboard condition.

The results in Tables 4.4 and 4.5 indicate that Alternative 3A would result in 10 to 40 cm increase in water surface elevations for larger storm events (>25-year events) between Cross-Sections 233 and 230. The results in Tables 4.6 and 4.7 indicate that Alternative 3A would satisfy the minimum 0.3 m freeboard condition along Highway 407, although reductions to freeboard compared to existing conditions would nevertheless be anticipated. The results further indicate that the existing riparian storage could be maintained under this alternative, although this would require the implementation of equalization culverts under the Transitway, to maintain access to the existing floodplain on the east side of the Transitway.

The results in Tables 4.4 and 4.5 indicated that Alignment Alternative 3B combined with floodplain regrading would generally reduce water surface elevations for the 2 to 100-year storm events as compared to existing conditions. The results in Tables 4.6 and 4.7 further indicate that Alternative 3B would maintain existing freeboard along Highway 407. The existing riparian storage within this reach of watercourse could be maintained with some grading and re-contouring of the floodplain between the watercourse and the Transitway, without requiring equalization culverts to maintain access to the existing floodplain east of the Transitway. This alternative offers further opportunity to redefine the limit of the existing floodplain, and increase the extent of developable land east of the Transitway. This is discussed in further detail in Section 4.4.

4.3.4 Transitway Segment 4

Alternative Transitway alignments within this segment are highly constrained by Highway 407 to the west, the Union Gas site, existing east-west oriented gas pipelines, property access required off of Ninth Line and existing woodlot in the southwest quadrant of the Derry Road and Ninth Line

intersection. Under existing conditions, the floodplain through this area is confined to the limits of the online pond and the constructed watercourse, and does not encroach onto adjacent property, and the riparian storage is provided primarily by the online pond. Consequently, maintaining the alignment of the Transitway adjacent to Highway 407 in the vicinity of the online pond is considered to represent the optimal alignment for the roadway from the perspective of maintaining flood protection and riparian storage and minimizing environmental impacts.

The alignment alternatives for this segment of the Transitway are depicted on Figure 4. Alignment Alternative 4 corresponds to the alignment advanced in the 1998 Transitway Corridor Protection Study, which would site the Transitway within the Highway 407 right-of-way in the vicinity of the online ponds, and generally follow parallel to the alignment of the watercourse in the vicinity of the Highway 407 and Derry Road Interchange. Alignment Alternative 4 utilizes sub-standard radii of 250 m radii to traverse around, as opposed to through, the Highway 407 and Derry Road interchange and requires a single grade separation at Derry Road.

Alignment Alternative 4A represents the alternative alignment, whereby the Transitway would traverse through the interchange of Highway 407 and Derry Road and requires four (4) grade separations with Derry Road and the associated Highway 407 interchange ramps.

Alignment Alternatives 4 and 4A would be situated overtop of the watercourse just upstream of the online ponds, hence a bridge structure on piers would be required in order to allow the watercourse to meander under the Transitway in this area, and encroach into the existing online ponds. Based upon preliminary grading assessments, it is anticipated that Alignment Alternative 4A would require steep vertical grades and realignment of the interchange ramps to traverse over the ramps in the southeast quadrant of the interchange and under Derry Road and the ramp in the northeast quadrant of the interchange, similar to that being implemented at the Mississauga BRT crossing of Winston Churchill Boulevard, and likely require a pumping station at the underpass in order to address drainage requirements.

Further analysis of the alignment options in this segment of the Transitway is required in order to establish a preferred alternative, and is recommended to be completed as part of the future Environmental Assessment to be initiated by the MTO. For the purpose of this study, both alternatives have been advanced for further consideration.

4.3.5 Transitway Segment 5

The alternative alignments for this segment of the Transitway are depicted on Figure 5. Alignment Alternative 5 corresponds to the alignment advanced in the 1998 Transitway Corridor Protection Study. Additional alignment alternatives have been developed based upon opportunities to realign the existing watercourse to support both the Transitway and future urbanization within the Ninth Line Lands. The optimal location for the watercourse has been identified immediately east of Highway 407 and west of the Transitway, in order to maintain direct access between the Transitway and the parking area without requiring a watercourse crossing between the two facilities. Similarly, realigning the watercourse to between Highway 407 and the Transitway would provide a buffer between developable land and the highway, and would provide for a more contiguous and efficient developable area.

For planning purposes, a preliminary cross-section of the realigned watercourse corridor has been developed based upon the following criteria:

- 30 m minimum bottom width to address fluvial geomorphologic criteria for meander belt width;
- 15 m setback required on each side of the corridor based upon current requirements for hazard protection from Conservation Halton; and,
- 5 m side slopes on each side of the corridor for grading.

Based upon the foregoing criteria, a minimum planning corridor width of 70 m has been used to establish Alignment Alternative 5A. Alternatively, Alignment Alternative 5B has been developed, predicated upon maintaining riparian storage along this reach.

A comparison of water surface elevations completed for the three alignment alternatives with respect to existing conditions are provided in Tables 4.8 and 4.9. Furthermore, assessments for freeboard and riparian storage have been performed for this area. The results are presented in Tables 4.10 and 4.11.

Table 4.8:
Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 5

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
Existing								
259		207.27	207.47	207.50	207.57	207.64	207.70	207.92
258		207.25	207.43	207.36	207.37	207.41	207.46	207.62
257		205.81	205.93	207.26	207.30	207.33	207.35	207.42
256		204.84	205.15	207.26	207.30	207.33	207.35	207.41
255.5		204.27	205.14	207.26	207.30	207.33	207.35	207.41
255	U/S Hudson Railway	203.49	205.10	207.24	207.28	207.32	207.34	207.41
254	D/S Hudson Railway	203.27	203.72	203.79	203.84	203.88	203.92	204.06
253		202.65	202.79	202.88	202.94	202.99	203.03	203.19
252.5		202.14	202.23	202.29	202.33	202.37	202.40	202.51
252		201.11	201.30	201.45	201.55	201.64	201.72	202.17
251		200.87	201.02	201.14	201.20	201.25	201.31	201.58
250		199.98	200.13	200.22	200.29	200.36	200.42	200.78
249		198.88	199.05	199.19	199.28	199.37	199.44	199.86
248.5		198.33	198.43	198.51	198.57	198.62	198.67	198.94
248	U/S of Derry Road W	196.84	197.10	197.34	197.49	197.63	197.76	198.54
Alternative 5								
259		207.31	207.54	207.59	207.65	207.69	207.74	207.91
258		207.25	207.51	207.46	207.51	207.54	207.57	207.66
257		205.97	206.01	207.24	207.28	207.33	207.38	207.56
256		204.52	205.26	207.24	207.28	207.33	207.38	207.55
255.5		204.13	205.26	207.24	207.28	207.33	207.37	207.55
255	U/S Hudson Railway	203.68	205.20	207.20	207.21	207.23	207.24	207.04

Table 4.8: Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 5								
HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
254	D/S Hudson Railway	203.57	203.77	204.07	204.28	204.47	204.65	205.88
253		203.08	203.26	203.35	203.41	203.45	203.50	203.65
252.5		202.64	202.79	202.87	202.92	202.96	203.01	203.31
252		201.01	201.15	201.27	201.35	201.43	201.51	201.95
251		200.22	200.36	200.47	200.54	200.60	200.66	201.11
250		199.19	199.33	199.44	199.51	199.62	199.71	200.12
249		198.09	198.22	198.35	198.43	198.46	198.51	199.04
248.5		197.43	197.57	197.63	197.68	197.84	197.98	198.79
248	U/S of Derry Road W	196.84	197.10	197.34	197.49	197.63	197.76	198.54
Alternative 5A								
259		207.31	207.54	207.59	207.65	207.69	207.74	207.91
258		207.25	207.51	207.46	207.51	207.54	207.57	207.66
257		205.97	206.01	207.24	207.28	207.33	207.38	207.56
256		204.52	205.26	207.24	207.28	207.33	207.38	207.55
255.5		204.13	205.26	207.24	207.28	207.33	207.37	207.55
255	U/S Hudson Railway	203.68	205.20	207.20	207.21	207.23	207.24	207.04
254	D/S Hudson Railway	203.57	203.77	204.07	204.28	204.47	204.65	205.88
253		203.08	203.26	203.35	203.41	203.45	203.50	203.65
252.5		202.64	202.79	202.87	202.92	202.96	203.01	203.31
252		201.01	201.15	201.27	201.35	201.43	201.51	201.95
251		200.22	200.36	200.47	200.54	200.60	200.66	201.11
250		199.19	199.33	199.44	199.51	199.62	199.71	200.12
249		198.09	198.22	198.35	198.43	198.46	198.51	199.04
248.5		197.43	197.57	197.63	197.68	197.84	197.98	198.79
248	U/S of Derry Road W	196.84	197.10	197.34	197.49	197.63	197.76	198.54
Alternative 5B								
259		207.30	207.51	207.55	207.61	207.65	207.69	207.84
258		207.24	207.48	207.43	207.47	207.50	207.53	207.60
257		205.96	206.00	207.23	207.28	207.31	207.35	207.49
256		204.51	205.26	207.23	207.27	207.31	207.34	207.49
255.5		204.12	205.26	207.23	207.27	207.31	207.34	207.49
255	U/S Hudson Railway	203.69	205.20	207.19	207.21	207.22	207.20	206.98
254	D/S Hudson Railway	203.57	203.80	204.07	204.27	204.46	204.64	205.85
253		203.07	203.23	203.32	203.37	203.41	203.44	203.54
252.5		202.63	202.76	202.83	202.86	202.89	202.93	203.15

Table 4.8:
Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 5

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
252		200.99	201.10	201.20	201.27	201.34	201.40	201.74
251		200.19	200.31	200.40	200.45	200.49	200.53	200.93
250		199.17	199.28	199.37	199.46	199.54	199.61	199.88
249		198.05	198.18	198.27	198.31	198.33	198.37	198.91
248.5		197.42	197.52	197.59	197.69	197.83	197.96	198.76
248	U/S of Derry Road W	196.84	197.10	197.34	197.49	197.63	197.76	198.54

Table 4.9:
Differences in Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 5 Compared to Existing Conditions

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
Alternative 5								
259		0.04	0.07	0.09	0.08	0.05	0.04	-0.01
258		0.00	0.08	0.10	0.14	0.13	0.11	0.04
257		0.16	0.08	-0.02	-0.02	0.00	0.03	0.14
256		-0.32	0.11	-0.02	-0.02	0.00	0.03	0.14
255.5		-0.14	0.12	-0.02	-0.02	0.00	0.03	0.14
255	U/S Hudson Railway	0.19	0.10	-0.04	-0.07	-0.09	-0.09	-0.37
254	D/S Hudson Railway	0.30	0.05	0.28	0.44	0.59	0.73	1.82
253		0.43	0.47	0.47	0.47	0.46	0.47	0.46
252.5		0.50	0.56	0.58	0.59	0.59	0.61	0.80
252		-0.10	-0.15	-0.18	-0.20	-0.21	-0.21	-0.22
251		-0.65	-0.66	-0.67	-0.66	-0.65	-0.65	-0.47
250		-0.79	-0.80	-0.78	-0.78	-0.74	-0.71	-0.66
249		-0.79	-0.83	-0.84	-0.85	-0.91	-0.93	-0.82
248.5		-0.90	-0.86	-0.88	-0.89	-0.78	-0.69	-0.15
248	U/S of Derry Road W	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alternative 5A								
259		0.04	0.07	0.09	0.08	0.05	0.04	-0.01
258		0.00	0.08	0.10	0.14	0.13	0.11	0.04
257		0.16	0.08	-0.02	-0.02	0.00	0.03	0.14
256		-0.32	0.11	-0.02	-0.02	0.00	0.03	0.14
255.5		-0.14	0.12	-0.02	-0.02	0.00	0.03	0.14

Table 4.9:
Differences in Water Surface Elevation for Proposed Conditions Through Ninth Line Area Section 5 Compared to Existing Conditions

HEC-RAS Section ID	Location	Return Period (Years)						
		2	5	10	25	50	100	Regional
255	U/S Hudson Railway	0.19	0.10	-0.04	-0.07	-0.09	-0.09	-0.37
254	D/S Hudson Railway	0.30	0.05	0.28	0.44	0.59	0.73	1.82
253		0.43	0.47	0.47	0.47	0.46	0.47	0.46
252.5		0.50	0.56	0.58	0.59	0.59	0.61	0.80
252		-0.10	-0.15	-0.18	-0.20	-0.21	-0.21	-0.22
251		-0.65	-0.66	-0.67	-0.66	-0.65	-0.65	-0.47
250		-0.79	-0.80	-0.78	-0.78	-0.74	-0.71	-0.66
249		-0.79	-0.83	-0.84	-0.85	-0.91	-0.93	-0.82
248.5		-0.90	-0.86	-0.88	-0.89	-0.78	-0.69	-0.15
248	U/S of Derry Road W	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alternative 5B								
259		0.03	0.04	0.05	0.04	0.01	-0.01	-0.08
258		-0.01	0.05	0.07	0.10	0.09	0.07	-0.02
257		0.15	0.07	-0.03	-0.02	-0.02	0.00	0.07
256		-0.33	0.11	-0.03	-0.03	-0.02	-0.01	0.08
255.5		-0.15	0.12	-0.03	-0.03	-0.02	-0.01	0.08
255	U/S Hudson Railway	0.20	0.10	-0.05	-0.07	-0.10	-0.14	-0.43
254	D/S Hudson Railway	0.30	0.08	0.28	0.43	0.58	0.72	1.79
253		0.42	0.44	0.44	0.43	0.42	0.41	0.35
252.5		0.49	0.53	0.54	0.53	0.52	0.53	0.64
252		-0.12	-0.20	-0.25	-0.28	-0.30	-0.32	-0.43
251		-0.68	-0.71	-0.74	-0.75	-0.76	-0.78	-0.65
250		-0.81	-0.85	-0.85	-0.83	-0.82	-0.81	-0.90
249		-0.83	-0.87	-0.92	-0.97	-1.04	-1.07	-0.95
248.5		-0.91	-0.91	-0.92	-0.88	-0.79	-0.71	-0.18
248	U/S of Derry Road W	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 4.10:
Freeboard Assessment for Proposed Conditions Through Ninth Line Area Section 5**

HEC-RAS Section ID	Location	Scenario/Alignment							
		Existing Without Transitway		Transitway Alignment 5		Transitway Alignment 5A		Transitway Alignment 5B	
		100-Year	Regional	100-Year	Regional	100-Year	Regional	100-Year	Regional
259		6.3	6.1	6.3	6.1	6.3	6.1	6.3	6.2
258		3.3	3.1	3.2	3.1	3.2	3.1	3.2	3.1
257		2.3	2.3	2.3	2.1	2.3	2.1	2.3	2.2
256		7.3	7.3	7.3	7.1	7.3	7.1	7.3	7.2
255.5		8.4	8.4	8.4	8.2	8.4	8.2	8.4	8.3
255	U/S Hudson Railway	8.9	8.9	9.0	9.2	9.0	9.2	9.1	9.3
254	D/S Hudson Railway	12.3	12.2	11.6	10.3	11.6	10.3	11.6	10.4
253		13.1	12.9	12.6	12.4	12.6	12.4	12.6	12.5
252.5		13.0	12.9	12.4	12.1	12.4	12.1	12.4	12.2
252		5.8	5.3	6.0	5.6	6.0	5.6	6.1	5.8
251		2.7	2.4	3.3	2.9	3.3	2.9	3.5	3.1
250		1.2	0.8	1.9	1.5	1.9	1.5	2.0	1.7
249		2.6	2.1	3.5	3.0	3.5	3.0	3.6	3.1
248.5		4.7	4.4	5.4	4.6	5.4	4.6	5.4	4.6
248	U/S of Derry Road W	7.2	6.4	7.2	6.4	7.2	6.4	7.2	6.4

Table 4.11: Riparian Storage Assessment for Proposed Conditions Through Ninth Line Area Section 5

Scenario	Riparian Storage (m^3)
Existing Without Transitway	67,190
Transitway Alignment as per 1998 Study	53,450
Transitway Alignment 5A	59,820
Transitway Alignment 5B	65,620

The differences in water surface elevations, as presented in Tables 4.8 and 4.9 indicate that for each alignment alternative with the proposed Transitway and realigned watercourse in place, the 2 through 100 year and Regional storm event water surface elevations would generally decrease, as compared to existing water surface elevations. The reduction in water surface elevations range between 0.1 m to 1.0 m for the less frequent and more formative events (50 year and greater) subject to implementing an appropriately sized hydraulic structure at the railway crossing of the realigned watercourse.

The results in Tables 4.10 and 4.11 indicate that all three alternative alignments considered for the Transitway through this area would provide more than 1.0 m freeboard along the segment of Highway 407 through this area for both the 100 year and Regional Storm events. The results also further indicate that Alternative 5B would best maintain existing riparian storage through this area,

although the reductions to riparian storage associated with the Alignment Alternatives 5 and 5A are considered relatively minor.

As noted above, the alternative alignments of the Transitway through this area have been established assuming a 15 m setback which would notionally be required from the top of bank of the realigned watercourse to Highway 407 and the Transitway, based upon current requirements of Conservation Halton. Discussion with the Authority will be required in order to confirm whether a reduced setback may be implemented due to the disturbed nature of the riparian corridor and the back slope of the adjacent roadways. Furthermore, the alignments would also need to consider requirements to accommodate or adjust the footprint of the existing stormwater management facility at the north limit of this area, as well as requirements for a replacement structure at the railway crossing of the realigned watercourse.

4.4 Compatibility with Station Parking Facility Planning

The foregoing alternatives for siting the Transitway, as well as the other considerations for further reducing the floodplain through the implementation of offsite works and/or formally altering the Regional Storm Floodplain, are recognized to influence the planning for the station parking facility in the vicinity of Britannia Road. Due to the proposed watercourse realignment north of Derry Road, the proposed facility siting north of Derry Road would not be influenced by any of the Transitway alignments considered for that segment. However, the siting of the facility in the vicinity of Britannia Road has been further evaluated in light of the information in the preceding sections, and is discussed further as follows.

Based upon previous discussions, it is understood that the parking facility in this area may be situated either north or south of Britannia Road, depending upon the extents of the floodplain. The conceptual location of the parking facility south of Britannia Road would be situated within the Regional Storm Floodplain. Consultation with Conservation Halton will be required to confirm whether this would be acceptable, as well as the requirements or criteria for designing and implementing a parking facility within the floodplain. However, as indicated from the hydraulic analyses presented in Section 4.5.1, replacing the hydraulic structure at the downstream CNR crossing would reduce the extent of the Regional Storm Floodplain in this area, similarly reducing the depth and extent of the parking area located within the floodplain. However, the feasibility of this alternative would require further coordination with stakeholders to secure agreement for replacement of the downstream hydraulic structure.

Alternatively, the parking facility has been proposed to be sited north of Britannia Road. As noted previously, adjusting the extent of the Regional Storm Floodplain would require constructing a landform, which would require approval and coordination with various stakeholders, and would only be implemented if Alignment Alternative S3B is advanced in this segment. Nevertheless, if implemented, this would be anticipated to reduce the limitations to constructing the parking area in this area, subject to agreement from area landowners. Alternatively, if either of the other two alternatives were implemented in this segment (whereby equalization culverts were constructed), the parking facility would be situated within the Regional Storm Floodplain, hence consultation with Conservation Halton would be required as noted previously for siting the facility within the floodplain south of Britannia Road.

4.5 Alternative Assessment Summary

The results of the foregoing alternative assessment is summarized in Tables 4.12 through 4.16 for the segments of the Transitway. The recommended Transitway alignment is detailed in Drawings 10A to 10E.

Table 4.12

Summary of Transitway Alternative Alignment Assesment – Segment No. 1: Highway 403 / 407 Interchange to Highway 407 Crossing of Sixteen Mile Creek East Tributary			
Criteria	**Criteria Indicator**	**Alignment Alternative No. S1**	**Alignment Alternative No. S1A**
Conveyance Capacity	Potential adverse effects on existing or proposed freeboard criteria	N/A	N/A
Riparian Storage	Potential adverse effects on existing or proposed riparian storage requirements and associated impacts on the extent of developable lands	N/A	N/A
Watercourse Crossings	Requirement for watercourse crossings and impacts conveyance and/or riparian storage	N/A	N/A
Drainage Requirements	Potential requirements for drainage infrastructure where surface flow is not feasible	Pumping station anticipated to be required for underpass drainage.	Pumping station anticipated to be required for underpass drainage.
Transitway Design Standards	Adherence to 2011 Transitway horizontal alignment design criteria	Radii are substandard and spiral curves are not provided	Meets horizontal alignment design criteria
Roadway Grade Separations	Requirement for grade separations including associated constructability and construction cost implications	Transitway to pass beneath Highway 404 and requires grade separations	Transitway to pass beneath Highway 404 and requires grade separations
Transitway Station Facilities	Compatibility with Station Parking Facility Planning	N/A	N/A
Land Use Planning	Extent of impacts on available developable lands within the study corridor	N/A	N/A
Alternative Ranking		2	1

Table 4.13

Summary of Transitway Alternative Alignment Assessment – Segment No. 2: Highway 407 Crossing to Britannia Road				
Criteria	***Criteria Indicator***	**Alignment Alternative No. S2**	**Alignment Alternative No. S2A**	**Alignment Alternative No. S2B**
Conveyance Capacity	Potential adverse effects on existing or proposed freeboard criteria	Minor reductions in freeboard anticipated along Highway 407	Minor reductions in freeboard anticipated along Highway 407	Transitway may provide freeboard protection for Highway 407
Riparian Storage	Potential adverse effects on existing or proposed riparian storage requirements and associated impacts on the extent of developable lands	Minor reductions in riprarian storage anticipated	Minor reductions in riprarian storage anticipated; alignment affords opportunity to provide compensatory riparian storage	Minor reductions in riprarian storage anticipated
Watercourse Crossings	Requirement for watercourse crossings and impacts conveyance and/or riparian storage	No new watercourse crossings required	No new watercourse crossings required	New watercourse crossing of main channel required
Drainage Requirements	Potential requirements for drainage infrastructure where surface flow is not feasible	Stormwater management may be incorporated into facilities for existing or future development	Stormwater management may be incorporated into facilities for existing or future development	Limited opportunities to incorporate stormwater management with requirements for existing or future development
Transitway Design Standards	Adherence to 2011 Transitway horizontal alignment design criteria	Radii are substandard and spiral curves are not provided	Meets horizontal alignment design criteria	Meets horizontal alignment design criteria
Roadway Grade Separations	Requirement for grade separations including associated constructability and construction cost implications	Single grade separation required at Britannia Road crossing	Single grade separation required at Britannia Road crossing	Four grade crossings required to traverse the Highway 407 and Britannia Road interchange
Transitway Station Facilities	Compatibility with Station Parking Facility Planning	Parking facility located within floodplain; potential restrictions/criteria for implementation.	Parking facility located within floodplain; potential restrictions/criteria for implementation.	Parking facility located within floodplain; potential restrictions/criteria for implementation. Parking facility not proximate to Transitway.
Land Use Planning	Extent of impacts on available developable lands within the study corridor	No impact on developable land.	No impact on developable land.	No impact on developable land.
Alternative Ranking		2	1	3

Table 4.14

Summary of Transitway Alternative Alignment Assessment – Segment No. 3: Britannia Road to Outlet of Online Road				
Criteria	***Criteria Indicator***	**Alignment Alternative No. S3**	**Alignment Alternative No. S3A**	**Alignment Alternative No. S3B**
Conveyance Capacity	Potential adverse effects on existing or proposed freeboard criteria	Reduced freeboard along Highway 407 compared to existing conditions.	Freeboard along Highway 407 reduced, however would be greater than 0.3 m minimum.	Minor reductions in Freeboard along Highway 407 compared to existing conditions.
Riparian Storage	Potential adverse effects on existing or proposed riparian storage requirements and associated impacts on the extent of developable lands	Equalization culverts required to maintain riparian storage.	Equalization culverts required to maintain riparian storage.	Riparian storage maintained within creek corridor without requiring equalization culverts.
Watercourse Crossings	Requirement for watercourse crossings and impacts conveyance and/or riparian storage	One crossing required toward upstream limit of segment.	One crossing required toward upstream limit of segment.	One crossing required toward upstream limit of segment.
Drainage Requirements	Potential requirements for drainage infrastructure where surface flow is not feasible	Limited opportunities to incorporate stormwater management into facilities for future development (due to extent of floodplain)	Limited opportunities to incorporate stormwater management into facilities for future development (due to extent of floodplain)	Stormwater management requirements may be incorporated into facilities for future development.
Transitway Design Standards	Adherence to 2011 Transitway horizontal alignment design criteria	Radii are substandard and spiral curves are not provided, however can be upgraded with minor impacts	Meets horizontal alignment design criteria	Meets horizontal alignment design criteria
Roadway Grade Separations	Requirement for grade separations including associated constructability and construction cost implications	N/A	N/A	N/A
Transitway Station Facilities	Compatibility with Station Parking Facility Planning	Parking facility located within floodplain; potential restrictions/criteria for implementation.	Parking facility located within floodplain; potential restrictions/criteria for implementation.	Opportunity to redefine Regional Floodplain and develop parking facility outside of floodplain.
Land Use Planning	Extent of impacts on available developable lands within the study corridor	No impact.	No impact	Opportunity to increase extent of developable area.
Alternative Ranking		3	2	1

Table 4.15

Summary of Transitway Alternative Alignment Assessment – Segment No. 4: Outlet of Online Pond to Derry Road			
Criteria	***Criteria Indicator***	**Alignment Alternative No. S4**	**Alignment Alternative No. S4A**
Conveyance Capacity	Potential adverse effects on existing or proposed freeboard criteria	Minor reduction to conveyance capacity where road is situated above watercourse.	Minor reduction to conveyance capacity where road is situated above watercourse; grading of overpass/underpass at interchange may further reduce conveyance capacity.
Riparian Storage	Potential adverse effects on existing or proposed riparian storage requirements and associated impacts on the extent of developable lands	Minimal impacts to riparian storage may be offset by expanding footprint of online facility.	Minimal impacts to riparian storage may be offset by expanding footprint of online facility; grading of overpass/underpass at interchange may further reduce riparian storage.
Watercourse Crossings	Requirement for watercourse crossings and impacts conveyance and/or riparian storage	Road over watercourse required to be on piers.	Road over watercourse required to be on piers.
Drainage Requirements	Potential requirements for drainage infrastructure where surface flow is not feasible	Limited opportunities to incorporate into stormwater management for future development.	Pumping station required for underpass at Derry Road; limited opportunities to incorporate into stormwater management for future development.
Transitway Design Standards	Adherence to 2011 Transitway horizontal alignment design criteria	Radii are substandard and spiral curves are not provided	Meets horizontal alignment design criteria
Roadway Grade Separations	Requirement for grade separations including associated constructability and construction cost implications	Single grade separation required at Britannia Road crossing	Four grade crossings required to traverse the Highway 407 and Britannia Road interchange
Transitway Station Facilities	Compatibility with Station Parking Facility Planning	N/A	N/A
Land Use Planning	Extent of impacts on available developable lands within the study corridor	No anticipated impacts to future developable land; impacts to existing development and terrestrial features requires further assessment.	No anticipated impacts to future developable land.
Alternative Ranking		*	*

* Given existing constraints and complexities within Segment 4, selection of a preferred alternative requires further analysis and needs to be considered in more detail as part of the MTO Environmental Assessment and Preliminary Design.

Table 4.16

Summary of Transitway Alternative Alignment Assessment – Segment No. 5: Upstream of Derry Road					
Criteria	***Criteria Indicator***	**Alignment Alternative No. S5**	**Alignment Alternative No. S5A**	**Alignment Alternative No. S5B**	**Alignment Alternative No. 5C**
Conveyance Capacity	Potential adverse effects on existing or proposed freeboard criteria	Limited reduction in freeboard along Highway 407.	Limited reduction in freeboard along Highway 407.	Limited reduction in freeboard along Highway 407.	Limited reduction in freeboard along Highway 407.
Riparian Storage	Potential adverse effects on existing or proposed riparian storage requirements and associated impacts on the extent of developable lands	Minor reduction in riparian storage compared to existing conditions.	Minor reduction in riparian storage compared to existing conditions.	Existing riparian storage maintained.	Minor reduction in riparian storage compared to existing conditions.
Watercourse Crossings	Requirement for watercourse crossings and impacts conveyance and/or riparian storage	Crossing requirements depend upon alignment for Segment 4; no additional crossings required compared to other alternatives.	Crossing requirements depend upon alignment for Segment 4; no additional crossings required compared to other alternatives.	Crossing requirements depend upon alignment for Segment 4; no additional crossings required compared to other alternatives.	Crossing requirements depend upon alignment for Segment 4; no additional crossings required compared to other alternatives.
Drainage Requirements	Potential requirements for drainage infrastructure where surface flow is not feasible	Opportunity to integrate into stormwater management requirements for future development. Significant adjustments/relocation of existing stormwater management facility required.	Opportunity to integrate into stormwater management requirements for future development. Minor impacts to existing stormwater management facility.	Opportunity to integrate into stormwater management requirements for future development. Minor impacts to existing stormwater management facility.	Opportunity to integrate into stormwater management requirements for future development. Minor impacts to existing stormwater management facility.
Transitway Design Standards	Adherence to 2011 Transitway horizontal alignment design criteria	Radii are substandard and spiral curves are not provided. Potential lateral clearance issues with existing hydro towers.	Meets horizontal alignment design criteria.	Meets horizontal alignment design criteria.	Meets horizontal alignment design criteria. Potential lateral clearance issues with existing hydro towers.
Roadway Grade Separations	Requirement for grade separations including associated constructability and construction cost implications	N/A	N/A	N/A	N/A
Transitway Station Facilities	Compatibility with Station Parking Facility Planning	Watercourse realignment provides opportunity to site the parking facility proximate to the Transitway.	Watercourse realignment provides opportunity to site the parking facility proximate to the Transitway.	Watercourse realignment provides opportunity to site the parking facility proximate to the Transitway.	Watercourse realignment provides opportunity to site the parking facility proximate to the Transitway.
Land Use Planning	Extent of impacts on available developable lands within the study corridor	Watercourse realignment optimizes development potential for adjacent lands; slightly greater development area due to narrower watercourse corridor.	Watercourse realignment optimizes development potential for adjacent lands.	Watercourse realignment optimizes development potential for adjacent lands; slightly lower development area due to wider watercourse corridor for riparian storage.	Watercourse realignment optimizes development potential for adjacent lands; slightly greater development area due to narrower watercourse corridor. Upgrade of horizontal alignment reduces extent of developable land.
Alternative Ranking		4	2	1	3

4.6 Other Considerations

4.6.1 Offsite Works to Reduce Extent of Floodplain

As noted, hydraulic analyses have been completed to assess the potential benefits associated with improving the conveyance capacity at the railway crossing of the Sixteen Mile Creek Tributary west of Highway 407. Specifically, these analyses have been completed to determine whether replacing the existing hydraulic structures at the railway crossing with a larger size structure would improve the conveyance through the hydraulic structures, and reduce the Regional Storm floodplain through the downstream limit of the Ninth Line Lands. For this assessment, the existing six (6) 2.0 m diameter pipe structures at the downstream railway have been notionally replaced with a 25 m span bridge structure, and the water surface elevations and freeboard during the Regional Storm event have been determined accordingly. The 25 m span crossing would increase the flow area from the current 18.9 m^2 to approximately 62 m^2, and would convey the peak flow from the Regional Storm below the rail with no overtopping. The 100-year and Regional Storm event water surface elevations through the Ninth Line Lands under this scenario are presented in Table 4.17, and compared with the water surface elevations under existing conditions to assess changes in water surface elevations. The impact to the freeboard along Highway 407 is presented in Table 4.18. The Regional Storm Floodplain under this condition is presented in Drawing 2.

