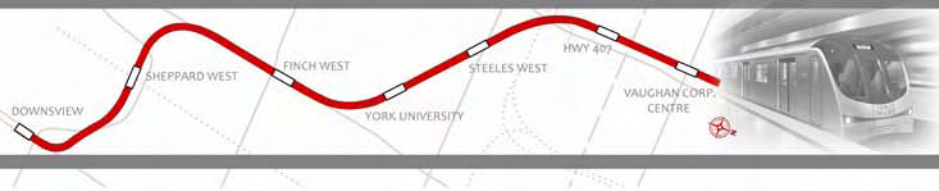




**Toronto-York Spadina  
Subway Extension**



## **Tower 158 Avoidance EA Amendment**

### **York Region Highway 7 Corridor & Vaughan North-South Link Public Transit Improvements Environmental Assessment**

### **and the 2007 Vaughan North-South Link Condition of Approval Report**

**EA 02-06-02**



## **Toronto-York Spadina Subway Extension**

**December 21, 2009**

**Reference: 2506090**

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- C Selected Borehole Data
- D Highway 407 Station Initial Geo-Engineering Design Draft Report (September 2009)
- E Black Creek Highway 407 10% Design Submission Geomorphological Component (June 2009)
- F Highway 407 Station Existing Conditions Report (September 2009)
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## 1. MODIFICATION TO THE UNDERTAKING AND AMENDMENT PROCESS

The Toronto Transit Commission (TTC) in association with the Government of Canada, Province of Ontario, City of Toronto and York Region is undertaking the design and construction of the Toronto-York Spadina Subway Extension (TYSSE). The project is an 8.6 km subway extension consisting of six stations beginning at the Downsview Station in the City of Toronto and extending north into York Region and the City of Vaughan. The project was subject to two separate provincial Environmental Assessments (EA) and, with the receipt of federal funding, a Canadian Environmental Assessment Act (CEAA) screening report was prepared.

### 1.1 Authorizing Provincial Environmental Assessment

The proposed amendment described in this report is to York Region's "Highway 7 Corridor and Vaughan North-South Link Public Transit and Associated Road Improvements Environmental Assessment" (Highway 7 EA) and the subsequent "Highway 7 and Vaughan North-South Link Condition of Approval – Subway Alignment Selection Report" (COA Report). The Highway 7 EA was approved by the Ministry of the Environment (MOE) in November 2006 (refer to MOE approval letter in **Appendix A**). The north-south public transit link referred to in the title of the Highway 7 EA was approved as buses travelling on Jane Street between the Steeles West Station and the Vaughan Corporate Centre, generally west of Jane Street at Highway 7.

### 1.2 Approved Design Components and Amending Boundary of the COA Report

Section 11.2.2.2 of the Highway 7 EA described the plan for an ultimate subway extension phase. Section 11.6 of the Highway 7 EA proposed an amendment process to complete the Vaughan North-South Link preferred subway design. The MOE's approval included a Condition (8) – Selection of the Optimum Location for the Alignment. The COA Report was subsequently submitted to the MOE in June 2007 to satisfy this condition. **Figure 1-1** shows the preferred subway alignment from the COA Report and the individual elements as listed below:

- A tunnel alignment from the Steeles West Station north to the Vaughan Corporate Centre (VCC) Station;
- A YRT bus terminal at Steeles West Station located north of Steeles Avenue West and access roads for the parking facility including Streets A, B and C and an East-West Road connecting the Steeles West Station commuter parking lots with Jane Street;



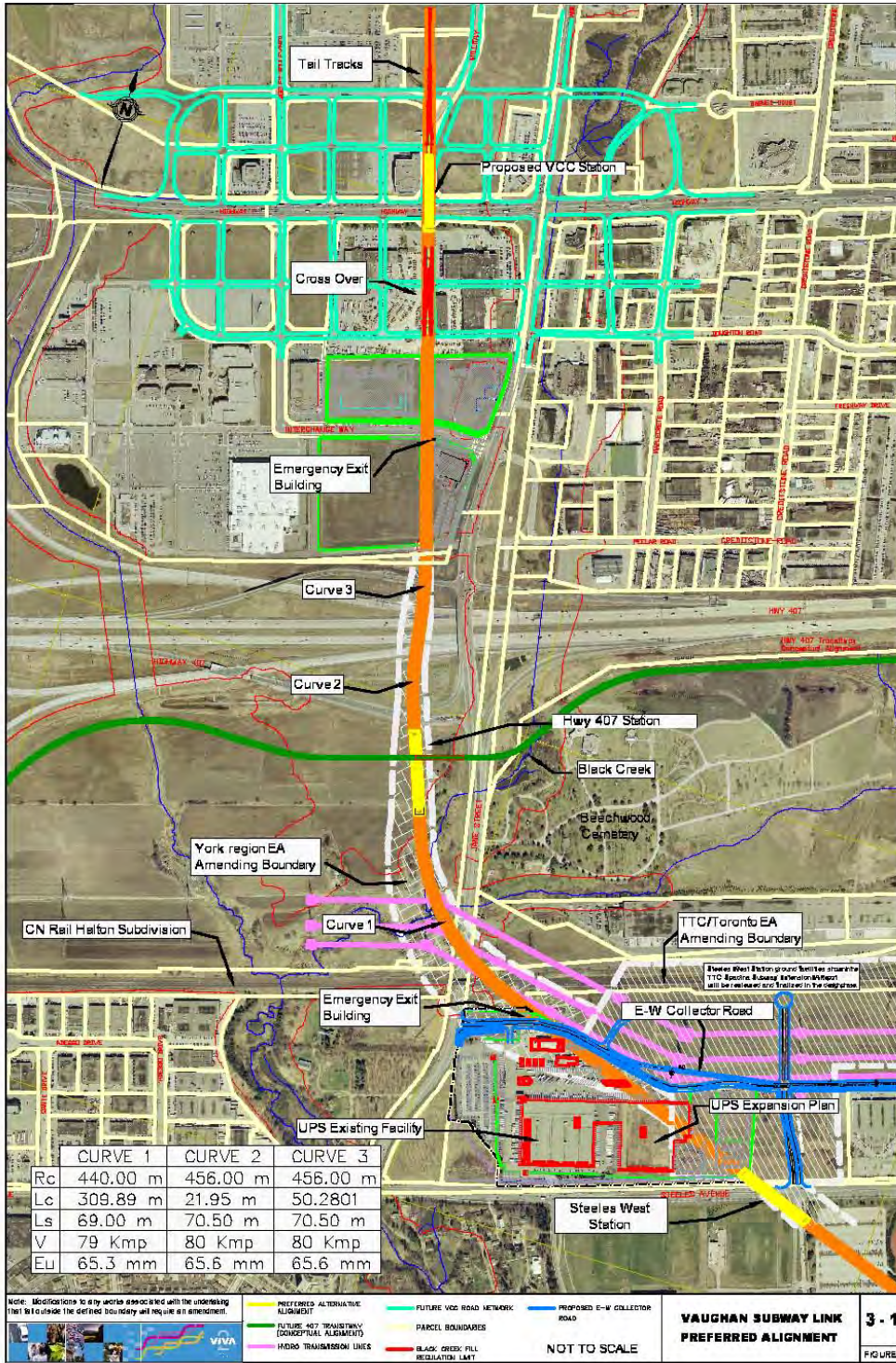


Figure 1-1  
COA Report Preferred Alignment and Amending Boundaries

- A Highway 407 Station at the southwest corner of Jane Street and the 407 ETR with a 600 space parking facility, a GO/YRT bus terminal, a bridge across Black Creek opposite the entrance to the Beechwood Cemetery, and a second access road from Jane Street immediately south of the 407 ETR ramps; and
- A VCC Station including a cross over track, a tail track and on street bus transfer.

The COA Report also includes an amending boundary, within which, changes to the design are considered design refinements. The COA amending boundary is shown in **Figure 1-1** as white cross hatching as well as the approved alignment and design curves. **Figure 1-2** shows both the approved and proposed alignments as well as the amending boundary for comparison purposes. The proposed alignment is outside of the COA amending boundary.

### 1.3 Approved Amending Procedures

Amending procedures for the subway elements of the Highway 7 EA are found in Section 11.5, "Modifying the Preferred Design". This section recognizes the need to distinguish between minor and major changes. The section states:

"A major design change would require completion of an amendment to this EA, while a minor change would not. For either kind of change, it is the responsibility of the Regional Municipality of York, as proponent, to ensure that all possible concerns of the public and affected agencies are addressed."

"Minor design changes may be defined as those which do not appreciably change the expected net impacts associated with the project."..."Due to unforeseen circumstances, it may not be feasible to implement the project as described in this EA report. Accordingly, any significant modification to the project or change in the environmental setting for the project which occurs after the filing of this EA shall be reviewed by York Region and an addendum to the EA shall be prepared."

The changes proposed to avoid locating the subway tunnels under a 500 kV hydro tower (Tower 158) and the resulting changes to the location of the Highway 407 Station subway box are considered a significant modification which requires an addendum to the EA.

Design changes to the TYSSE are approved through a management review process. The Design/Methodology Change Request (D/MCR) system provides a formal way to track changes that arise during the project. A D/MCR report is prepared documenting the need for the change, its scope and, at times, alternatives to the change and the impact upon cost, schedule and construction methods. Review by the TYSSE management is documented and the management team approves the request.



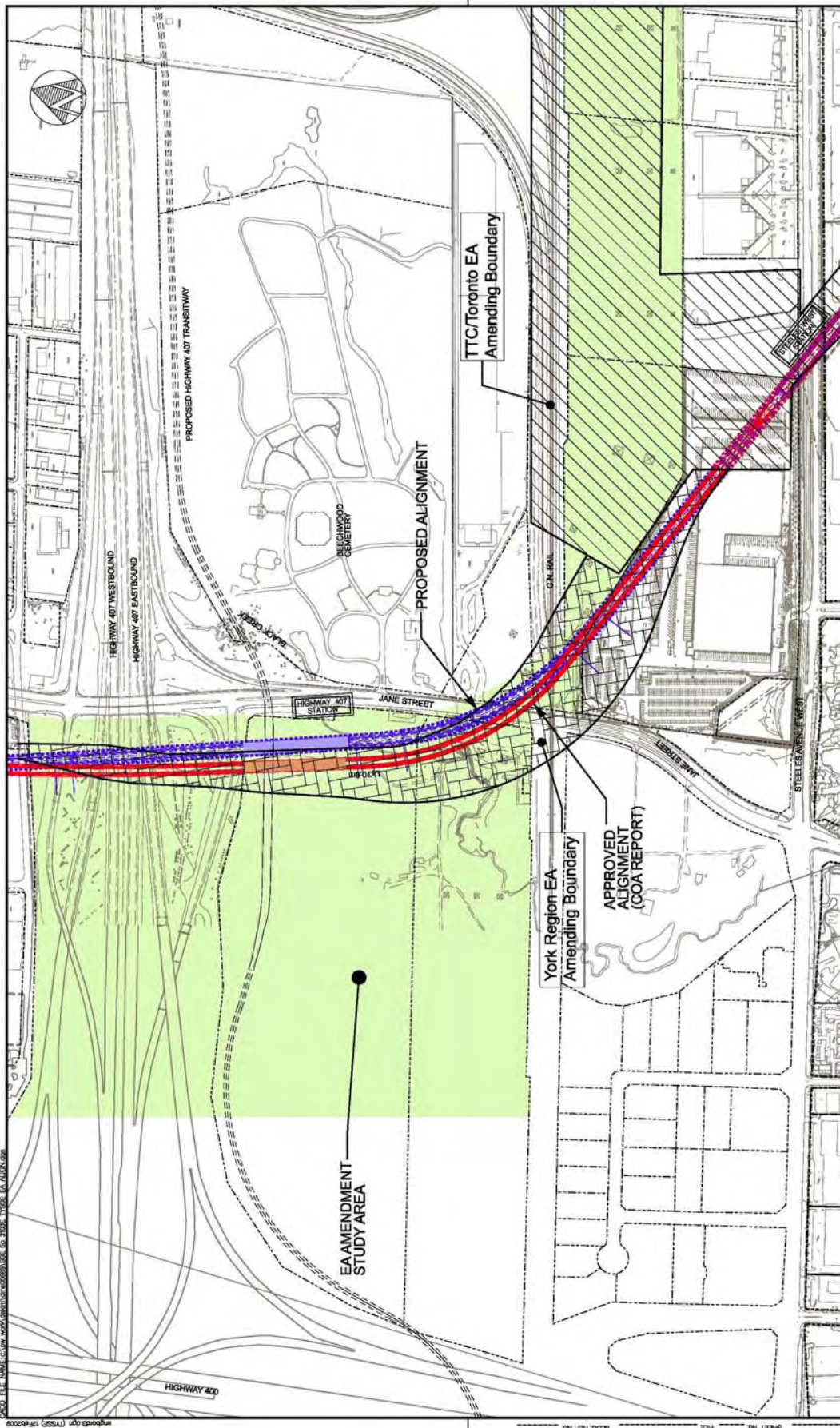


Figure 1-2  
EA Amendment Study Area

D/MCR- 001 documents the need and approval of the change proposed in this EA Amendment.

This EA Amendment Report evaluates the following modifications to the approved EA which are outside of the approved amending boundary: altering the twin tunnel alignment adjacent to Hydro Tower 158 resulting in a shift in location of Highway 407 Station and a realignment of a section of Black Creek. **Figure 1-2** highlights the study area for this EA Amendment Report, the approved and proposed subway alignment and the associated shift in the location of the Highway 407 Station.

#### **1.4 Ontario Ministry of the Environment - Environmental Assessment Act**

Part II, Section 12 of the Environmental Assessment Act (R.S.O. 1990, Chapter E.18) sets out the requirements for a change/amendment to an EA undertaking. The proposed realignment of the twin tunnels and the Highway 407 Station location does not change the basic undertaking of providing subway connections between the City of Toronto and the Vaughan Corporate Centre. Furthermore, the proposed realignment is within the same general area of the approved alignment, the proposed realignment maintains the same number and general location of the stations, associated commuter parking lots, bus terminals and passenger pick-up and drop-off locations (PPUDO), as well as the ancillary subway components including Emergency Exit Buildings (EEBs), cross passages, access roads and connections to the proposed 407 Transitway.

#### **1.5 Ontario Realty Corporation Class Environmental Assessment Requirements**

The majority of the study area (refer to **Figure 1-2**) covered by this EA Amendment falls within the jurisdiction of the Ontario Realty Corporation (ORC). The Ministry of Energy and Infrastructure (MEI) manages the Ontario Government's real estate and therefore ORC acts on behalf of the Minister for the MEI. ORC is required to prepare its own EA if there will be a lease, easement or outright conveyance of ORC properties in accordance with the Class EA process set out by the MEI in their document "MEI Class Environmental Assessment Process: Class EA Process for the Ministry of Energy and Infrastructure (MEI) for Realty Activities Other Than Electricity Projects" (MEI Class EA).

The TTC and its partner agency York Region Rapid Transit intend to purchase or lease property for the proposed alignment from the Ontario Realty Corporation (ORC). To support ORC's ability to convey lands for the TYSSE project, this EA amendment covers all lands in the Parkway Belt under ORC control including the Hydro One Network Inc. (HONI) Cherrywood-Clairville Hydro Corridor. The alignment as shown in the COA Report and the proposed alignment described in this EA Amendment Report are also included in this figure.

Therefore, in order to develop the Highway 407 Station, lands will need to be conveyed from the ORC to York Region and/or the TTC. This EA Amendment Report is intended to satisfy the MEI Category B Undertaking as described in Section 4.2 of the MEI Class EA document.

## 2. RATIONALE FOR THE MODIFICATION

In late 2008, TYSSE held stakeholder consultations with HONI to review the tunnel alignment in the vicinity of the 500kV hydro lines/towers within the Cherrywood-Clairville Hydro Corridor. At that time, HONI indicated that the risk associated with the construction of the approved subway alignment, 6 m below the foundations of Tower 158, was not acceptable. TYSSE began to evaluate alternatives and involve stakeholders in the discussions.

### 2.1 Amendment Study Area

The study area for the amendment described in this report is shown in green on **Figure 1-2**. The entire study area falls within ORC lands, as described in Chapter 1.