Table 4.17:
Simulated 100 Year and Regional Stormwater Surface Elevations Through Ninth Line Lands With Hydraulic Structure Improvements at Downstream Railway Crossing (m)

HEC-RAS Section ID	Location	Scenario				Difference	
		Existing		With 25 m Span at d/s Railway			
		100-Year	Regional	100-Year	Regional	100-Year	Regional
259		207.70	207.92	207.70	207.92	0	0
258		207.46	207.62	207.46	207.62	0	0
257		207.35	207.42	207.35	207.42	0	0
256		207.35	207.41	207.35	207.41	0	0
255.5		207.35	207.41	207.35	207.41	0	0
255	U/S Hudson Railway	207.34	207.41	207.34	207.41	0	0
254	D/S Hudson Railway	203.92	204.06	203.92	204.06	0	0
253		203.03	203.19	203.03	203.19	0	0
252.5		202.40	202.51	202.40	202.51	0	0
252		201.72	202.17	201.72	202.17	0	0
251		201.31	201.58	201.31	201.58	0	0
250		200.42	200.78	200.42	200.78	0	0
249		199.44	199.86	199.44	199.86	0	0
248.5		198.67	198.94	198.67	198.94	0	0
248	U/S of Derry Road W	197.76	198.54	197.76	198.54	0	0

Table 4.17:
Simulated 100 Year and Regional Storm Water Surface Elevations Through Ninth Line Lands With Hydraulic Structure Improvements at Downstream Railway Crossing (m)

HEC-RAS Section ID	Location	Scenario				Difference	
		Existing		With 25 m Span at d/s Railway			
		100-Year	Regional	100-Year	Regional	100-Year	Regional
247	D/S of Derry Road W	197.74	198.47	197.74	198.47	0	0
246		197.65	198.35	197.65	198.35	0	0
245.5		197.25	197.95	197.25	197.95	0	0
245		196.79	197.45	196.79	197.45	0	0
244		195.49	196.00	195.49	196.00	0	0
243		195.38	195.92	195.38	195.92	0	0
242		195.37	195.90	195.37	195.90	0	0
241		195.11	195.53	195.11	195.53	0	0
240		195.05	195.48	195.05	195.48	0	0
239		195.04	195.47	195.04	195.47	0	0
238		195.04	195.47	195.04	195.47	0	0
237		195.04	195.46	195.04	195.46	0	0
236	Outlet of Online Pond	194.85	195.16	194.85	195.16	0	0
235	D/S of Online Pond	194.00	194.65	194.00	194.65	0	0
234		192.89	193.04	192.89	193.04	0	0
233		191.26	191.60	191.26	191.60	0	0
232		191.04	191.38	191.04	191.34	0	-0.04
231		190.91	191.30	190.91	191.23	0	-0.07
230		190.67	191.20	190.67	190.93	0	-0.27
229		190.13	191.16	190.12	190.78	-0.01	-0.38
228		189.93	191.15	189.89	190.76	-0.04	-0.39
227		189.71	191.15	189.31	190.73	-0.40	-0.42
226		189.68	191.14	189.17	190.72	-0.51	-0.42
225	Osprey Marsh	189.67	191.14	189.11	190.71	-0.56	-0.43
224		189.65	191.13	189.06	190.69	-0.59	-0.44
223	U/S of Britannia Road W	189.54	190.96	188.75	190.28	-0.79	-0.68
222	D/S of Britannia Road W	189.49	190.04	188.53	189.75	-0.96	-0.29
221		189.48	190.02	188.36	189.68	-1.12	-0.34
220		189.47	189.96	188.24	189.59	-1.23	-0.37
219		189.46	189.94	188.16	189.54	-1.30	-0.40

Table 4.17: Simulated 100 Year and Regional Stormwater Surface Elevations Through Ninth Line Lands With Hydraulic Structure Improvements at Downstream Railway Crossing (m)							
HEC-RAS Section ID	Location	Scenario				Difference	
		Existing		With 25 m Span at d/s Railway			
		100-Year	Regional	100-Year	Regional	100-Year	Regional
218		189.46	189.92	188.11	189.51	-1.35	-0.41
217		189.46	189.91	188.10	189.50	-1.36	-0.41
216		189.45	189.90	188.07	189.48	-1.38	-0.42
215		189.45	189.88	188.04	189.46	-1.41	-0.42
214		189.45	189.87	188.03	189.45	-1.42	-0.42
213		189.45	189.86	188.02	189.43	-1.43	-0.43
212		189.45	189.86	188.01	189.42	-1.44	-0.44
211		189.45	189.85	188.00	189.41	-1.45	-0.44
210		189.44	189.82	187.96	189.36	-1.48	-0.46
209		189.44	189.79	187.91	189.30	-1.53	-0.49
208		189.43	189.76	187.85	189.21	-1.58	-0.55
207.7		189.43	189.73	187.82	189.18	-1.61	-0.55
207.3		189.42	189.70	187.74	189.06	-1.68	-0.64
207	U/S of Highway 407	189.42	189.67	187.75	189.06	-1.67	-0.61

Table 4.18: Freeboard Assessment for Highway 407 Through Ninth Line Lands With Hydraulic Structure Improvements at Downstream Railway Crossing (m)					
HEC-RAS Section ID	Location	Scenario			
		Existing		With 25 m Span at d/s Railway	
		100-Year	Regional	100-Year	Regional
259		6.3	6.1	6.3	6.1
258		3.3	3.1	3.3	3.1
257		2.3	2.3	2.3	2.3
256		7.3	7.3	7.3	7.3
255.5		8.4	8.4	8.4	8.4
255	U/S Hudson Railway	8.9	8.9	8.9	8.9
254	D/S Hudson Railway	12.3	12.2	12.3	12.2
253		13.1	12.9	13.1	12.9
252.5		13.0	12.9	13.0	12.9
252		5.8	5.3	5.8	5.3

Table 4.18:
Freeboard Assessment for Highway 407 Through Ninth Line Lands With Hydraulic Structure Improvements at Downstream Railway Crossing (m)

HEC-RAS Section ID	Location	Scenario			
		Existing		With 25 m Span at d/s Railway	
		100-Year	Regional	100-Year	Regional
251		2.7	2.4	2.7	2.4
250		1.2	0.8	1.2	0.8
249		2.6	2.1	2.6	2.1
248.5		4.7	4.4	4.7	4.4
248	U/S of Derry Road W	7.2	6.4	7.2	6.4
247	D/S of Derry Road W	7.2	6.5	7.2	6.5
246		6.2	5.5	6.2	5.5
245.5		3.2	2.5	3.2	2.5
245		1.7	1.0	1.7	1.0
244		2.3	1.8	2.3	1.8
243		2.2	1.6	2.2	1.6
242		1.9	1.3	1.9	1.3
241		2.1	1.7	2.1	1.7
240		2.1	1.6	2.1	1.6
239		2.0	1.6	2.0	1.6
238		1.8	1.4	1.8	1.4
237		1.1	0.7	1.1	0.7
236	Outlet of Online Pond	1.0	0.7	1.0	0.7
235	D/S of Online Pond	1.4	0.8	1.4	0.8
234		1.3	1.2	1.3	1.2
233		1.5	1.2	1.5	1.2
232		1.1	0.7	1.1	0.8
231		0.9	0.5	0.9	0.6
230		1.1	0.6	1.1	0.8
229		2.2	1.1	2.2	1.5
228		2.4	1.2	2.5	1.6
227		2.3	0.8	2.7	1.3
226		2.1	0.7	2.7	1.1
225	Osprey Marsh	1.8	0.3	2.4	0.8
224		1.5	0.0	2.1	0.5
223	U/S of Britannia Road W	4.6	3.2	5.4	3.9

Table 4.18:
Freeboard Assessment for Highway 407 Through Ninth Line Lands With Hydraulic Structure Improvements at Downstream Railway Crossing (m)

HEC-RAS Section ID	Location	Scenario			
		Existing		With 25 m Span at d/s Railway	
		100-Year	Regional	100-Year	Regional
222	D/S of Britannia Road W	7.0	6.4	7.9	6.7
221		6.0	5.5	7.1	5.8
220		4.4	3.9	5.7	4.3
219		2.4	1.9	3.7	2.3
218		2.1	1.7	3.5	2.1
217		2.0	1.5	3.3	1.9
216		1.9	1.5	3.3	1.9
215		0.7	0.3	2.1	0.7
214		0.3	-0.1	1.7	0.3
213		0.4	-0.1	1.8	0.4
212		0.4	0.0	1.9	0.5
211		0.9	0.5	2.3	0.9
210		1.8	1.4	3.3	1.9
209		2.4	2.1	4.0	2.6
208		2.8	2.4	4.3	3.0
207.7		2.8	2.5	4.4	3.1
207.3		2.9	2.6	4.5	3.2
207	U/S of Highway 407	2.9	2.6	4.5	3.2

The results in Table 4.17 indicate that replacing the hydraulic structures at the railway with a 25 m span bridge structure would reduce the water surface elevations within the Ninth Line Lands by up to 0.64 m for Regional Storm event and up to 1.68 m for 100-year storm event. The results also indicate that the reduction in Regional Stormwater surface elevations would extend through the reach of watercourse between the Highway 407 crossing (ref. HEC-RAS Section 207) and just downstream of the outlet of the online pond south of Derry Road (ref. HEC-RAS Section 232).

The results in Table 4.18 indicate that the reduction in Regional Stormwater surface elevations would correspondingly increase the freeboard along Highway 407 between the Highway 407 crossing and the outlet of the online pond, eliminating the existing negative freeboard (i.e. flooding) condition along Highway 407, and achieving a minimum freeboard of 0.3 m along the entire length of Highway 407.

The floodline mapping indicates that the replacement of the existing hydraulic structure at the railway crossing would reduce the extent of the Regional Storm floodplain downstream of the online pond (i.e. downstream of HEC-RAS Section 233), and in particular downstream of Britannia Road.

4.6.2 Formal Flood Protection North of Britannia Road

Over the course of the Ninth Line Lands Study and the Transitway assessment, it became apparent that the construction of the Transitway provides a unique opportunity to provide flood protection for flood susceptible lands within the Ninth Line Lands. The Transitway in of itself represents public infrastructure and is essentially a large engineered earthen berm with a roadway on top. As such the Transitway would separate and protect flood prone lands by creating a barrier between the watercourse and the flood susceptible lands. It should be noted that Provincial legislations do not recognize berms as *permanent* flood management works due to the potential for failure, hence despite "protecting" lands susceptible to flooding, MNRF would not recognize the berm as eliminating the flood risk permanently hence the Regulatory floodplain would continue to be in effect on those lands at risk, therefore there could be no development on the affected lands.

In recent years, various Conservation Authorities and the MNRF have considered opportunities for *permanent* flood protection in the form of "super berms" or Flood Protection Land Forms (FPL). Draft criteria developed by TRCA in 2013 represent the most current standards for structural requirements to formally alter the Regulatory Limit using FPLs. According to these criteria, structures which formally alter the Regulatory Limit are designated as landforms, and must fulfill certain requirements, including:

- Crest of landform must be at least 0.3 m above the Regulatory Water Level;
- Crest of landform must be at least 3 m in width;
- No buried infrastructure or pipes are permitted within or crossing the landform;
- Side slopes are to not to exceed 10 % toward the watercourse; and,
- Side slopes are to be between 1.5 % and 2.5 % on the side opposite the watercourse; local grades as steep as 5 % may be permitted, subject to Conservation Authority approval.

In addition to the foregoing criteria, there are various restrictions on the land uses permitted on the slopes of the landform. However, at the point where the landform matches existing grade on the slope opposite the watercourse, development would be considered removed from the Regulatory Limit and may proceed without restrictions.

The preferred Transitway alignment through Segment 3 has been reviewed in order to determine the opportunity for developable land which would be permitted if the Transitway were constructed on the top of a landform. For this assessment, cross-sections have been developed to depict the Transitway atop the landform, implemented in accordance with the grading criteria provided. The cross-sections have been used to develop the approximate footprint of the landform, and thereby to determine the extent of additional developable land which would result from the implementation of a landform. The results are provided in Drawings 3 and 4.

The information shown on Drawings 3 and 4 indicates that the Transitway atop a landform would remove approximately 12.5 ha +/- from the Regulatory Floodplain, potentially allowing development to proceed unrestricted. In addition, and subject to Conservation Halton and MNRF approval, other land uses may be permitted on the slopes of the landform, primarily in the form of passive park land and open spaces. As noted, buried infrastructure and pipes are not permitted within or crossing the landform. As such, the Transitway atop the landform would be required to provide a rural drainage system with swales and ditches promoting surface drainage.

5.0 SUMMARY AND NEXT STEPS

The Transitway alignment provided in the 1998 Transitway Corridor Protection Study has been assessed and revised as part of this assessment, based upon hydraulic constraints and criteria specific to the watercourses and features within the Ninth Line Lands. The preferred alignment presented herein is considered to represent the optimal location for addressing the hydraulic criteria within the study area, while minimizing conflicts with existing infrastructure, and integrating the planning for the Transitway and associated parking facilities with the overall land use planning for the Ninth Line Lands. Moreover, the integrated planning for the Transitway and the Ninth Line Lands has provided opportunities to further increase the developable area within the Ninth Line Lands, as well as reducing constraints associated with the planning and siting of the parking facilities for the Transitway.

The Scoped Subwatershed Study has been initiated in order to assess the constraints and opportunities within the Ninth Line Lands related to the terrestrial and aquatic ecology, stream system, and surface water and groundwater resources (quantity/quality), and is being completed under the management and oversight of a Technical Steering Committee. The Technical Steering Committee is comprised of representatives from the City of Mississauga, the Region of Peel, and Conservation Halton. In addition, the City of Mississauga has engaged representatives from the MTO and 407 ETR to coordinate the planning and servicing of the Ninth Line Lands specific to the future of the Transitway corridor which constitutes a significant future land use within the study area. Through the course of the Secondary Plan Study and the Scoped Subwatershed Study for the future development within the Ninth Line Lands, the preferred alignment presented herein is to be further evaluated and refined.

Consultation with the MTO is being coordinated, to review the findings of this assessment, and to confirm concurrence with the preferred alternative for the Transitway alignment. Consultation with Conservation Halton is required to confirm acceptance of the proposed alignment, and siting of the parking facilities, as well as to verify any limitations or requirements for placement of the facilities within existing floodplains. Analysis of Transitway parking facility capacities, plan areas and locations is addressed under separate cover, and will be coordinated with the preferred Transitway alignment and adjacent land development.

As noted above, opportunities exist to modify the extent of flooding through the replacement of downstream hydraulic structures and/or the construction of landforms to formally alter the extent of the Regional Floodplain within certain segments of the Ninth Line Lands. Consultation with various stakeholders is required (i.e. Conservation Halton, Hydro One, and CNR) in order to secure concurrence for the proposed works and agreement for the adjustment to the extent of developable land within the study area, as well as any requirements or criteria for implementation.

Report prepared by:

Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited

Per: Aaron Farrell, M.Eng., P.Eng.
Associate

Per: Jim Scale, P.Eng.
Associate

LEGEND

257 — HEC–RAS CROSS–SECTION AND REFERENCE NUMBER

REGIONAL FLOODLINE (2004 PEL)

REGIONAL FLOODLINE (2015 EXISTING)

EXISTING HIGHWAY 407 FENCELINE

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

EXISTING FLOODPLAIN MAPPING

amec foster wheeler

Scale 1:3000

0 25 50 100

Consultant File No. TP114008

Drawing No. SHEET 1A

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Plotted By: josh.seroj

Last Saved By: josh.seroj

Plotted: 2015-09-15

Last Saved: 2015-09-15

LEGEND

257 — HEC–RAS CROSS–SECTION AND REFERENCE NUMBE

REGIONAL FLOODLINE (2004 PEL)

REGIONAL FLOODLINE (2015 EXISTING)

EXISTING HIGHWAY 407 FENCELINE

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

EXISTING FLOODPLAIN MAPPING

amec foster wheeler

Scale 1:3000

0 25 50 100

Consultant File No. TP114008

Drawing No. 1B

Path: P:\Work\TP114008\water\dwg\15-09\Dwg-1(Floodline-ExUpd).dwg

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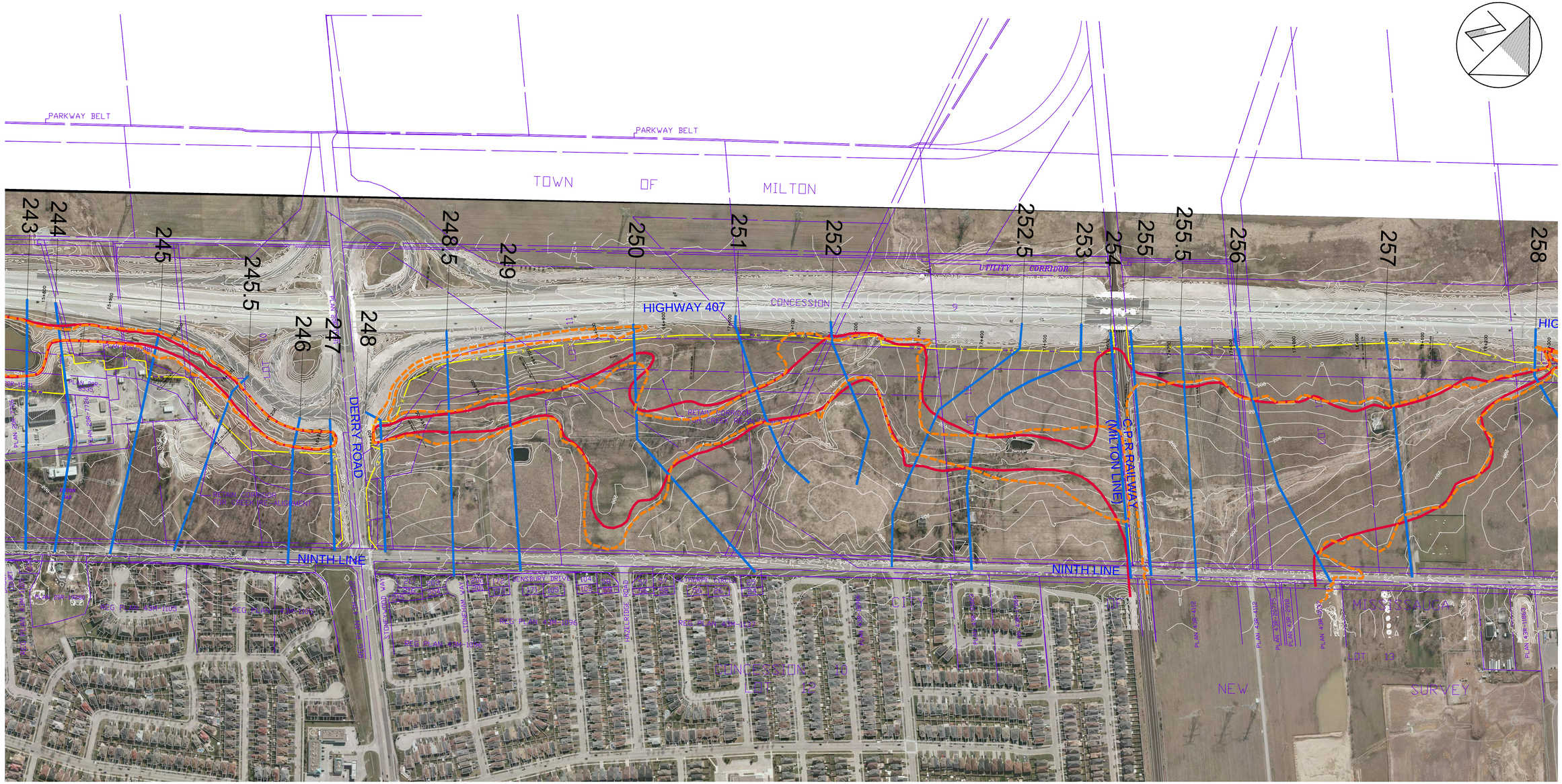

LEGEND

257 — HEC–RAS CROSS–SECTION AND REFERENCE NUMBE

REGIONAL FLOODLINE (2004 PEL)

REGIONAL FLOODLINE (2015 EXISTING)

EXISTING HIGHWAY 407 FENCELINE

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

EXISTING FLOODPLAIN MAPPING

amec foster wheeler

Scale 1:3000

0 25 50 100

Consultant File No. TP114008

Drawing No. 1C

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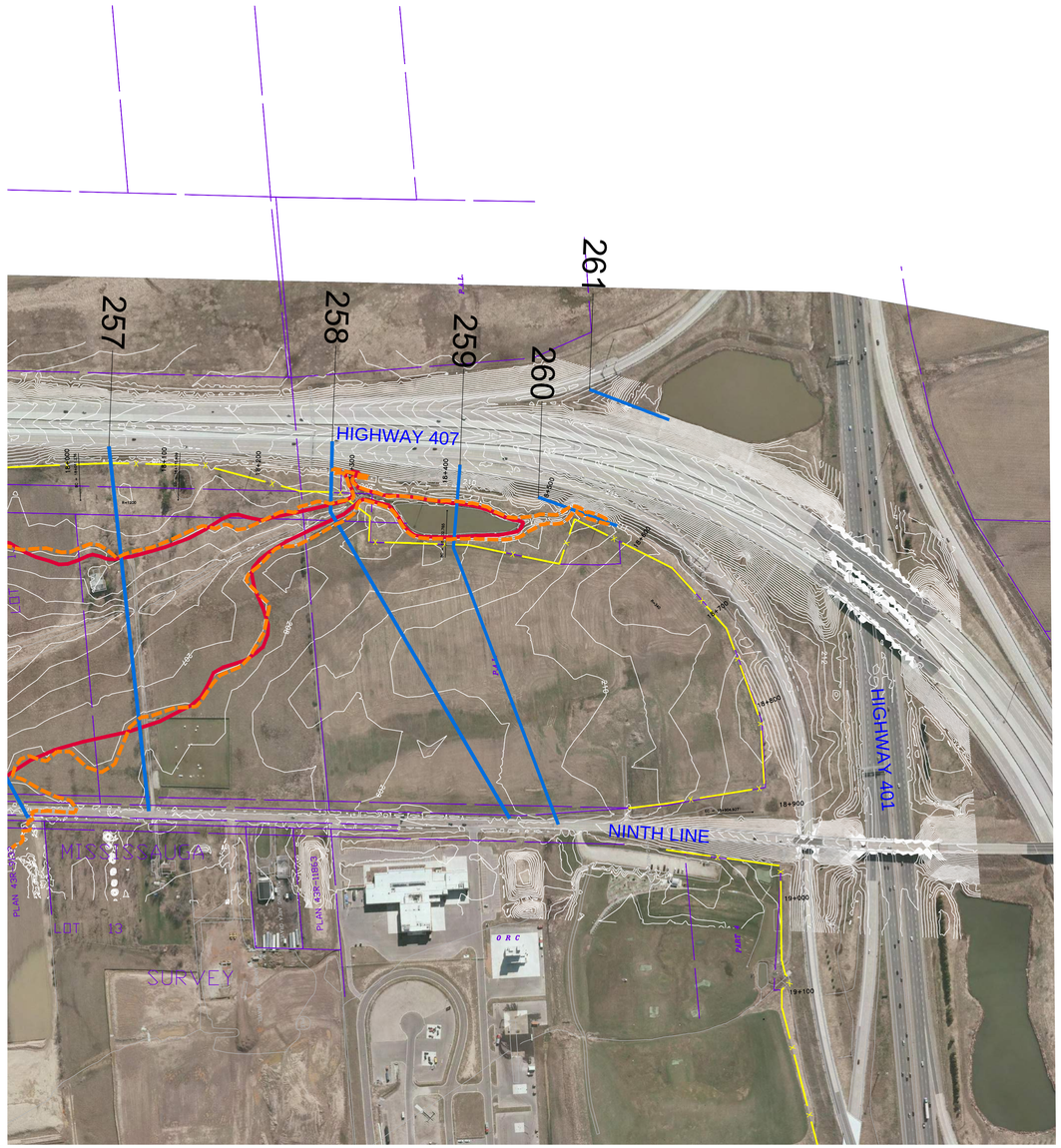
Plotted: 2015-09-15

Last Saved: 2015-09-15



LEGEND

257 — HEC–RAS CROSS–SECTION AND REFERENCE NUMBE

REGIONAL FLOODLINE (2004 PEL)

REGIONAL FLOODLINE (2015 EXISTING)

EXISTING HIGHWAY 407 FENCELINE

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

EXISTING FLOODPLAIN MAPPING

amec foster wheeler

Scale 1:3000 (0 25 50 100)

Consultant File No. TP114008

Drawing No. 1D

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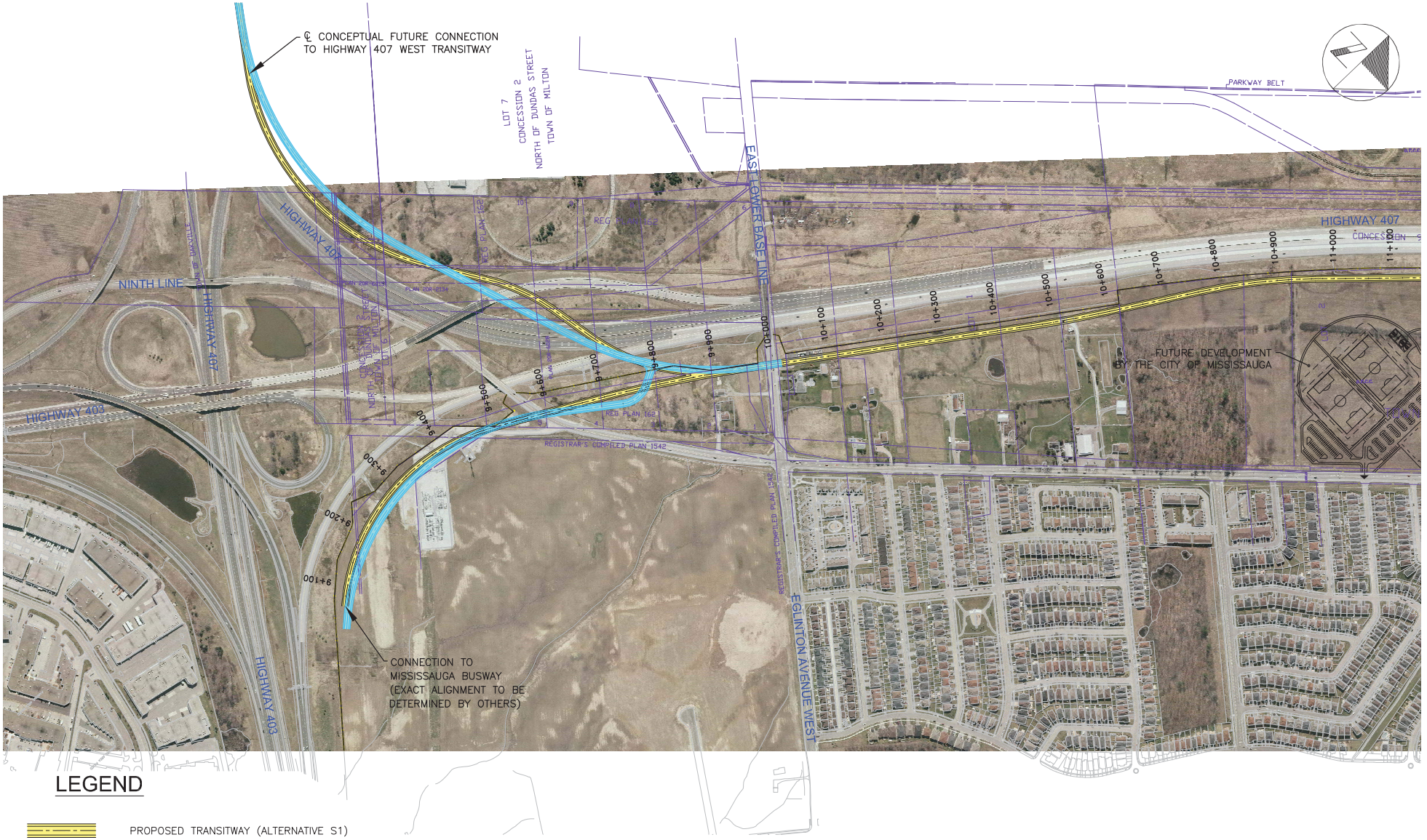

LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S1)
- PROPOSED BUS STATION (ALTERNATIVE S1)
- PROPOSED TRANSITWAY (ALTERNATIVE S1A)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PROPOSED TRANSITWAY ALIGNMENT ALTERNATIVES -

SEGMENT 1

amec foster wheeler

Scale 1:3000
0 25 50 100

Consultant File No.
TP114008

Drawing No.
2

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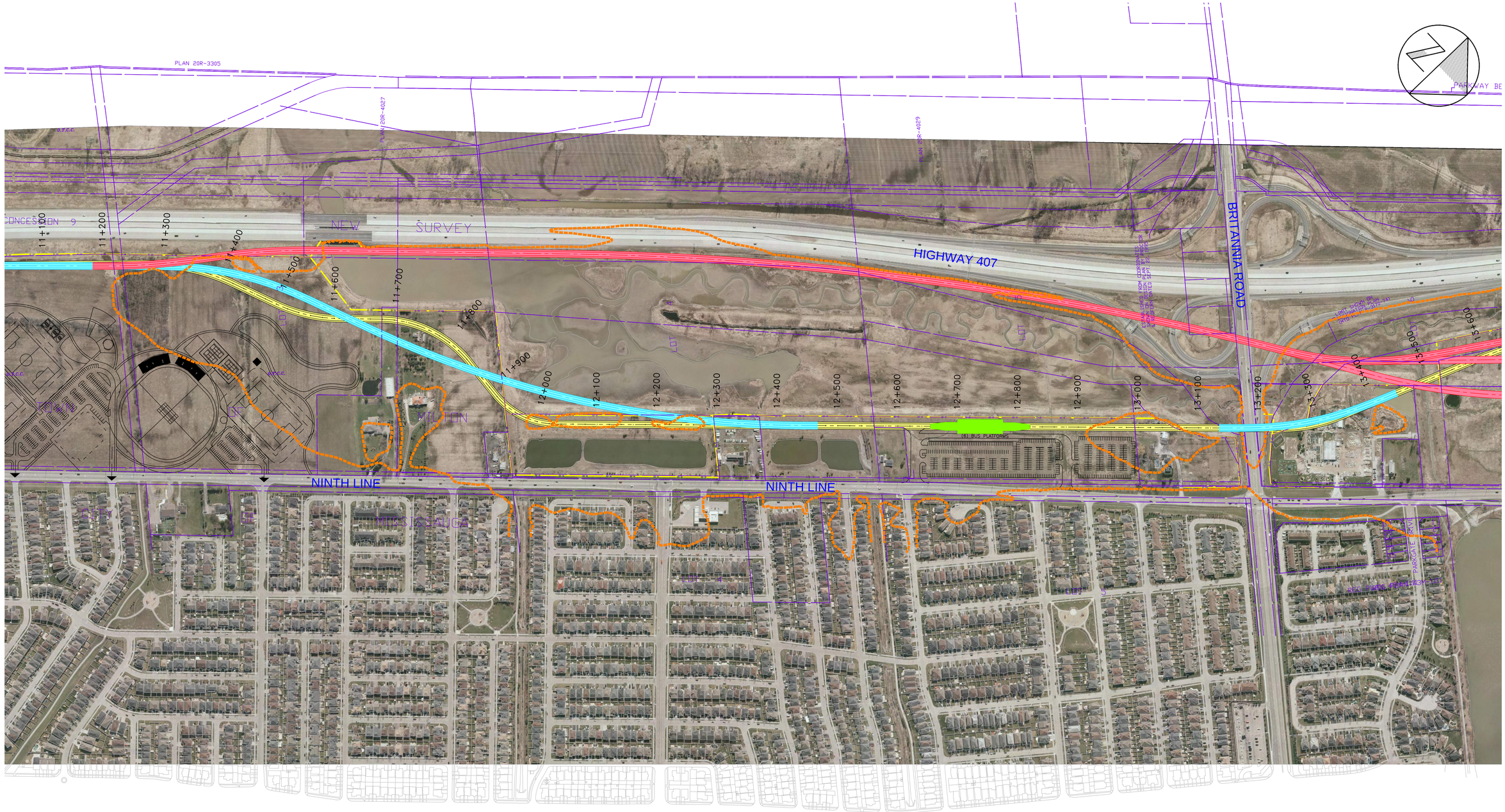
Last Saved By: kevin.ding
Plotted: 2016-06-02
Last Saved: 2016-06-02



LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S2)
- PROPOSED BUS STATION (ALTERNATIVE S2)
- PROPOSED TRANSITWAY (ALTERNATIVE S2A)
- PROPOSED TRANSITWAY (ALTERNATIVE S2B)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PROPOSED TRANSITWAY ALIGNMENT ALTERNATIVES -

SEGMENT 2

amec foster wheeler

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Consultant File No.
TP114008

Drawing No.
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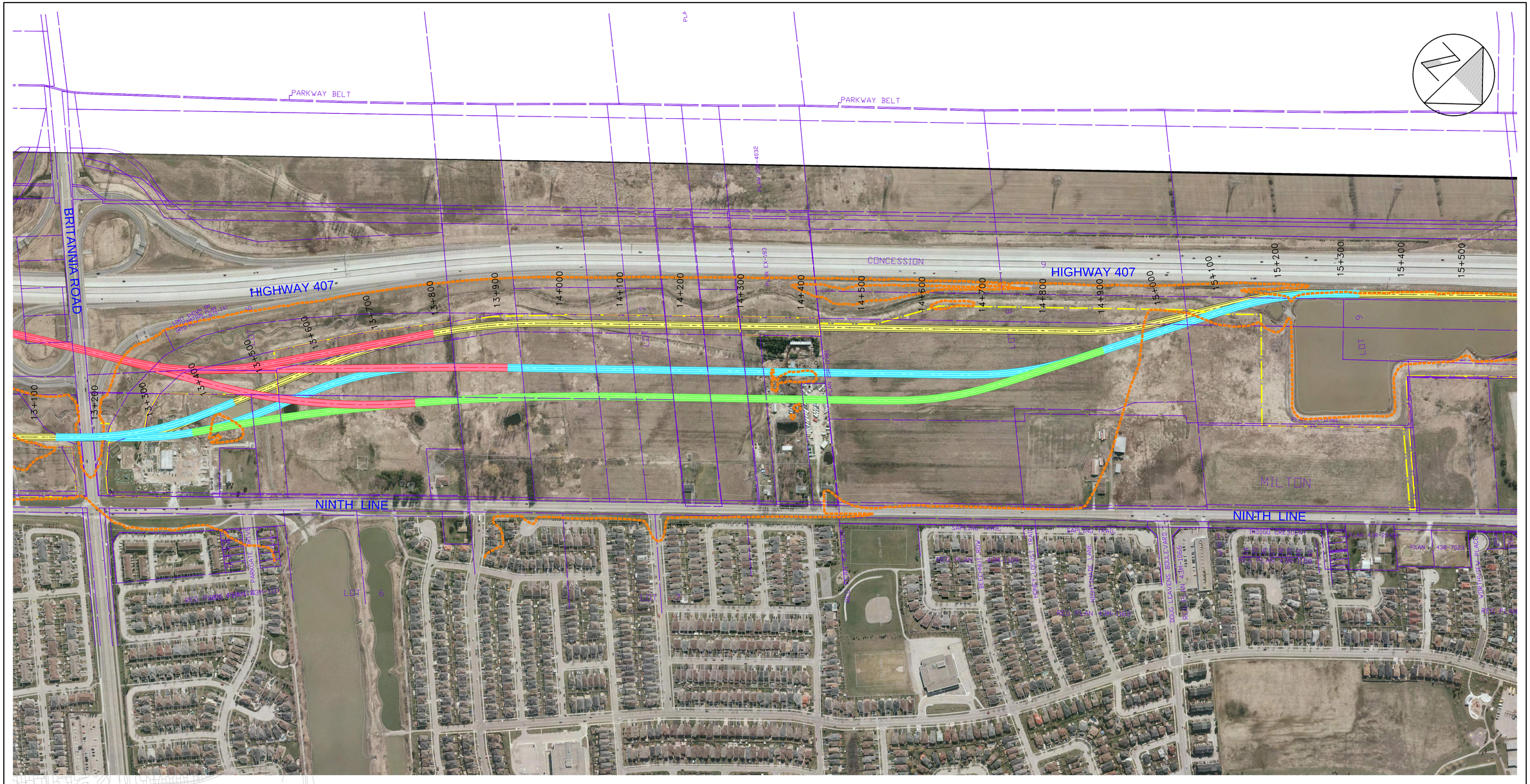

LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S3)
- PROPOSED BUS STATION (ALTERNATIVE S3)
- PROPOSED TRANSITWAY (ALTERNATIVE S2B)
- PROPOSED TRANSITWAY (ALTERNATIVE S3A)
- PROPOSED TRANSITWAY (ALTERNATIVE S3B)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PROPOSED TRANSITWAY ALIGNMENT ALTERNATIVES -

SEGMENT 3

amec foster wheeler

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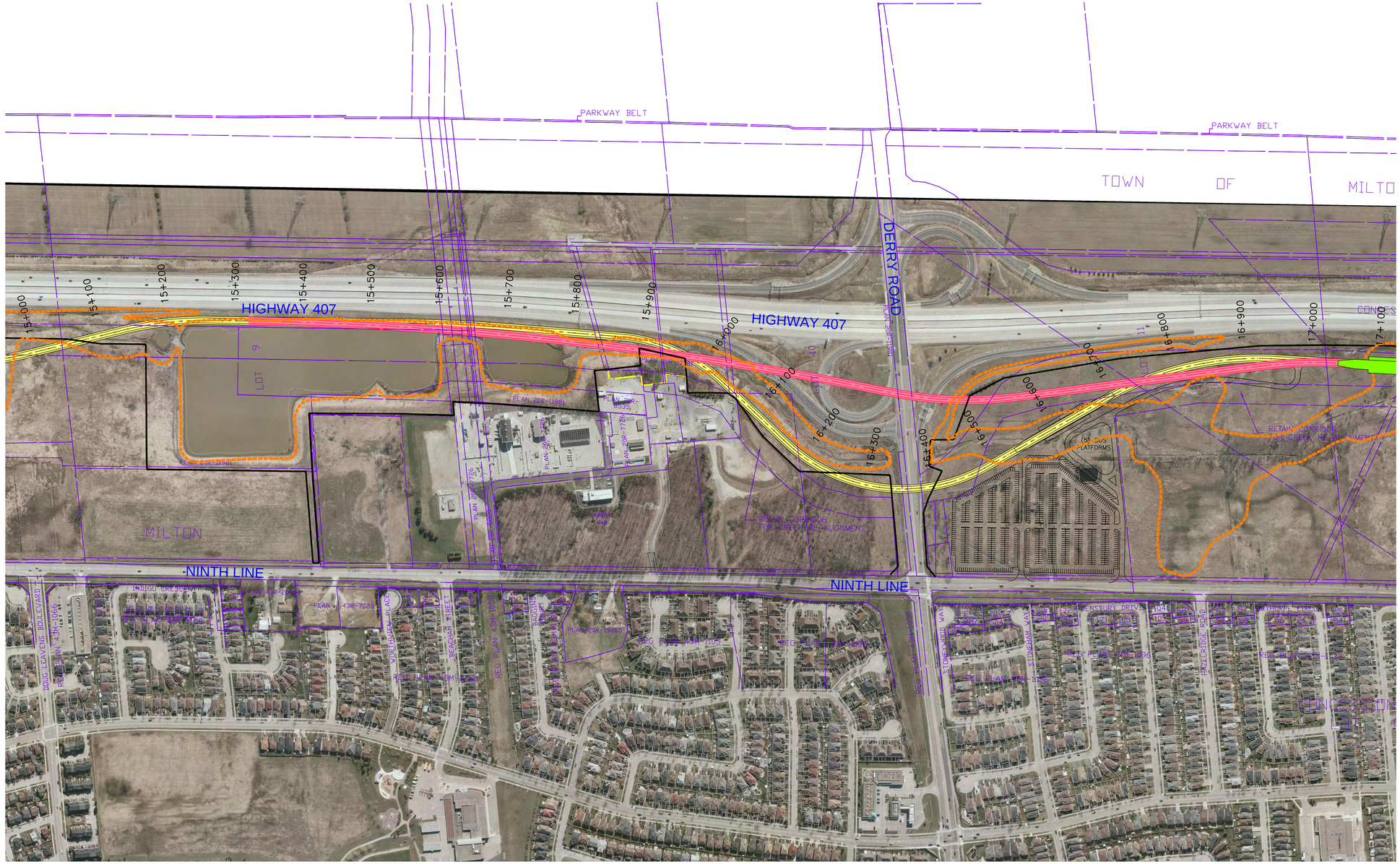

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Last Saved By: kevin.ding

Plotted: 2016-06-02
Last Saved: 2016-06-02

LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S4)
- PROPOSED BUS STATION (ALTERNATIVE S4)
- PROPOSED TRANSITWAY (ALTERNATIVE S4A)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PROPOSED TRANSITWAY ALIGNMENT ALTERNATIVES - SEGMENT 4

amec foster wheeler

SCALE VALID ONLY FOR 24"x36" VERSION

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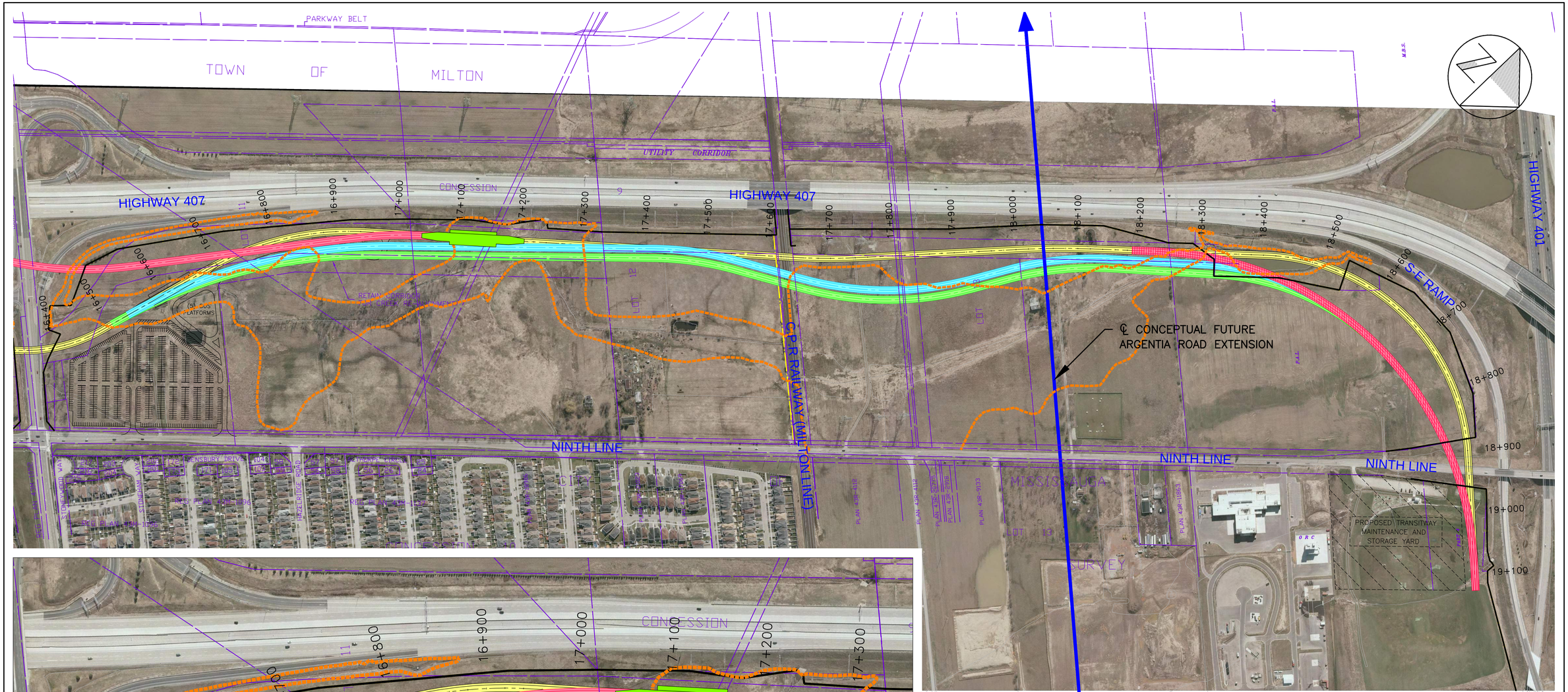

LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S5)
- PROPOSED BUS STATION (ALTERNATIVE S5)
- PROPOSED TRANSITWAY (ALTERNATIVE S4A)
- PROPOSED TRANSITWAY (ALTERNATIVE S5A)
- PROPOSED TRANSITWAY (ALTERNATIVE S5B)
- PROPOSED TRANSITWAY (ALTERNATIVE S5C)
- EXISTING HIGHWAY 407 FENCELINE
- REGIONAL FLOODLINE (2015 EXISTING)
- EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PROPOSED TRANSITWAY ALIGNMENT ALTERNATIVES -

SEGMENT 5

amec foster wheeler

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Consultant File No.
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Drawing No.
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LEGEND

- CROSS SECTION NUMBER
- EXISTING REGIONAL FLOOD ELEVATION (m)
- PROPOSED REGIONAL FLOOD ELEVATION (m)

232 191.38 191.34 — HEC–RAS CROSS SECTION LOCATION

- EXISTING REGIONAL FLOODLINE (2015)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

FLOODLINE MAPPING WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

amec foster wheeler

Scale 1:3000
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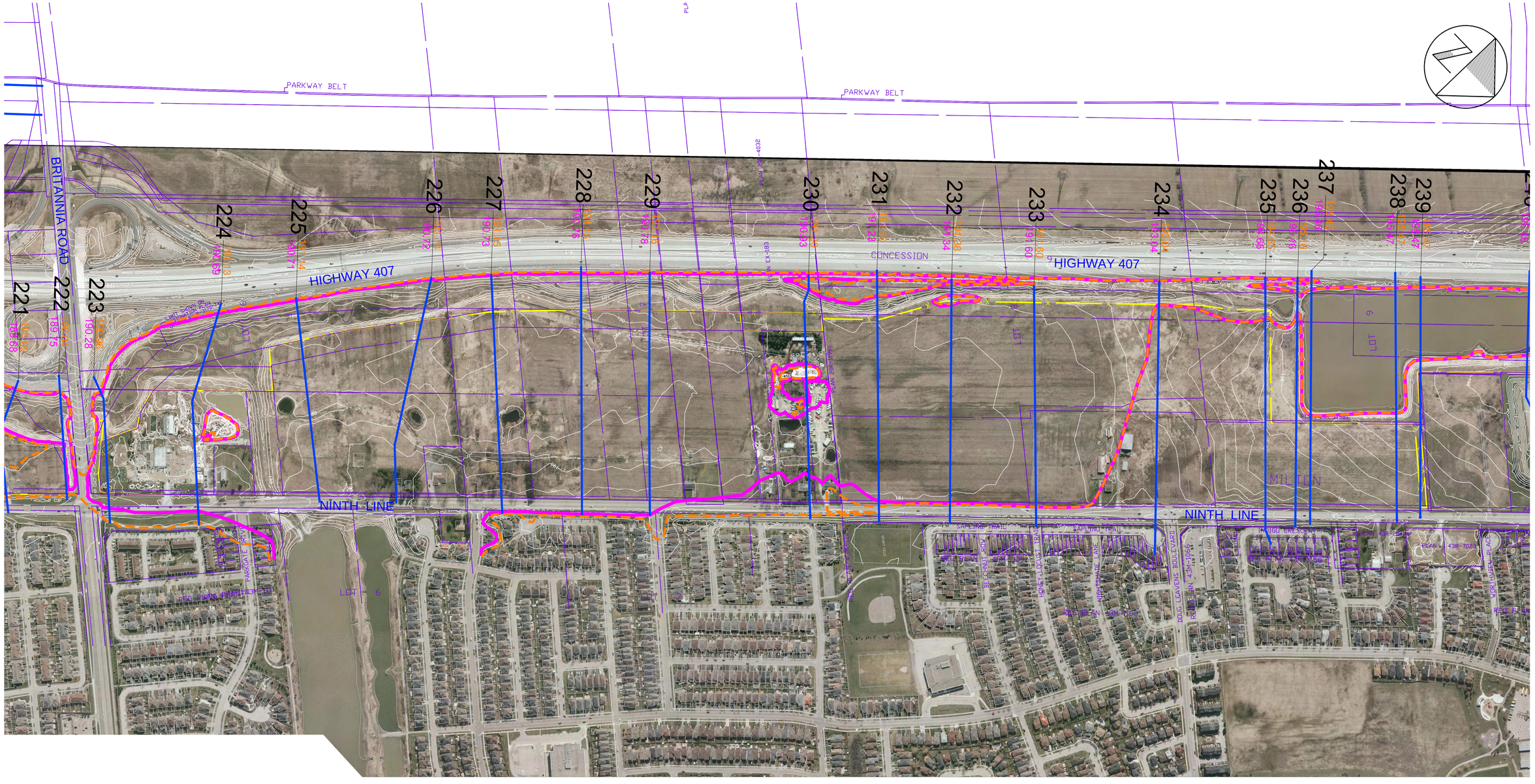
Consultant File No.
TP114008

Drawing No.
7A



LEGEND

232 — CROSS SECTION NUMBER

191.38 — EXISTING REGIONAL FLOOD ELEVATION (m)

191.34 — PROPOSED REGIONAL FLOOD ELEVATION (m)

HEC–RAS CROSS SECTION LOCATION

EXISTING REGIONAL FLOODLINE (2015)

PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

EXISTING HIGHWAY 407 FENCELINE

EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

FLOODLINE MAPPING WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

amec foster wheeler

Scale 1:3000

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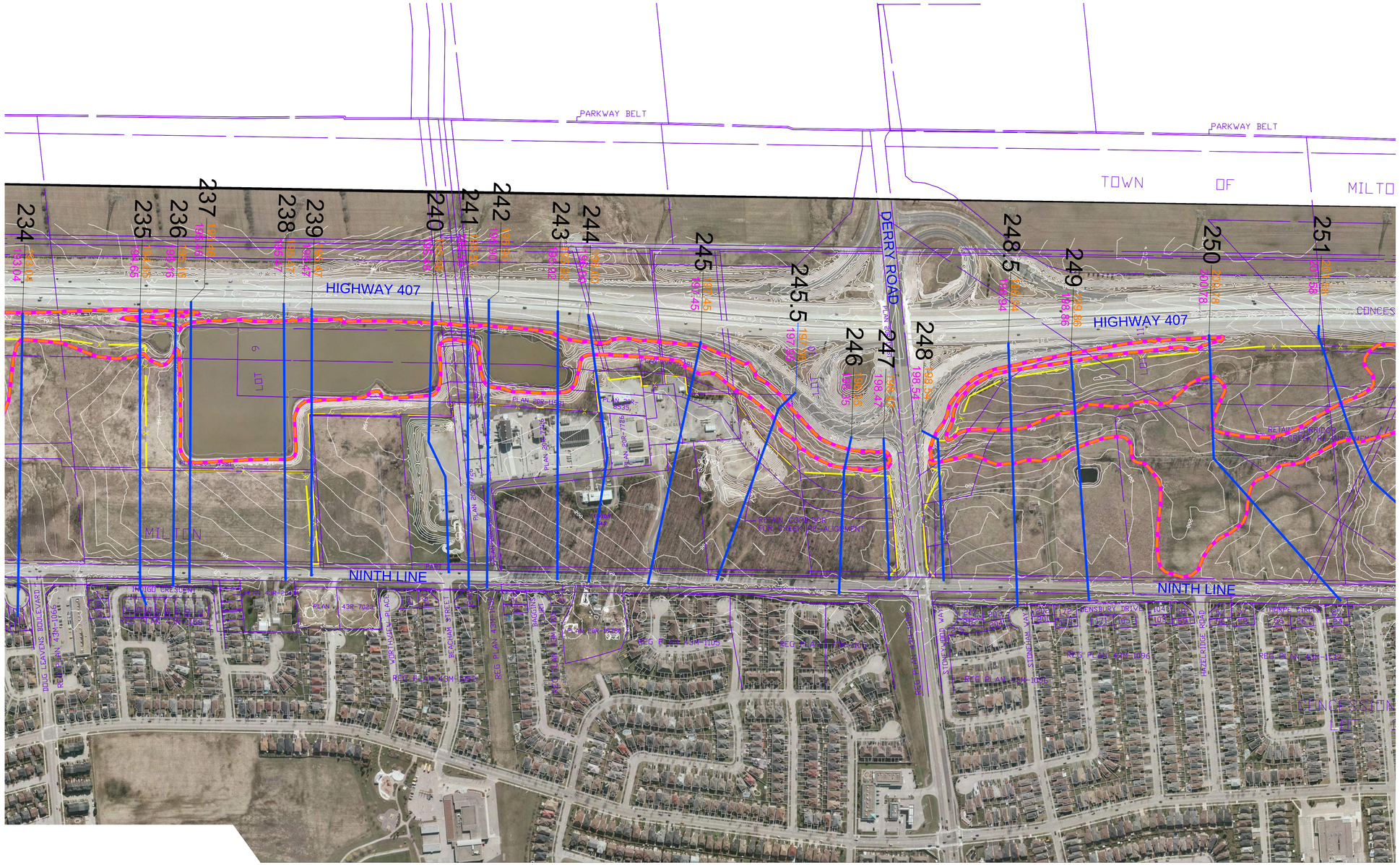
Consultant File No.
TP114008

Drawing No.
7B



LEGEND

232 — 191.38 / 191.34

- CROSS SECTION NUMBER
- EXISTING REGIONAL FLOOD ELEVATION (m)
- HEC–RAS CROSS SECTION LOCATION
- PROPOSED REGIONAL FLOOD ELEVATION (m)
- EXISTING REGIONAL FLOODLINE (2015)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

FLOODLINE MAPPING WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

amec foster wheeler

Scale 1:3000
0 25 50 100

Consultant File No.
TP114008

Drawing No.
7C

LEGEND

- CROSS SECTION NUMBER
- EXISTING REGIONAL FLOOD ELEVATION (m)
- 232 — 191.38 / 191.34 — HEC–RAS CROSS SECTION LOCATION
- PROPOSED REGIONAL FLOOD ELEVATION (m)
- EXISTING REGIONAL FLOODLINE (2015)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

FLOODLINE MAPPING WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

amec foster wheeler

Scale 1:3000
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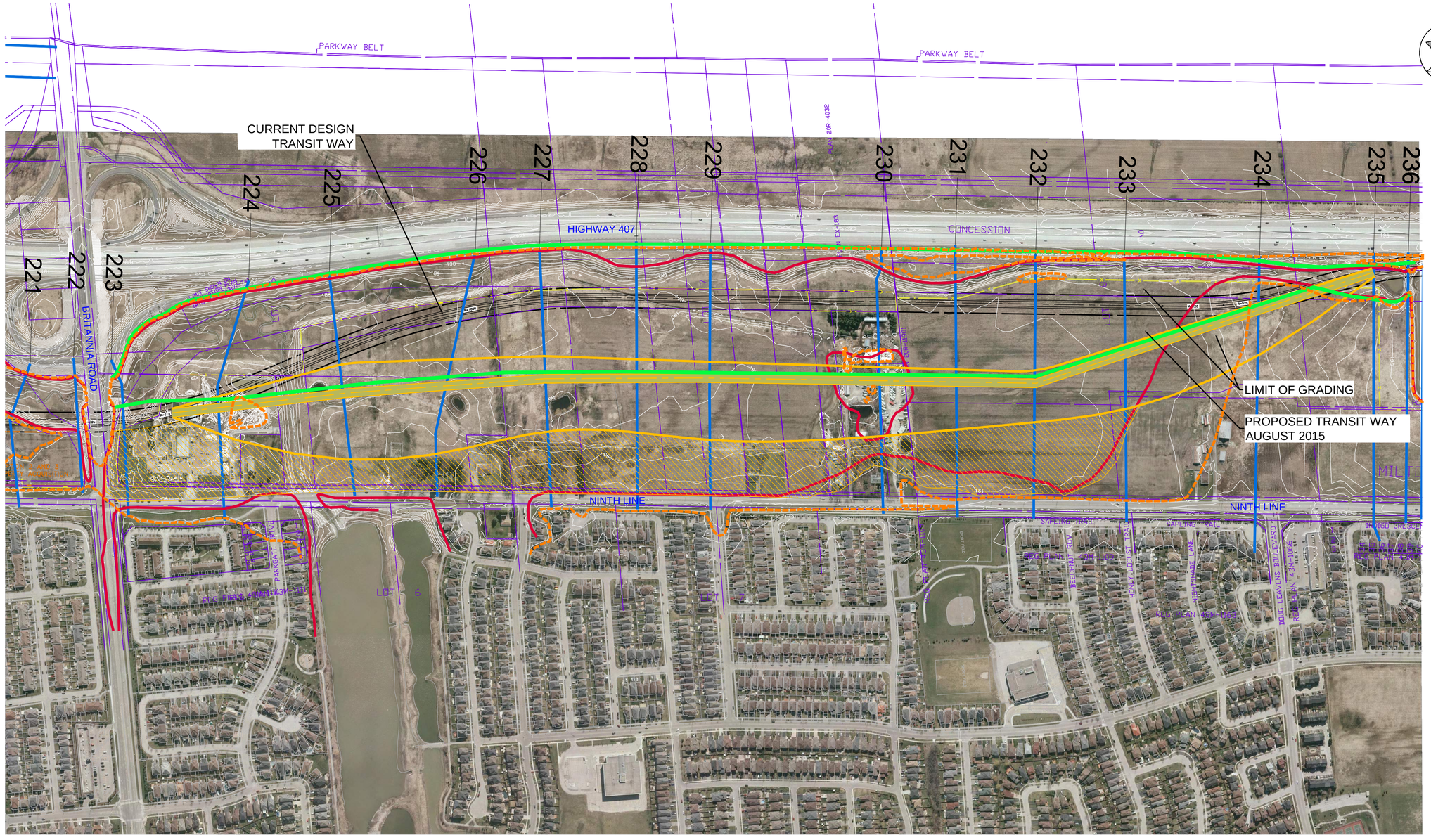
TP114008

Drawing No.
7D



LEGEND

- 227 — HEC–RAS CROSS–SECTION
- REGIONAL FLOODLINE (2004 PEL)
- REGIONAL FLOODLINE (AMEC FOSTER WHEELER 2015)
- PROPOSED REGIONAL FLOODLINE
- POTENTIAL DEVELOPABLE AREA
- PROPOSED TRANSIT WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT CITY OF MISSISSAUGA	LIMIT OF PROPOSED TRANSIT WAY GRADING	amec foster wheeler	Scale 1:3000 (0 25 50 100) Consultant File No. TP114008 Drawing No. 8

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Plotted: 2015-09-15
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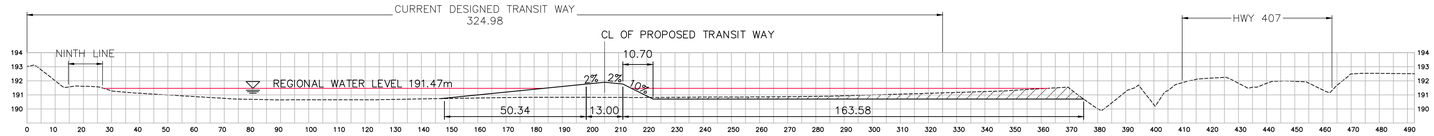

HEC-RAS SECTION-232

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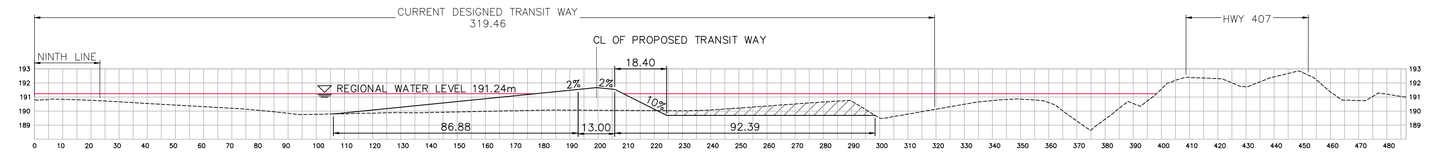

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SCALE

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HEC-RAS SECTION-227

SCALE

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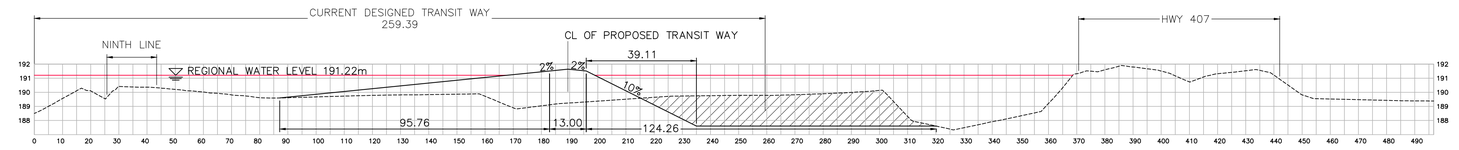

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Plotted By: josh.seraj

Last Saved By: josh.seraj

Plotted: 2015-09-15

Last Saved: 2015-09-11

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

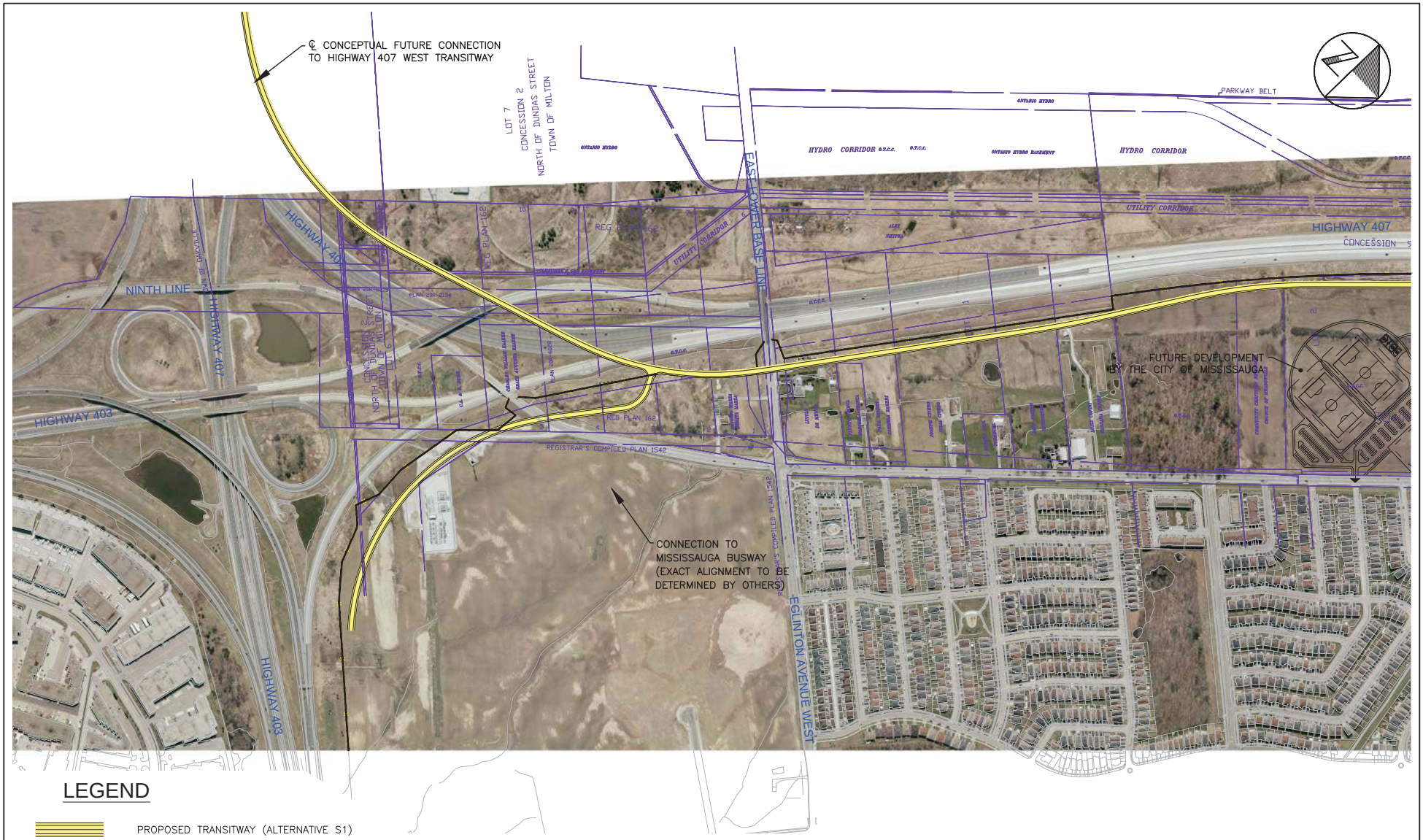
HEC-RAS SECTIONS

amec foster wheeler

Scale N.T.S

Consultant File No. TP114008

Drawing No. 9



LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S1)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