### 2.2 Avoidance of Hydro Tower 158

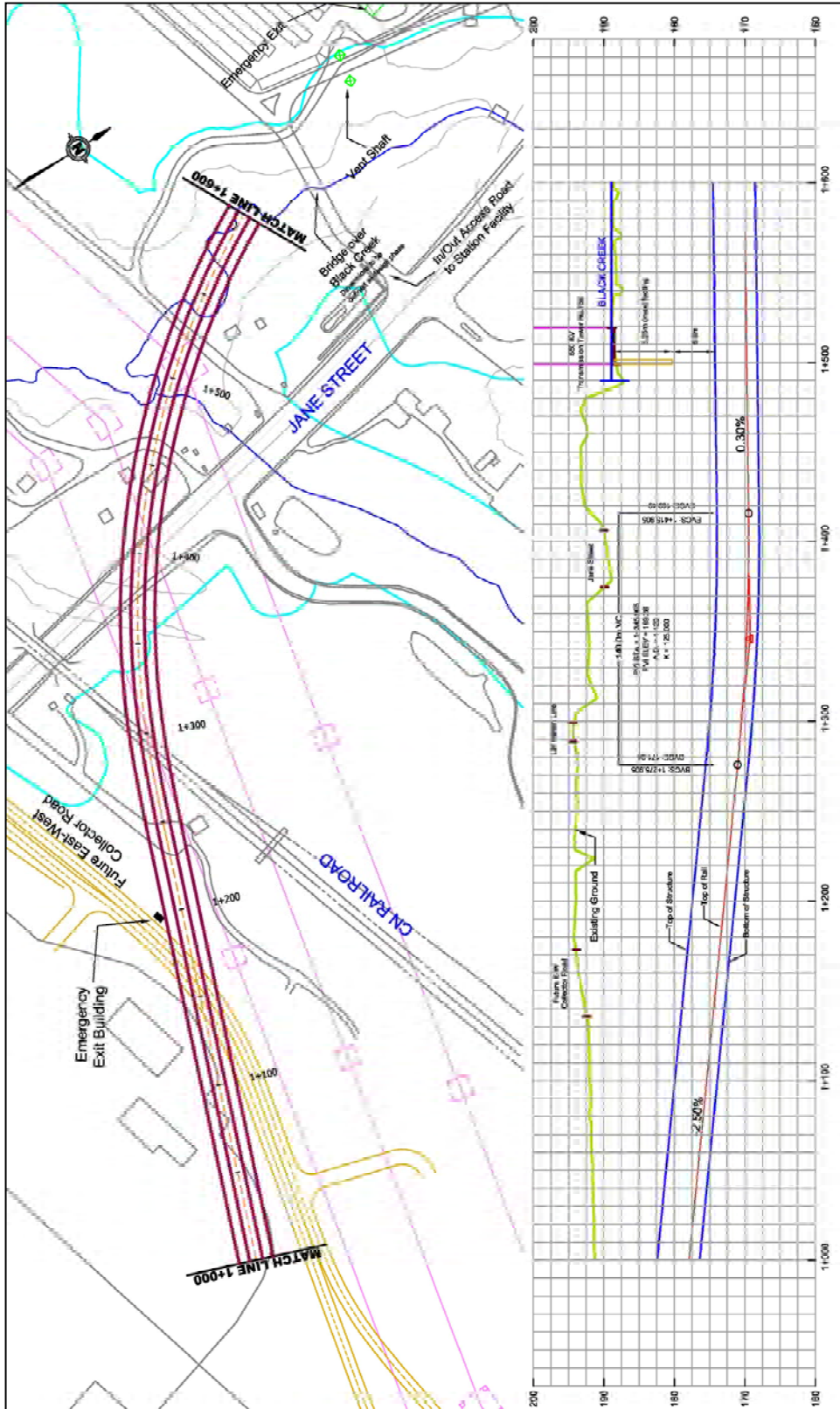
In reviewing the approved EA alignment north of Steeles Avenue a major technical and approval risk to the project was identified. The approved subway alignment passed directly underneath the foundations of Hydro Tower 158 (500kV - circuit C551VP) in the Cherrywood-Clairville Hydro Corridor (refer to **Figures 2-1** and **2-2**). Tower 158 is a critical piece of HONI's electrical distribution network for southern Ontario and the north-eastern United States.

Tunnelling underneath this tower was determined to present a high technical and approval risk to the project. Delayed, or no approval, from HONI would result in unacceptable delays to the project. Tunnelling underneath the tower's foundations also necessitated the subway tunnels being deep, resulting in Highway 407 Station being approximately 27m below ground.

In order to mitigate the schedule risk to the project, due to delayed or no approval from HONI, and the technical risk associated with tunnelling under the hydro tower foundations, TYSSE staff evaluated alternative alignments that would avoid the need to tunnel directly underneath Tower 158.

A number of alternatives were evaluated and a preferred alternative was identified. The preferred alternative shifts the subway alignment east of Tower 158. As a consequence of this eastward shift, the length of the tunnelled running structure is reduced and the depth of Highway 407 Station is decreased (5m ± from EA approved depth). The avoidance of Tower 158 results in a shift of the Highway 407 Station subway box to the east and a realignment of a section of Black Creek. These effects will be highlighted in Chapter 6 of this report.





Source: COA Report, 2007

Figure 2-1  
COA Report Approved EA Alignment: STA. 1 + 100 TO STA. 1 + 600



Source: COA Report, 2007

Figure 2-2  
COA Report Approved EA Alignment: 1 + 600 to STA. 2 + 200



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### **3. EXISTING CONDITIONS**

Detailed environmental and geotechnical field investigations were initiated as part of the Compliance Monitoring activities associated with the COA Report approval. Necessary archaeological survey work has been initiated and continues. These studies have been used to supplement investigations completed in support of the COA Report. In addition, fluvial geomorphologic surveys were initiated in November 2008 in order to evaluate the alternatives for re-aligning Black Creek. The field investigations continue in support of the ongoing design of the tunnel alignment and the Highway 407 Station. Further investigation of utilities in this portion of the study area provided additional information which is documented in this chapter.

#### **3.1 SOCIAL ENVIRONMENT**

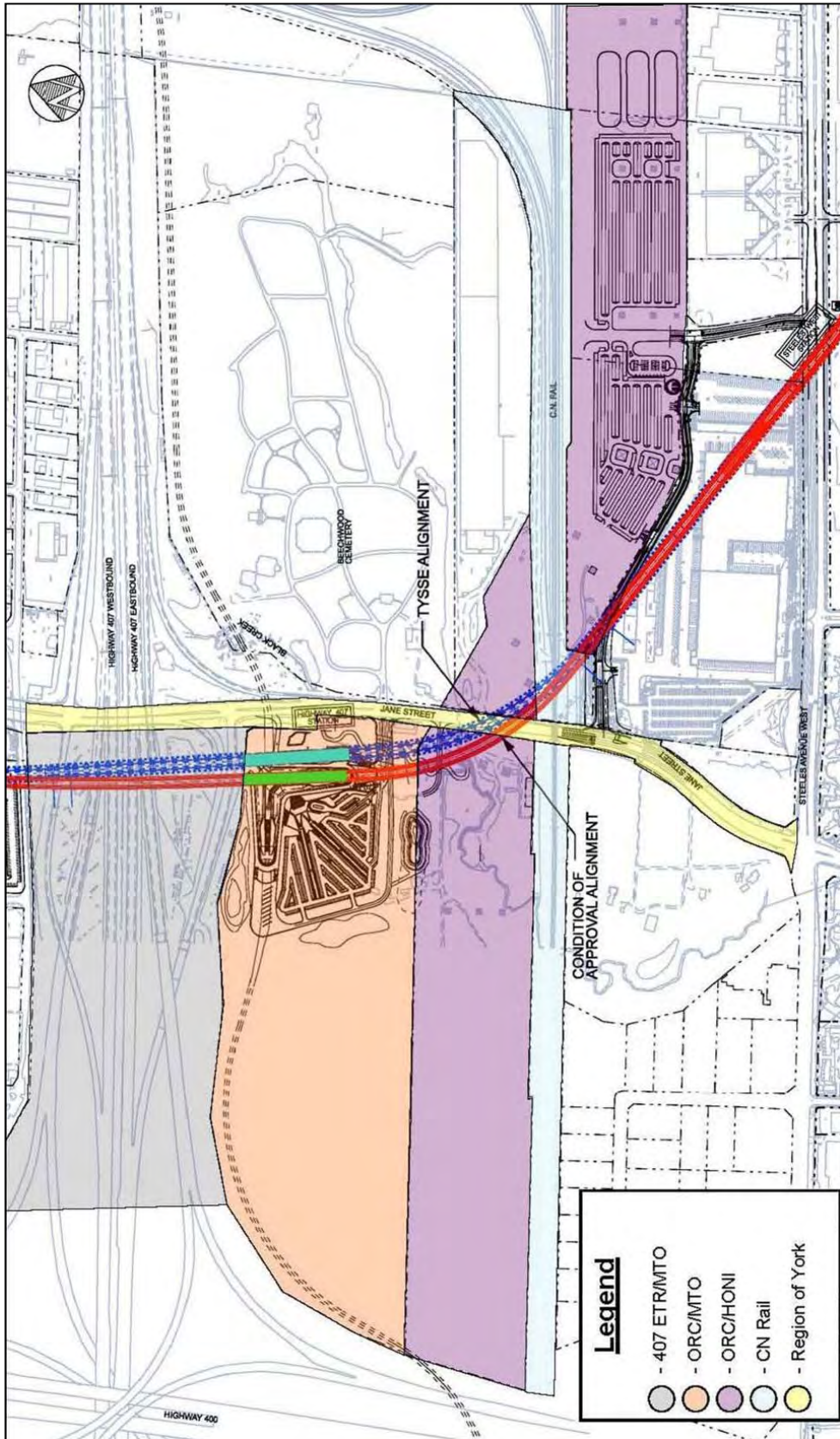
The lands and facilities covered by this EA amendment are located in the City of Vaughan in York Region, Ontario as shown in **Figure 3-1**.

##### **3.1.1 Land Ownership**

**Figure 3-1** shows the land ownership as well as the legal stakeholders for the affected properties. TTC intends to acquire land for the subway, stations, parking lots and ancillary facilities including bus terminals, the East –West Road, EEBs and electrical substations. In some cases, ownership may be stratified. In some locations, where outright TTC ownership is not possible, other forms of conveyance or provisions for long-term use may be used.

Ownership of the Highway 407 Station area primarily rests with provincial Government agencies and related bodies. Several provincial agencies have interests in the property:

- The lands on which the station, tunnels, bus terminal, parking and other associated uses (to be referred to collectively as Highway 407 Station) are to be constructed on Ontario Realty Corporation (ORC) lands on which the Ministry of Transportation (MTO) has placed an Order in Council (OIC), thus giving them the authority to approve the use of these lands.
- The property immediately south of the Highway 407 Station are ORC lands as well; however Hydro One (HONI) has easement rights over this land for its hydro corridor. This easement continues beyond Highway 400 to the east and, following a slight jog to the south across Jane Street, continues west beyond Keele Street.
- Immediately south of the HONI easement is the Canadian National Railway (CN) corridor.
- To the north of Highway 407 Station is Highway 407 which is under the ownership of MTO but is leased to and operated by 407 ETR, a private enterprise.



Source: TYSSE, 2009

Figure 3-1  
Land Ownership

- Adjacent to the east side of Highway 407 Station is the Jane Street right-of-way, is owned by the Regional Municipality of York (York Region).

### 3.1.2 Land Use Designations

The EA Amendment study area lies within the jurisdiction of York Region, in the City of Vaughan. Land use regulation and zoning by-laws within the EA Amendment study area generally fall within the City's purview, while York Region and Provincial plans provide broader direction. Refer to **Figure 3-2** for the illustration depicting the various land uses within the EA Amendment study area. Updated information regarding land use was obtained from the City of Vaughan.

#### 3.1.2.1 The Parkway Belt West Plan

Land use designations within the EA Amendment study area are covered variously by both the Province of Ontario and the City of Vaughan. Virtually all of these lands have land use designations covered under the Government of Ontario's "The Park Belt West Plan". These lands include the following, as outlined in the Government of Ontario document "The Parkway Belt West Plan", Map 5-2, July 1978, Office Consolidation to June 2009:

- Highway 407, designated "Public Use Area – Road";
- The property directly south of Highway 407 and west of Jane Street, designated "Public Use Area – Inter-Urban Transit"; and
- Property within the Cherrywood-Clairville Hydro Corridor, designated "Public Use Area – Electric Power Facility" and "Public Use Area – Utility"

Portions of the study area west of Jane Street within the Black Creek valley as well as lands east of Jane Street also have City of Vaughan land use designations. The Black Creek valley is designated as "Major Open Space and Valley Lands" and the lands east of Jane Street within the study area are designated "Employment Areas" (City of Vaughan OPA 600, Schedule 'A').

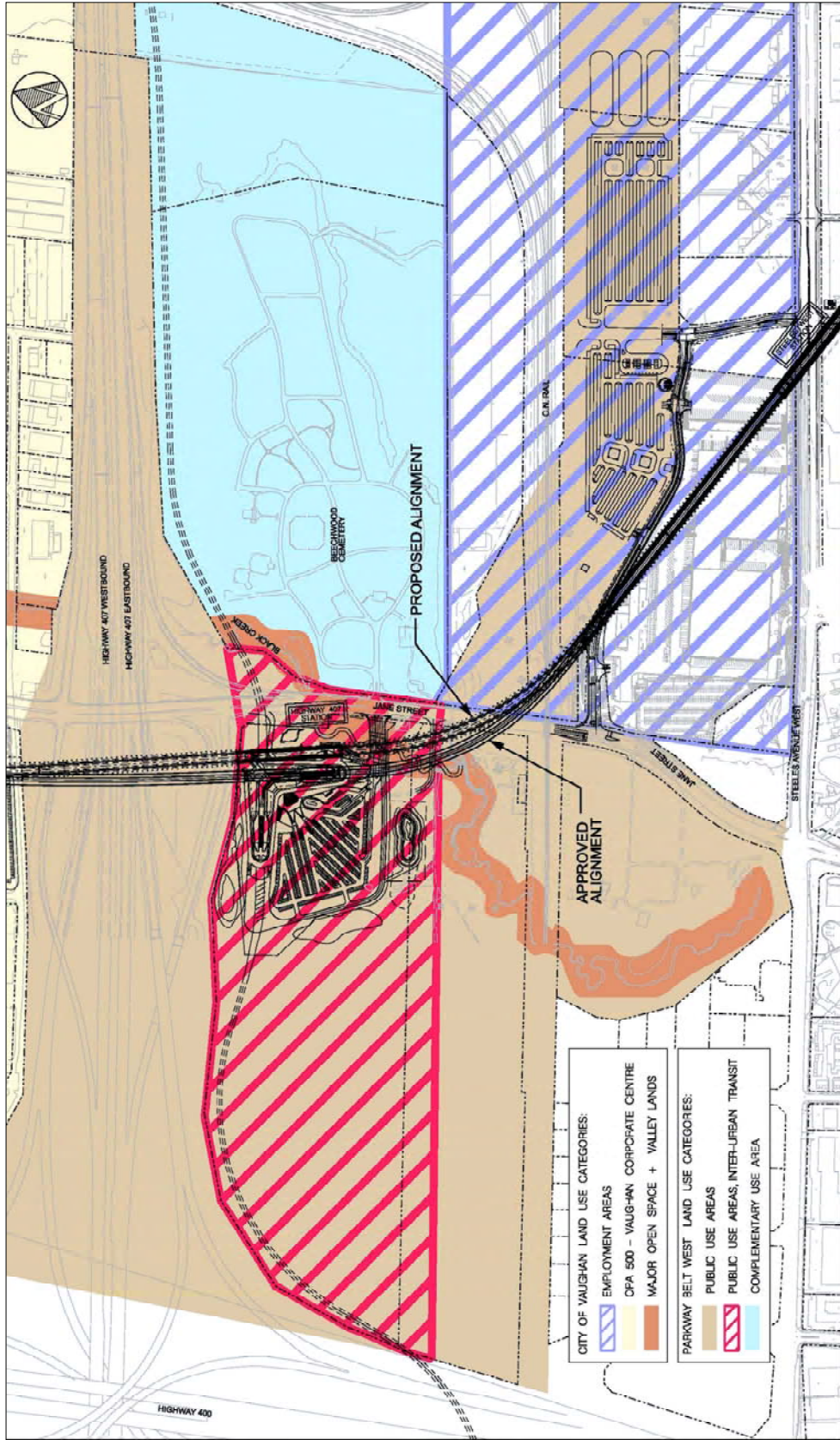
#### 3.1.2.2 York Region Official Plan

The York Region Official Plan (OP) contains policies that support implementation and expansion of major transit infrastructure to improve the natural environment, liveability and economic growth of the region, with specific objectives and policies that support implementation and expansion of major transit infrastructure to improve the natural environment, liveability and economic growth of the region, with specific objectives and policies supporting the Toronto-York Spadina Subway Extension.