SEGMENT 1

amec foster wheeler

Scale 1:3000
0 25 50 100

Consultant File No.
TP114008

Drawing No.
10A

Plotted: 2016-06-02
Last Saved: 2016-06-02
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Last Saved By: kevin.ding
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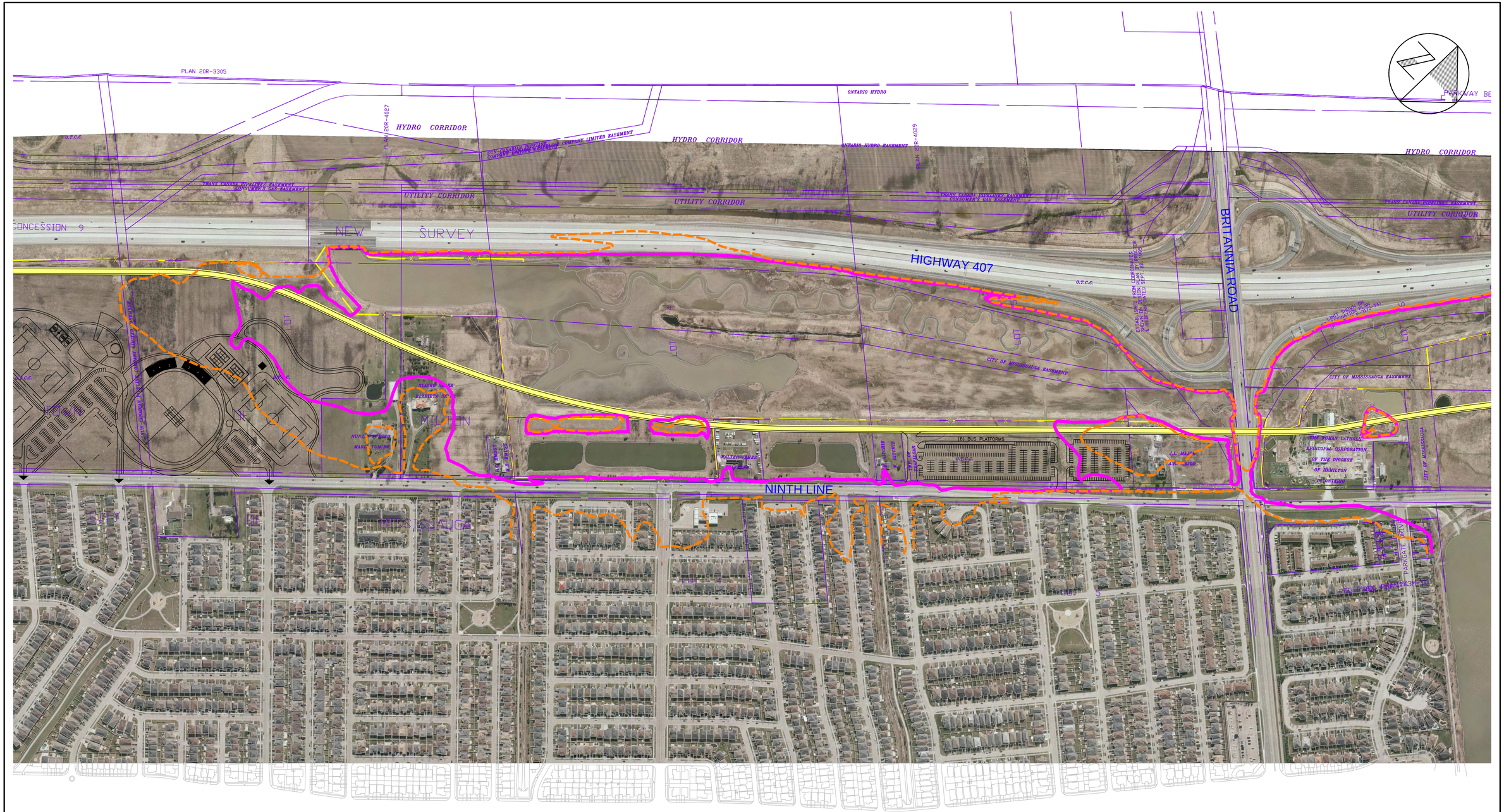

LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S2)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

SEGMENT 2

amec foster wheeler

Scale 1:3000
0 25 50 100

Consultant File No.
TP114008

Drawing No.
10B

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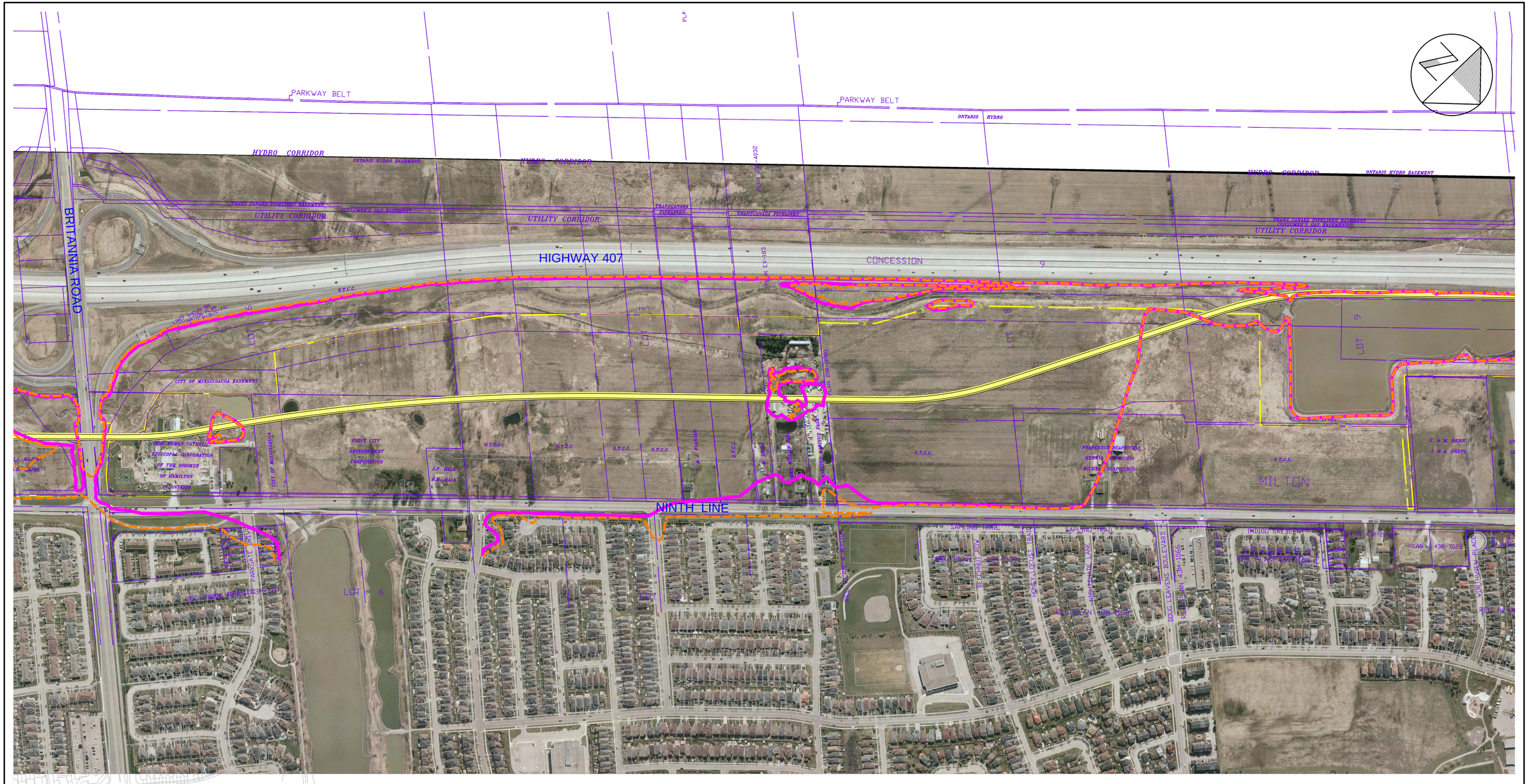
Last Saved By: josh.seroj
Plotted: 2015-09-16
Last Saved: 2015-09-16



LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S4)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

SEGMENT 3

amec foster wheeler

Scale 1:3000
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Consultant File No.
TP114008

Drawing No.
10C

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Plotted: 2015-09-16
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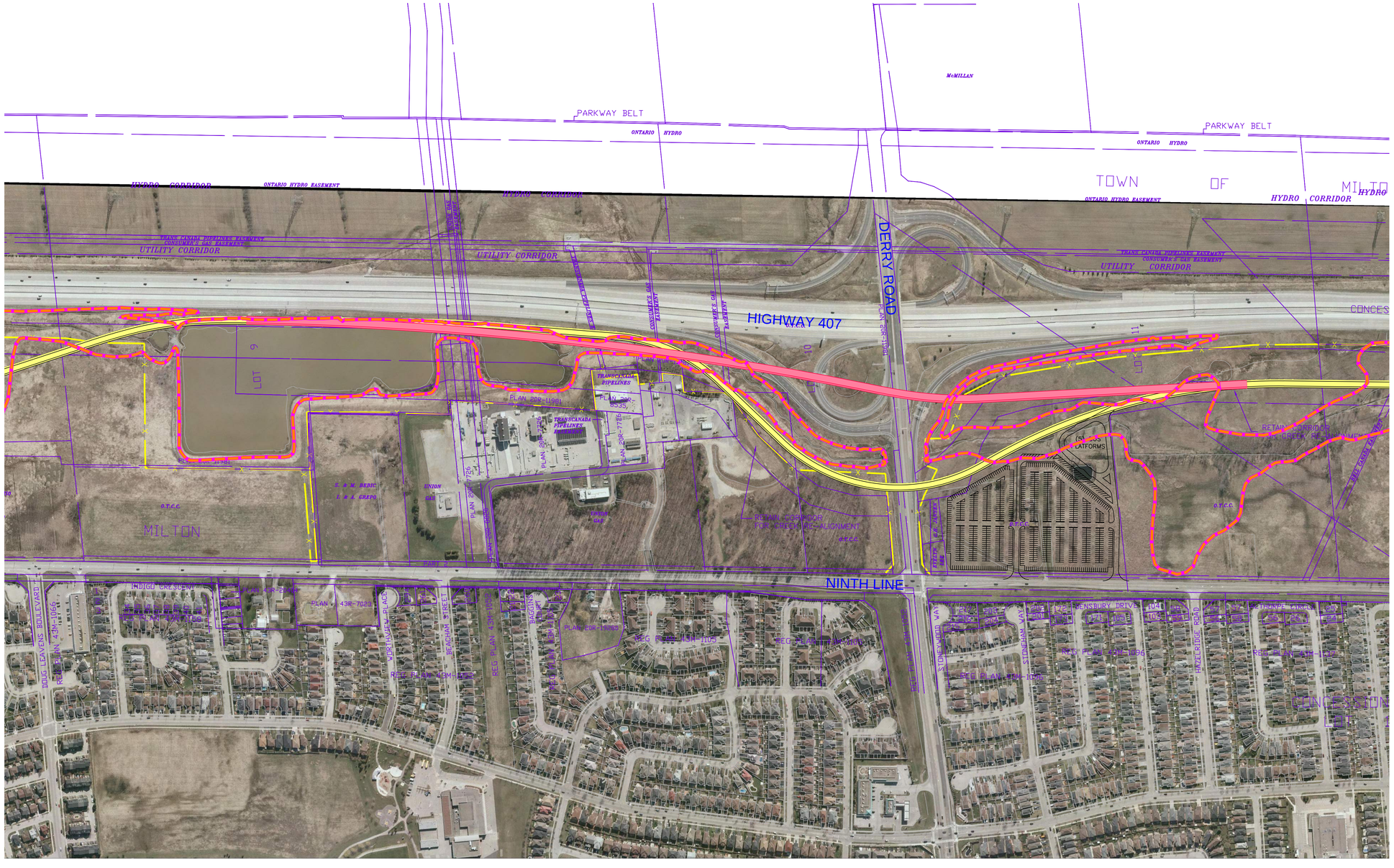

LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S4)
- PROPOSED TRANSITWAY (ALTERNATIVE S4A)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

SEGMENT 4

amec foster wheeler

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Consultant File No.
TP114008

Drawing No.
10D

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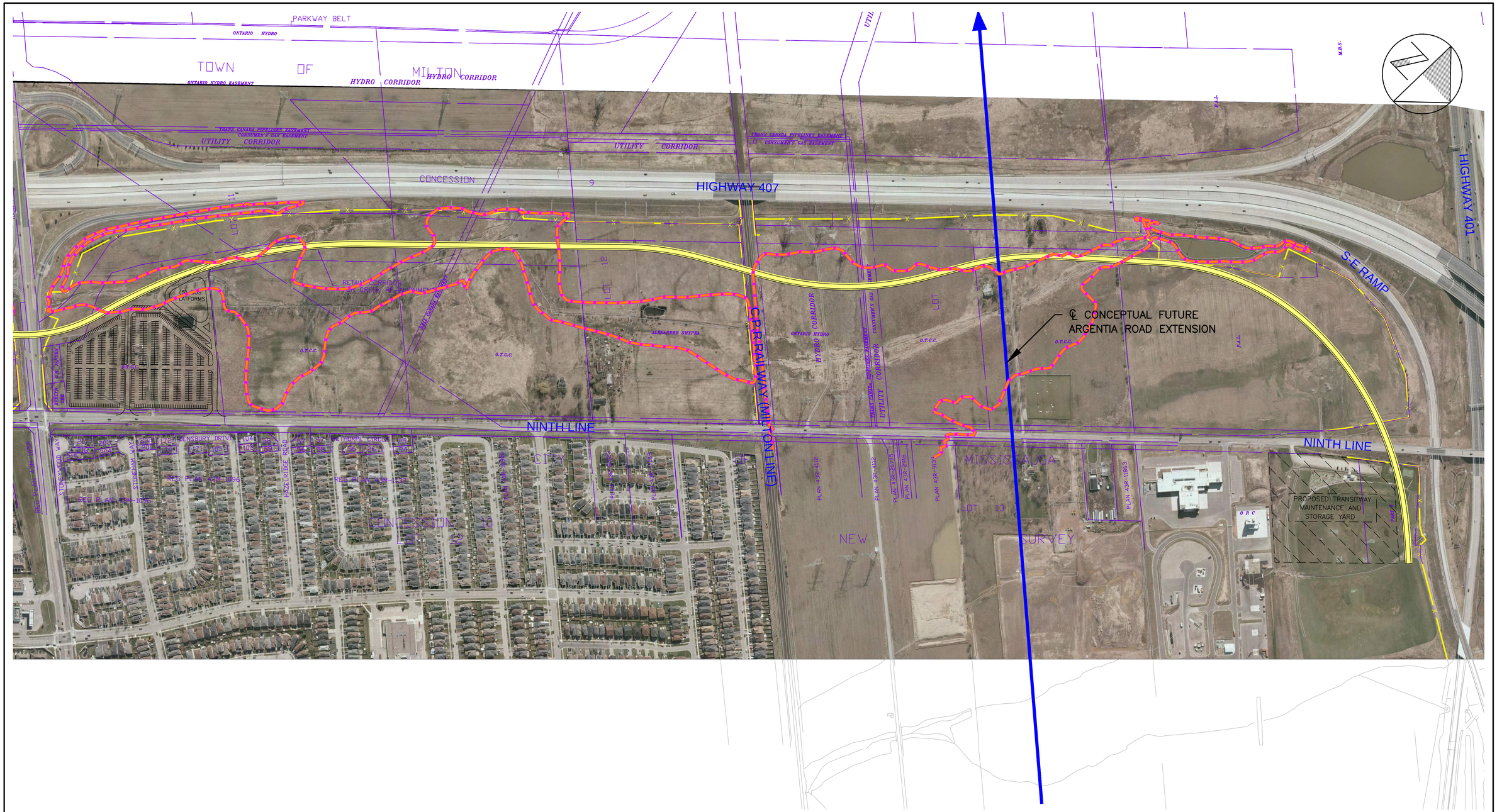
Plotted: 2015-09-16
Last Saved: 2015-09-16



LEGEND

- PROPOSED TRANSITWAY (ALTERNATIVE S5)
- EXISTING HIGHWAY 407 FENCELINE
- EXISTING RIGHT OF WAY
- REGIONAL FLOODLINE (2015 EXISTING)
- PROPOSED REGIONAL FLOODLINE WITH HYDRAULIC STRUCTURE IMPROVEMENTS AT CNR

SCALE VALID ONLY FOR 24"x36" VERSION

NINTH LINE DISTRICT TRANSIT WAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

SEGMENT 5

amec foster wheeler

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Consultant File No.
TP114008

Drawing No.
10E

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Last Saved: 2015-09-16

Appendix A

Consultation

Meeting agenda

Date: **May 13, 2015** **Meeting at:** City of Mississauga
Civic Centre Boardroom 5B

File No.: TP114008

Subject/Purpose: **Highway 407 Transitway Review – Progress Meeting**

Attendees:

Joe Perrotta	City of Mississauga
Frank Marzo	City of Mississauga
Susan Tanabe	City of Mississauga
Mel Kayama	City of Mississauga
Muneef Ahmad	City of Mississauga
Virpal Kataure	Region of Peel
Brian Hill	Region of Peel
Tarita Diczki	Ministry of Transportation
Adrian Firmani	Ministry of Transportation
Liz Howson	Macaulay Shiomi Howson
Ron Scheckenberger	Amec Foster Wheeler
Aaron Farrell	Amec Foster Wheeler
James Scale	Amec Foster Wheeler

To be presented/discussed:

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Burlington, ON L7N 3G2
905-335-2353
amecfw.com

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a division of Amec Foster Wheeler Americas Limited

Continued…

1. Introductions
2. Process Summary
3. Key Issues
    a. Stations and Parking Facilities
        i. Parking Capacity
        ii. Ridgeway Station / Parking Facility
        iii. Integration of Carpool and Transitway Parking Capacity
        iv. Compatibility with or Restrictions on Adjacent Land Use
        v. Impacts on Highway 407 Ridership Volumes
    b. Transitway Geometric Design
        i. Connectivity to Highway 407 Westbound and City of Mississauga BRT (including compatibility with Metrolinx)
        ii. Minimum Radii
        iii. Cross-Section (including encroachment into Hwy 407 ROW)
        iv. Implementation of Retaining Systems
        v. Extension of Argentia Road
    c. Environmental (social, economic and natural) Considerations
    d. Water Resources
        i. Freeboard Requirements
        ii. Joint Use Stormwater Management Facilities
4. Next Steps
    a. Agency Liaison (Metrolinx, 407 ETR, Union Gas and Ontario Hydro)
    b. Landowner Liaison/ Meeting
    c. Schedule
5. Other Business

Continued…

Stations and Parking Facilities

1. What is the basis for the 4,000 estimated parking stall capacity within the Ninth Line lands? Can parking be phased in with due consideration of vertical parking garages? What is the relationship between parking facility functionality and capacity (Note: upper threshold at most parking facilities appears to be between 800 and 1,200)?

2. Is a Transitway station/ parking facility still being considered at Ridgeway?

3. Are there concerns and/ or restrictions on mixed use parking facilities to accommodate both carpooling and Transitway users? Would this preclude parking structures?

4. Are there any land use restrictions adjacent to or along the roadway in frontage of Transitway stations/ parking facilities?

5. Is there an issue with the placement of parking facilities adjacent to 407 ETR given the need to remain "revenue compatible" with 407?

Transitway Geometric Design

6. Is the Transitway connection to Highway 407 westbound at the south limit of the Ninth Line lands still planned as the primary move? Is it still proposed to be an underpass? Has it been coordinated with access to the City of Misissauga's BRT and Metrolinx's proposed Highway 407 westbound ramp connection from the Winston Churchill Station?

7. The minimum radii (130 m absolute and 250 m desirable) proposed in the 1998 Transitway Functional Planning Study meets the requirements for LRT, however is below the minimum radii (525 m) required for BRT and a corresponding design speed of 100 km/hr. What rationale/ restrictions were considered in reducing the radii below 525 m?

8. Is all future Highway 407 widening to occur within the existing median? If so, can the Transitway be situated within the Highway 407 right-of-way in select areas (e.g. south of Derry Road) to minimize impacts to existing stormwater management infrastructure?

9. Is there an issue with respect to space/land planning with assuming retaining walls to avoid impact to floodplain (e.g. crossing at Britannia) or minimize Transitway right-of-way width at the crossing roads as part of the functional assessment?

10. If Argentia Road is extended west of Ninth Line as an overpass crossing of Highway 407, is there sufficient space within the existing Highway 407 roadway cross-section to accommodate a centre median pier?

Transitway Environmental (Socio, Economic and Natural) Considerations

11. Is the Transitway crossing of a cultural heritage protection property (Bussell) north of the CPR crossing a constraint for the MTO?

12. Would pedestrian access to lands west of the Transitway be allowed vis-à-vis tunnels under the Transitway?

Continued…

Water Resources

13. Given existing segments of Highway 407 currently are designed for zero stormwater freeboard, what parameters are to be assumed for design?

14. The Transitway routing would currently affect an existing stormwater management facility at the north end of the system, could this be replaced as a joint use facility between Highway 407 and the Transitway?

Stakeholder Liaison

15. At what point would the City and MTO need to engage 407 in the planning of the Transitway?

16. At what point would the MTO foresee engaging Union Gas and Ontario Hydro for Transitway planning?

17. At what point would the MTO foresee engaging landowners for Transitway planning?

Minutes

Date Prepared:	Thursday, May 21, 2015
File #:	TP114008-75
Date & Time:	Wednesday May 13, 2015 @ 1:30 p.m.
Meeting at:	Civic Centre, City of Mississauga
Subject:	Transitway Functional Design from Highway 403 to Highway 401 Progress Meeting

Attendees:

Joe Perrotta, City of Mississauga (Part Time)	Adrian Firmani, MTO
Susan Tanabe, City of Mississauga	Virpal Kataure, Region of Peel
Frank Marzo, City of Mississauga	Alejandro Cifuentes, Region of Peel
Mel Kayama, City of Mississauga (Part Time)	Liz Howson, MSH
Graham DeRose, MTO	Ron Scheckenberger, Amec Foster Wheeler (Part Time)
Tarita Diczki, MTO	Jim Scale, Amec Foster Wheeler

MATTERS DISCUSSED **ACTION BY:**

The purpose of this meeting was to discuss the key planning and design matters related to the Transitway with representatives of the City of Mississauga, Ministry of Transportation and Region of Peel.

Stations and Parking Facilities

1. Amec Foster Wheeler provided an overview of the parking facility assessment that concluded the following:

    a. Preliminary estimates of parking demand established and documented in the MTO "Transitway Corridor Protection Study Highway 407/ Parkway Belt West Corridor from Highway 403 to Markham Road" dated December 1998 Final Report (1998 Corridor Protection Study), includes discrepancies between the overall forecasted parking demands, stated parking capacity provided and the actual parking capacity accommodated in the preliminary layouts. The

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MATTERS DISCUSSED **ACTION BY:**

difference between the forecasted demand and the capacity of the preliminary layouts is 985 additional vehicles.

b. As per the MTO's correspondence dated March 30, 2015, Metrolinx confirmed that it has no plans to relocate the existing Lisgar Station or add another station at the proposed CPR Galt Station on Ninth Line. As such, it is understood that the MTO will be removing plans for the CPR Galt Station and the associated parking capacity will have to be reassigned to the Britannia Station and Derry Station parking facilities accordingly.

c. The MTO indicated that it is of the opinion that the overall forecasted parking demand determined in the 1998 Corridor Protection Study is outdated and highly underestimated. The current MTO recommended parking demand of 4,000 spaces represents a 180% (13.01 ha) and 65% (8.02 ha) increase in the calculated demand and protected capacity identified in the 1998 Corridor Protection Study respectively.

More accurate numbers will not be available until the Environmental Assessment stage, however the MTO is of the opinion that the 4,000 station capacity is still understated. Estimates in the 1998 Corridor Protection Study were based on 2031 projections, however 2051 projections are likely to be considered once the environmental assessment is initiated. The environmental assessment is not anticipated for another two to three years with completion potentially in 2020. The environmental assessment has been delayed to permit advancement of other transit initiatives.

The MTO indicated that parking capacities determined in the 1998 Corridor Protection Study were developed on the understanding that the stations along the Ninth Line lands were deemed "end of the line". As such the stations served a broader regional purpose, and were functioning as the major 407 Transitway access points for Transitway users from Halton Region. Subsequent to the completion of the 1998 Corridor Protection Study, it was recommended that the 407 Transitway be extended into Halton. As a result, the Mississauga stations will serve a more centralized function as opposed to a regional function. Despite the change in functionality and potential demand, current requested station capacities have increased considerably over and above the projections from the 1998 Corridor Protection Study.

The MTO indicated that the requested Mississauga station capacities include consideration of station capacities on the future Hwy 407 Transitway extension into Oakville and Burlington. The City indicated that the rationale should take into account current growth and transportation policies discussed in more detail below. An acceptable medium between theoretical station demand, and associated land use, needs to be balanced with current growth policies and intensification objectives. The MTO will review the rationale used in establishing the requested station capacities and provide a response to the City. **MTO**

MATTERS DISCUSSED **ACTION BY:**

Amec Foster Wheeler questioned the functionality of the parking facilities given the required plan area needed at each of the two (2) parking facilities to accommodate 4,000 at-grade parking spaces. The MTO indicated it had no concerns with the potential size and functionality of the parking facilities to accommodate the stated volumes.

The upper threshold at most parking facilities established as part of the 1998 Corridor Protection Study ranged between 800 and 1,200 spaces in areas with greater intensification than proposed along the Ninth Line lands. The MTO indicated that the majority of these locations are within built up areas and capacities are constrained by adjacent development, as opposed to the Ninth Line lands which are not subject to these existing constraints.

The City expressed concerns regarding the traffic demand on the local roadway network generated by the stated parking capacities. The City also expressed concerns that the proposed capacity is not consistent with current policies encouraging alternative modes of transportation. Providing large capacity parking facilities as currently proposed, will reduce reliance on alternative transportation modes such as walking, bicycling and transit, to access the Transitway. Although Ninth Line in its entirety is not currently serviced by existing bus service, bus routing will be reviewed/ modified as development proceeds west of Ninth Line.

The requested capacities have a considerable impact on the availability of developable lands within the Ninth Line lands. The MTO indicated that all MTO owned and operated parking facilities, existing or future, are at-grade facilities and parking structures will not be considered within the Ninth Line lands.

The City expressed concerns that the exclusion of parking structures is inconsistent with current intensification and density targets in the Growth Plan and the goal of developing mixed-use and transit-supportive communities. MTO will further review integration of parking structures internally and follow up with the City. **MTO**

2. Access and visibility to the station/ parking facilities was raised, including the ability to set the parking facilities back from the Ninth Line road allowance, and provide alternative land use along the frontage of Ninth Line. The MTO indicated that access to the parking facilities is to be controlled by traffic signals, and controlled access to the parking facility must be maintained. Shared access is not permitted, and the MTO prefers to maintain Ninth Line frontage across the entire length of the parking facilities. MTO will further review land use requirements / restrictions, including mixed or alternative land use along the Ninth Line frontage, and follow up with the City. **MTO**

3. The MTO indicated that there are no restrictions on the proximity of the Transitway and associated stations relative to the Highway 407 right-of-

MATTERS DISCUSSED **ACTION BY:**

way. Ideally the Transitway design should mitigate encroachment into the Highway 407 right-of-way, however exceptions will be considered on a case by case basis.

4. The MTO has no plans to construct a Transitway station at Ridgeway Drive or provide a connection to the Mississauga BRT. Need, justification and construction of a connection from the Mississauga Bus Rapid Transitway (BRT) to the 407 Transitway will be the responsibility of the City.

   The Ridgeway Station is still being protected in the City's Official Plan (as identified in the 1992 Transitway EA), however is not included in the Mississauga Bus Rapid Transitway (BRT) construction contract which will terminate at the Winston Churchill station. As per email correspondence dated April 27, 2015, Metrolinx indicated to the City that the Ridgeway Station is not part of the 407 west Connection Project (discussed in further detail below). Further clarification is required to confirm if a station at Ridgeway it is part of any future Transitway initiatives outside Metrolinx's current 407 West Connection Project. **Amec Foster Wheeler/ City**

Transitway Geometric Design

5. Two alternatives were developed by Amec Foster Wheeler for the 407 Transitway alignment south of Lower Base Line Road in previous studies and include:

   1. Maintaining connection to the Mississauga BRT east of Winston Churchill as the primary move; and

   2. Maintaining connection to the Highway 407 westbound Transitway as the primary move.

   The 407 Transitway alternative connecting to Highway 407 westbound Transitway was proposed as a grade separation below Highway 407 to minimize impact to 407 ETR operations during construction.

   The MTO confirmed Alternative 2 remains the preferred alternative including grade separation below Highway 407. Connectivity to the Mississauga BRT station at Winston Churchill will be the responsibility of the City.

   Metrolinx completed a feasibility study for a proposed bus connection from the Mississauga BRT station at Winston Churchill to Highway 407 Westbound. The recommended alternative includes an at-grade intersection at Ridgeway Drive and a connection (Texas "T") off of the existing Ridgeway structure over Highway 403 to the existing Highway 403 westbound exit ramp to Highway 407.

   MTO staff was not aware of the current Metrolinx study. Additional liaison with Metrolinx will be required to confirm compatibility of the Texas "T" **MTO**

MATTERS DISCUSSED	ACTION BY:
concept with the proposed 407 Transitway corridor, and whether or not this is a short or long term solution. The Metrolinx design, as currently planned, will not permit direct connection to the 407 Transitway west of the Highway 403 interchange.	
Further coordination between the City, MTO and Metrolinx is required to confirm the recommended concepts to be carried forward as part of the current 407 Transitway protection study.	**Amec Foster Wheeler/ City/ MTO**
6. The GTA West study is ongoing and will impact the north end of the study limits within the Highway 407 and Highway 401 interchange. Alternatives have been developed, however the recommended plan will not be determined until the Fall or Winter of 2015.	
A review of the alternatives will be completed to protect for the worst case scenario until such time as the recommended alternative is determined.	**MSH**
7. As per correspondence with the MTO, spiral curves are to be provided for the horizontal alignment of the 407 Transitway as part of the current functional design. The 1998 Corridor Protection Study utilized simple curves.	**Amec Foster Wheeler**
8. The horizontal alignment developed as part of the 1998 Corridor Protection Study utilizes a number of radii less than the minimum BRT radius of 525 m and a corresponding design speed of 80 km/h. Radii do meet minimum light rail transit requirements.	
There are several locations where the application of radii less than 525 m are advantageous to mitigate impacts to existing Highway 407 interchanges, property (Union Gas) and maintain close proximity to the existing Highway 407 and Highway 401 right-of-ways to maximize developable land.	
The MTO requested that the geometric design of the Transitway be based on the 407 Transitway Design Standards developed by Delcan for the planning and preliminary design of the 407 Transitway from Highway 400 to Kennedy Road. The standards require a minimum BRT radius of 525 m based on an 80 km/h design speed.	**Amec Foster Wheeler**
Amec Foster Wheeler indicated that this would have significant impacts to the horizontal alignment of the 407 Transitway at the Derry Road interchange and the transition to an east-west orientation along Highway 401 at the north end of the assignment.	
Implementation of the 525 m radius at Derry Road would necessitate the 407 Transitway to be aligned through the existing interchange with grade separations required at several ramp crossings and Derry Road. An alternative similar to that being constructed at Winston Churchill for the Mississauga BRT would have to be considered resulting in significant cost	

MATTERS DISCUSSED **ACTION BY:**

increases for the grade separations and associated retaining walls that are anticipated to be required.