Transit Policies include:

- "...The establishment of two subway routes and a series of rapid transit and transit priority corridors are the cornerstones of York Region's transit network..."





Source: TYSSE, 2009

Figure 3-2  
Land Use Designations

- Transit Policy 38 – To co-ordinate the planning, integration and operation of existing and new transit services with local municipalities, GO Transit, the Toronto Transit Commission, the Province, Metrolinx and adjacent municipalities.

The plan also includes objectives and policies for the protection of the natural environment:

Natural Features: Components of the Greenlands System include:

- Significant Woodlands: Objective is “To protect significant woodlands and encourage reforestation to provide environmental, social and economic benefits for the residents of York Region.”
- Watershed Planning: Policy 28(a): “To work in partnership with local municipalities, conservation authorities, adjacent regions/cities and other agencies to co-ordinate watershed planning initiatives and implement watershed plan recommendations that...protect and enhance river system function, linkages and sensitivities...”

### 3.1.2.3 City of Vaughan Municipal Official Plan Amendments (OPA)

OPA 600 and OPA 529

As stated in the original Highway 7 EA, the City of Vaughan recognizes the need for and benefits of a rapid transit system. OPA 600 Public Transit Policies state in pertinent parts as follows:

- General Public Transit Policy 8.3.1(ix): “The City of Vaughan shall facilitate the planning of a comprehensive transit system for the City in consultation and cooperation with GO Transit, the Toronto Transit Commission, the Regional Municipality of York and any other appropriate agency.”
- Public Transit Improvement Policy 8.3.2(v): “...The City of Vaughan has completed the “City of Vaughan Higher Order Transit Corridor Protection Study – York University to the Vaughan Corporate Centre”. The purpose of the study was to identify and to protect a higher order transit right-of-way leading from York University to the Vaughan Corporate Centre...This study formed the basis for Official Plan Amendment No. 529.”

OPA 620 – Steeles Corridor – Jane to Keele – Secondary Plan

The northern boundary of this secondary plan is coterminous with the southernmost boundary of the subject EA amendment, with the exception that the portion of proposed east-west road within the study area is actually within the OPA 620 area. Similar to OPA 500 (and subsequent amendments to it), one of the primary



principles of this secondary plan is the intensification of major transit facilities to serve Transit Oriented Development (TOD). Development principles and objectives from this OPA include:

- 2.1: A transit-supportive plan: support and capitalize on existing and planned transit investments.  
(f) To optimize the use of existing public lands within and surrounding the area for infrastructure and community amenities, thereby maximizing the potential of private lands for transit-supportive development.
- 2.8: Integrate transit facilities, roads and development as seamlessly as possible with surrounding development.  
(e) To continue to work closely with York Region, York University and the various transit providers to implement the transit and road system improvements complementing the development policies in this Secondary Plan.

Protection of the Black Creek Valley system is also a Secondary Plan objective as noted in Section 2.12 of the OPA: “Promote and demonstrate environmental sustainability (h) To protect the integrity of the Black Creek valley system”.

#### **3.1.2.4 City of Vaughan Zoning By-Laws**

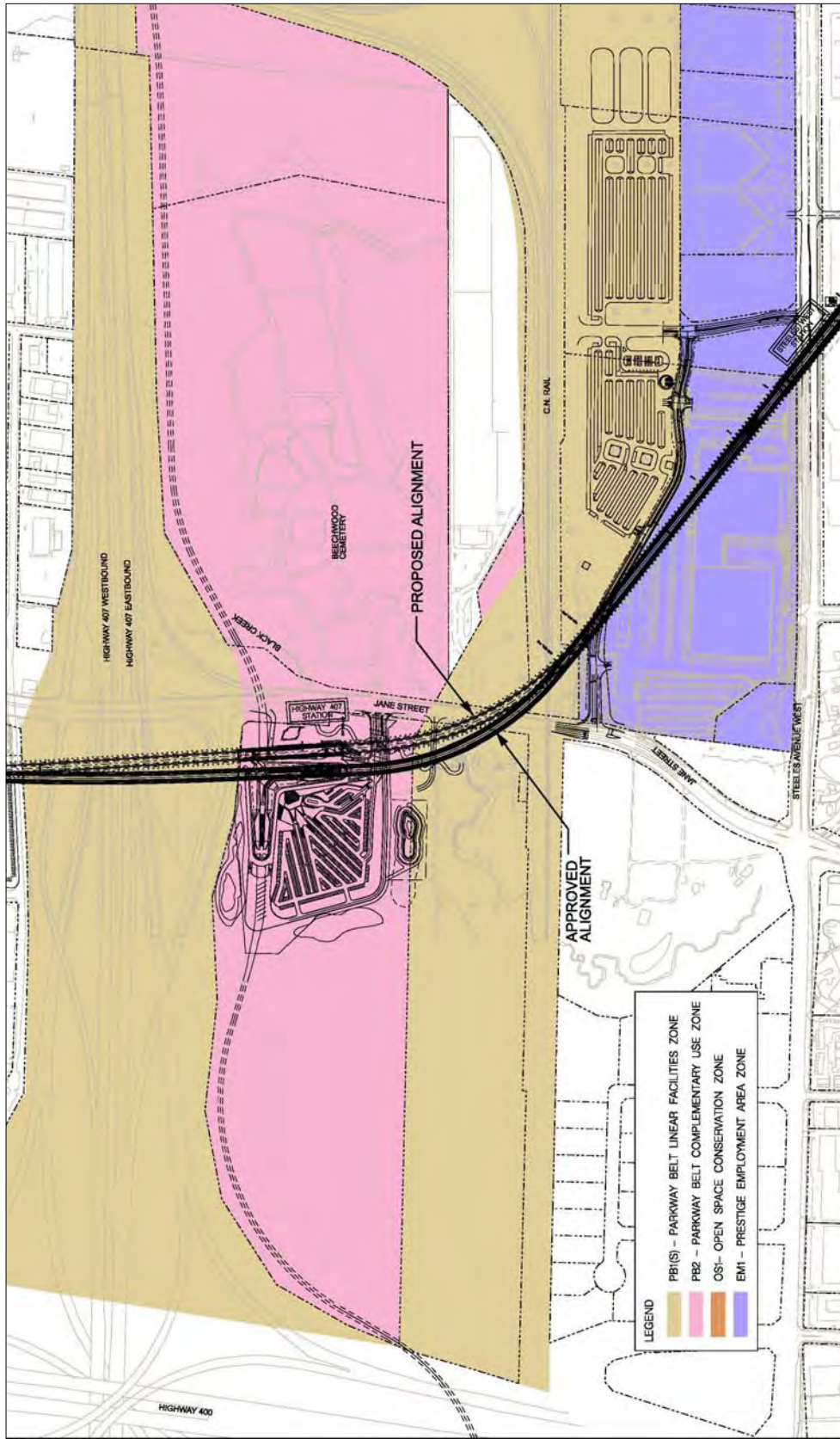
The zoning district designations within the area of this EA Amendment are shown in **Figure 3-3** and outlined below.

- PB1(S) -- Parkway Belt Linear Facilities Zone
- PB2 – Parkway Belt Complementary Use Zone
- OS1 – Open Space Conservation Zone

The two Parkway Belt zoning districts are derived from the Province’s “The Parkway Belt West Plan”, while the other two zoning districts are derived from the City of Vaughan Official Plan. The City of Vaughan By-Law permits public uses (such as transit facilities) on lands within PB1(S) and PB2 zoning districts, but does not allow for structures within OS1 zones other than for conservation or flood control projects. This OS1 district appears to follow the regulatory flood limits of Black Creek west of Jane Street.

#### **3.1.2.5 Prime Agricultural Lands**

None of these uses are on lands designated as Prime Agricultural Lands, or within agricultural zoning districts.



Source: COA Report, 2007

Figure 3-3  
Zoning By-Laws

### **3.1.3 Services and Utilities**

There are several City of Vaughan services and utilities that cross the tunnel alignment within this EA Amendment study area. All are installed at a depth that allows the tunnel boring machines to pass underneath. The impacts will be discussed in two distinct segments: from Steeles West Station northwards to the end of the curve just west of Jane Street, and from the end of the curve to the north end of Highway 407 Station. **Figure 3-4** provides an overview of the various utility locations across this study area.

#### **3.1.3.1 Steeles West Station to North End of Curve**

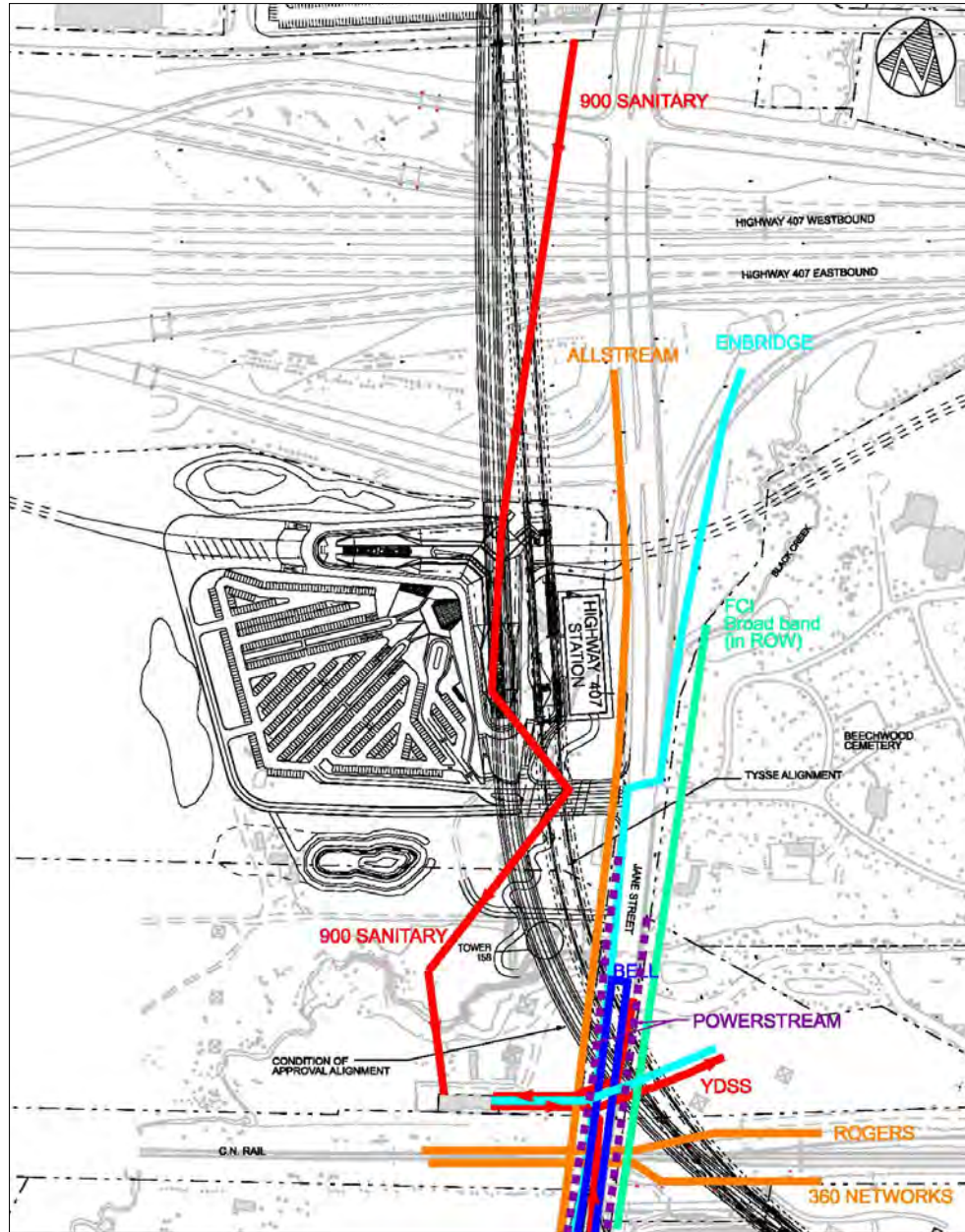
The subway tunnels pass under sanitary sewer and water services, an Enbridge gas line, and above ground Powerstream power lines as it crosses Jane Street. There are also communications lines (fibre optic) owned by Bell, FCI Broadband, and Allstream parallel to Jane Street. Furthermore, there are Rogers and 360 Networks fibre optic lines that run parallel to the CN right-of-way. Finally, the York District Sanitary System (YDSS) consists of two 600 mm forcemain sewers flowing from the pumping station west of Jane Street eastwards running north and parallel to the CN ROW. The forcemains pass under Jane Street at an invert elevation of 185.478 and have higher inverts to the east. The tunnel crown elevation is currently designed to be 180.0 +/- in this vicinity.

This portion of the alignment also passes under the existing HONI Cherrywood-Clairville Hydro Corridor as has been noted earlier in this report. HONI has future plans for the installation of a fourth transmission line in this corridor to the north, which may result in a new tower being installed in close proximity to the tunnels under the proposed scenario.

HONI has surface access requirements that include a 15 m setback exclusion zones around each tower. Tower 158 is accessed by an existing driveway from the west side of Jane Street, which is within the Black Creek floodplain. The towers to the east of Jane Street are accessed by driveways off Jane Street.

#### **3.1.3.2 North end of Curve to North edge of Highway 407 ETR Right-of-Way**

The tunnels pass parallel to the existing Jane Street (900 mm) Trunk Sanitary Sewer that flows from north to south from north of the EA Amendment study area at Exchange Avenue (Peelar Road) through the existing farmland on ORC lands to the YDSS pumping station. The alignment shown in the COA Report locates the station such that it interrupts this sewer. The eastward shift of the Highway 407 Station subway box removes this direct conflict between the station box and the sewer. The subway tunnels will pass under the sewer and beneath the 407 ETR right-of-way.



Source: TYSSE 2009

**Figure 3-4  
Utilities and Services**

## 3.2 NATURAL ENVIRONMENT

The existing natural environment within the EA Amendment study area is associated with two of the stations for the TYSSE project. The ORC lands south of the CN railway are covered by the Steeles West Station design and the lands north of the CN railway to the 407 ETR are covered by the Highway 407 Station design.

### 3.2.1 Physiography and Soils

Refer to **Appendix B** for the interpreted stratigraphic profile associated with the EA Amendment study area. The Quaternary deposits of Toronto and York Region consist predominantly of glacial till, glaciolacustrine sand, silt, and clay deposits, and shallow post glacial lacustrine sediments. Recent deposits of alluvium are found in the river and stream valleys and their flood plains. The bedrock formation is about 250 m thick and has a regional dip to the southeast of about 5 m/km. The overburden thickness is in excess of 50 m in the study area and it is expected that bedrock will be at depths exceeding those necessary for foundations and excavations. The significant deposits encountered within the study area and the surrounding York Region include the fine grained soils of the Newmarket Till, Halton Till, Sunnybrook Till and sandy/granular soils from the Thorncliffe, Scarborough and Don Formations.

The majority of the surficial deposits in the EA Amendment study area are believed to have been deposited during the Wisconsinian glacial period. Numerous small pockets of lake or pond deposits are to be found scattered throughout the till plain in depressions at the till surface. These deposits tend to be concentrated along the edges of the major stream valleys.

The EA Amendment study area is located within the physiographic region known as the Peel Plain. Most of the tableland area consists of till partly modified by the former presence of shallow glacial lakes or post-glacial erosion features (locally existing streams and rivers). The till in the EA Amendment study area is mapped as Halton Till.

The Halton Till is generally considered a fine-grained diamicton with minor fine-grained lacustrine sediments incorporated within the body of the unit, likely from glacial reworking of underlying lacustrine sediments. The Halton Till is typically stiff to hard in consistency. The Halton Till also contains cobbles and boulders. In some areas, "boulder pavements" can be encountered where boulders are nested or concentrated in a layer within the till unit. Experience on other construction projects in this deposit suggests that boulders may typically form about 0.1 to 0.5 percent of the total deposit volume, though in some areas, boulders can form up to 2 percent of the total deposit volume.



### 3.2.2 Hydrogeology and Geology

The following sections describe the preliminary results of the TYSSE geotechnical investigation program in the area of this EA Amendment.

#### 3.2.2.1 Site Stratigraphy

As part of the initial subsurface investigation recently completed for the proposed Highway 407 Station, twenty-three (23) boreholes were advanced between February 2, 2009 and June 19, 2009, and four boreholes were also advanced south of the proposed Highway 407 Station along the proposed tunnel alignment on either side of the CN Railway. For the proposed Steeles West Station, twenty-three (23) boreholes were advanced during previous investigations carried out in 2006 and 2007. The approximate location of relevant boreholes advanced between Steeles West Station and Highway 407 Station and the Record of Borehole sheets, are provided in **Appendix C**.

The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling, observations of drilling progress and results of Standard Penetration Tests and, therefore, represent transitions between soil types rather than exact planes of geological change. Subsoil conditions will vary between and beyond the borehole locations. It should be noted that the interpreted stratigraphy shown in **Appendix B** is a simplification of the subsurface conditions. Variation in the stratigraphic boundaries between boreholes will exist and are to be expected. The interpreted stratigraphy also does not necessarily represent a direct borehole to borehole linking of similar soil types.

The soil types described on the stratigraphic figure in **Appendix B** are given twelve different classifications and graphical symbols consistent with the range of soil deposits anticipated to be encountered for subway construction in the Greater Toronto Area.

The graphical representations of these material types are supplemented by colour to facilitate visualization of the geologic and material characteristics of the soil deposits. It is to be noted that soil Types 11 and 12 are interpreted as a till deposit (lodgement or basal till) on the basis of their heterogeneous structure, the relatively broad grain size distribution and the documented local geology. These soil material types have also been grouped together according to the major sedimentary deposits identified along the TYSSE alignment and near the proposed Highway 407 Station. Precedence in this interpretation has therefore been given to naming the different soil units based on relative elevation and grain size composition and plasticity.

The general stratigraphy in the area of and between the proposed Steeles West and Highway 407 Stations is defined by a sheet of predominantly cohesive glacial till (Upper Till) encountered from near surface to depths on the order of 5 m to 10 m thick. Below the Upper Till, deposits of relatively uniform glaciolacustrine or glaciofluvial sand and silt (Upper Sand/Silt Deposit) were encountered with



thicknesses on the order of less than 1 m to 10 m. The Upper Sand/Silt Deposit thins out and becomes discontinuous layers in the area of Steeles West Station and absent north of Highway 407 Station. Cohesive deposits were encountered below the Upper Sand/Silt Deposit in the boreholes, designated as the Lower Till Deposit. Within the soil deposits, there are smaller zones of compositionally different materials. Materials from interstadial deposits, which include discontinuous zones of granular till, as well as sand and silt, became incorporated into the basal glacial till, as exhibited by the boreholes advanced in the area of Steeles West and Highway 407 Station.

The subsurface materials encountered in the recently drilled boreholes in the vicinity of the proposed Highway 407 Station typically consist of a cohesive till (Upper Till) which was encountered just below the fill materials and extends up to 5.6 m below ground surface. Sand and silt to silt deposits were encountered between Elevation 193.2 m and 181.0 m, with the thickest layer of about 10 m encountered near the proposed Highway 407 Station. The Upper Sand/Silt Deposit narrows towards the north and south of the proposed station, and was not encountered in boreholes recently drilled south of the CN Railway and north of Highway 407. The cohesive Lower Till Deposit underlies the Upper Sand Silt Deposit and was confirmed down to an Elevation of approximately 157 m.

The subsurface soils encountered in the area north of the proposed Steeles West Station are predominately comprised of an extensive Till Deposit beneath the existing fill materials. Discontinuous interstadial layers of sand and silt are present within the Till Deposit. These layers are generally about 1.5 m thick; however, lenses as thick as 5.4 m were encountered in some boreholes and continuity of these layers/lenses between several boreholes has been interpreted.

#### 3.2.2.2 Site Hydrogeology

Based on analysis groundwater is expected to be encountered within about 1 m to 2 m of existing ground surface at the Highway 407 Station, and slopes to about 4 m to 5 m below ground surface at the Steeles West Station. The follow paragraphs provide comments on temporary dewatering at the Highway 407 Station and Steeles West Station based on the information available during preparation of this report.

#### 3.2.2.3 Highway 407 Station

As indicated from the shallow monitoring wells (installed above Elevation 181 m) installed during the recent investigation, the interpreted groundwater levels within the Upper Sand/Silt Deposit vary between 189 m and 195 m. The groundwater elevation in the Lower Sand/Silt Deposit is significantly lower, at about Elevation 173 m. The Lower Sand/Silt Deposit provides under drainage for the entire site and is responsible for downward seepage gradients that are present through the Lower Till Deposit.

Monitoring well installations and water level measurements are shown on the Record of Borehole sheets and on the interpreted stratigraphic profiles in **Appendix B**. The interpreted groundwater levels in the Upper Sand/Silt Deposit and the Lower Sand/Silt Deposit are illustrated in **Appendix B**. Perched groundwater levels are expected in the fill soils above the Upper Till Deposit and or Upper Sand/Silt Deposit. It should be expected that the groundwater level along the alignment will be subject to seasonal fluctuations, particularly the perched levels in the fills during spring flows and precipitation events. A total of eleven single well response tests were conducted at the Highway 407 Station site. Based on results of the single well response tests and grain size analysis of granular soils, the representative hydraulic conductivity for the stratigraphic layers are interpreted as follows:

Upper Sand	-	$4 \times 10^{-5}$ m/s;
Upper Silt	-	$7 \times 10^{-7}$ m/s; and
Upper/Lower Till	-	$1 \times 10^{-7}$ m/s.

It is to be noted that gravelly sand encountered at Borehole 407-017 from Elevation 188.4 m to 185.3 m is currently interpreted to represent an isolated lens. As part of the complementary geotechnical investigation, a pumping test is proposed to confirm that the potential yield of the granular soil will be governed by the low hydraulic conductivity of the surrounding Till Deposit.

The details of how the radius of the dewatering influence from the Highway 407 Station area is calculated is shown in **Appendix D**. Based on this analysis, the steady-state groundwater pumping rate is estimated to be approximately 100 m<sup>3</sup>/day. As such, an Ontario Ministry of Environment (MOE) Permit to Take Water (PTTW) will be required to support the construction of the proposed Highway 407 Station.

Additional pumping will be required to remove overburden storage and direct precipitation onto the excavation area. To quickly remove the precipitation inflow and overburden storage, the dewatering system should be capable of removing 500 m<sup>3</sup>/day from the proposed excavation.

#### 3.2.2.4 Steeles West Station

The groundwater elevation in the shallow monitoring wells installed above Elevation 190 m at the Steeles West Station site, as observed on May 1, 2008, ranged from about Elevation 192.7 m to Elevation 201.7 m, while the groundwater elevations in deep monitoring wells installed below Elevation 190 m ranged from about Elevation 172.9 m to Elevation 191.0 m. The results suggest that the groundwater level exhibits a downward hydraulic gradient below Elevation 190 m, further suggesting that groundwater seepage in the Till Deposit is toward deeper underlying deposits that have a lower total head than is present in the upper portion of the Till Deposit. Downward hydraulic gradients are indicated by progressively lower groundwater levels having been measured in monitoring wells that have their measuring tips sealed at progressively lower elevations. It should be noted that a piezometric line

was not interpreted for the overall Steeles West Station site due to the fact that groundwater conditions within the Till Deposit are not hydrostatic (i.e. there is not a single groundwater table).

Considering the relatively low hydraulic conductivity of the overburden (predominantly comprised of the Till Deposit), it is anticipated that a small degree of groundwater flow occurs laterally, in a south westerly direction, towards Black Creek.

To support the dewatering rate and zone of influence calculations for the proposed Steeles West Station excavation, a groundwater pumping test was undertaken in October 2009. The evaluation of this data is on-going during the preparation of this report.

### **3.2.3 Fluvial Geomorphology**

As a result of the amended Highway 407 Station location, including realignment of a section of Black Creek, a fluvial geomorphic study was undertaken to document the existing conditions and review the potential implications of the proposed works on the creek and valley system. The geomorphological component initially compiled, as shown in **Appendix E**, has been updated to account for the proposed realignment of Black Creek as described in this report. These updates are discussed in detail in this section.

Based on the digital aerial photographs, two reaches were identified for Black Creek within the EA Amendment study area, as shown in **Figure 3-5**. Reach 1 extends from the Cherrywood-Clairville Hydro Corridor downstream to the CN railway and Reach 2 extends from Jane Street downstream to the Cherrywood-Clairville Hydro Corridor.

Bankfull dimensions within Reach 1 ranged from 5-8 m in width and 0.4-0.8 m in depth. The reach displayed a well-defined riffle-pool morphology, with pool substrate in the range of pebble to large gravel while the riffles were dominated by gravel to small cobble-sized material. Channel disturbances included a culvert at the upstream extent of the reach and several woody debris jams. Downstream of the culvert, a hairpin meander was identified. Rapid Geomorphic Assessment (RGA) scores indicated that the reach was in a stressed or transitional state, with widening identified as the predominant form of adjustment. Evidence of widening included extensive toe erosion, exposed tree roots and fallen/leaning trees.

Bankfull dimensions within Reach 2 ranged from 2.5-5 m in width and 0.5-1.3 m in depth. The reach was characterized as highly sinuous, with coarse gravel and small cobble dominating the riffle and pool substrate. Channel disturbances included two culvert crossings and woody debris. The banks were heavily vegetated with a mixture of grasses, herbaceous species, trees and shrubs. Reach 2 also scored as being in a stressed or transitional state, with evidence of widening, aggradation and



Source: Parish Geomorph, January 2009

**Figure 3-5**  
**Black Creek Reach Delineation within EA Amendment Study Area**

planform adjustment documented. This evidence included basal scour, slumping banks, bar formation, deposition on point bars and formation of chutes.

The dominant geomorphic processes affecting Black Creek were assessed using the Rapid assessment techniques (RGA and Rapid Stream Assessment Technique (RSAT)). A Geomorphic Assessment (RGA) documents observed indicators of channel instability (MOE, 1999). Observations are quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. An RSAT provides a broader view of the system by also considering the ecological functioning of the stream (Galli, 1996). Observations include in-stream habitat, water quality, riparian conditions, and biological indicators. Additionally, the RSAT approach includes semi-quantitative measures of bankfull channel dimensions, type of substrate, vegetative cover, and channel disturbance.

The existing conditions of Black Creek supported an RGA assessment suggesting that the creek is stressed or in transition. The RSAT score, however, indicates that Black Creek as a moderate health as shown in **Table 3-1**.

**Table 3-1**  
**Reach RSAT Condition RGA Condition**

<b>Reach</b>	<b>RSAT</b>	<b>Condition</b>	<b>RGA</b>	<b>Condition</b>
1	23	Moderate	0.26	Transitional
2	23.5	Moderate	0.31	Transitional

For the purposes of this geomorphic assessment, detailed field work was conducted within Black Creek in vicinity of the proposed Subway extension. As part of the detailed field assessment, standard protocols and known field indicators were used to quantify bankfull cross-sectional dimensions (e.g. bankfull depth and width). A modified Wolman pebble count was used to characterize the channel bed substrate materials. In addition to noting bank characteristics, an in situ shear stress test was performed on bank materials.

A level survey of the site provided a measure of the local energy gradient. Long-term monitoring in the form of a control cross-section and erosion pins was also established. Results of the detailed field investigations are summarized in **Table 3-2**.

**Table 3-2**  
**Channel Characteristics for Black Creek (Reach 2)**

<b>Parameter</b>	<b>Reach 2</b>
Bankfull Width (m)	4.86
Bankfull Depth (m)	0.56
Average Bankfull Gradient (%)	0.76
Entrenchment Ratio	13.7
Bed Material D50 (cm)	2.6
Bed Material D84 (cm)	11.3
Bank Materials	Si/Ms/Fs
Manning's 'n' at Bankfull*	0.035

Note: \*Visual Estimate

Findings of the detailed field investigation indicated average bankfull dimensions of 4.86 m wide and 0.56 m deep. The reach displayed a moderate gradient of 0.76% and a low degree of entrenchment (i.e., the channel was well-connected to a functional floodplain). Riparian vegetation consisted of tall grasses and herbaceous species, with scattered shrubs and trees.

### 3.2.3.1 Meander Belt Width

In support of both the Provincial Policy Statement and the Valley and Stream Corridor Management Program, the TRCA has produced a detailed document which outlines Belt Width Delineation Procedures (PARISH Geomorphic Ltd., 2004) for confined and unconfined systems. This document provides a process-based methodology for determining the meander belt width for watercourses within the jurisdiction of the Toronto and Region Conservation Authority (TRCA) based on background information, historic data (including aerial photography), degree of

valley confinement and channel planform. Refer to **Figure 3-6** for an illustration of the channel planforms. To assist in the



Source: Parish Geomorphic, January 2009

**Figure 3-6**  
**Historic Overlay of Channel Planform within EA Amendment Study Area**

determination of the meander belt width and erosion rates, digital imagery from 2005 were used. The meander belt width was determined by identifying the spatial extent of the meander pattern within each reach. Tangential lines were then drawn along the extent of these governing meanders, following the general downstream valley trend. The width also accounts for the historical location of the channel. This included digital aerial photography dating to 1978. Based on this information, a meander belt width dimension of 80 m was identified for Reach 1 and 60 m was identified for Reach 2.

### 3.2.3.2 100-Year Erosion Rate

The initial erosion assessment involved a comparison of 1:2000 topographic mapping. The overlay below demonstrates that the channel has experienced some dramatic movement, as well as being subjected to direct alteration. The most recent example of channel alteration was associated with the Jane Street culvert as part of the Highway 407 construction. In order to determine a specific 100-year erosion rate, aerial photographs dating back to 1954 were reviewed. Unfortunately, there were few consistent points of reference over the years to enable precise



measurements. Only the 1978 aerial photography could be traced to provide the overlay results. Based on the coverage available, the 100-year erosion rate was determined to be conservatively 12 cm/yr or 12m over 100 years.

### **3.2.4 Aquatic Habitats and Communities**

The Ecological Existing Conditions Report for Highway 407 Station is included in **Appendix F**. Black Creek flows through a concrete box culvert under the Jane Street right-of-way at the north-east corner of the EA Amendment study area. It flows in a south westerly direction towards Steeles Avenue West with a prominent meander. The creek channel is approximately 5m to 8 m west of Jane Street and contained within a well defined valley. Approximately 200m south of the concrete culvert the creek passes through a double corrugated steel pipe (CSP) culvert under the HONI access road. A small tributary enters the creek south of the culvert from the east. Just south of the tributary, the channel makes a tight turn to the west where it continues through the Cherrywood-Clairville Hydro Corridor towards the CN rail line. The creek is approximately 312 m in length from the Jane Street culvert to the CSP culverts associated with the HONI Access Road.

Details related to the various reaches of Black Creek are included in Section 2.2 of **Appendix F**. The banks of the stream downstream of the culvert at Jane Street have been reinforced for approximately 20 m on both sides with riprap (refer to **Figure 3-7**). There is evidence of water taking from this section as witnessed by the presence of a black pipe and associated pumps. Throughout the middle section of the reach the stream banks can be described as steeply sloped with evidence of slumping. Although bank erosion is present, approximately 85% of the stream banks remain vegetated and stable (refer to **Figure 3-8**). The CSP culverts passing beneath the HONI Access Road have been reinforced with sand bags but show signs of recent erosion (refer to **Figure 3-9**).