Implementation of the 525 m radius at the north end of the assignment will pull the 407 Transitway away from the existing Highway 407 south to Highway 401 east ramp resulting in increased undevelopable land between the 407 Transitway and the Highway 401 ramp.

9. The 1998 Corridor Protection Study recommended a 407 Transitway alignment south of Derry Road that essentially maintained clear zone requirements adjacent to the Highway 407 northbound lanes, however has significant impacts to two (2) existing stormwater management facilities. It also impacts the northwest quadrant of the Union gas property and potentially impacts existing Union Gas infrastructure.

   An alternative to align the 407 Transitway immediately adjacent to the Ninth Line road allowance was reviewed. The alternative is not recommended given the requirement for several grade separations to accommodate access to properties west of the proposed 407 Transitway (including Union Gas), impacts to an existing gas line running perpendicular to Highway 407 and impacts to an existing woodlot.

   The MTO previously indicated that future widening of Highway 407 would be accommodated within the existing Highway 407 median. To minimize impacts to the existing stormwater management facilities and mitigate impacts to Union Gas property, an alternative to align the 407 Transitway immediately adjacent to the existing Highway 407 northbound speed change lane was developed. The two roadways would be separated by concrete barrier.

   The MTO indicated that introduction of the barrier separation introduces a roadside safety hazard, and would require long-term maintenance of the barrier and associated storm sewer infrastructure. The MTO requested that an alternative be developed to maintain required roadside safety clearances relative to the Highway 407 northbound lanes.

10. There are a number of constraints within the Ninth Line lands impacting the location of the 407 Transitway corridor, including but not limited to, requirements for grade separation at the east-west road crossings, proximity to the existing flood plain, watercourses and other natural features, and associated land impacts. As such there are several locations where retaining structures need to be considered.

    The extent to which the 407 Transitway functional design and establishment of the corridor are dependent on the implementation retaining systems were discussed. The MTO acknowledges the need to provide retaining structures at the crossing road grade separations, however indicated they are not to be considered elsewhere.

MATTERS DISCUSSED **ACTION BY:**

11. The City would like Amec Foster Wheeler to include a review of the Argentia Road extension west of Ninth Line as part of the 407 Transitway functional design. The assessment will include both underpass and overpass alternatives at the 407 Transitway and Highway 407. Potential constraints to the extension include:

    - Proximity of Ninth Line to Highway 407 and associated impacts on achieving required vertical clearances;
    - Width of the existing Highway 407 median and ability to accommodate future median widening and introduction of a median pier for an underpass option;
    - Location of the 407 Transitway and associated impacts on achieving required vertical clearances; and
    - Impacts to an existing heritage property (Bussell).

    MTO indicated it prefers a single structure crossing of the 407 Transitway and Highway 407 (i.e. pier located between the two facilities). The MTO will provide details regarding the ultimate Highway 407 median widening. **MTO**

Transitway Environmental (Socio, Economic and Natural) Considerations

12. The west limits of the heritage property (Bussell) located north of the CPR rail line needs to be confirmed along with any potential impacts to the Transitway corridor. The MTO indicated that impacts to the heritage property would be reviewed as part of the future 407 Transitway Environmental Assessment.

13. Pedestrian access to lands west of the Transitway south of Britannia vis-à-vis tunnels under the 407 Transitway was discussed. MTO does not have any objections to tunnels below the 407 Transitway to provide the connectivity, as well as, potential consideration of a multi-use path within the lands between the 407 Transitway and Highway 407 right-of-way.

Water Resources

14. Coordination of the 407 Transitway alignment alternatives with the stormwater management assessment is ongoing as an iterative exercise.

    A hydraulic assessment of the existing watercourses was completed to assess permitted 407 Transitway encroachment into the flood plain. The results of the assessment are being used to assist in positioning the 407 Transitway. Depending on the 407 Transitway alignment selected, additional lands may be required east of the adopted 407 Transitway corridor to address riparian storage requirements. This would be accomplished through the installation of equalization culverts across the 407 Transitway. Opportunities to increase storage capacity west of the established 407 Transitway will be reviewed.

MATTERS DISCUSSED **ACTION BY:**

The MTO indicated it expected the 407 Transitway to be positioned immediately adjacent to the Highway 407 right-of-way south of Britannia Road. Amec Foster Wheeler indicated that placement of the 407 Transitway immediately adjacent to the Highway 407 right-of-way will require an additional grade separation of the 16 Mile Creek East Branch and significant reconstruction/ relocation of existing drainage channel and associated flood plain storage. Placement of the 407 Transitway adjacent to, or within, the flood plain will not have an impact on the area of available developable land. Placement of the 407 Transitway east of the flood plain is recommended given it is a more cost effective design.

15. Based on Amec Foster Wheeler's review of existing stormwater conditions within the Ninth Line lands, it was determined that there is an existing segment of Highway 407 which currently provides zero freeboard under the Regional Storm event. Amec Foster Wheeler requested clarification on the extent to which the zero freeboard criteria could be applied to the balance of Highway 407 within the study limits.

    The MTO will review freeboard requirements with it's Drainage and Hydrology Engineering group and provide a response to the City. **MTO**

    Amec Foster Wheeler will prepare a memorandum summarizing this issue. **Amec Foster Wheeler**

16. Amec Foster Wheeler conducted an assessment of existing hydraulic capacity restrictions imposed by the CNR culvert crossing south of the main 16 Mile Creek East Branch crossing of Highway 407. The assessment assumed no hydraulic restriction at the CNR crossing and the corresponding reduction in upstream surface water elevations extend northerly to Derry Road. While it is understood the CNR crossing will not be eliminated, there are potential opportunities to improve capacity of the existing crossing with potential improvements extending into the Ninth Line lands.

    MTO is receptive to a cost sharing arrangement for downstream improvements if it benefits the 407 Transitway and development of the Ninth Line lands. Amec Foster Wheeler will provide a memorandum outlining the proposed scope of work and associated benefits to the 407 Transitway and proposed development. **Amec Foster Wheeler**

17. The 407 Transitway alignment may impact an existing stormwater management facility at the north end of the system. Amec Foster Wheeler recommended the stormwater management facility be relocated and operate as a joint use facility. MTO indicated the facility could operate as a joint use facility for Highway 407 and the 407 Transitway, however could not be used for adjacent private development.

Stakeholder Liaison

MATTERS DISCUSSED	ACTION BY:
18. The City and Amec Foster Wheeler will consult with Union Gas and Hydro One as it relates to impacts to their existing infrastructure.	**Amec Foster Wheeler/ City**
Consultation has been initiated with Metrolinx, and follow-up discussions will be required to coordinate the 407 Transitway assessment with Metrolinx's short and long term plans at the south end of the study.	**Amec Foster Wheeler/ City/ MTO**
Consultation with other landowners will be deferred until the recommended plan has been developed in more detail and vetted through City and MTO Senior Management.	**City**
All liaison with 407 ETR will be facilitated through the MTO.	

Meeting Minutes prepared by,

Amec Foster Wheeler Environment & Infrastructure
a division of Amec Foster Wheeler Americas Limited

Per: James Scale, P. Eng.
Associate, Transportation

JS/js/cc

c.c. All attendees
Aaron Farrell – Amec Foster Wheeler

Farrell, Aaron

From: DeRose, Graham (MTO) <Graham.DeRose@ontario.ca>
Sent: May-28-15 3:07 PM
To: Scale, Jim; Frank Marzo; Susan Tanabe; Mel Kayama; Joe Perrotta; Kataure, Virpal; Scheckenberger, Ron; Farrell, Aaron; Liz Howson; Alejandro.Cifuentes@peelregion.ca
Cc: Diczki, Tarita (MTO); Firmani, Adrian (MTO); Kulathinal, Rina (MTO)
Subject: RE: Hwy 407 Transitway Assessment - Minutes of Meeting - MTO Comments
Attachments: 15-05-13 Prg Mtg Min.pdf; 15-05-13 MTO Prg Mtg Agenda.pdf

Importance: High

Good Afternoon,

Thank you for circulating the Meeting Minutes (attached). Also attached is a copy of the Meeting Agenda with a list of questions that were discussed. MTO has provided answers (in blue) to some of the agenda questions below:

1. What is the basis for the 4000 estimated parking stall capacity within the Ninth Line lands?

MTO must maintain that 4000 parking spaces be protected within the Ninth Line lands. Given our experience on new 407 Transitway station design, we feel these 4000 spaces are still highly underestimated. The next closest station moving west is at Trafalgar Road and Highway 407 interchange, approximately 8km away from the Britannia Station site. The current Trafalgar GO lot has capacity of 374 spaces, with ultimate protection for 550 spaces when the Transitway is built. Due to the increasing population and ever expanding catchment area for potential transit users in the vicinity of Ninth Line (both Mississauga and Milton), we need to continue to protect for at least 4000 spaces. MTO is open to discuss how these 4000 parking spaces are divided between the two lots, as we no longer feel it has to be an even 2000 each for Britannia and Derry. As mentioned, this number will be refined/revised during the next 407 Transitway Environmental Assessment, still a few years away.

Also, due to cost and maintenance, structured parking is not a consideration. MTO does not protect for structured parking anywhere along the entire 150 km alignment (plus 55+ stations) of the 407 Transitway (from Burlington-Halton Region to Hwy 35/115-Durham Region).

If 4000 parking spaces are not accommodated between the Britannia and the Derry stations, MTO will have to continue to protect for all station and runningway alignment alternatives until detailed analysis and forecasting can be done during the EA. If there is still disagreement to the 4000 parking spaces and the City/Region will not abide by these requirements, MTO will need to reassess the benefits and needs of this study as it pertains to the 407 Transitway.

4. Are there any land use restrictions adjacent to or along the roadway in frontage of Transitway stations/parking facilities?

MTO's preference is to have its own signalized access for each station to/from Ninth Line. However, MTO has made accommodations for shared signalized access into stations in the past and are open to discuss this option further, if required.

MTO requires station frontage along Ninth Line and will not permit any alternative land uses between the station envelopes and Ninth Line frontage. As described at the meeting, MTO is open to reconfiguring the stations to minimize the Ninth Line frontage.

8. Is all future Highway 407 widening to occur within the existing median?

Yes

10. If Argentia Road is extended west of 9th Line as an overpass crossing of Highway 407, is there sufficient space within the existing Highway 407 roadway cross-section to accommodate a centre median pier?

Yes

13. Given existing segments of Highway 407 currently are designed for zero stormwater freeboard, what parameters are to be assumed for design?

MTO was under the impression that all specific Drainage questions to be sent in a follow-up email so we can convey all questions/information to MTO's Drainage Engineer. If further clarifications are required, MTO may ask Amec Foster Wheeler to contact the MTO Drainage Engineer directly.

Sincerely,

Graham DeRose
Project Manager
Route Planning & Transit Initiatives
Ministry of Transportation, Central Region
Tel: 416.235.5255

Memo

To: Graham DeRose, Ministry of Transportation Ontario

From: Ron Scheckenberger, Amec Foster Wheeler

Date: June 3, 2015

File: TP114008-10

Re: **Highway 407 Transitway Assessment**

Further to the meeting of May 13, 2015 and your subsequent email of May 28, 2015, we herewith provide you with the specific drainage questions so that you can review further with Ministry of Transportation Ontario's (MTO's) Drainage Engineer. Thank you in advance for your assistance in this regard.

1. Based on the updated assessment by Amec Foster Wheeler, it is apparent that portions of the Highway 407 currently have a zero freeboard for the Regulatory (Hurricane Hazel) event (i.e. water surface measured from edge of travelled right-of-way). Clearly this is less than the typical design standard however would it be safe to assume that if the Transitway does not reduce the existing freeboard in these areas (i.e. result in flooding of the 407), the preliminary geometric design of the Transitway would be acceptable despite the existing deficient freeboard?

   Similarly, if the Transitway has an impact by way of reducing the freeboard in some areas compared to existing condition, is there an acceptable tolerance for this reduction, provided that it does not result in less than zero freeboard condition?

2. In many locations the Transitway, as currently being planned and sited, would be within the Regulatory event floodplain. As such, in order to preserve floodplain storage without major excavation, it would be necessary to access the floodplain on both sides of the Transitway. To this end, it would be necessary to design a series of equalization culverts across the Transitway; does MTO support this design philosophy? Does MTO have any specific technical requirements for such systems?

3. At the north limit of the corridor, north of the railway, there is a stormwater management facility on the east side of Highway 407 which serves to treat a portion of the highway in this location. Due to space restrictions, it is possible that this stormwater management facility may need to be relocated, due to alignment conflicts with the Transitway.

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In doing so, would it be possible to combine its function so as to treat runoff from both the existing portion of the highway plus part of the Transitway? If so, would there need to be any special design considerations? Also, can you confirm whether or not it would be possible to establish a joint use stormwater management facility which could treat runoff from the highway, Transitway and future development?

4. As discussed at the May 13, 2015 meeting, Amec Foster Wheeler has conducted a preliminary assessment of the potential benefits to the Ninth Line lands of replacing/upgrading the railway culvert downstream of Highway 407 on the main branch of the tributary. The objective in this regard would be to lower Regulatory water levels upstream of the railway within the backwater zone affecting the Ninth Line lands, which would have multiple benefits including:

   - Reducing height (and associated fill) requirements to flood protect the Transitway
   - Reduce scale of compensatory storage due to Transitway construction
   - Improve flood protection to portions of Highway 407
   - Increase potential lands available for development in the Ninth Line lands

   Given that these works would potentially benefit multiple parties (City, MTO, 407 ETR) including CNR, there would need to be some form of cost sharing agreement for the future upgrade of the railway culvert, should this be deemed to be a cost beneficial activity. The financial benefits and details of cost sharing strategy/percentages are beyond the current scope of the Transitway project and Scoped Subwatershed Study assessment, however key considerations for MTO's review at this time include:

   - Method of apportioning benefit including potential for Municipal Development Charges to support
   - Staging of upgrade; interim management approach
   - Need to consider as part of a future Environmental Assessment

   It is understood (from our dialogue May 13, 2015) that since the works would not be revenue generating for 407 ETR, it would be unlikely that it (407 ETR) would participate; that said the flood risk to the highway would be reduced.

   The question which we have for MTO at this time is whether or not there is support for this potential management strategy and what specifics MTO would be seeking at this time and in the future?

We thank you in advance for your time and input and look forward to continuing to work with Amec Foster Wheeler and the City on this assessment.

RBS/cc

c.c. Frank Marzo, City of Mississauga
Susan Tanabe, City of Mississauga
Muneef Ahmad, City of Mississauga
Virpal Kataure, Region of Peel
Liz Howson, MSH

Farrell, Aaron

From: DeRose, Graham (MTO) <Graham.DeRose@ontario.ca>
Sent: June-09-15 8:55 AM
To: Campbell, Candice
Cc: Scheckenberger, Ron; Farrell, Aaron; Frank Marzo (frank.marzo@mississauga.ca); Susan Tanabe (susan.tanabe@mississauga.ca); Muneef Ahmad (muneef.ahmad@mississauga.ca); Virpal Kataure (Virpal.Kataure@peelregion.ca); Elizabeth Howson, BES, MCIP (howson@mshplan.ca); Firmani, Adrian (MTO); Kulathinal, Rina (MTO)
Subject: Ninth Line Land Use Study - MTO Drainage Response
Attachments: 15-06-03 MTO-GDeRose.pdf

Importance: High

Good Morning,

Please find MTO's Drainage & Hydrology section responses below (in red) to the specific drainage questions for the City of Mississauga's Ninth Line Land Use Study. Original memo attached for reference:

1. Based on the updated assessment by Amec Foster Wheeler, it is apparent that portions of the Highway 407 currently have a zero freeboard for the Regulatory (Hurricane Hazel) event (i.e. water surface measured from edge of travelled right-of-way). Clearly this is less than the typical design standard however would it be safe to assume that if the Transitway does not reduce the existing freeboard in these areas (i.e. result in flooding of the 407), the preliminary geometric design of the Transitway would be acceptable despite the existing deficient freeboard?

Yes, design would be acceptable to MTO as long as post to pre-development water levels are maintained and there is no impact on MTO drainage system and adjacent riparians.

Similarly, if the Transitway has an impact by way of reducing the freeboard in some areas compared to existing condition, is there an acceptable tolerance for this reduction, provided that it does not result in less than zero freeboard condition?

MTO requires Zero increase in headwater elevations for 2- to 100-year and Regional storms resulting from proposed development. If all options have been explored and there is an insignificant increase that would not impact MTO`s drainage system, MTO`s lands and adjacent riparian lands then we can look into the proposed change in water levels. An approval from Engineering Manager is required if a design does not meet MTO`s drainage standard.

2. In many locations the Transitway, as currently being planned and sited, would be within the Regulatory event floodplain. As such, in order to preserve floodplain storage without major excavation, it would be necessary to access the floodplain on both sides of the Transitway. To this end, it would be necessary to design a series of equalization culverts across the Transitway; does MTO support this design philosophy? Does MTO have any specific technical requirements for such systems?

Provide (equalization) culverts to maintain drainage pattern and floodplain storage function. MTO attempts to match floodplain storage when possible. MTO does not have a specific design standard for such systems.

3. At the north limit of the corridor, north of the railway, there is a stormwater management facility on the east side of Highway 407 which serves to treat a portion of the highway in this location. Due to space restrictions, it is possible that this stormwater management facility may need to be relocated, due to alignment conflicts with the Transitway.

In doing so, would it be possible to combine its function so as to treat runoff from both the existing portion of the highway plus part of the Transitway? If so, would there need to be any special design considerations? Also, can you confirm whether or not it would be possible to establish a joint use stormwater management facility which could treat runoff from the highway, Transitway and future development?

Relocation of stormwater management facility (SWM) can be looked into. Use of existing 407 ETR SWM facility to treat runoff from the proposed Transitway could be achievable in theory depending on detail investigations for the pond retrofit and constraints for storage, land and topography.
Treatment of runoff from future development is not acceptable by SWM ponds on MTO's RoW. A possibility of joint facility can be further explored if it is on municipal RoW. Ownership of such facilities seems to be an issue with regards to future maintenance.

4. As discussed at the May 13, 2015 meeting, Amec Foster Wheeler has conducted a preliminary assessment of the potential benefits to the Ninth Line lands of replacing/upgrading the railway culvert downstream of Highway 407 on the main branch of the tributary. The objective in this regard would be to lower Regulatory water levels upstream of the railway within the backwater zone affecting the Ninth Line lands, which would have multiple benefits including:

- Reducing height (and associated fill) requirements to flood protect the Transitway
- Reduce scale of compensatory storage due to Transitway construction
- Improve flood protection to portions of Highway 407
- Increase potential lands available for development in the Ninth Line lands

Given that these works would potentially benefit multiple parties (City, MTO, 407 ETR) including CNR, there would need to be some form of cost sharing agreement for the future upgrade of the railway culvert, should this be deemed to be a cost beneficial activity. The financial benefits and details of cost sharing strategy/percentages are beyond the current scope of the Transitway project and Scoped Subwatershed Study assessment, however key considerations for MTO's review at this time include:

- Method of apportioning benefit including potential for Municipal Development Charges to support
- Staging of upgrade; interim management approach
- Need to consider as part of a future Environmental Assessment

It is understood (from our dialogue May 13, 2015) that since the works would not be revenue generating for 407 ETR, it would be unlikely that it (407 ETR) would participate; that said the flood risk to the highway would be reduced.

The question which we have for MTO at this time is whether or not there is support for this potential management strategy and what specifics MTO would be seeking at this time and in the future?
in the future?

MTO may not look into cost sharing till a separate EA for the Transitway is completed by MTO to confirm cost and benefits.

Sincerely,

Graham DeRose
Project Manager
Route Planning & Transit Initiatives
Ministry of Transportation, Central Region
Tel: 416.235.5255

From: Campbell, Candice [mailto:candice.campbell@amecfw.com]
Sent: June 3, 2015 10:34 AM
To: DeRose, Graham (MTO)
Cc: Scheckenberger, Ron; Farrell, Aaron; Frank Marzo (frank.marzo@mississauga.ca); Susan Tanabe (susan.tanabe@mississauga.ca); Muneef Ahmad (muneef.ahmad@mississauga.ca); Virpal Kataure (Virpal.Kataure@peelregion.ca); Elizabeth Howson, BES, MCIP (howson@mshplan.ca)
Subject: Highway 407 Transitway Assessment

Good morning,

Please find attached memorandum correspondence (dated June 3, 2015) regarding the Highway 407 Transitway Assessment.

Thank you,
Candice Campbell
Administrative Assistant
Amec Foster Wheeler
Environment & Infrastructure

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Appendix B

HEC-RAS Models

APPENDIX B

PRELIMINARY CORRIDOR ASSESSMENT

Memo

To: Frank Marzo, City of Mississauga

From: James Scale, Amec Foster Wheeler

Date: October 19, 2015

File: 114008

cc: **Ron Scheckenberger, Amec Foster Wheeler**
Aaron Farrell, Amec Foster Wheeler
Liz Howson, Macaulay Shiomi Howson (MSH)

Re: **Highway 407 Transitway Functional Design and Hydraulic Stormwater Management Assessment – Preliminary Corridor Assessment**

BACKGROUND

The proposed Highway 407 Transitway extends through the Ninth Line Lands in the City of Mississauga, and is generally bounded by Highway 407 to the west, Ninth Line to the east, Highway 401 to the north and the Highway 407 and Ninth Line overpass to the south. In 2014, the City initiated the Ninth Line Lands Secondary Plan Study to establish a planning framework for the Ninth Line Lands and guide future growth and development. As part of that process, a Scoped Subwatershed Study has been initiated in order to assess the constraints and opportunities within the Ninth Line Lands related to the terrestrial and aquatic ecology, stream system, and surface water and groundwater resources (quantity/quality).

During the course of the Secondary Plan Study and the Scoped Subwatershed Study, a major land use influence was identified related to the Ministry of Transportation (MTO) planning for a Transitway to be located through the Ninth Line Lands, in order to service GO and regional/ local commuter transit. MTO had earlier completed a preliminary Transitway corridor protection study in 1998, the limits of which extended from Highway 403 to Markham Road. The focus of that study was to establish the mainline Transitway alignment and assess station locations, parking facilities, access connections and associated facilities, with the objective of determining the general property requirements necessary to implement the Transitway. The 1998 Transitway corridor assessment recommended horizontal and vertical Transitway alignments and established a corresponding 30.0 m right-of-way (ROW). Approval to implement the ultimate Transitway will be pursued by the MTO through the Provincial Class Environmental Assessment Process for Provincial Transportation Facilities, the timing of which is yet to be confirmed.

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Based on Transitway studies undertaken since the 1998 Transitway Corridor Protection Study, MTO is recommending a 60.0 m Transitway ROW width be considered along with a 14.0 m buffer to adjacent development.

Although the planning for the Transitway has not proceeded beyond that of a corridor protection study, it has been recognized that the planning of the Transitway and the future development within the Ninth Line Lands should be integrated. Improved clarity would be gained from advancing the planning for the Transitway as part of the planning for the Ninth Line Lands concurrently. Understanding the interface between the proposed Ninth Line Lands grading, stormwater management, roadway design and municipal servicing, and the functional design of the Transitway, is considered critical to advancing an improved understanding of land use planning within the Ninth Line Lands.

In order to better assess integration of the Transitway into the land use planning for the Ninth Line Lands, with the objective of optimizing potential development within the Ninth Line lands, the following assessments have been undertaken and documented under separate cover:

- Assessment of stormwater conveyance and riparian storage requirements for the watercourses and associated floodplains within the Ninth Line lands and integration of the stormwater management requirements with siting of the Transitway; and,
- Assessment of Transitway station locations along with interim and ultimate parking capacities and associated plan areas.

The next phase of the analysis, as documented in this memorandum, includes establishing the preferred vertical profile and corridor width for the Transitway compatible with the following criteria:

- Transitway design standards established under the 2011 Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road (Ministry of Transportation – Delcan/ IBI);
- Stormwater freeboard criteria;
- Siting of the Transitway stations; and,
- Compatibility with existing terrain.

DESIGN CRITERIA

Design criteria for the Transitway was based on the Highway 407 Transitway Planning and Preliminary Design from East of Highway 400 to Kennedy Road, 407 Transitway Design Standards, July 2011 (Ministry of Transportation – Delcan/ IBI).

The following design criteria was applied to the development of the vertical alignment and assessment of required corridor widths:

Design Speed:

- Design speed 110 km/h

Cross-Section:

- Lanes widths 2x3.75 m
- shoulder widths 2x2.25 m
- Rounding widths 2x1.00 m
- Granular side slopes 4:1
- Earth fore slope (cut) 4:1
- Earth fore slope (fill) 4:1 under 3.0m fill height and 2:1 above 3.0 m fill height
- Earth back slope (cut) 2:1
- Cut and fill ditch depths 0.50 m
- Flat-bottom ditch widths 1.00 m
- Tangent cross-falls 2.0 %
- Superelevation 6.0 % maximum

Vertical Profile:

- Minimum curve length 110.0 m
- Minimum crest-curve factor 90
- Minimum sag-curve factor 50
- Maximum/ Minimum grade (Station) 0.5 %
- Maximum grade (Transitway) 4.5 %
- Minimum grade (Transitway) 0.3 %
- Minimum vertical clearance (Structure) 5.0 m road structure and 7.0 m rail structure

The above criteria satisfies both bus and light rail transit design requirements.

TRANSITWAY ALIGNMENTS

The recommended horizontal alignment was developed, as documented under separate cover, based on the following evaluation criteria:

- Maintain conveyance capacity and available freeboard along Highway 407 during Regional Storm event (no reduction where freeboard is less than 0.3 m, and 0.3 m minimum elsewhere);
- Maintain available riparian storage (no reduction preferred);
- Minimize number of watercourse crossings (minimum number of crossings preferred);
- Meet 2011 Transitway design standards;
- Minimize number of roadway grade separations; and,
- Provide compatibility with adjacent land use planning.

The recommended plan is provided in Appendix A of this memorandum.

The vertical profile for the Transitway was developed in accordance with the above design criteria to meet the following design objectives:

- Maintain minimum freeboard of 0.3 m during Regional Storm event;
- Provide compatibility with existing underground utility infrastructure; and,

- Minimize the Transitway grading footprint and associated right-of-way width.

The Transitway crossing of Highway 407 and Lower Base Line Road at the southern limit of the study area are designed below grade to minimize impact to Highway 407 operations during construction. This is consistent with the 1998 Transitway Corridor Protection Study and direction received from MTO as part of the current study. All other Transitway crossings of roadways and railways are proposed to be above grade to minimize potential concerns with draining the low points along the Transitway resulting from required vertical clearances.

The recommended profile is provided in Appendix A of this memorandum.

DESIGN CROSS-SECTION

A rural design cross-section was developed in accordance with the above design criteria as depicted below in Figure 1 and applied to the assessment of grading requirements.

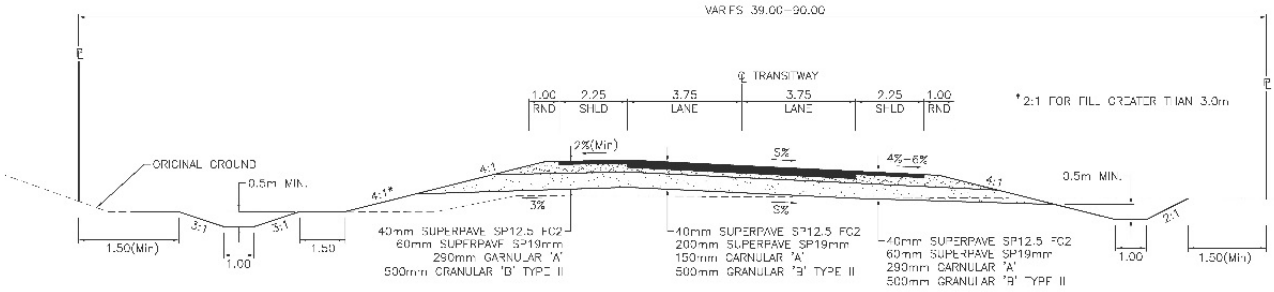


Figure 1 – Transitway Typical Design Cross-Section

RIGHT-OF-WAY

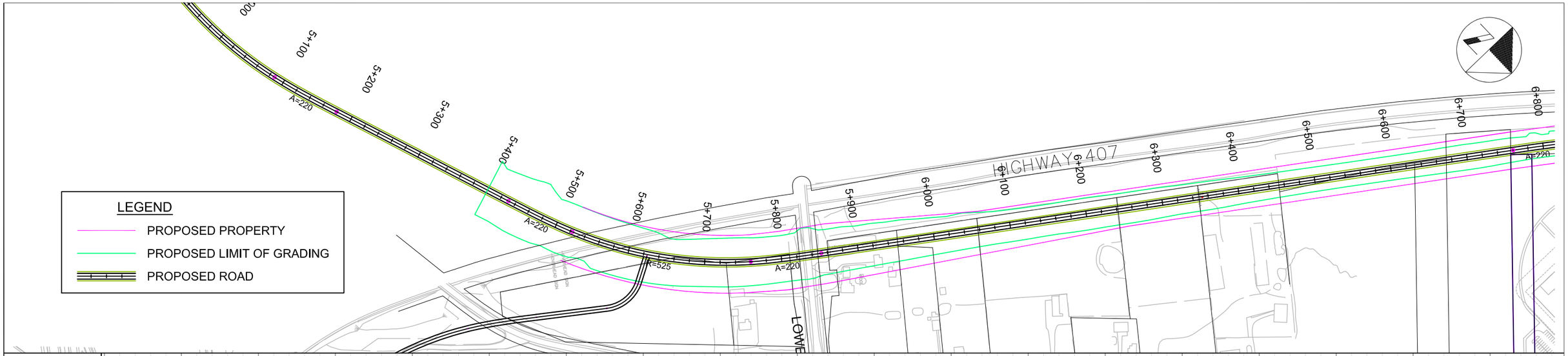
In keeping with efforts to maximize and support development within the Ninth Line lands, the required Transitway corridor widths were reviewed and tailored to accommodate the recommended Transitway alignments and design cross-section developed as part of this study.

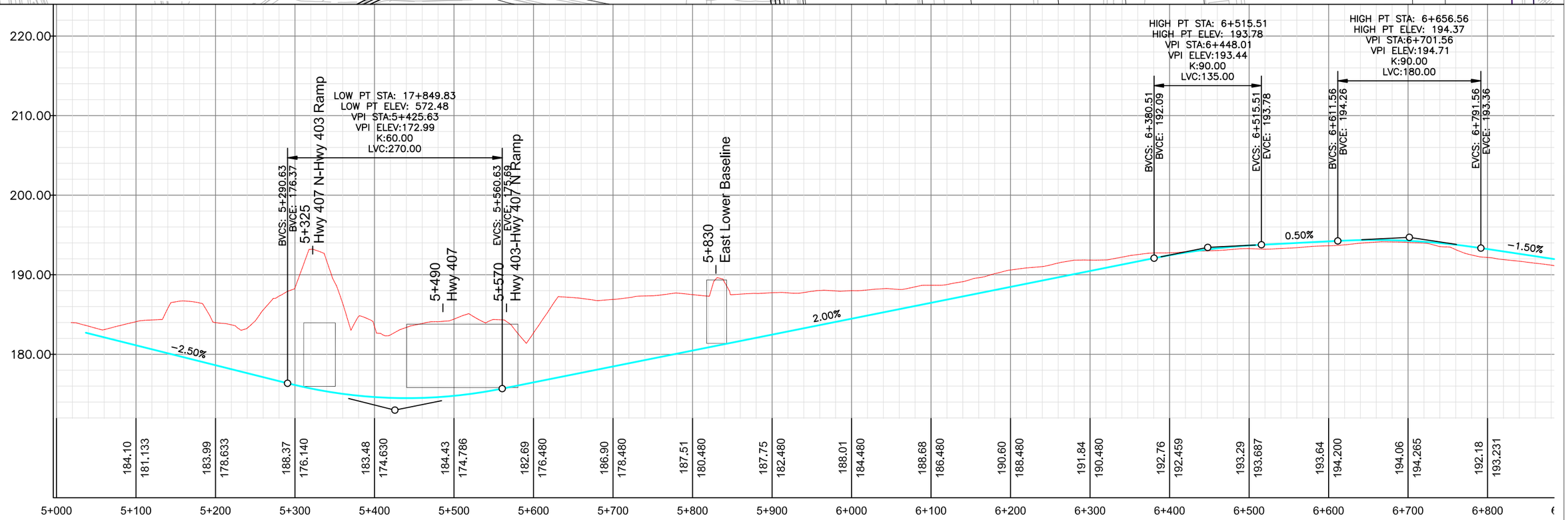
The corridor widths vary from 39 m to 90 m and are not necessarily centred on the Transitway horizontal alignment to address localized Transitway grading requirements within the study limits. Transitions in corridor widths are generally developed over the lengths of the proposed horizontal spiral curves.