Aquatic vegetation is typically absent, growing primarily on shoals along and within shallow areas of the channel. The dominant form of aquatic vegetation is emergent grasses. There is no evidence of groundwater (indicated by presence of watercress) within the study area. Algal growth occurs on most instream substrate, including those of anthropogenic origins. Riparian vegetation communities contain typical of cultural meadow and cultural wetland species. Small shrubs were common along the banks.

The surrounding lands are generally agricultural areas, although the study site is bordered on three sides by major transportation corridors: 407 ETR to the north, Highway 400 to the west and Jane Street to the east.



**Figure 3-7**  
**Riprap Reinforced Banks at Upstream section of Reach 1 (looking downstream)**



**Figure 3-8**  
**Straightened Channel 40 m downstream of Jane Street culvert (looking downstream)**



**Figure 3-9**  
**Crossing under HONI Access Road (looking downstream at CSP culverts)**

The Natural Heritage Features Report associated with the Steeles West Station is included in **Appendix G**. For the Cherrywood-Clairville Hydro Corridor east of Jane Street and north of Steeles West Station, no fish habitat (spawning, nursery, feeding or migration) was found on the subject lands. In August, 2009 the deep water pond (SAS1-1 as shown in **Figure 3-10**) was sampled however seining found no fish, but did find green frog tadpoles and Water Boatman beetles.

#### 3.2.4.1 Water Quality

Black Creek resides in a predominantly urban and industrial landscape. Although groundwater inputs to the creek the dominant source of water is surface runoff. Recorded flows within Black Creek at the study site range from 26 litres per second to 42 litres per second under non precipitation conditions. Following a rain event, the flows within Black Creek increase significantly, reaching as high as 1960 litres per second. The water quality of Black Creek reflects the surface inputs from its urban industrial surroundings. Typical water quality parameters are provided in **Table 3-3**.

#### 3.2.4.2 Fish Surveys/Rare/Threatened/Endangered

The fisheries community of Black Creek consists of warm water tolerant species. The dominant species present within the study area is White Sucker (*Catostomus commersonii*), followed by Creek Chub (*Semotilus atromaculatus*). Single observations of Blacknose Dace (*Rhinichthys atratulus*), Pumpkinseed (*Lepomis gibbosus*), and Bluegill (*Lepomis macrochirus*) were observed within the EA Amendment study area. In addition, the study area was not found to provide habitat for endangered or threatened aquatic species and there are no historical records of endangered or threatened species occurring. The fish present in the sampled reaches of the east and west Black Creek tributaries are listed in **Table 3-4**.

**Table 3-3**  
**Water Quality of Black Creek**

Water Quality Parameter	Measure	PWQO	Black Creek
<b>Calculated Parameters</b>			
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	-	65
Calculated TDS	mg/L	-	212
Cation Sum	me/L	-	3.71
Hardness (CaCO <sub>3</sub> )	mg/L	-	99
Ion Balance (% Difference)	%	-	0.870
<b>Inorganics</b>			
Total Ammonia-N	mg/L	-	0.16
Conductivity	umho/cm	-	405
Dissolved Organic Carbon	mg/L	-	4.9
Orthophosphate (P)	mg/L	-	0.03
pH	pH	6.5-8.5	7.6

Water Quality Parameter	Measure	PWQO	Black Creek
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	-	19
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	-	66
Dissolved Chloride (Cl)	mg/L	-	68
Nitrite (N)	mg/L	-	0.02
Nitrate (N)	mg/L	-	0.3
Nitrate + Nitrite	mg/L	-	0.3
Total Suspended Solids	mg/L	-	78
<b>Metals</b>			
Dissolved Calcium (Ca)	mg/L	-	32.6
Dissolved Magnesium (Mg)	mg/L	-	4.34
Total Aluminum (Al)	ug/L	-	1400
Total Antimony (Sb)	ug/L	20	1.4
Total Arsenic (As)	ug/L	5	ND
Total Barium (Ba)	ug/L	-	41
Total Cadmium (Cd)	ug/L	0.1	<b>0.2</b>
Total Calcium (Ca)	ug/L	-	39000
Total Chromium (Cr)	ug/L	-	5
Total Cobalt (Co)	ug/L	0.9	<b>1.6</b>
Total Copper (Cu)	ug/L	5	<b>36</b>
Total Iron (Fe)	ug/L	300	<b>2600</b>
Total Lead (Pb)	ug/L	3-5*	<b>7.3</b>
Total Magnesium (Mg)	ug/L	-	6800
Total Manganese (Mn)	ug/L	-	120
Total Molybdenum (Mo)	ug/L	40	1
Total Nickel (Ni)	ug/L	25	3
Total Phosphorus (P)	ug/L	30	<b>250</b>
Total Potassium (K)	ug/L	-	2300
Total Selenium (Se)	ug/L	100	ND
Total Silicon (Si)	ug/L	-	3300
Total Silver (Ag)	ug/L	0.1	0.1
Total Sodium (Na)	ug/L	-	41000
Total Strontium (Sr)	ug/L	-	130
Total Titanium (Ti)	ug/L	-	65
Total Uranium (U)	ug/L	5	0.3
Total Vanadium (V)	ug/L	6	4
Total Zinc (Zn)	ug/L	20	<b>67</b>

\* dependent on CaCO<sub>3</sub>

**Bold numbers** exceed their respective Province Water Quality Objectives (PWQO)  
Source: AECOM, 2009

**Table 3-4  
Summary of Fish Present in Sampled Reaches of Black Creek**

Common Name of Species	Scientific Name	Number Observed
Blacknose Dace	<i>Rhinichthys atratulus</i>	1
Bluegill	<i>Lepomis macrochirus</i>	1
Creek Chub	<i>Semotilus atromaculatus</i>	58
Pumpkinseed	<i>Lepomis megalotis</i>	1
White Sucker	<i>Catostomus commersonii</i>	59

Source: AECOM, 2009

### 3.2.5 Vegetation and Vegetative Communities

The proposed EA Amendment study area is dominated by agriculture land use. Existing vegetation is associated with the Black Creek valley and the HONI corridor to the south of the study area.

Vegetation communities present within the study area are maintained through anthropogenic activities and composed of young to mid-aged culturally defined vegetation communities, including cultural meadow, cultural woodlands, cultural thicket, cultural hedgerow, and fresh-moist bur oak deciduous forest (refer to **Figure 3-10**).

#### CUH Cultural Hedgerow

These communities are usually found along the borders of agricultural fields and typically do not provide significant habitat for either flora or fauna species. Within the study site they are made up of Siberian Elm (*Ulmus pumila*), and White Spruce (*Picea glauca*)

#### CUM1-1 - Dry-Moist Old Field Meadow Type

Abandoned agricultural fields that are reverting to naturally vegetated areas are classified as cultural meadows under ELC methodology, and are usually composed of a mixture of grass and herbaceous plant species. Old-fields, account for large portion of the cultural communities within the study area. Common species found in these old fields include Smooth Brome (*Bromus inermis*), Teasel (*Dipsacus fullonum*), Queen Anne’s Lace (*Daucus carota*), Common Milkweed (*Asclepias syriaca*), Canada Goldenrod (*Solidago canadensis*), and Canada thistle. The absence of a shrub layer in these fields indicates that they have been exposed to disturbance within the last few years.



### CUW1 Mineral Cultural Woodland

Cultural woodlands are defined as an area with a relatively recent history of human disturbance, with tree canopy cover between 35 and 60%. Several Cultural Woodlands are found within the study lands. The woodlands are low in quality, and have a sparse under story. They are typically comprised of Manitoba Maple, but others include Black Walnut (*Juglans nigra*) and Butternut (*Juglans cinerea*).

### CUT1 Mineral Cultural Thicket

Cultural Thickets are defined as tree cover <25% and >25% shrub cover. One thicket is found encompassing the aquatic community and is primarily composed of Willow species.

### FOD9-3 Fresh-Moist Bur Oak Deciduous Forest

A natural vegetation community associated with the ORC lands located within the HONI Cherrywood-Clairville Hydro Corridor in the location of the proposed commuter parking lot associated with the Steeles West Station. The canopy is scattered and open and dominated by mature Bur Oak. Many of the trees appear to be in decline with poorly developed crowns

Within these communities, vegetation is typical of that found within central and southern Ontario, including the presence of non-native species. Within the Highway 407 Station area 57 plant species were identified; of which 33 species or, 58% of the community composition is non-native to Ontario

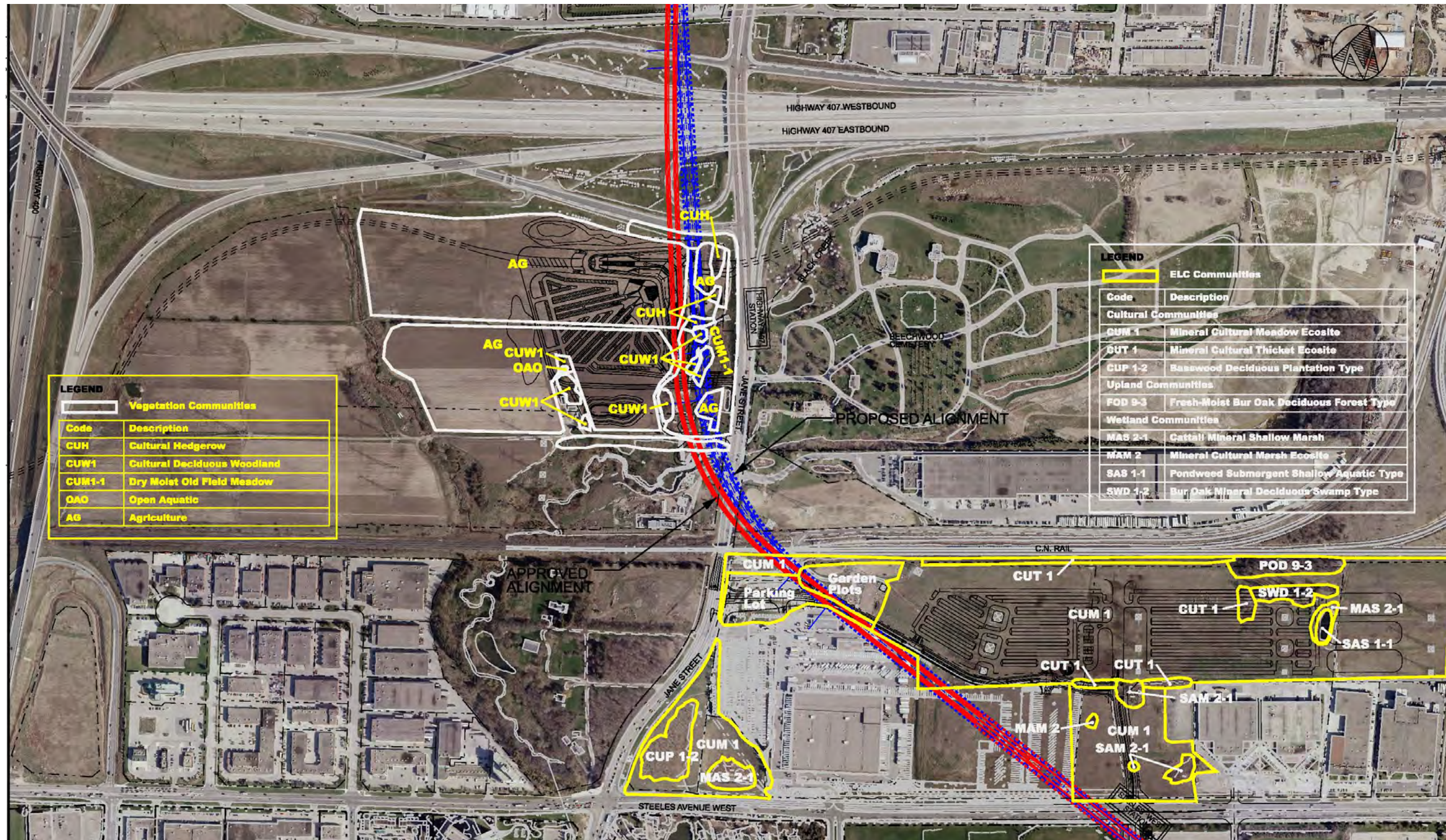
In reference to the national (COSEWIC), provincial (COSSARO) and regional criteria, one species of provincial significance (Butternut) and one regionally rare species (Black Walnut; *Juglans nigra*) were found within the Highway 407 Station study lands.

#### 3.2.5.1 Provincially Designated Species – Butternut Tree

Provincially endangered Butternut (*Juglans cinera*) trees were located within the Black Creek valley approximately within 10 m of Black Creek (refer to **Figure 3-11**). Three trees were identified; one large tree measuring 20 cm in diameter at breast height, a smaller tree measuring 14 cm in diameter at breast height and one seedling. A certified Butternut Health Assessor assessed the trees and determined that they were in good condition, with the largest tree producing a seed set. The trees have been identified as pure strain Butternut trees and will therefore require consideration and appropriate permitting under the Provincial Endangered Species Act. Butternut are also listed as a federal Species at Risk, however the Species at Risk act does not apply at this site as the lands are not federally owned.

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Source: AECOM, 2009 and Beacon Environmental, 2009

Figure 3-10  
Natural Features within the EA Amendment Study Area



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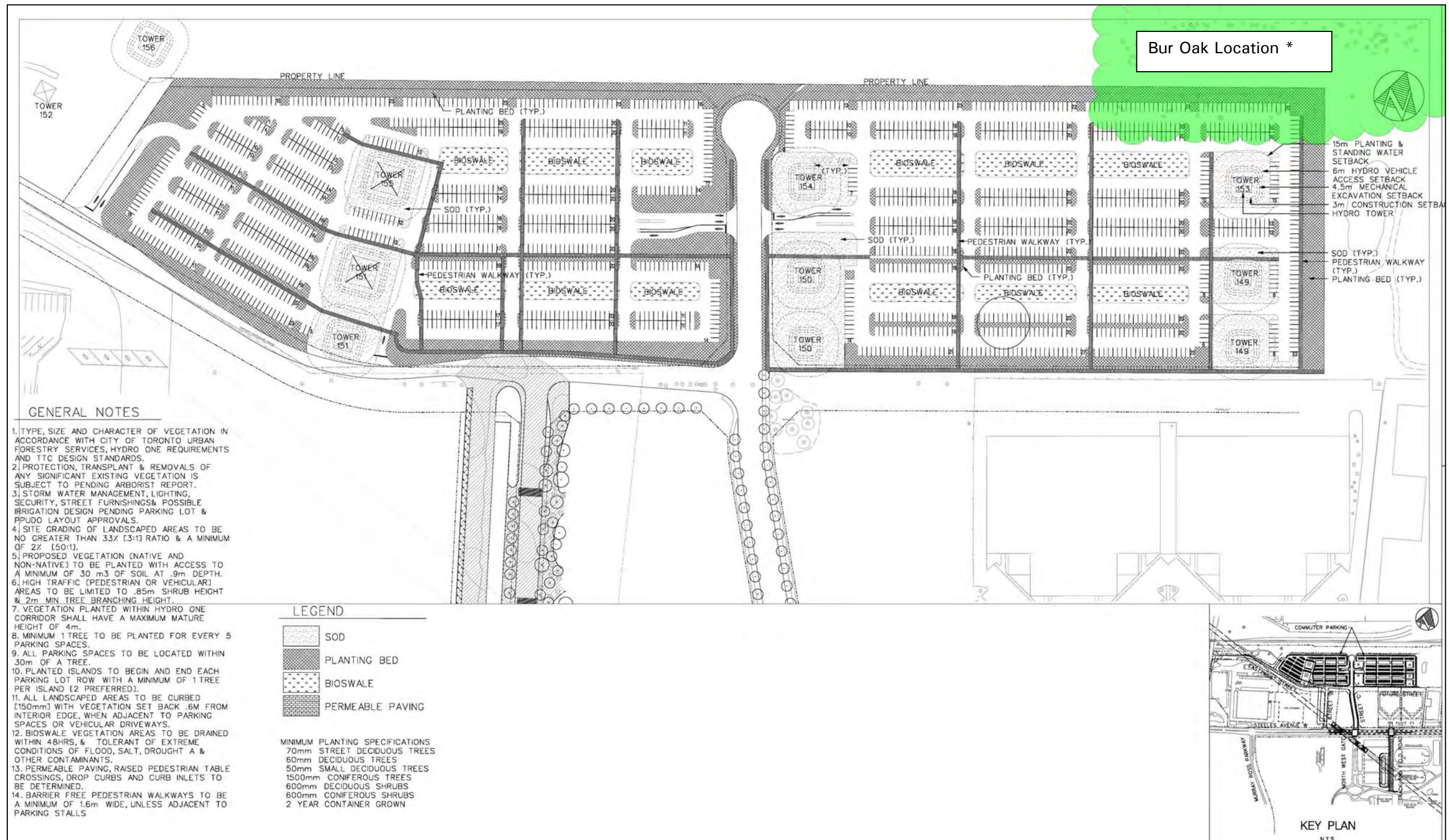


Source: AECOM, 2009

Figure 3-11  
Location of Butternut Trees



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Source: TSGA, 2009

Figure 3-12  
Location of Bur Oak Wood Lot

\* Note: Parking lots design shown above is conceptual and will be refined in detailed design.

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### 3.2.5.2 Bur Oak Woodlot

There is a forest stand located in the north-east corner of the proposed commuter parking lot area associated with Steeles West Station within the ORC lands (refer to **Figure 3-12**). These species represents a small remaining fragment of the forest community that once occurred on the ORC lands.

### 3.2.6 **Environmental Condition of Property (Contaminants)**

A preliminary assessment of the environmental quality of the subsurface soil and groundwater conditions in relation to applicable environmental regulations was carried out during the initial subsurface investigations for the Highway 407 Station and the associated tunnel portion between Highway 407 and Steeles West Stations, to help identify the potential of encountering subsurface contaminants during construction. The Phase 1 Environmental Site Assessment (ESA) have been undertaken and are included in **Appendix H** for Highway 407 Station and **Appendix I** for the Steeles West Hydro Corridor.

Representative soil and groundwater samples were obtained using standard MOE procedures as outlined in the document "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario", December, 1996. Selected soil samples and groundwater sampled from the monitoring wells were submitted to AGAT Laboratories in Mississauga, Ontario for analysis. Soil and groundwater quality standards provided under Ontario Regulation 153/04 in the Ontario MOE document "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", March 2004, were used to assess the site data.

The proposed Highway 407 Station is classified as a "sensitive site" under Ont. Reg. 153/04 due to the presence of a surface water body (i.e., Black Creek). MOE's generic site condition standards would likely apply to portions of the "site" that are more than 30 m from the watercourse, however, the entire "site" was considered as a "sensitive site" for purposes of environmental characterization.

#### 3.2.6.1 Soil Quality

Refer to the Phase 1 ESA's included in **Appendices H and I** for soil quality details within the EA Amendment study area. In general, the findings indicate that the predominant soil types encountered during these investigations included surficial ground coverings (i.e., topsoil, vegetation, granulars) and fill materials overlying native soils comprising of glacial till deposits, with interstadial sand and silt to silt layers. The fill materials were encountered in all boreholes drilled and primarily consisted of different layers of brown and grey clayey silt, sandy silt and/or sand and gravel with organic matter (i.e., topsoil, rootlets), that extended to relatively shallow depths of approximately 1 m to 4 m below the ground surface.

Some localized debris / aesthetic contaminants (i.e., wood pieces and possibly black organic matter) were encountered within the fill materials in Boreholes 407-001, 407-003, 407-010, 407-011, 407-012, 407-013 and 407-015, with some charcoal

pieces noted within the fill in Borehole 407-013. In Boreholes 407-001, 407-011, 407-013 and 407-019, black “staining” (or discolouration) was noted on the boreholes logs within the native till deposits below depths of approximately 2 m and 19 m below ground surface. Otherwise, there were no obvious visual or olfactory indications of significant contamination in the fill materials and native soil samples obtained from the twenty-three (23) boreholes advanced during this investigation.

No testing for organic parameters was conducted on samples of the native till deposits with black discolouration in this area.

Soil vapour “headspace” testing was carried out on the majority of the soil samples using a photoionization detector (PID) instruments, calibrated to isobutylene. The results of the soil vapour testing indicate that measurable soil gas concentrations in the fill and native materials were generally less than 13 parts per million (ppm), which are not considered high enough to suggest significant contamination by organic compounds.

For characterization purposes, select soil samples were obtained to depths of up to about 24 m below the ground surface (i.e., generally within the anticipated excavation depths). A total of seventy (70) soil samples obtained from the boreholes advanced during the initial investigations for the Highway 407 Station and the associated tunnel section were selected for analysis. Forty-eight (48) bulk soil samples were submitted for analyses of select metals and inorganic parameters in accordance with the March 2004 MOE Document. Twenty-two (22) soil samples were analysed for petroleum hydrocarbons (PHCs) fractions (F1 to F4), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX). Seventeen (17) soil samples were submitted for analyses of volatile organic compounds (VOCs), and twenty (20) samples for polycyclic aromatic hydrocarbons (PAHs).

#### 3.2.6.2 Soil Quality Results

Based on the analytical results and the standard comparison, the concentrations of the tested parameters of soil samples submitted for analysis were below the reportable detection limit and/or met MOE’s 2004 Table 1 Background Standards, with the exception of barium concentrations in two (2) samples of native till soils from Borehole 407-008 (15.2 m to 15.9 m depth) and Borehole 407-018 (22.9 m to 23.5 m depth); and, naphthalene levels in two (2) samples from Borehole 407-017 (depths of 7.6 to 7.8 m below ground surface and 9.2 to 9.4 m below ground surface).

The measured barium concentrations were 238  $\mu\text{g/g}$  and 274  $\mu\text{g/g}$ , respectively, which are above the MOE’s 2004 Table 1 Standard (210  $\mu\text{g/g}$ ), but are below the respective Table 2 Standard of 2,000  $\mu\text{g/g}$ . The naphthalene levels of 0.12  $\mu\text{g/g}$  to 0.18  $\mu\text{g/g}$  are slightly above the 2004 Table 1 Standard of 0.09  $\mu\text{g/g}$ , but are below the 2004 Table 2 Standard of 4.6  $\mu\text{g/g}$ . These concentrations may be considered an anomaly.



It is noted that PHC F1 fractions of 6.1  $\mu\text{g/g}$  were detected in a sample from Borehole 407-019 (34.4 m to 34.5 m below ground surface). The concentration is well below the Table 2 Standard for PHC F1 of 230  $\mu\text{g/g}$ .

#### Leachate Analyses

For waste classification purposes for possible landfill disposal, four (4) soil samples were submitted for leachate analyses of metals and inorganic compounds, ignitability, PCBs, and VOCs in accordance with Ontario Regulation 347 (as amended by Ontario Regulation 558/00). The results of the leachate analyses met the respective Schedule 4 criteria provided under Ontario Regulation 347, and the material was not ignitable. On this basis, the material can be classified and managed as non-hazardous solid waste.

### 3.3 CULTURAL HERITAGE RESOURCES

#### 3.3.1 Historical Summary

As stated in the original EA, the British government purchased land from the native Mississaugas in 1787 that became York County, and the Township of Vaughan was surveyed from 1795 to 1851. The earliest settlers in Vaughan were Pennsylvanian Germans from the U.S. Later in the 1820s, Crown and Clergy Reserve land became available for purchase, leading to increased population growth.

##### 3.3.1.1 19th Century Development

During the early-to-mid 19th Century, Vaughan Township grew and became a prosperous farming community, supplying Toronto with agricultural goods. By the late 1880s, two railroads had been constructed, which increased access to nearby markets.

According to information contained in the Stage 3 Archaeological Assessment Report (refer to **Appendix J**) for the EA Amendment study area:

“Background research established that the original Crown Land Patent for 200 acres in Lot 2, Concession 2, was granted to King’s College on January 3<sup>rd</sup>, 1828 who, in 1837, sold all 190 acres to James Brown. James Brown sold 60 and 130 acres to Richard Brown in 1848 and 1849, respectively.”

Various portions of the property were transferred within and outside of the Brown family until 1891. An 1878 Atlas map indicated that two structures were located on the property.

##### 3.3.1.2 20th Century Development

Vaughan remained an agricultural community for the first half of the 20th Century. The construction and subsequent upgrades on Highway 7 as well as other major

roads and highways led to post-World War II suburban residential and commercial development.

20th Century development within the EA amendment study area included the construction of municipal and regional streets, highways (407), CN rail facilities, and the large east-west hydro corridor. Primarily industrial uses were introduced, and a significant amount of agricultural use continues to the present day.

Rapid urbanization occurred within the City of Vaughan in the 1980s and 1990s, and continues to the present day. In recent years, Vaughan has developed a planning vision to redevelop lands near major transit facilities and hubs in a more intensified transit-supportive urban pattern. The EA Amendment study area is in the heart of the area Vaughan has envisioned for its most intense future urban development.

### **3.4 IDENTIFICATION OF BUILT HERITAGE FEATURES & CULTURAL LANDSCAPES**

The EA amendment study area consists primarily of open land occupied corridors containing hydro facilities (towers and power lines), highways, streets and rail lines, as well as agricultural fields and natural open space including the Black Creek ravine and a number of scattered tree stands.

Within the boundaries of the study area, there are no Built Heritage Features or Cultural Landscapes officially identified by the City of Vaughan, York Region, the Province of Ontario, or the federal government.

### **3.5 ARCHAEOLOGICAL RESOURCES**

The Phase 2 and 3 Archaeological Assessment Reports, included in **Appendix J** for Highway 407 Station and **Appendix K** for Steeles West Station, for the EA Amendment study area indicate that there are historical artefacts related to nineteenth century Euro-Canadian agricultural settlement that must be retrieved and studied prior to construction. A Phase 4 archaeological assessment is underway and the report is being prepared.

## **4. DEVELOPMENT AND ASSESSMENT OF ALTERNATIVES FOR THE AMENDMENT**

In late 2008, as a result of the discussions with HONI described in Section 2, TYSSE initiated a review of the alignments considered in the original COA Report as well as additional alternatives to the vertical and horizontal alignments of the tunnels between Steeles West Station and the 407 ETR. TYSSE also initiated fluvial geomorphology studies of Black Creek, flood analysis and detailed utility investigations in the area west of Jane Street, south of the 407 ETR and north of the CN railway. The purpose of these studies was to assist in the development of alternatives to the approved alignment which would address stakeholder concerns as documented in comments on the COA Report.

### **4.1 Alignment Alternatives from Conditions of Approval (COA) Report**

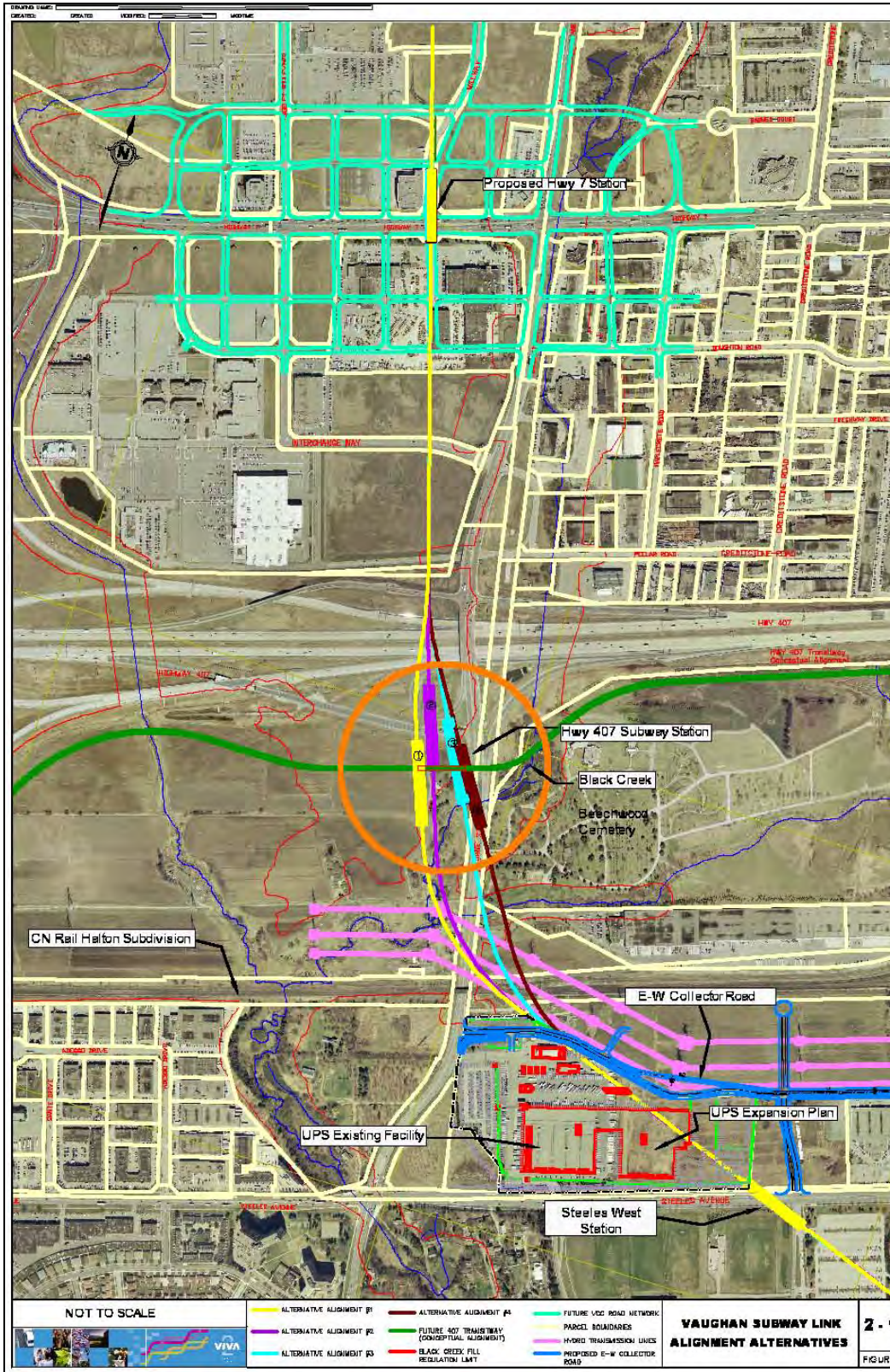
The approved COA Report considered four alignments as shown in **Figure 4-1**. The alignments were evaluated using a set of criteria that dealt with transportation, social environment, natural environment, and cost. Alignment 1 was determined the preferred alternative as outlined in Section 2.4.1 of the COA Report. Comments received during the public comment period emphasized that:

- CN Railroad maintained their concern with having the tunnels pass directly under a large cluster of their switches, and
- TRCA had issues regarding the protection and enhancement of Black Creek – specifically its aquatic, fish, terrestrial, wildlife and habitat and attributes, as well as flooding issues associated with this section of the creek.

### **4.2 TYSSE Proposed Tunnel Alignment Alternatives**

To mitigate the impact of tunnelling underneath the foundations of Hydro Tower 158, as required by the COA Report EA approved alignment, four alternative tunnel alignments through the Cherrywood-Clairville Hydro Corridor were developed by TYSSE. These considered:

- Setbacks of the alignment from Hydro Tower 158;
- Comments provided by stakeholders on the COA Report;
- Results of the fluvial geomorphology study regarding the Black Creek Meander Belt between the Jane Street culvert and the CN Railroad culverts;
- Potential realignment of Black Creek options that would meet Fisheries and Oceans Canada criteria;
- Identification of the existing Jane Collector Sanitary Sewer (900mm diameter) that flows from north to south across the existing farmland on ORC lands through the approved elevation and location of the Highway 407 Station site into the YDSS pumping station;



Source: COA Report, 2007

Figure 4-1  
Alignment Alternatives Reviewed in COA Report

- Results of hydraulic analysis of several bridge span lengths and skews as well as abutment and station grading options to consider flooding effects using TRCA's HEC/RAS model for this portion of Black Creek;
- Erosion and flooding issues identified early in the Black Creek Optimization Study; and
- Effects on other properties/stakeholders to the north and south of the study area of changes to the alignments, (e.g. UPS, Bentall, 407 ETR, and Smart Centres).

Each of the TYSSE alternatives, as described below, were evaluated further and discussed with stakeholders.