A summary of the proposed corridor widths is provided in Table 1.

Table 1 – Summary of Transitway Corridor Widths

Stationing	Corridor Width Overall (m)	Corridor Width Lt Centreline (m)	Corridor Width Rt Centreline (m)
5+540 ~ 5+760	75	35	40
5+760 ~ 6+260	48-75	24-35	24-40
6+620 ~ 7+600	48	24	24
7+600 ~ 7+700	48-65	24-35	24-30
7+700 ~ 8+660	65	35	30
8+660 ~ 9+680	50-80	25-40	25-40
9+680 ~ 10+840	50	25	25
10+840 ~ 11+140	39-55	14-25	25-30
11+140 ~ 11+700	44	14	30
11+700 ~ 12+500	39-80	14-40	25-40
12+500 ~ 12+900	50	25	25
12+900 ~ 13+240	50-70	25-35	25-35
13+240 ~ 13+900	70	35	35
13+900 ~ 14+020	70-90	35-45	35-45
14+020 ~ 14+700	90	45	45





NINTH LINE DISTRICT
TRANSITWAY ASSESSMENT
CITY OF MISSISSAUGA
PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

amec foster wheeler

Project No. TP114008

Scale 0 50 100 150 HOR.
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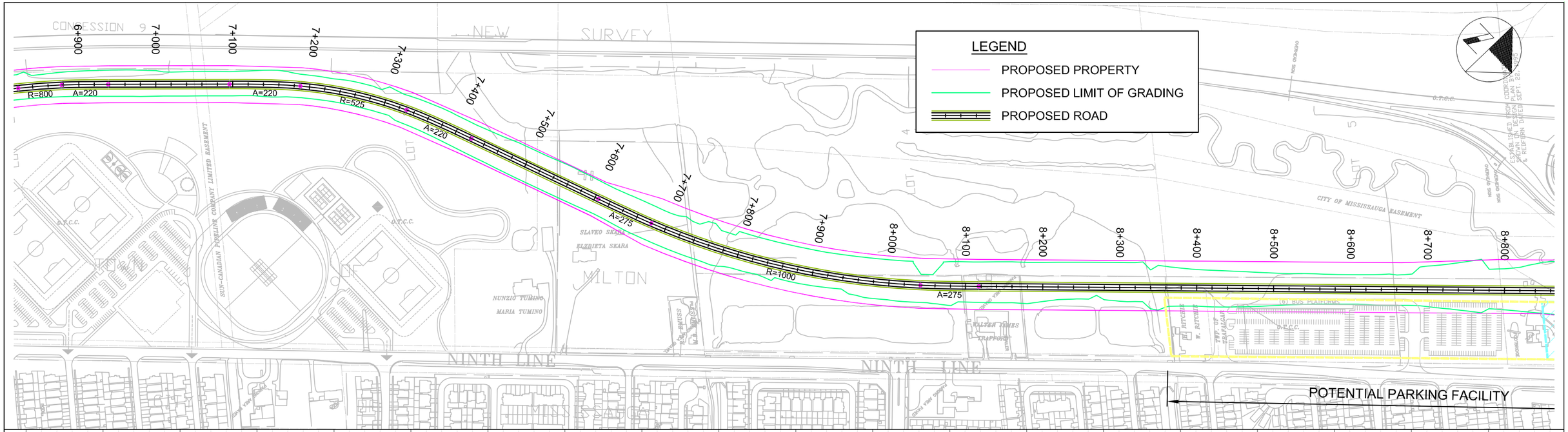
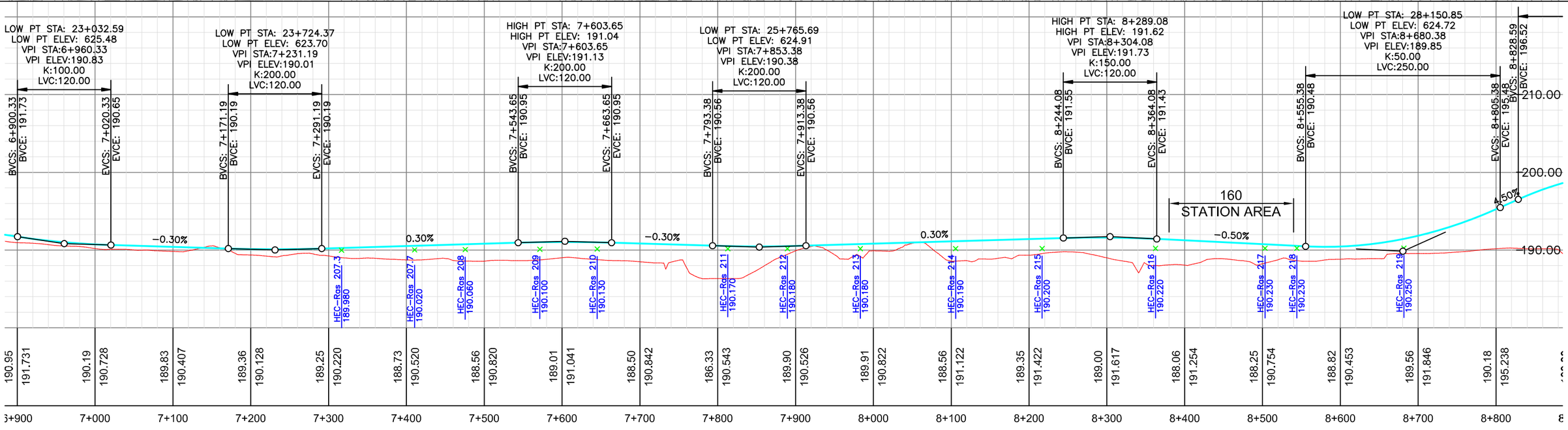
Drawing No. 1





NINTH LINE DISTRICT
TRANSITWAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

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Project No. TP114008

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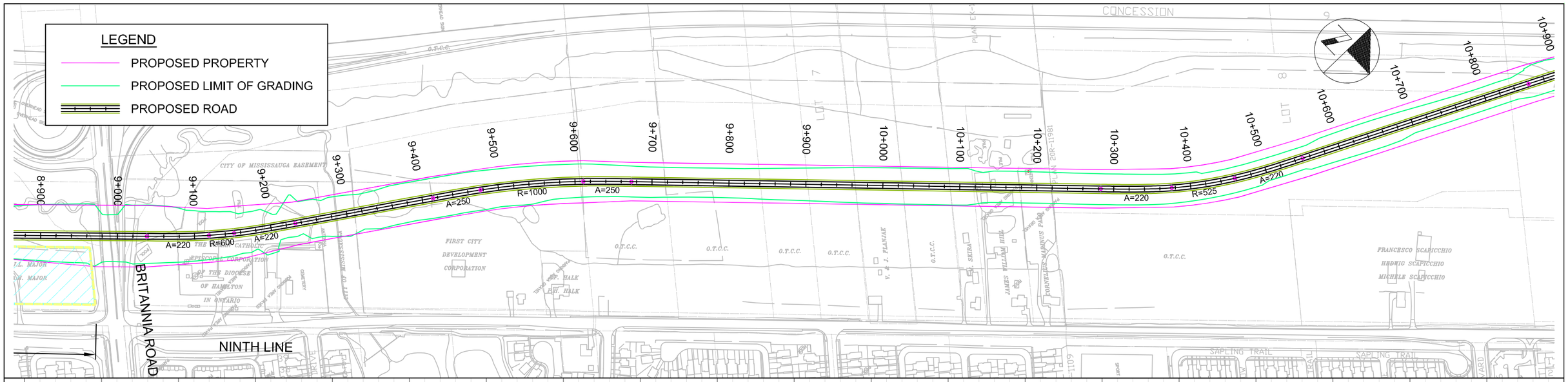
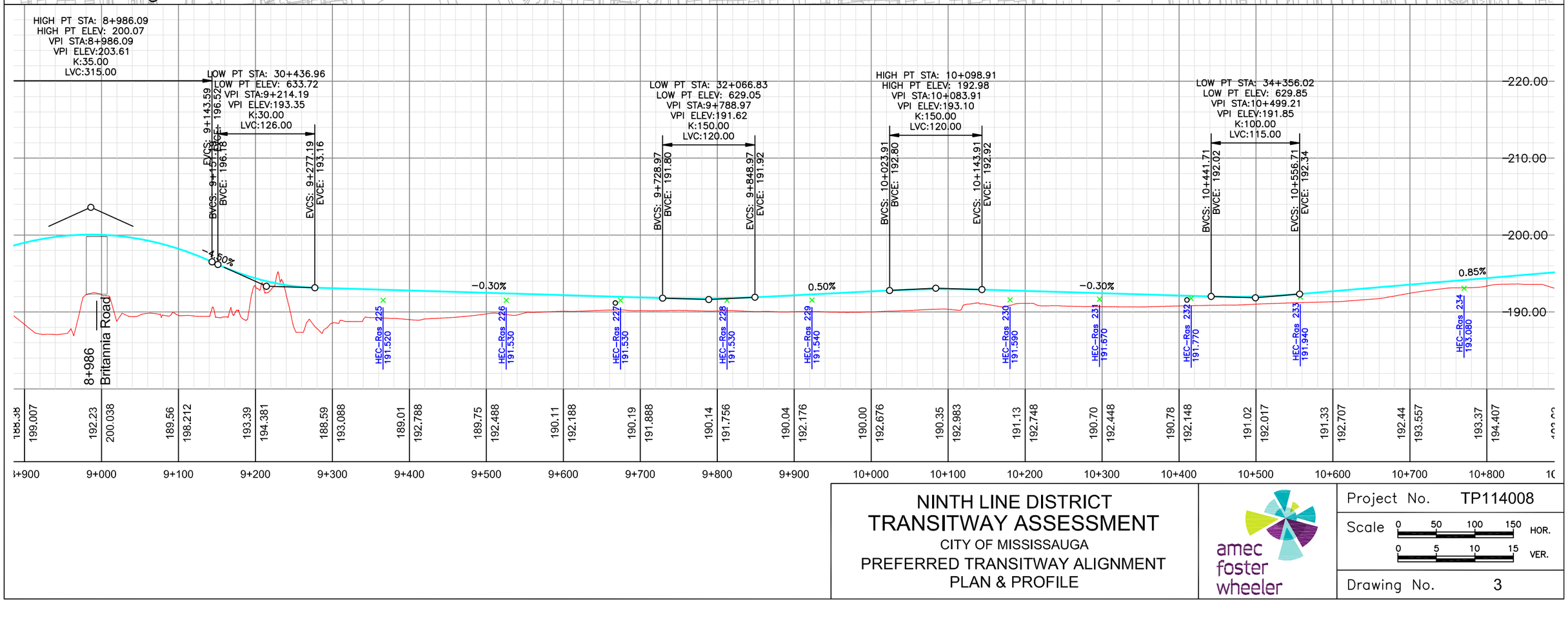
Drawing No. 2





NINTH LINE DISTRICT
TRANSITWAY ASSESSMENT
CITY OF MISSISSAUGA
PREFERRED TRANSITWAY ALIGNMENT
PLAN & PROFILE

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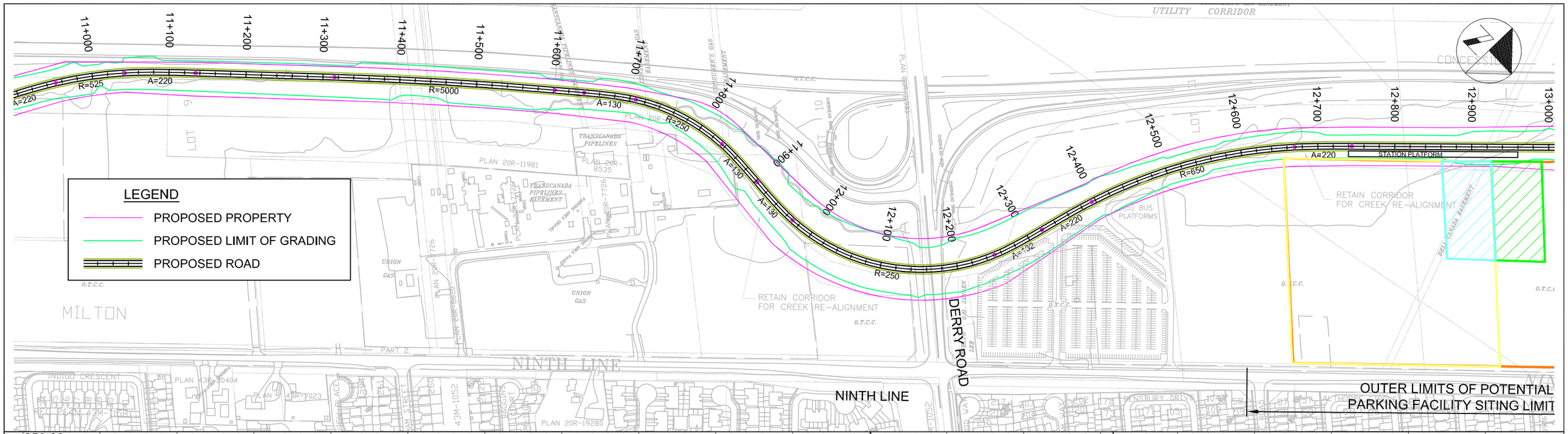
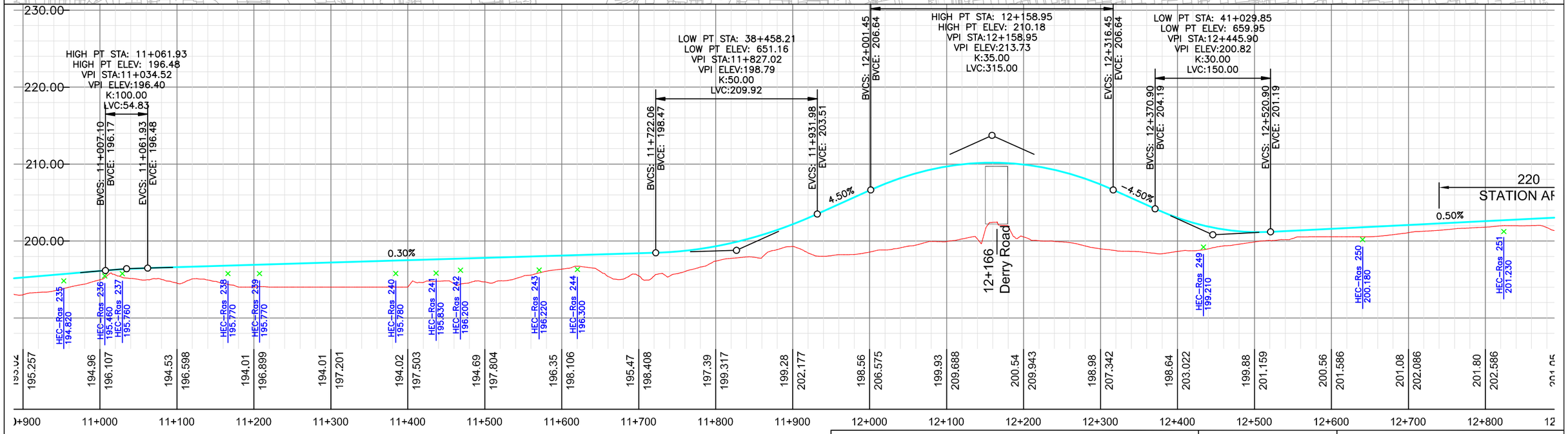
Drawing No. 3





NINTH LINE DISTRICT TRANSITWAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

PLAN & PROFILE

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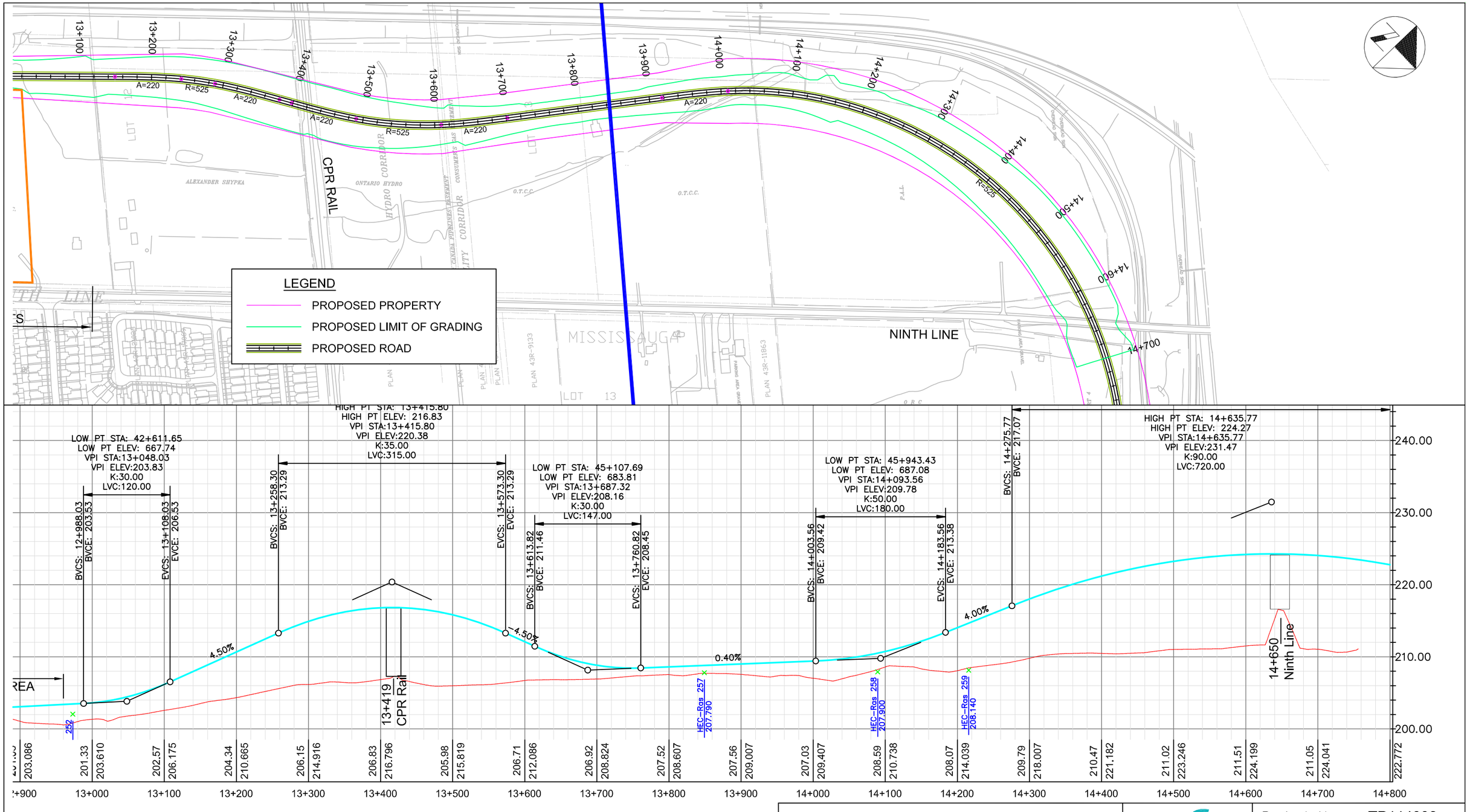
Project No. TP114008

Scale 0 50 100 150 HOR.

0 5 10 15 VER.

Drawing No. 4



NINTH LINE DISTRICT TRANSITWAY ASSESSMENT

CITY OF MISSISSAUGA

PREFERRED TRANSITWAY ALIGNMENT

PLAN & PROFILE

amec foster wheeler

Project No. TP114008

Scale 0 50 100 150 HOR.

0 5 10 15 VER.

Drawing No. 5

APPENDIX C

PRELIMINARY PARKING EVALUATION

Memo

To: Frank Marzo, City of Mississauga

From: James Scale, Amec Foster Wheeler

Date: April 15, 2015 – Revised September 18, 2015
Revised October 19, 2015
Revised November 5, 2015

File: 114008

cc: **Ron Scheckenberger, Amec Foster Wheeler**
Aaron Farrell, Amec Foster Wheeler
Liz Howson, Macaulay Shiomi Howson (MSH)

Re: **Highway 407 Transitway Functional Design and Hydraulic Stormwater Management Assessment – Preliminary Parking Evaluation**

BACKGROUND

The Highway 407 Transitway Functional Design and Hydraulic Stormwater Management Assessment has included a review of the Transitway station parking facilities proposed within the Ninth Line corridor. Preliminary estimates of parking demand were established and documented in the "Transitway Corridor Protection Study Highway 407/ Parkway Belt West Corridor from Highway 403 to Markham Road" Final Report dated December 1998. Daily parking demands were estimated for the demand year 2031 and are summarized in Table 1. As summarized in Table 1, it is noted that the report includes discrepancies between the overall forecasted parking demands, stated parking capacity provided and the actual parking capacity accommodated in the preliminary layouts. The difference between the forecasted demand and the capacity of the preliminary layouts is 985 additional vehicles.

As per MTO correspondence dated March 30, 2015 (reference attached), Metrolinx confirmed that it has no plans to relocate the existing Lisgar Station or add another station at the proposed CPR Galt Station on Ninth Line. As such, it is our understanding that MTO will be removing plans for the CPR Galt Station identified in the 1998 Corridor Protection Study. As such, the parking capacity proposed at the CPR Galt Station will have to be reassigned to the Britannia Station and Derry Station parking facilities accordingly.

MTO also indicated that it is of the opinion that the overall forecasted parking demand determined in the 1998 Corridor Protection Study is outdated and highly underestimated. MTO indicated that

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a detailed analysis of parking demand will be undertaken as part of the future Highway 407 Transitway Environmental Assessment (EA) for this section of the Transitway. Given the anticipated timing of the EA and in order to facilitate completion of the current Corridor Protection Study, MTO recommends that 2,000 spaces be protected for at each of the two (2) remaining stations at Britannia and Derry for a total of 4,000 spaces. MTO noted that land use designations will be reassessed following completion of the Transitway EA, should reductions in parking demand be recommended.

Table 1 – Summary of Parking Demand and Plan Areas (1998)

Station	Forecasted Demand (Spaces)	Preliminary Parking Capacity Stated (Spaces)	Preliminary Parking Capacity Protected (Spaces)	Preliminary Plan Area Required (Ha)	Capacity Ratio Required (Ha/Space)
Britannia	760	400	575	3.05	0.00530
Derry	380	800	925	4.07	0.00440
CPR Galt	290	500	915	5.10	0.00557
	* 1,430	** 1,700	*** 2,415	12.22	

The volumes stated above were obtained from the "Transitway Corridor Protection Study Highway 407/ Parkway Belt West Corridor from Highway 403 to Markham Road" Final Report dated December 1998 as specified below:

* Section 3.12 Transitway Station Parking Requirements, Page 3-43, Exhibit 3.12.1 Transitway Station Parking Requirements;

** Section 8.1.2 Details, Page 8-8 through 8-10

*** Based on plans provided in the report

PRELIMINARY ASSESSMENT AND REVIEW

It should be noted that all layouts developed as part of this preliminary parking assessment are conceptual and are intended to establish plan area requirements for comparative purposes only. Station locations and configurations will be refined as part of a subsequent phase of the current Transitway assessment in conjunction with the Secondary Plan Study being undertaken by the City of Mississauga, and will consider other applicable land use planning criteria.

The following alternatives have been assessed to determine the impact on Transitway Facility planning based on eliminating the CPR Galt Station, with and without an increase in projected parking demand to 4,000 spaces:

Option 1. Maintain the parking capacity provided in the preliminary layouts developed as part of the 1998 Corridor Protection Study (i.e. total capacity of 2,415 spaces) – Included for comparative purposes;

Option 2. Transfer the CPR Galt Station capacity to the Britannia Station (requires acquisition of private property north and south of the currently proposed facility) and Derry Station parking facilities without an increase in the parking capacity provided in the preliminary layouts included in the 1998 Corridor Protection Study (i.e. total capacity of 2,415 spaces);

Option 3. Transfer the CPR Galt Station capacity to the Britannia Station (requires acquisition of private property north and south of the currently proposed facility) and Derry Station parking facilities with an increase in the parking capacity provided in the preliminary layouts included in the 1998 Corridor Protection Study (i.e. total capacity of 4,000 spaces);

Option 4. Transfer the CPR Galt Station capacity to the Derry Station parking facilities without an increase in the parking capacity provided in the preliminary layouts included in the 1998 Corridor Protection Study (i.e. total capacity of 2,415 spaces); and

Option 5. Transfer the CPR Galt Station capacity to the Derry Station parking facilities with an increase in the parking capacity provided in the preliminary layouts included in the 1998 Corridor Protection Study (i.e. total capacity of 4,000 spaces).

Given property restrictions at the preliminary location of the Britannia Station (proximity to the floodplain to the west, Britannia Road to the north, the Ninth Line right-of-way to the east and the existing stormwater management system to the south) expansion of the Britannia Station under Options 2 and 3 would be limited to the extents of the private properties immediately north and south of the currently proposed parking facility.

Elimination of the CPR Galt Station would require reallocation of 915 parking spaces and a significant increase in the parking demand on the Britannia Station and Derry Station parking facilities. Given the limited ability to expand the Britannia Station parking facility as outlined in the foregoing, the majority of the demand that would need to be accommodated at the Derry Station parking facility, as presented in Option 5. Option 6 has been developed to offset the parking demand and mitigate potential impacts on the functionality of the Derry Station and associated parking facility and includes establishment of an Argentia Station to coordinate with the potential future extension of Argentia Road west of Ninth Line. Option 6 is outlined as follows:

Option 6. Maintain the Britannia Station and Derry Station parking facilities and relocate the CPR Galt Station to coordinate with the potential future extension of Argentia Road **with an increase** in the parking capacity provided in the preliminary layouts included in the 1998 Corridor Protection Study (i.e. total capacity of 4,000 spaces).

An average capacity ratio of 0.00506 Ha/Space was established based on the preliminary layouts and corresponding capacity of the preliminary at-grade parking facilities developed as part of the 1998 Corridor Protection Study. The ratio has been used to establish preliminary sizing of the parking facilities needed to address the elimination of the CPR Galt Station alternative and the associated increase in parking demand to 4,000 spaces.

The results of the foregoing analysis are summarized in Table 2 and illustrated in Figures 1 through 3. The northern limit for Options 2 through 6 outlined in Figure 2 represents the northern limit of the expanded parking facility including the originally proposed parking facility developed in the 1998 Corridor Protection Study.

For comparative purposes, the 2031 forecasted demand of 1,430 spaces specified in the 1998 Corridor Protection Study corresponds to a total parking facility plan area of 7.23 ha.

Table 2 – Parking Facility Alternatives

Station	Options											
	Option 1		Option 2		Option 3		Option 4		Option 5		Option 6	
	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)
Britannia (South)	2.91	575	4.49	885	4.49	885	2.91	575	2.91	575	2.91	575
Derry (South)	4.68	925	7.74	1,530	15.76	3,115	9.31	1,840	17.33	3,425	8.60	1,700
CP Galt	4.63	915	-	-	-	-	-	-	-	-	-	-
Argentia	-	-	-	-	-	-	-	-	-	-	8.73	1,725
Totals	12.22	2,415	12.22	2,415	20.24	4,000	12.22	2,415	20.24	4,000	20.24	4,000

Upon review of the above analysis (as outlined in the April 2015 version of the memo) and associated impacts on development within the Ninth Line Lands, further dialogue was conducted between the City of Mississauga and MTO regarding refinement of the required parking capacity estimates and integration of vertical parking structures to optimize development within the Ninth Line lands. In addition to the above, an assessment of Transitway alignment alternatives was completed to complement the 1998 Transitway Corridor Protection Study, and concurrently consider the overall stormwater management requirements within the Ninth Line Lands. The report has been prepared under separate cover and recommends refinements to the 1998 Transitway Corridor Protection Study alignment. Given parking capacities being considered, review of access to the stations developed in the 1998 Transitway Corridor Protection Study, and proposed refinements to the Transitway alignment, consideration has been given to station options north of the Britannia and Derry station options identified in the 1998 Transitway Corridor Protection Study. In light of the above, the following additional station options were assessed:

Option 7. Include a parking structure within the Britannia (South) and Derry (South) parking plan area developed as part of the 1998 Corridor Protection Study;

Option 8. Include a parking structure within the expanded Britannia Road (South) parking plan area established in Options 2 and 3 (requires acquisition of private property north and south of the currently proposed facility);

Option 9. Provide 1,000 at-grade parking spaces for each of the Britannia (North), Derry (South) and Derry (North) locations;

Option 10. Provide 1,000 at-grade parking spaces and parking structure for each of the Britannia (North), Derry (South) and Derry (North) locations;

Option 11. Provide 1,500 at-grade parking spaces for each of the Britannia (North), Derry (South) and Derry (North) locations;

Option 12. Provide 2,000 at-grade parking spaces for each of the Britannia (North), Derry (South) and Derry (North) locations;

The following design parameters were used in the assessment of the parking structures based on preliminary parking structure layout data for several GO parking structures provided by the City of Mississauga:

- Average length = 115 m
- Average width = 75 m
- Average plan area = 8,625 m^2
- Average capacity = 250 vehicles/ level

The results of the foregoing analysis are summarized in Table 2A and illustrated in Figures 4 through 7. Options 9 through 12 are outlined relative the Transitway alignment recommended for integration with the overall stormwater management requirements within the Ninth Line Lands.

Table 2A – Parking Facility Alternatives

Station	Options											
	Option 7		Option 8		Option 9		Option 10		Option 11		Option 12	
	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)
Britannia (South)	2.91	905 to 1,905	4.49	1,217 to 2,217	-	-	-	-	-	-	-	-
Britannia (North)	-	-	-	-	5.06	1,000	5.92	1,500 to 2,500	7.59	1,500	10.12	2,000
Derry (South)	4.68	1,255 to 2,255	4.68	1,255 to 2,255	* -	* -	* -	* -	* -	* -	* -	* -
Derry (North)	-	-	-	-	5.06	1,000	5.92	1,500 to 2,500	7.59	1,500	10.12	2,000
Totals	7.59	2,160 to 4,160	9.17	2,472 to 4,472	10.12	2,000	11.84	3,000 to 5,000	15.18	3,000	20.24	4,000

* Values for Derry (North) apply to Derry (South) as well

Based on discussions between the City of Mississauga and MTO following the September 18, 2015 update to the memorandum, the following additional alternatives have been assessed to accommodate a staged parking implementation based on a total of 2,800 initial at-grade spaces and ultimate expansion to 4,000 spaces either at-grade or with incorpration of parking structures:

Option 13. Interim – Expanded Britannia Road (South) at-grade parking plan area established in Options 2 and 3 (requires acquisition of private property north and south of the currently proposed facility and provides a capacity of 885 spaces) and provide 1,915 at-grade spaces at either Derry (South) or Derry (North) locations;

Option 14. Ultimate – Expanded Britannia Road (South) parking plan area established in Options 2 and 3 (requires acquisition of private property north and south of the currently proposed facility and provides a capacity of 885 spaces) and provide additional 1,200 spaces at expanded Britannia Road (South) and either Derry (South) or Derry (North) with parking structure within the interim (Option 13) footprints;

Option 15. Ultimate – Expanded Britannia Road (South) parking plan area established in Options 2 and 3 (requires acquisition of private property north and south of the currently proposed facility and provides a capacity of 885 spaces) and provide additional 1,200 spaces at parking structure within expanded Britannia Road (South) and with parking structure outside either the interim Derry (South) or Derry (North) (Option 13) footprint;

Option 16. Ultimate – Expanded Britannia Road (South) at-grade parking plan area established in Options 2 and 3 (requires acquisition of private property north and south of the currently proposed facility and provides a capacity of 885 spaces) and provide 3,115 at-grade spaces at either Derry (South) or Derry (North) locations;

Option 17. Interim – Provide 1,400 at-grade parking spaces at Britannia (North) and 1,400 at-grade at either Derry (South) and Derry (North) locations;

Option 18. Ultimate – Provide 2,000 spaces at Britannia (North) and 2,000 spaces at either Derry (South) or Derry (North) with parking structures within the interim (Option 14) footprint;

Option 19. Ultimate – Provide 2,000 spaces at Britannia (North) and 2,000 spaces at either Derry (South) or Derry (North) with parking structure outside the interim (Option 14) footprint; and,

Option 20. Ultimate – Provide 2,000 at-grade parking spaces at Britannia (North) and 2,000 at-grade parking spaces at either Derry (South) and Derry (North) locations.