#### 4.2.1 TYSSE Alternative 1

This alternative avoids the need to tunnel under Hydro Tower 158 by shifting the tunnel alignment to the west of the approved EA alignment and bifurcating the tunnels around Hydro Tower 153B on the southernmost 230kV line (circuit V75P). This alternative also shifts the tunnel alignment to the west through the 407 ETR lands and property owned by Bentall to the north of the 407 ETR. The resultant alignment moves the Highway 407 station west so that it avoids Black Creek and the City of Vaughan's 900 mm sanitary sewer. Refer to **Figure 4-2** for this alignment. This alternative was evaluated and eliminated as the preferred alternative for the following reasons:

- It has a negative impact on the future Bentall development to the north of the 407 ETR;
- The alignment of the bifurcated tunnels impact additional hydro towers compared to the EA alignment;
- There is added tunnel length in this alternative.
- The tunnels are closer to the CN overpass at Jane Street;
- Rail geometry is compromised due to the introduction of an additional horizontal curve, increasing track maintenance costs;
- The tunnel to the west of tower 153B tunnel passes close to York Region's Black Creek Pumping Station, posing a potential settlement risk and added cost; and
- It locates one of the tunnels underneath two existing UPS buildings posing additional settlement risk to the structures.

#### 4.2.2 TYSSE Alternative 2

This alternative, as shown in **Figure 4-2** avoids the need to tunnel under Hydro Tower 158 by shifting the tunnel alignment to the west of the approved EA alignment and bifurcating the tunnels around Tower 154 on the middle 500kV line (circuit C550VP). This alternative also shifts the tunnel alignment to the west through the 407 ETR lands and Bentall property. The resultant alignment moves the Highway 407 station west so that it avoids Black Creek and the City of Vaughan's 900 mm sanitary sewer.



This alternative was evaluated and eliminated as the preferred alternative for the following reasons:

- It has a major impact on the future Bentall development to the north of the 407 ETR;
- One of the tunnels is closer to the CN overpass at Jane Street;
- One of the tunnels is adjacent to a second building on the UPS property;
- Rail geometry is compromised due to the introduction of an additional small-radius horizontal curve, increasing track maintenance costs;
- There is added tunnel length in this alternative; and
- The alignment of the bifurcated tunnels impact additional hydro towers compared to the EA/COA approved alignment.

#### **4.2.3 TYSSE Alternative 3**

TYSSE Alternative 3 shifts the subway alignment east of the EA/COA approved alignment and therefore to the east of Hydro Tower 158 as well. As a consequence of this eastward shift, both the length of the tunnelled running structure and the depth of Highway 407 Station are reduced. This alternative alignment requires Black Creek to be realigned within the meander belt area to permit the construction of Highway 407 Station. For additional details refer to **Figure 4-3**.

Of the four alternatives, this alternative was evaluated and identified as the preferred alternative because:

- It mitigates potential impact to Hydro Tower 158, including settlements, by moving the alignment to the east of the tower;
- The vertical profile of the twin tunnels can be raised;
- Tunnel length decreases in this alternative;
- There is no change in effect over the COA alignment to either the UPS or the Bentall properties;
- There is no change to the impact on the CN Railway switches;
- It is anticipated that the proposed Black Creek realignment could meet net gain improvements in fish habitat, within the existing meander belt width; and
- The Black Creek realignment and associated grading will result in a revised Regulatory Fill Line and floodplain without changing the flooding characteristics and the effect on back flow from the CN culverts.

Subsequent to this initial analysis, TYSSE Alternative 3 alignment was revised slightly using detailed subway train acceleration and deceleration tables (which were received from the train car manufacturer) and the spiral length and curve radii were optimized to provide an acceptable alignment. This results in the alignment being more centred between the hydro towers. This preferred alignment is discussed in detail in Section 5.

#### 4.2.4 TYSSE Alternative 4

TYSSE alternative 4 shifted the twin tunnels approximately 120 m to the west of the alignment established in the EA. This alignment avoids any impact on the hydro towers as shown in **Figure 4-3**. However, after being evaluated this alignment was eliminated as a preferred option because of the significant impacts it has on third party stakeholders. In particular:

- The tunnels would be located outside of the section of the existing UPS building that has been designed (reinforced) to accommodate any potential settlements caused by tunneling;
- The tunnel to the west of Hydro Tower 153B tunnel passes close to York Region's Black Creek Pumping Station, posing a potential settlement risk;
- There is added tunnel length in this alternative; and
- The tunnels would change the Steeles Avenue West Station location to be within the footprint of York University's existing football field. Therefore, the future redevelopment of these lands would be impacted due to the station's location.

#### 4.3 Stakeholder Discussions on TYSSE Alternatives – Leading to a Preferred Alternative

In January 2009, TYSSE presented the four TYSSE Alternatives and supporting studies to HONI, CN and the TRCA. Supporting information was also presented including a preliminary creek realignment concept, preliminary grading, and a flood analysis for bridge spans. Additional discussions with the Ministry of Transportation (MTO) have occurred to coordinate the station location and its relationship to the future MTO 407 Transitway, the associated bus terminal connections, integrated surface and underground connections, as well as conditions of Black Creek east of Jane Street.

The initial discussion with HONI was held on January 12, 2009 with supplemental information provided on January 20, 2009. Subsequent discussions with HONI have focused on the development of more detailed designs for TYSSE Alternative 3 as the preferred alternative. Refinements in the distance from the Tower footing have been incorporated. Ongoing discussions regarding the use of a HONI access road for construction traffic, the location of the site's storm water management pond, as well as, the proposed re-alignment of Black Creek in relation to Hydro Tower 158 have occurred.

TYSSE met with the TRCA on January 16<sup>th</sup> to present the initial information regarding all four TYSSE alternatives and the geomorphology and floodplain analysis in support of TYSSE Alternative 3. Additional meetings were held with the TRCA on April 30, 2008 reporting on further refinements to the grading, flood analysis, bridge and station designs. An additional package of information was provided to the TRCA in June, 2008 reporting on subsequent refinements to the proposed Black

Creek realignment and the stormwater management and grading options. In July, 2009 the TRCA issued a Stage 1 approval in principal, with requirements for additional analysis and review. Description of the refinements to date is found in Chapter 5 of this report. Results of studies on fish, fish habitat, terrestrial studies have been presented to TRCA at regular monthly meetings and are described in Chapter 3.

TYSSE attends the Black Creek Optimization Study (BCOS) Stakeholder's group meetings and presented the initial floodplain and fluvial geomorphology results to the BCOS team. Discussions with CN have focused on the crossing agreement and construction methods in order to minimize effects on railroad operations as the location of the railroad crossing does not change from that of the approved EA.



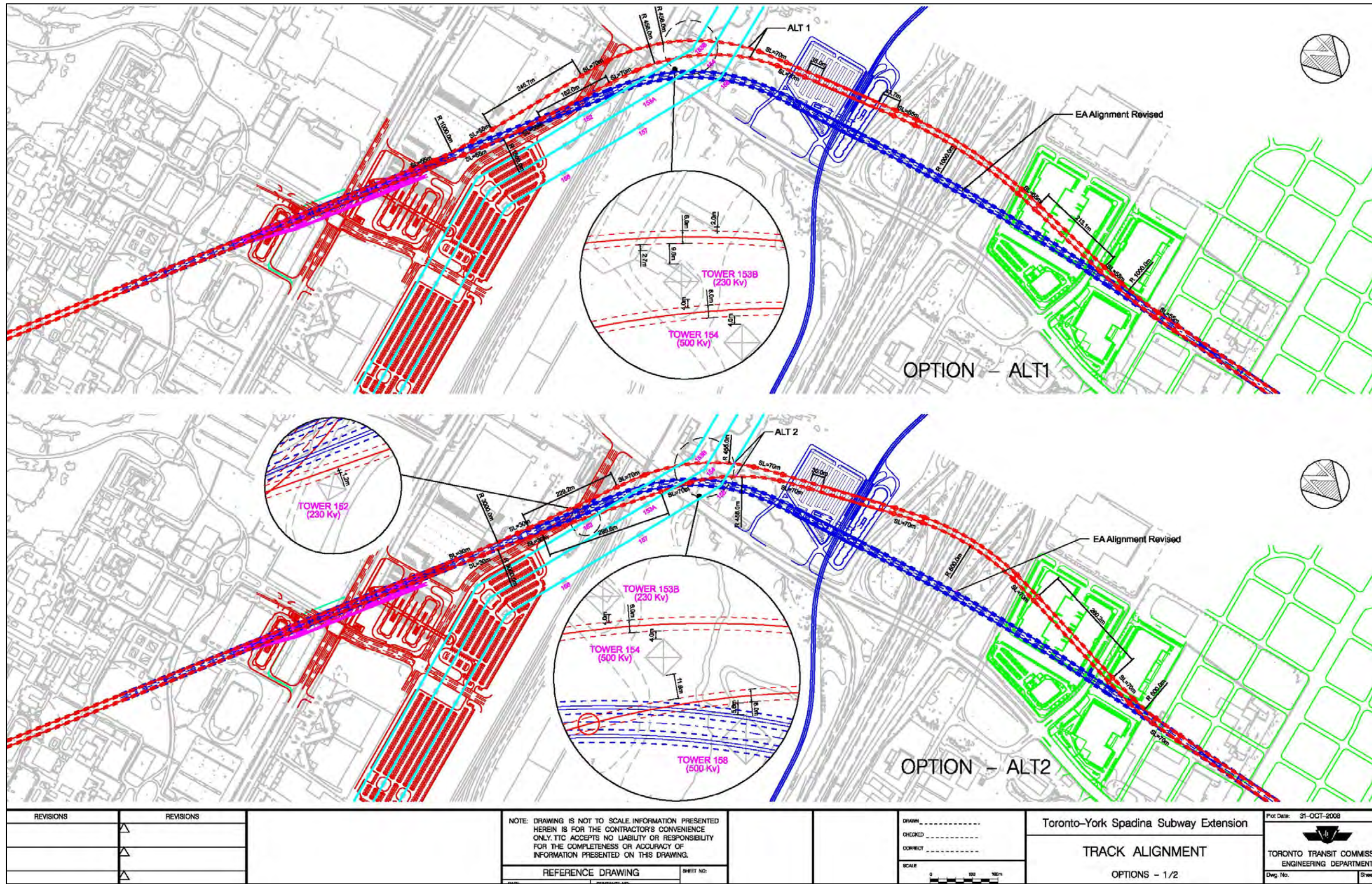


Figure 4-2  
TYSSE Alignment Alternatives 1 and 2



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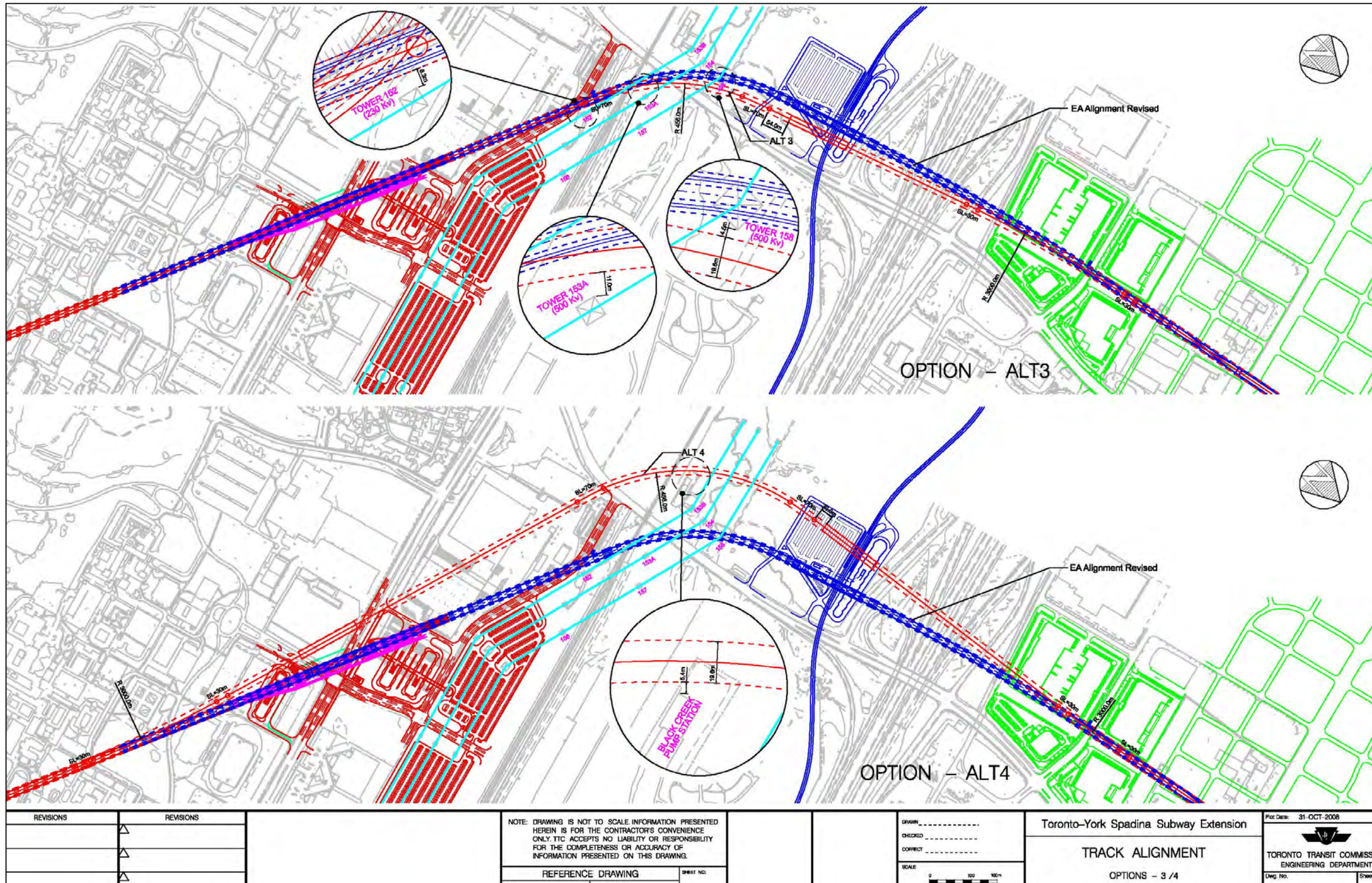


Figure 4-3  
TYSSE Alignment Alternatives 3 and 4



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## 5. PREFERRED ALIGNMENT

The preferred alignment, taking into account all of the requirements discussed in this report, is shown in **Figure 5-1**. This figure will replace Figures 3-2, 3-3 and 3-4 of the COA Report upon approval of this proposed amendment. The preferred alignment includes the revised curve radii and lengths as noted in **Table 5-1**.

**Table 5-1**  
**Preferred Alignment Curve Geometry**

<b>Curve Parameters</b>	<b>Curve 1</b>
Radius of Curve (Rc)	500.000 m
Length of Curve (Lc)	338.570 m
Length of Spiral (Ls)	80.000 m
Velocity (k/hr) (V)	80.00 km/h
Unbalanced Super-elevation (Eu)	48 mm

Source: TYSSE Track Designer

In comparing the COA Report alignment and the alignment described in this report, please note that a single revised chainage is now used for the combined Toronto and York portions of the approved alignment. At the time of the COA Report, two separate chainage systems were used by the two Environmental Assessments. The COA Report approved alignment included three curves and the amended alignment has been revised into a single curve.

All other Highway 407 Station facilities; parking lot, passenger pick up and drop off, bus terminal bridge and northern access road are generally as described in the original COA report. Layouts and designs for each have been advanced to a much greater level of detail through the ongoing design process.

### 5.1 Preferred Alignment

The proposed preferred alignment has the following advantages over the COA Report alignment, it:

- Eliminates the need to tunnel underneath the foundations of HONI's Tower 158;
- Reduces the HONI approval risks for the TYSSE and the technical risks to the power distribution grid;
- Improves the subway track curve geometry resulting in improvements to subway operating characteristics;
- Reduces the depth of Highway 407 Station by up to 5 m to a depth of approximately 175 m<sub>+</sub>, thereby reducing construction impacts and the quantities of earth to be removed at the site;

- Upon completion of the bridge construction and with HONI's approval, it will permit the removal of two corrugated steel pipes (CSP) culverts at the HONI access road crossing of Black Creek which results in an improved fish habitat with fewer barriers to fish movement;
- Results in an alignment of the Black Creek tributary which reduces erosion potential in support of the Black Creek Optimization Study (BCOS);
- Results in improved fish habitat and removal of invasive and non-native species within the portion of the Black Creek valley impacted by this project;
- Maintains the Highway 407 Station location south of the 407 ETR right-of-way;
- Maintains compatibility with the proposed York University, York Region, City of Vaughan and Bentall/Toromont development plans;
- Provides an overall station area design that provides space on site for future Transit Oriented Development (TOD); and
- Maintains compatibility with the UPS building settlement mitigation efforts. The preferred alignment of the tunnels remains under the reinforcement built into the structure of the UPS expansion building.