Table 2B – Parking Facility Alternatives

Station	Options															
	Option 13		Option 14		Option 15		Option 16		Option 17		Option 18		Option 19		Option 20	
	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)
Britannia (South)	4.49	885	4.49	1,215 To 2,215	4.49	1,385 To 2,385	4.49	885								
Britannia (North)									7.08	1,400	7.08	1,730 To 2,730	7.94	1,900 To 2,900	10.12	2,000
Derry (North) *	9.69	1,915	9.69	2,245 To 3,245	10.55	2,415 To 3,415	15.76	3,115	7.08	1,400	7.08	1,730 To 2,730	7.94	1,900 To 2,900	10.12	2,000
Totals	14.18	2,800	14.18	3,385 To 4,115	15.04	3,800 To 5,800	20.25	4,000	14.16	2,800	14.16	4,000 To 5,460	15.88	3,800 To 5,800	20.24	4,000

* Values for Derry (North) apply to Derry (South) as well

SUMMARY

Table 3 summarizes the parking criteria in terms of capacity and facility area required to accommodate the 1998 Corridor Protection Study demands and proposed increase interim and ultimate capacities of 2,800 and 4,000 spaces at-grade respectively.

Table 3 – Parking Facility Requirements

Parking Criteria	Capacity (Spaces)	Area (Ha)
Forecasted Demand – 1998 Protection Study	1,430	7.23
Stated Parking Capacity – 1998 Protection Study	1,700	8.60
Parking Capacity Protected – 1998 Protection Study	2,415	12.22
Recommended Interim Demand – 2015	2,800	14.17
Recommended Ultimate Demand – 2015	4,000	20.24

As indicated in Tables 1 and 3, there is considerable variation in the calculated parking demand and protected capacity as outlined in the 1998 Corridor Protection Study, corresponding to a 69% increase in capacity provided, compared to demand calculated.

The currently recommended parking demand of 4,000 spaces represents a 180% and 65% increase in the calculated demand and protected capacity identified in the 1998 Corridor Protection Study respectively. The corresponding increases in plan area required to facilitate the increase in parking demand are 13.01 ha and 8.02 ha respectively, and significantly reduce the lands available for development in the Ninth Line lands as detailed in Figures 1 and 2.

Elimination of the CPR Galt Station capacity requires that the majority of the parking demand be transferred to the Derry Station parking facility due to factors limiting the extent to which the Britannia Station parking facility can be expanded. To address potential impacts on the functionality of the Derry Station and parking facility, associated with the increased demand under the 4,000 space requirement, it is recommended that consideration be given to re-establishing a third station that aligns with the potential future extension of Argentia Road or moving the Britannia Station north of Britannia Road.

The proposed options outlined in the foregoing are based on meeting the parking demands with parking infrastructure provided at ground level. As discussed previously, further dialogue was conducted between the City of Mississauga and MTO regarding refinement of the required parking capacity estimates and integration of vertical parking structures to optimize development within the Ninth Line lands. Table 4 summarizes the parking criteria in terms of capacity and facility area required to accommodate the revised capacities and vertical integration of parking structures as discussed between the two parties.

Table 4 – Parking Facility Requirements

Parking Criteria	At-Grade Capacity (Spaces)	Parking Structure Capacity * (Spaces)	Total (Spaces)	Area (Ha)
At-grade with Parking Structures – Parking Structure within 1998 Parking Footprint	1,160	1,000 to 3,000	2,160 to 4,160	7.59
At-grade with Parking Structures – Parking Structure external to 1998 Parking Footprint	1,500	1,000 to 3,000	2,500 to 4,500	9.31
At-grade with Parking Structures	2,000	1,000 to 3,000	3,000 to 5,000	11.84
At-grade	2,000	0	2,000	10.12
At-grade	2,800	0	2,800	14.17
At-grade with Parking Structures	2,800	1,000 to 3,000	3,800 to 5,800	15.89
At-grade	3,000	0	3,000	15.18
At-grade	4,000	0	4,000	20.24

* Parking structure capacities are based on 2 structures with 2 to 6 stories each and 250 spaces per level

For comparative purposes, 4,000 at-grade spaces requiring a plan area of 20.24 ha could be accommodated by 2,500 at-grade spaces (Preliminary Parking Capacity Protected for in the 1998 Corridor Protection Study) combined with two-three story parking structures (750 spaces per parking structure) in a plan area of 14.37 ha. Alternatively one-six story parking structure could be utilized reducing the plan area to 13.51 ha. The above alternatives correspond to 29% and 33% reductions in parking facility footprint, as compared to the 4,000 at-grade requirement, and would accommodate a staged approach to increasing parking capacity in the event projected parking demand is realized.

Assuming a phased approach to satisfying targeted parking capacity with an initial 2,800 at-grade capacity, the optimized land use scenario to achieve the target capacity of 4,000 spaces would include one five story parking structure with a capacity of 1,250 spaces. This would result in no temporary loss in at-grade capacity required to construct the parking structure. The total area required would be 15.02 ha.

RECOMMENDATION

Given current uncertainties regarding parking capacity at the time of writing this memorandum, and subject to more detailed parking capacity analysis to be undertaken by MTO, it is recommended that an interim parking capacity of 2,800 spaces at-grade be accommodated within the Ninth Line land use scenarios.

Given issues with grade differentials between the Transitway station and adjacent lands, including Ninth Line and Derry Road, it is recommended that the Derry (North) location be carried forward as part of the land use scenario assessment.

Both the Britannia (South) and Britannia (North) locations are recommended for consideration as part of the land use planning assessment being undertaken by the City within the Ninth Line

Lands. As part of the City's land use planning assessment, it was determined that the Britannia (South) location is preferred from a land use planning perspective.

The following outlines the interim and ultimate requirements for the recommended parking facilities comprised of the Britannia (South) and Derry (North) station alternatives.

The interim parking capacity would be accommodated by Britannia (South) with 885 spaces and parking facility footprint of 4.49 ha and Derry (North) with 1,915 spaces and parking facility footprint of 9.69 ha. The overall parking facility footprint of 14.16 ha is required.

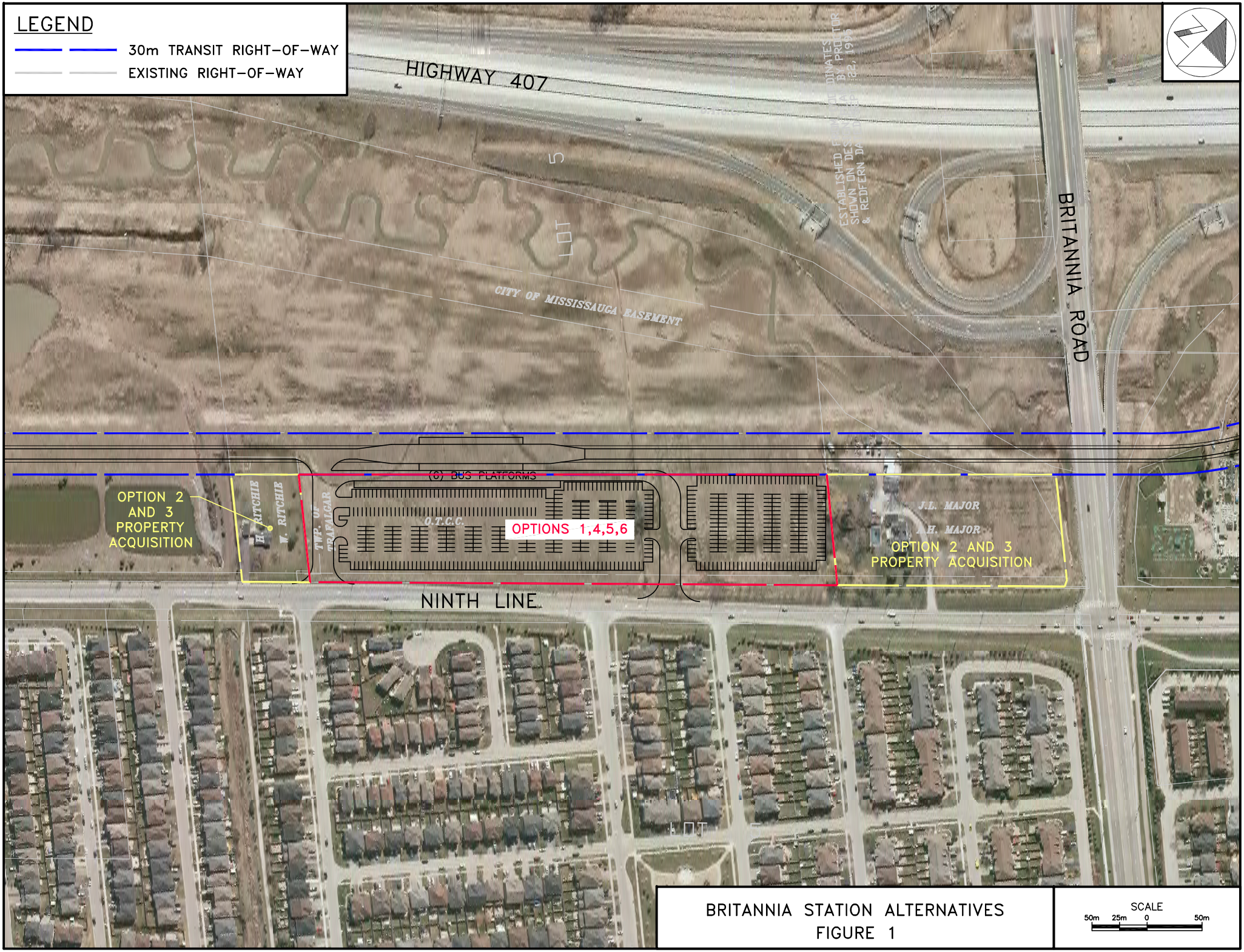
The land use planning scenarios should accommodate the following three potential options for expanding the interim parking capacity from 2,800 spaces to 4,000 spaces:

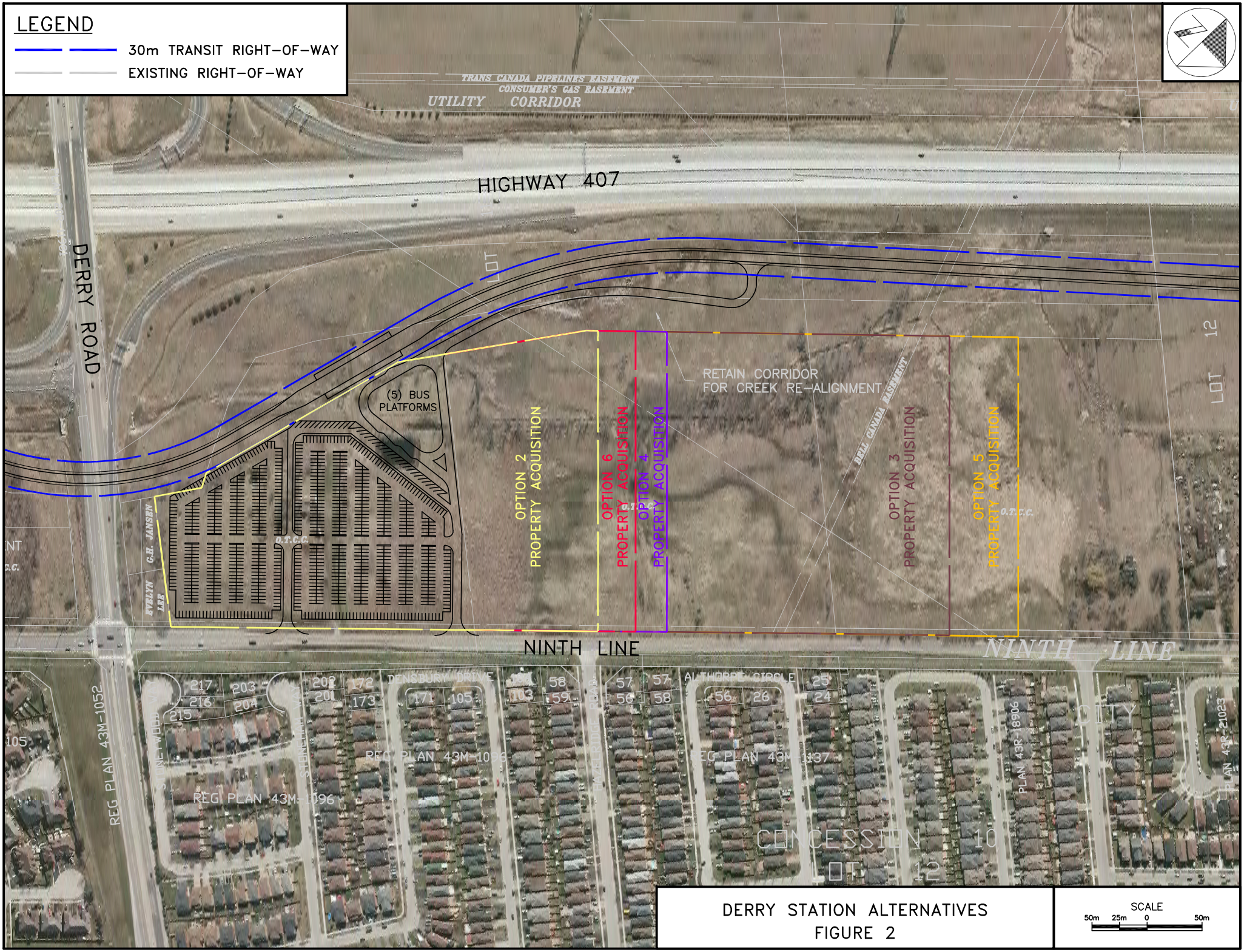
- An additional 1,200 spaces within one or two parking structures located within the limits of the interim 2,800 at-grade parking footprint of 14.16 ha; and,
- An additional 1,200 spaces within one or two parking structures, one located within the Britannia (South) interim parking facility footprint of 4.48 ha and a second outside the limits of the Derry (North) interim parking facility footprint 9.68 ha resulting in a Derry (North) parking facility footprint of 10.54 ha; and,
- An additional 1,200 spaces at-grade at Derry (North) corresponding to a Derry (North) capacity of 3,115 spaces and plan area increase of 6.07 ha outside the interim 1,915 spaces at-grade parking footprint of 9.69 ha for a total ultimate Derry (North) parking facility plan area of 15.76 ha.

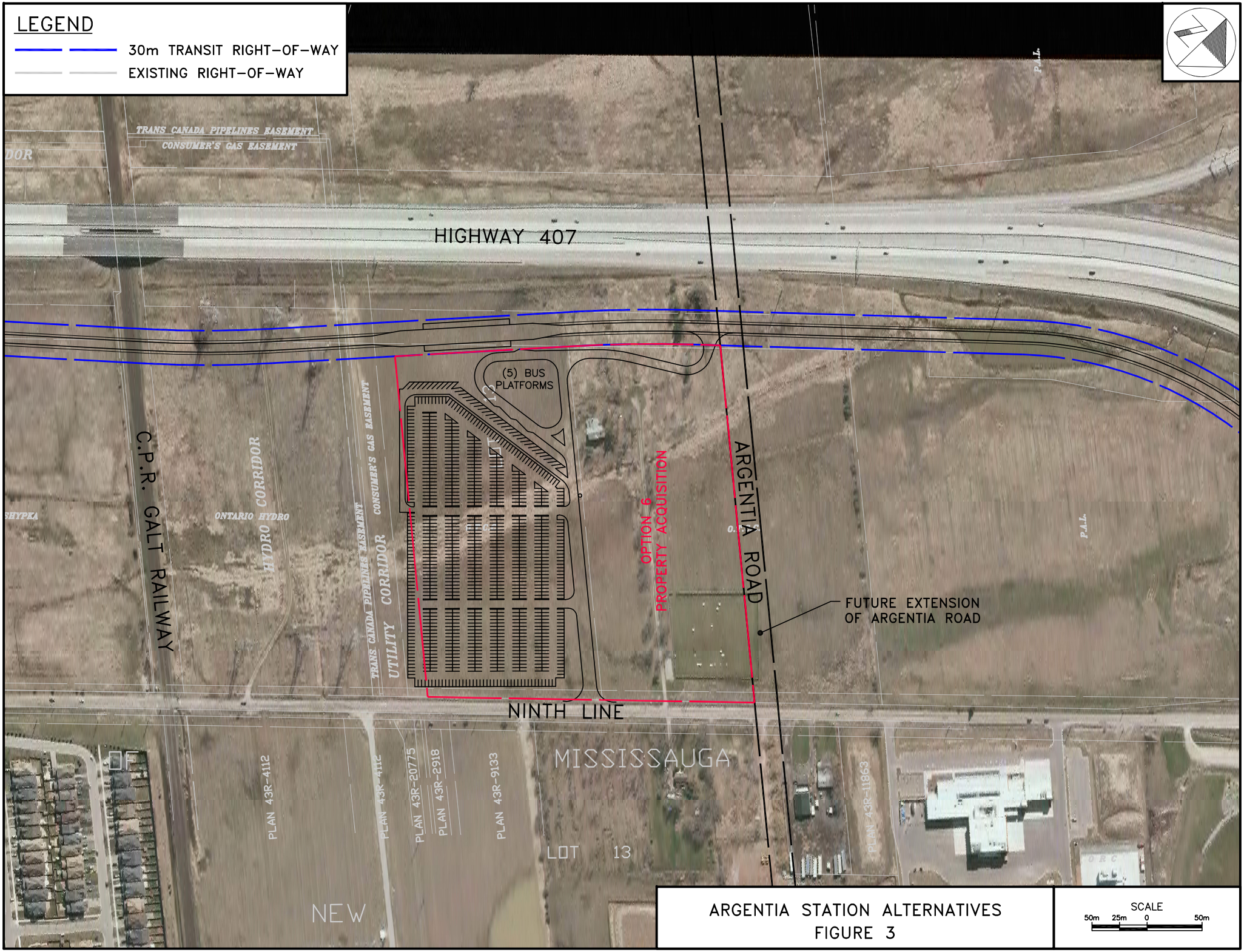
Table 5 – Britannia (South) and Derry (North) Interim and Ultimate Parking Facility Requirements

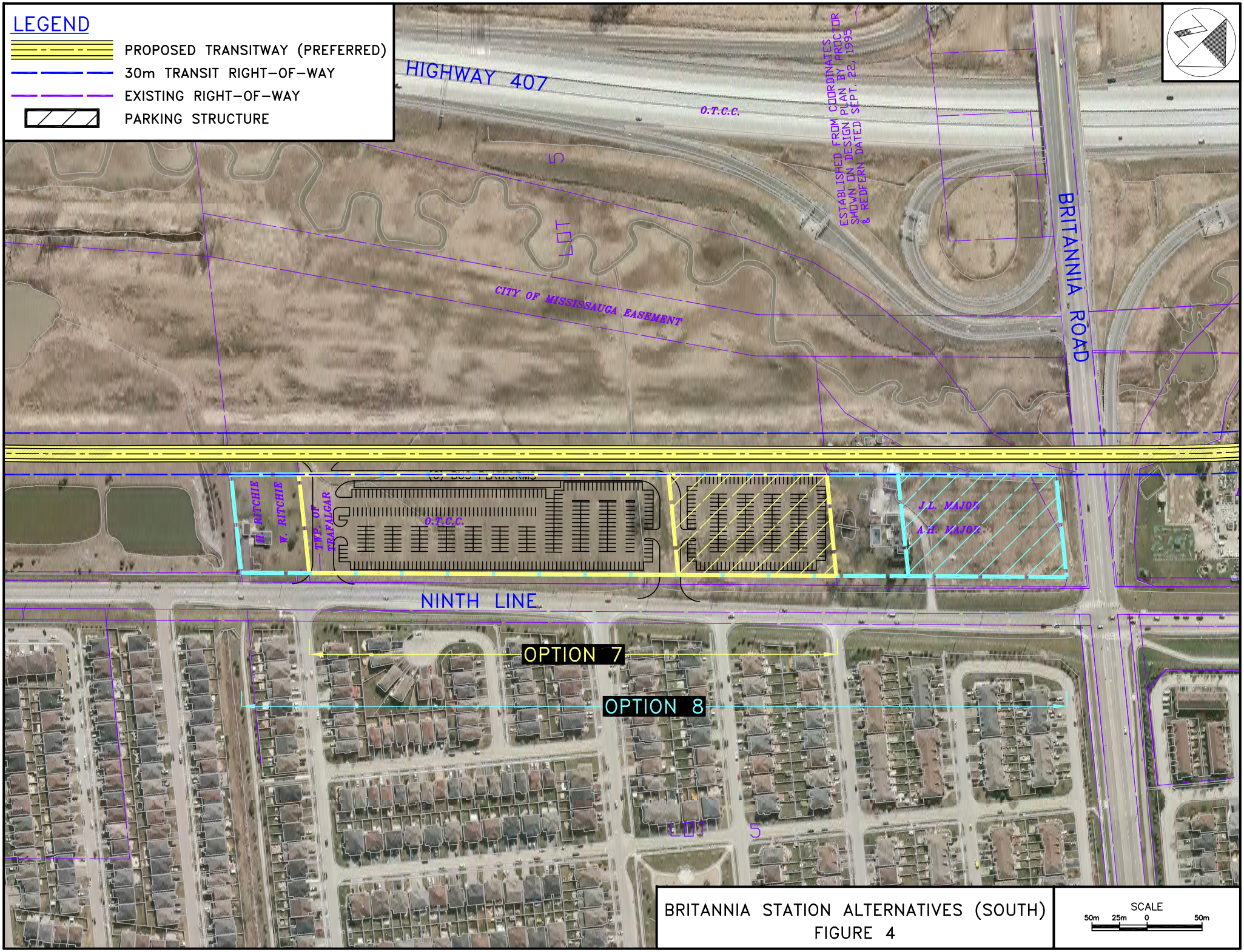
Station	Options							
	Option 13 Interim		Option 14 Ultimate		Option 15 Ultimate		Option 16 Ultimate	
	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)	Area (ha)	Capacity (spaces)
Britannia (South)	4.48	885	4.48	1,215 To 2,215	4.48	1,215 To 2,215	4.48	885
Derry (North)	9.68	1,915	9.68	2,240 To 3,240	10.54	2,415 To 3,415	15.76	3,115
Totals	14.16	2,800	14.16	3,455 To 5,455	15.02	3,630 To 5,630	20.24	4,000

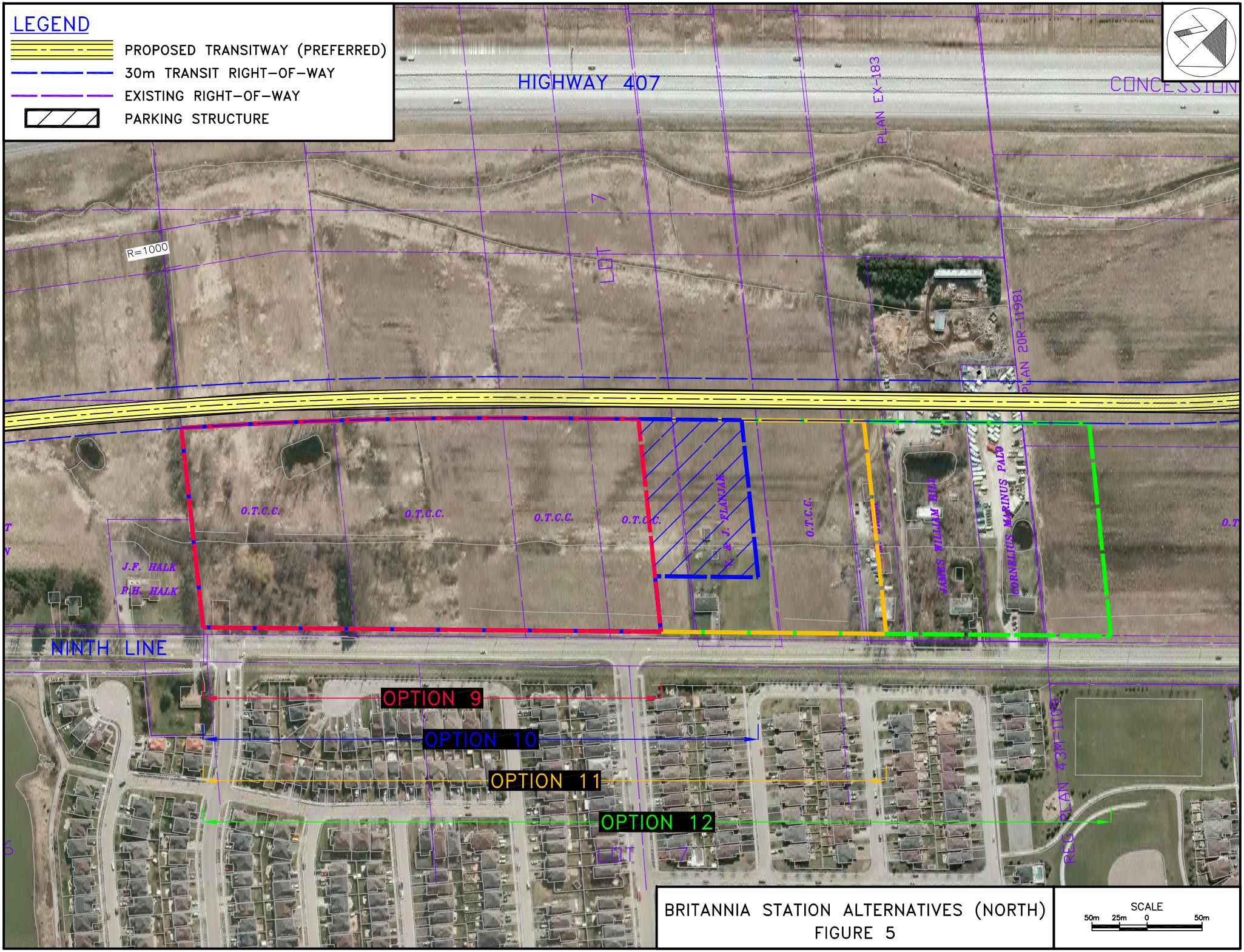
The parking structure capacity of 1,200 spaces can be accommodated by a total of five levels by means of one or two parking structures. It should be noted that if the two parking structures are ultimately provided and are extended to six levels each, the maximum parking capacity could be increased from 4,000 spaces to 5,455 and 5,630 for the parking structure alternatives within and outside the 2,800 at-grade parking footprint respectively.

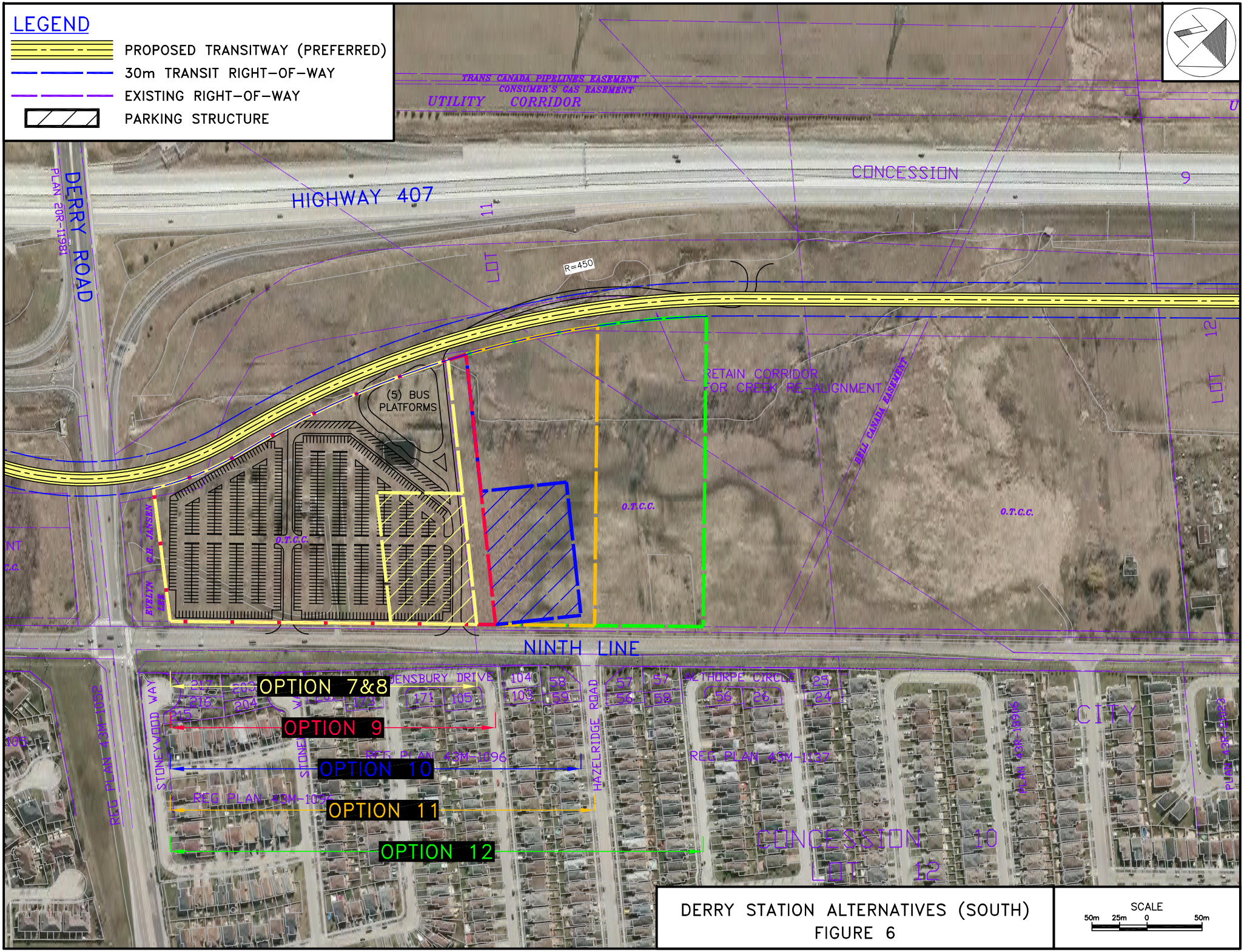

LEGEND
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
HIGHWAY 407
BRITANNIA ROAD
CITY OF MISSISSAUGA EASEMENT
(6) BUS PLATFORMS
O.T.C.C.
OPTIONS 1,4,5,6
OPTION 2 AND 3 PROPERTY ACQUISITION
H. RITCHIE
W. RITCHIE
TWP. OF TRAFALGAR
J.L. MAJOR
A.H. MAJOR
OPTION 2 AND 3 PROPERTY ACQUISITION
NINTH LINE
LOT
BRITANNIA STATION ALTERNATIVES
FIGURE 1
SCALE
50m 25m 0 50m


LEGEND
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
TRANS CANADA PIPELINES EASEMENT
CONSUMER'S GAS EASEMENT
UTILITY CORRIDOR
HIGHWAY 407
DERRY ROAD
LOT
LOT 12
(5) BUS PLATFORMS
OPTION 2 PROPERTY ACQUISITION
OPTION 6 PROPERTY ACQUISITION
OPTION 4 PROPERTY ACQUISITION
RETAIN CORRIDOR FOR CREEK RE-ALIGNMENT
BELL CANADA EASEMENT
OPTION 3 PROPERTY ACQUISITION
OPTION 5 PROPERTY ACQUISITION
O.T.C.C.
G.R. JANSEN
EVELYN LEE
NINTH LINE
REG PLAN 43M-1052
REG PLAN 43M-1096
REG PLAN 43M-1137
PLAN 43R-18906
PLAN 43R-21023
CONCESSION 10
LOT 12
DERRY STATION ALTERNATIVES
FIGURE 2
SCALE
50m 25m 0 50m


LEGEND
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
TRANS CANADA PIPELINES EASEMENT
CONSUMER'S GAS EASEMENT
HIGHWAY 407
(5) BUS PLATFORMS
C.P.R. GALT RAILWAY
ONTARIO HYDRO
HYDRO CORRIDOR
TRANS CANADA PIPELINES EASEMENT
CONSUMER'S GAS EASEMENT
UTILITY CORRIDOR
OPTION 6
PROPERTY ACQUISITION
ARGENTIA ROAD
FUTURE EXTENSION OF ARGENTIA ROAD
NINTH LINE
MISSISSAUGA
PLAN 43R-4112
PLAN 43R-20775
PLAN 43R-2918
PLAN 43R-9133
PLAN 43R-11863
LOT 13
NEW
ARGENTIA STATION ALTERNATIVES
FIGURE 3
SCALE
50m 25m 0 50m

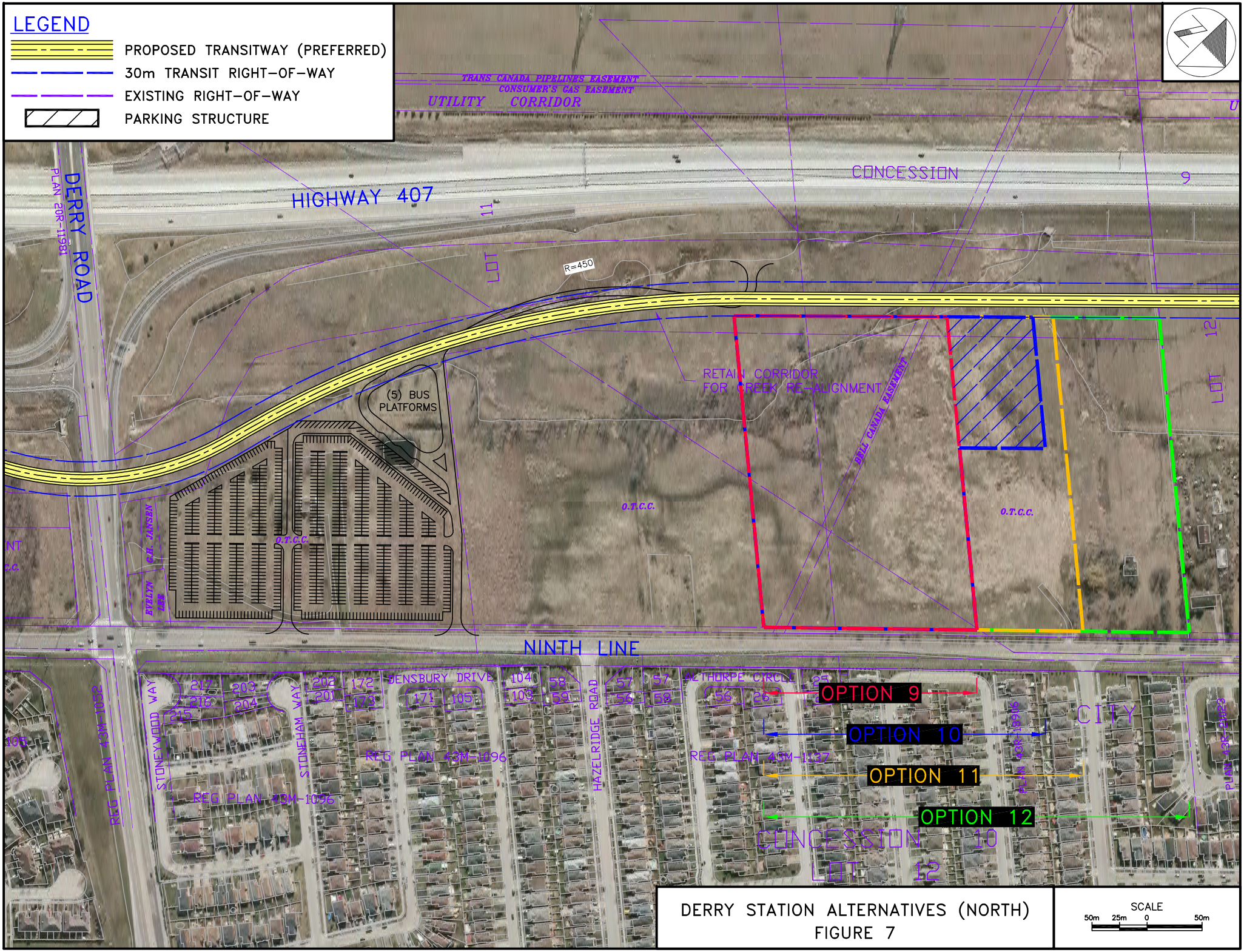

LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
HIGHWAY 407
O.T.C.C.
ESTABLISHED FROM COORDINATES SHOWN ON DESIGN PLAN BY ARROCTOR & REDFERN DATED SEPT. 22, 1995
BRITANNIA ROAD
LOT 5
CITY OF MISSISSAUGA EASEMENT
W. RITCHIE
W. RITCHIE
TWP. OF TRAFALGAR
O.T.C.C.
J.L. MAJOR
A.H. MAJOR
NINTH LINE
OPTION 7
OPTION 8
LOT 5
BRITANNIA STATION ALTERNATIVES (SOUTH)
FIGURE 4
SCALE
50m 25m 0 50m

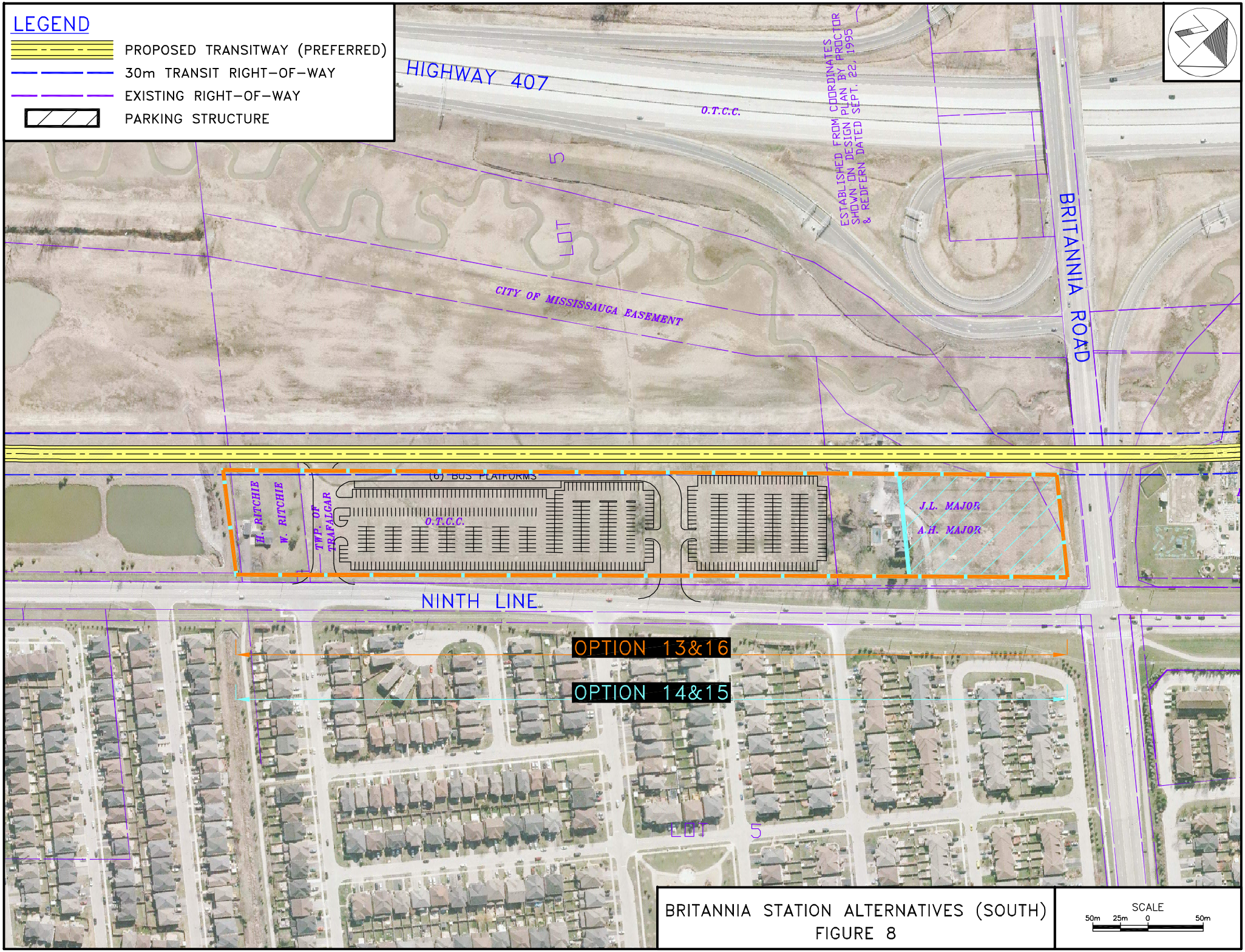

LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
HIGHWAY 407
CONCESSION
PLAN EX-183
PLAN 20R-11981
LOT 7
R=1000
O.T.C.C.
J. FLANJAK
JAMES VILLAM BELL
CORNELIUS MARINUS PALO
J.F. HALK
P.H. HALK
NINTH LINE
OPTION 9
OPTION 10
OPTION 11
OPTION 12
REG PLAN 43M-1109
BRITANNIA STATION ALTERNATIVES (NORTH)
FIGURE 5
SCALE
50m 25m 0 50m

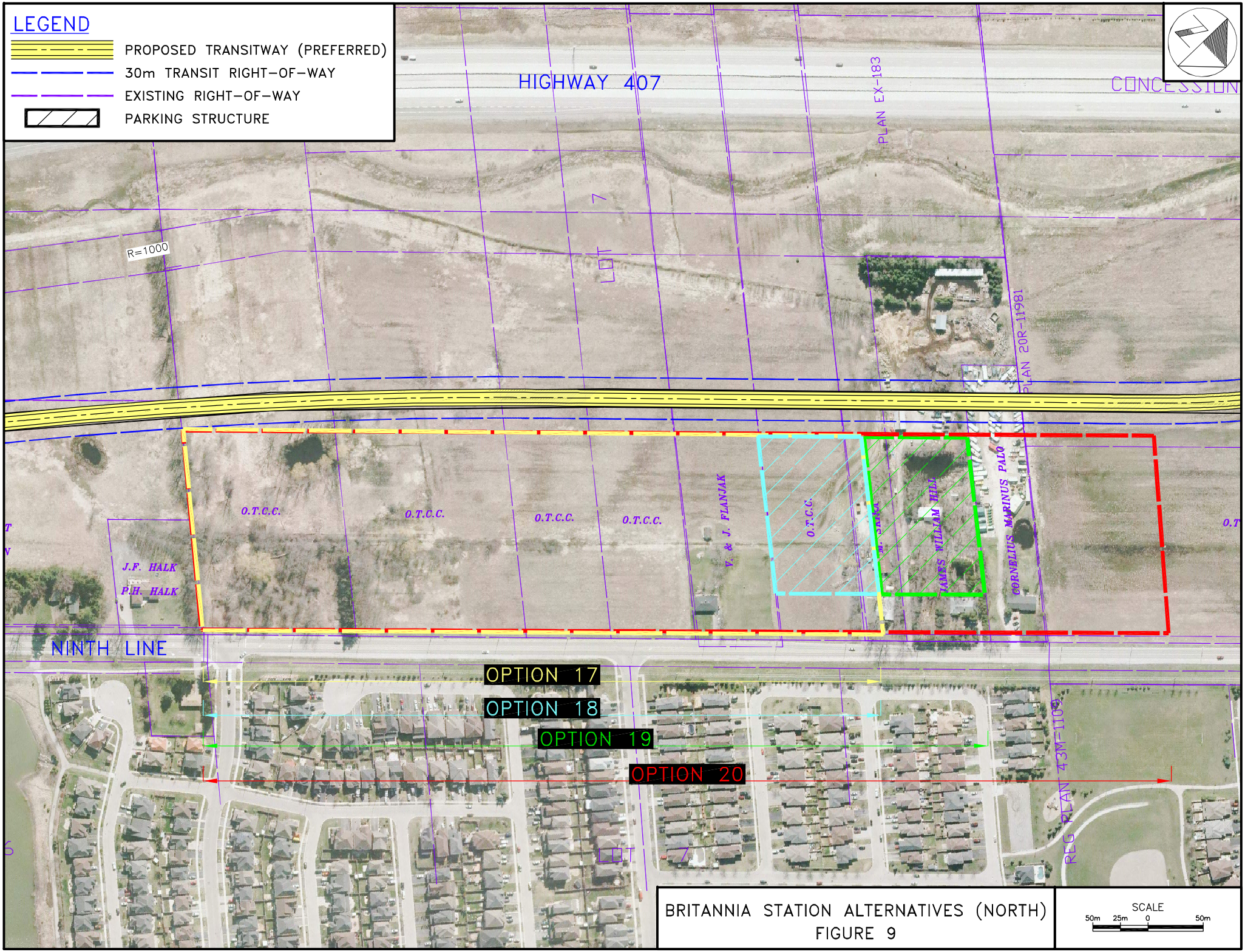


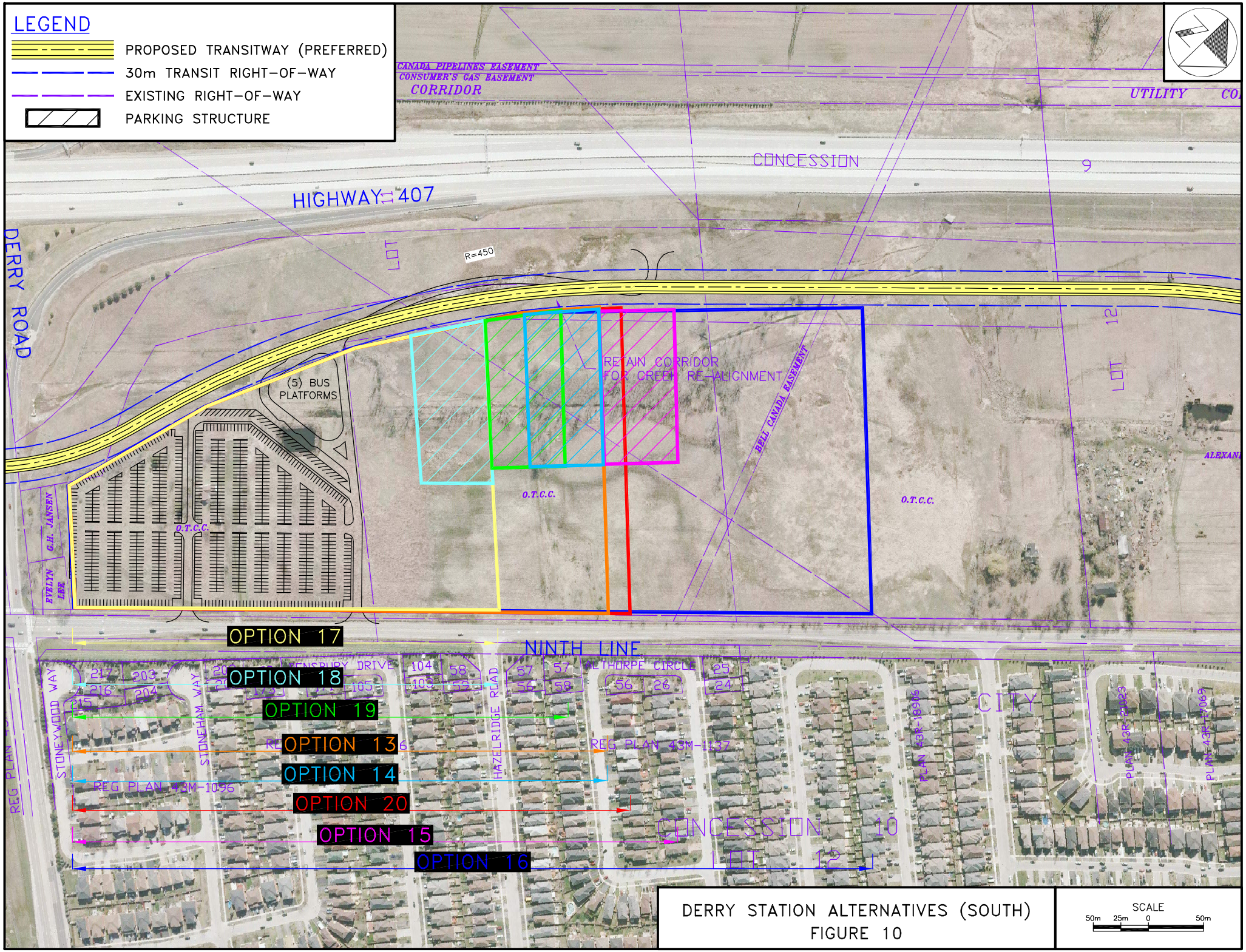
DERRY STATION ALTERNATIVES (SOUTH)
FIGURE 6

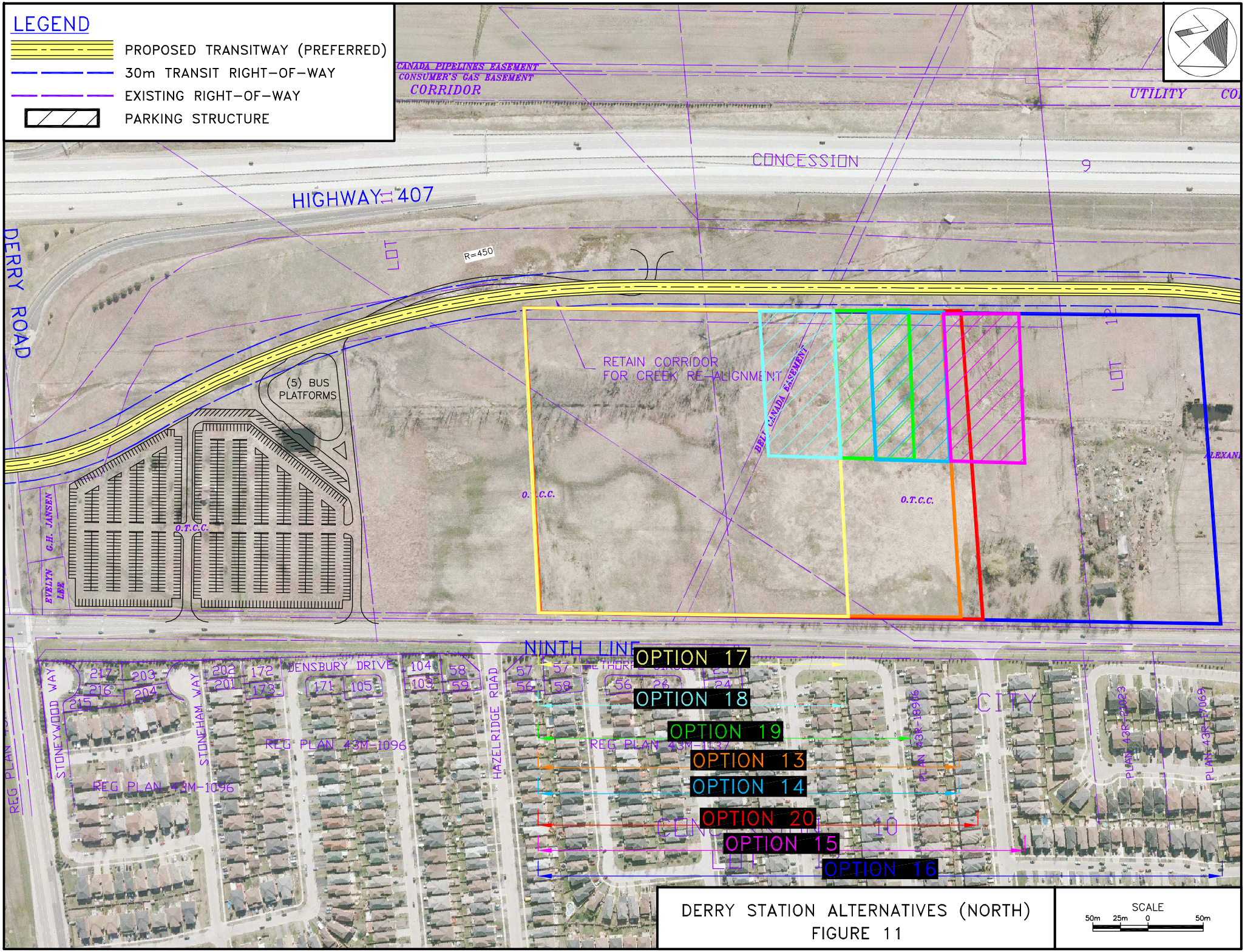
SCALE
50m 25m 0 50m


LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
TRANS CANADA PIPELINES EASEMENT
CONSUMER'S GAS EASEMENT
UTILITY CORRIDOR
HIGHWAY 407
DERRY ROAD
PLAN 20R-11981
CONCESSION 9
LOT 11
LOT 12
R=450
(5) BUS PLATFORMS
RETAIN CORRIDOR FOR CREEK RE-ALIGNMENT
BELL CANADA EASEMENT
O.T.C.C.
NINTH LINE
JENSBURY DRIVE
STONEYWOOD WAY
STONEHAM WAY
HAZELRIDGE ROAD
MCTHORPE CIRCLE
REG PLAN 43M-1096
REG PLAN 43M-1127
OPTION 9
OPTION 10
OPTION 11
OPTION 12
CITY
CONCESSION 10
LOT 12
DERRY STATION ALTERNATIVES (NORTH)
FIGURE 7
SCALE
50m 25m 0 50m


LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
HIGHWAY 407
O.T.C.C.
ESTABLISHED FROM COORDINATES SHOWN ON DESIGN PLAN BY PROCTOR & REDFERN DATED SEPT. 22, 1995
LOT 5
CITY OF MISSISSAUGA EASEMENT
BRITANNIA ROAD
(6) BUS PLATFORMS
H. RITCHIE
W. RITCHIE
TWP. OF TRAFALGAR
O.T.C.C.
J.L. MAJOR
A.H. MAJOR
NINTH LINE
OPTION 13&16
OPTION 14&15
LOT 5
BRITANNIA STATION ALTERNATIVES (SOUTH)
FIGURE 8
SCALE
50m 25m 0 50m


LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
HIGHWAY 407
CONCESSION
PLAN EX-183
PLAN 20R-11981
LOT 7
R=1000
O.T.C.C.
O.T.C.C.
O.T.C.C.
O.T.C.C.
O.F.C.C.
V. & J. FLANJAK
JAMES WILLIAM HILL
CORNELIUS MARINUS PALO
J.F. HALK
P.H. HALK
NINTH LINE
OPTION 17
OPTION 18
OPTION 19
OPTION 20
REG PLAN 43M-1109
LOT 7
BRITANNIA STATION ALTERNATIVES (NORTH)
FIGURE 9
SCALE
50m 25m 0 50m


LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
CANADA PIPELINES EASEMENT
CONSUMER'S GAS EASEMENT
CORRIDOR
UTILITY
CONCESSION 9
HIGHWAY 407
DERRY ROAD
LOT
R=450
(5) BUS PLATFORMS
RETAIN CORRIDOR FOR CREEK RE-ALIGNMENT
BELL CANADA EASEMENT
LOT 12
O.T.C.C.
G.H. JANSEN
EVELYN LEE
OPTION 17
NINTH LINE
OPTION 18
OPTION 19
OPTION 13
OPTION 14
OPTION 20
OPTION 15
OPTION 16
STONEYWOOD WAY
SIDNEHAM WAY
HAZELRIDGE ROAD
BETHORPE CIRCLE
REG PLAN 43M-1096
REG PLAN 43M-1137
REG PLAN 43R-16906
CITY
CONCESSION 10
LOT 12
DERRY STATION ALTERNATIVES (SOUTH)
FIGURE 10
SCALE
50m 25m 0 50m


LEGEND
PROPOSED TRANSITWAY (PREFERRED)
30m TRANSIT RIGHT-OF-WAY
EXISTING RIGHT-OF-WAY
PARKING STRUCTURE
CANADA PIPELINES EASEMENT
CONSUMER'S GAS EASEMENT
CORRIDOR
UTILITY
CONCESSION
9
HIGHWAY 407
DERRY ROAD
LOT
R=450
(5) BUS PLATFORMS
RETAIN CORRIDOR FOR CREEK RE-ALIGNMENT
BELL CANADA EASEMENT
O.T.C.C.
G.H. JANSEN
EVELYN LEE
NINTH LINE
OPTION 17
OPTION 18
OPTION 19
OPTION 13
OPTION 14
OPTION 20
OPTION 15
OPTION 16
STONEYWOOD WAY
SIDNEHAM WAY
JENSBURY DRIVE
HAZELRIDGE ROAD
REG PLAN 43M-1096
REG PLAN 43M-1137
REG PLAN 43R-18906
REG PLAN 43R-21023
REG PLAN 43R-17069
CITY
CENTRE LOT
10
DERRY STATION ALTERNATIVES (NORTH)
FIGURE 11
SCALE
50m 25m 0 50m

Scale, Jim

From: Minnes, Robb (MTO) <Robb.Minnes@ontario.ca>
Sent: March-30-15 1:59 PM
To: Scale, Jim
Cc: Diczki, Tarita (MTO); DeRose, Graham (MTO); Scheckenberger, Ron; Farrell, Aaron; Nguyen, John; Frank Marzo; Mel Kayama (City Mississauga)
Subject: RE: Hwy 407 Transitway at Ninth Line

Categories: 3.190 Corr-Traffic, 3.130 Corr-Highway, 3.090 Corr-External Agencies

Hi Jim:

Sorry for the delay in responding to you. Your summary is accurate and concise. I have added additional comments to some of the points.

- MTO will confirm that the ultimate widening of Hwy 407 will be accommodated in the median to assist in assessing potential pinch points were the transitway will be in close proximity to Hwy 407;
  This is to ensure that all Hwy 407 widening plans are within the 407 right-of-way. Our practice is to design the Transitway outside of the established 407 right-of-way unless it is absolutely necessary to venture within it.
- Confirmation will be required by Amec Foster Wheeler on the capacity of the ponds to address ultimate widening of Hwy 407;
- MTO issued a letter to Metrolinx requesting confirmation on the requirement for the CN Galt station – In the event the station is not to be carried forward, additional parking capacity will have to be accommodated at the other two stations – consideration could be given to coordinating with the potential extension of Agentia Road (to be discussed with the City of Mississauga);
  Metrolinx has responded to MTO confirming that it has no plans to move the Lisgar Station or add another at Ninth Line.
- The assessment of station parking capacity required in the Ninth Line corridor needs to be updated and is felt to be underestimated – MTO and the City of Mississauga to coordinate and provide updated estimates; With the confirmation from Metrolinx, MTO will be removing plans for a CN Galt 407 Transitway station. There will be a need to transfer CN Galt parking capacity to the remaining stations at Derry Road and Britannia Road. We will also need to add 200 spaces at each for car pool capacity. Finally, we believe the parking requirements determined in the mid 1990's for these stations are outdated and highly underestimated. MTO will be doing a detailed analysis of station needs in the future when the Transitway EA is done for this section. In advance of this we recommend that 2000 spaces be protected for at each of the two stations. Should the demand be determined to be lower through the Transitway EA, the stations can be reduced in area and the adjoining land use designations enlarged accordingly. We can discuss this further with Mississauga staff.
- An assessment of overhead versus underground crossing of the transitway and Hwy 407 at the south limit of the Ninth Line corridor was reviewed and underground (likely tunneling) was identified as preferred alternative to minimize impacts to Hwy 407 operations and required vertical clearances over the Hwy 407 N to Hwy 403 S ramp – MTO to provide base mapping to assist in any potential assessment of the overhead alternative;
- Opportunities to reduce the transitway corridor to a width less than 60 m will be considered where deemed appropriate to maximize the extent of the developable lands – consideration for increased widths will be evaluated as well (in particular in the vicinity of the grade separations and stations); and
- Horizontal alignment will be updated to reflect requirement for spiral curves as opposed to simple curves developed under the previous study.

Further to our discussions, can you please confirm the minimum clear zone width that should be considered between the north bound Hwy 407 lanes and the southbound transitway lane (10 m standard clear zone or 15 m enhanced clear zone)? Secondly, would it be feasible to install barrier protection along the Hwy 407 northbound shoulder to permit a reduced offset between the Hwy 407 northbound lanes and the transitway? We will confirm that the existing 407 right-of-way accommodates the required clear zone for the highway. As stated we design the Transitway to avoid the 407 right-of-way where possible. By staying outside the right-of-way this study will only have to address Transitway requirements.

Thanks

Robb

From: Scale, Jim [mailto:jim.scale@amecfw.com]
Sent: March-17-15 6:55 PM
To: Minnes, Robb (MTO)
Cc: Diczki, Tarita (MTO); Scheckenberger, Ron; Farrell, Aaron; Nguyen, John; Frank Marzo; Mel Kayama (City Mississauga)
Subject: RE: Hwy 407 Transitway at Ninth Line

Robb,

The following is a summary of our discussions earlier today (please clarify as required):

- MTO will confirm that the ultimate widening of Hwy 407 will be accommodated in the median to assist in assessing potential pinch points were the transitway will be in close proximity to Hwy 407;
- Confirmation will be required by Amec Foster Wheeler on the capacity of the ponds to address ultimate widening of Hwy 407;
- MTO issued a letter to Metrolinx requesting confirmation on the requirement for the CN Galt station – In the event the station is not to be carried forward, additional parking capacity will have to be accommodated at the other two stations – consideration could be given to coordinating with the potential extension of Agentia Road (to be discussed with the City of Mississauga);
- The assessment of station parking capacity required in the Ninth Line corridor needs to be updated and is felt to be underestimated – MTO and the City of Mississauga to coordinate and provide updated estimates;
- An assessment of overhead versus underground crossing of the transitway and Hwy 407 at the south limit of the Ninth Line corridor was reviewed and underground (likely tunneling) was identified as preferred alternative to minimize impacts to Hwy 407 operations and required vertical clearances over the Hwy 407 N to Hwy 403 S ramp – MTO to provide base mapping to assist in any potential assessment of the overhead alternative;
- Opportunities to reduce the transitway corridor to a width less than 60 m will be considered where deemed appropriate to maximize the extent of the developable lands – consideration for increased widths will be evaluated as well (in particular in the vicinity of the grade separations and stations); and
- Horizontal alignment will be updated to reflect requirement for spiral curves as opposed to simple curves developed under the previous study.

Further to our discussions, can you please confirm the minimum clear zone width that should be considered between the north bound Hwy 407 lanes and the southbound transitway lane (10 m standard clear zone or 15 m enhanced clear zone)? Secondly, would it be feasible to install barrier protection along the Hwy 407 northbound shoulder to permit a reduced offset between the Hwy 407 northbound lanes and the transitway?

If you have any questions or require any additional information, please contact me.

James Scale
Associate Engineer, Transportation
Amec Foster Wheeler
Environment & Infrastructure

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From: Minnes, Robb (MTO) [mailto:Robb.Minnes@ontario.ca]
Sent: March-17-15 11:01 AM
To: Scale, Jim

Cc: Diczki, Tarita (MTO)
Subject: RE: Hwy 407 Transitway at Ninth Line

Hi Jim

Further to our discussion today, attached are the plan and profile drawings from the 2004 Corridor Protection Study which supersede Plates 3 and 4 from the 1998 Corridor Protection Study. I reviewed the 2004 study and it simply indicates that the Transitway alignment passes under Lower Base Line/Hwy 407 and the ramps with no further analysis or discussion. As discussed, the over/under options need to be explored further giving consideration to drainage requirements and the cost impact of requiring tunneling at least under the 407 mainline due to the fact that it is not an MTO facility.
We will confirm the information in your email as soon as we receive it.

Robb