The disadvantages over the COA Report alignment are:

- Requires the realignment of portions of the Black Creek tributary between 407 ETR and the CN Railway west of the Jane Street culvert within its defined meander beltway (subject to TRCA/DFO approval of a proposed compensation plan);
- Results in the removal of the existing riparian habitat along the existing creek channel (subject to TRCA/DFO approval of a proposed compensation plan and a TRCA Regulation 166/06 permit);
- Requires additional construction work in the Black Creek floodplain to accommodate the construction of Highway 407 Station, the bridge abutments and the removal of portions of the City of Vaughan 900mm sanitary sewer (subject to TRCA and City of Vaughan approvals);
- Results in changes to the Black Creek regulated fill line in the portion of Black Creek between the 407 ETR, Jane Street and the HONI Cherrywood-Clairville Hydro Corridor;
- Continues to result in the removal of three federally and provincially listed species of Butternut trees, (*Juglans cinera*), not previously identified in the COA Report (subject to the approval of a proposed removal and compensation plan by MNR); and
- The alignment of the access bridge location to the Highway 407 Station Site has been adjusted slightly north, to be directly opposite the entrance to Beechwood Cemetery to meet Regional road standards for intersections.

Bus station and PPUDO facilities designs are as planned in the COA Report. All of the effects resulting from these changes are fully described in Chapter 6.

## 5.2 Other Changes to the Alignment within the Amending Boundary

As design progresses, several elements of the TYSSE tunnel have been relocated in response to tunnel alignment and station location design refinements. For simplicity purposes, these have been compiled here for future reference.

An Emergency Exit Building consists of a stairway up from subway tunnels to street level and an enclosed area at the top of the stairs. The location of an approved Emergency Exit Building (EEB 6) within this portion of the alignment has been adjusted within the amending boundary in response to the proposed change in length of the alignment. The revised location is shown on **Figure 5-1**.

Cross passages are connections between the two subway tunnels that are used in emergencies. There is no access to the ground surface at a cross passage. Locations of cross passages are shown on **Figure 5-1**. Cross passage 6 is located under the existing UPS parking lot, and cross passage 7 is located within the 407 ETR right of way, north of the westbound on-ramp in a parkway area between the ramp and the edge of the 407 ETR right of way.

## 5.3 Implementation

Chapter 5 of the COA Report details implementation methods of construction and additional implementation activities. The statements noted in the COA Report remain in effect and are not changed by this EA Amendment.

A comprehensive geotechnical investigation program (noted in Section 5.5.1 of the COA Report) is underway. Preliminary results for the areas covered by this EA Amendment have been summarized in Chapter 3 of this report and details included in the appendices.

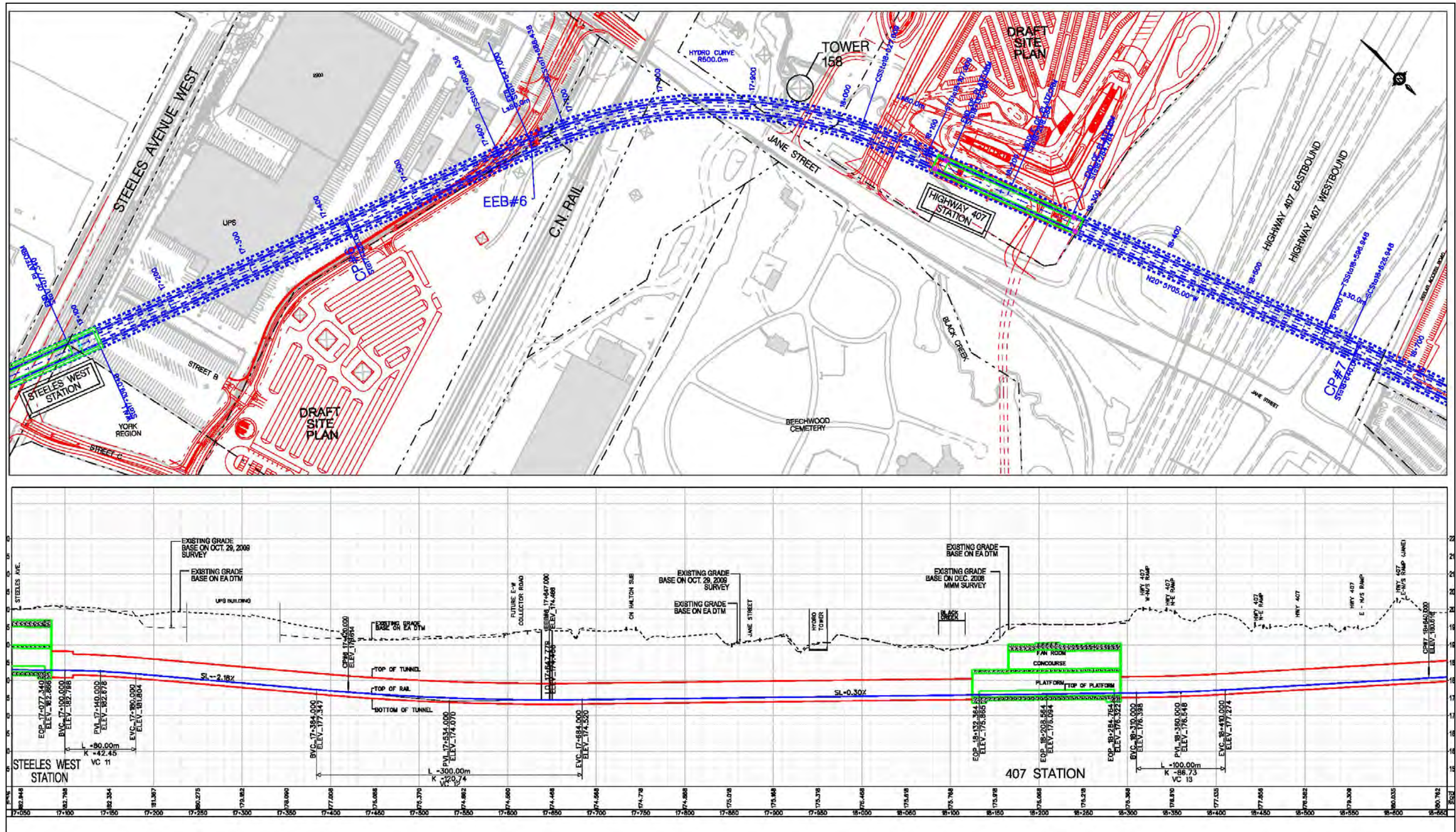
A pre-construction survey of all existing structures is planned, as noted in Section 5.5.2 of the COA Report.

A compliance monitoring plan for the COA Report was prepared for and approved by MOE in October 2008. This plan will be modified to include additional environmental commitments resulting from this EA Amendment.



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Source: TYSSÉ Alignment V3, December 2009

Figure 5-1  
Preferred Alignment



## 6. ENVIRONMENTAL EFFECTS

As was performed in the previous EA documents, an impact analysis was undertaken to identify and mitigate the potential effects, both positive and negative of the pre-construction, construction and operational activities required for the implementation of this EA amendment.

The evaluation of this EA amendment uses the same methodology as that from the Highway 7 EA and COA Report. The objectives used in this evaluation are the following:

- To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service;
- To protect and enhance the social environment in the corridor;
- To protect and enhance the natural environment in the corridor; and
- To promote smart growth and economic development in the corridor.

Only those effects pertaining to the amendment described in this report are noted in this section. **Tables 6-1 to 6-3** assess the effects and mitigation corresponding to the four objectives noted above. The proposed realignment of the tunnels and the Highway 407 Station subway box does not change any of the effects of the project on the fourth goal. For this reason, no discussion of these effects is included in this EA Amendment Report.

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**6.1 Objective A: To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service**

The effects analysis for Objective A of the proposed EA Amendment is tabulated in **Table 6-1**. Only those effects attributable to the change in alignment and the Highway 407 Station location are addressed in this table.

The proposed EA Amendment does not result in significant changes to the project’s ability to improve mobility. The revised alignment and station location still provides a fast, convenient, reliable and efficient rapid transit service.

A year of coordination with the MTO regarding an interface with the future 407 Transitway station has resulted in:

- Integrated vertical and horizontal designs of the subway and Transitway stations;
- A subway station that provides for future direct connection to the Transitway station at the concourse level; and
- An integrated GO Transit and YRT bus terminal facility that makes provisions for the future Transitway.

The planned facilities provide for the connection to a GO Transit/Metrolinx operated ultimate fixed guideway service (Objective A1). The current bus station design is scalable and expandable to meet MTO’s and GO Transit’s future needs (Objectives A3).

Changes to the tunnel’s horizontal profile result in an improved ride for passengers and less wear and tear and associated cost savings on the subway tracks (Objective A1). Changes to the vertical profile result in reduce construction costs and improved passenger access to the bus terminal facilities at grade by reducing the vertical separation from the subway (Objective A2). The relocation of the Highway 407 Station site to the east provides increased land area available for future transit oriented development (TOD) (Objective A3).

**Table 6-1  
Effects and Mitigation for Improved Mobility**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE A: To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service</b>												
A1	Maximize Inter-regional and local transit connectivity	Connections to inter-regional services and future gateways	✓		✓	Highway 407 Station Facility connections to 407 ETR.	Opportunity to connect to MTO’s future 407 Transitway and other local and regional transit services such as YRT/Viva, Brampton Transit and GO Transit.	The Highway 407 Station is designed to be a multimodal facility with coordination with YRRT and GO Transit. Station design provides for an integrated station and surface bus facility with shared parking and PPUDO facilities	None	None.	Positive effect	Complete design integration with the Highway 407 Transitway project and cost sharing agreement up until construction.
A2	Maximize speed and ride comfort and minimize safety risks and maintenance costs	Alignment geometry	✓		✓	EA Amendment Study Area	Geometry of the curve has been improved upon to allow better speed and therefore improving travel time and ride comfort and system safety.	Replacement of the three curves with a single long curve further reduces wear and tear on the rails and improves passenger ride.	None	None	Positive effect	None required.



**Table 6-1  
Effects and Mitigation for Improved Mobility**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE A: To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service</b>												
A3	Locate stations to maximize ridership potential and convenience of access for all users	Residents/employees within walking distance of station location. Accessibility of station/transit system.			✓	Highway 407 Station facility	Station at location with automobile-oriented land use could discourage rapid transit use.	This station is intended to serve mainly inter-regional park-and-ride passengers and GO Transit, YRT/Viva, Brampton Transit users, with few local residents. Promote transit use. Draw commuters out of automobiles and into transit. ORC reviewing future land use (TOD) on their lands in proximity to the station.	None	None	Positive effect	None required.

**6.2 Objective B: To protect and enhance the social environment in the corridor**

The effects analysis for Objective B of the proposed EA amendment is tabulated in **Table 6-2**. Only those effects attributable to the change in alignment and the Highway 407 Station location are addressed in this table. Overall, the various goals set to protect and enhance the social environment can be achieved with this EA Amendment. The assessment, in terms of the related environmental values, indicates that most adverse effects are generally mitigated by the built-in attributes of the design. Benefits for the existing and future communities served by the route can be maximized.

The proposed bridge design anticipates the York Region planned widening of Jane Street to six lanes, thereby ensuring York Region’s ability to improve capacity and traffic operations on Jane Street (Objective B1).

The purpose of this EA Amendment is to minimize any adverse effects of crossing under the Cherrywood-Clairville Hydro Corridor (Objective B2) while maintaining the alignment under the UPS Phase 2 expansion. The base slab of the recently completed UPS Phase 2 building has been reinforced above the tunnels. Changes to the alignment under the CN Halton Subdivision will still require construction monitoring while TBM machines operate beneath the railway tracks. The change to the alignment beneath the 407 ETR is on a somewhat less of a skew angle than in the COA Report and is shorter in length. A secondary purpose of this EA Amendment is to provide reliance to ORC for the conveyance or leasing of lands in the Highway 407 Station and Steeles West Station areas.

Noise and vibration effects will be addressed through construction monitoring to ensure compliance with applicable City of Vaughan By-laws (Objective B3). The potential for adverse effects on cultural landscapes has been reduced through the completion of Archaeological surveys (Appendices J and K) for the Cherrywood-Clairville Hydro Corridor lands. The results of the Stage 4 Archaeological excavation of Richard Brown Homestead site (H2) will be finalized. (Objective B4). Construction contract language will include requirements if additional artifacts are discovered during excavation.

Proposed landscape and re-vegetation plans, including the proposed Butternut Restoration Plan, recommend plant materials suitable for the sites and for the climates (Objective B5).

**Table 6-2  
Effects and Mitigation for Social Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE B: To protect and enhance the social environment in the corridor</b>												
B1	Maintain or improve road traffic and pedestrian circulation	Reduction in overall road capacity		✓	✓	Highway 407 Station Facility	Reduced capacity at Jane Street/Access Road intersections.  Design of bridge provides for future full width improvements along Jane St. Bridge designed for six lanes with sidewalks to accommodate future 407 Transitway and ORC TOD plans on balance of site.	Jane St./Bridge Access intersection improvements will be built in advance of the subway construction and the Jane Street widening to six lanes. The new intersection will be controlled by a traffic signal.	None expected	None expected	Impact on traffic will be limited to Jane Street detours during construction phase.	Traffic Management Plan will be implemented.
B2	Minimize adverse effects on stakeholders and property owners directly affected by the subway	Effects on structural integrity of existing facilities		✓		Crossing under UPS facilities	Portion of the subway alignment constructed under UPS Phase 2 building	Base slab reinforcement of the UPS Phase 2 building has been incorporated in its design and construction.	Unexpected ground conditions	Use of special construction techniques if necessary, suitable to overcome unexpected ground conditions.	Minimal	Settlement monitoring during construction phase.

**Table 6-2  
Effects and Mitigation for Social Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE B: To protect and enhance the social environment in the corridor</b>												
B2	Minimize adverse effects on stakeholders and property owners directly affected by the subway (con't)	Effects on structural integrity of existing facilities (con't)	✓	✓		Crossing under the Cherrywood-Clairville Hydro Corridor	Potential effects of tunnelling beneath or near transmission towers	This tunnel realignment addresses Hydro One's (HONI) continuing concerns about potential effects of tunnel drives on Tower 158. Horizontal separation of the tunnel alignment from the nearest corner of Tower 158 to a line 3 m beyond the outside edge of the nearest tunnel is 6 m. Tower 158 is approx. 17.6 m from alignment centreline and approx 9.8 m from nearest tunnel wall. Vertical clearance from the tunnel invert to the Tower 158 footings is 14.25 m and 8.1 m clearance to tunnel crown.  Initial geotechnical investigations show no unexpected soil configurations along tunnel drives.	Unexpected ground conditions	Use of special construction techniques if necessary, suitable to overcome unexpected ground conditions.	Minimal	Settlement monitoring during construction phase.  Use of EPB mode of tunnelling during construction when possible.
			✓	✓		Crossing under CN Halton Subdivision tracks.	Potential effects of tunnelling under the tracks	Distance from the top of the tunnel invert to the top of the CN Rail: 20.1 m to tunnel invert, 13.9 to tunnel crown (ground surface).  Tunnelling in EPB mode in conjunction with continuous monitoring should not result in settlement of the rail bed beyond acceptable limits for continued operation over the rail lines during tunnel construction.	Unexpected ground conditions	Use of special construction techniques if necessary, suitable to overcome unexpected ground conditions.	Rare	Depending on the ground conditions and construction techniques used.
			✓	✓		Crossings under Hwy 407 ETR	Possibility of settlement effects during tunnel construction.	The depth of cover between the roadway surfaces, as well as any associated utilities such as sewers and water-mains, and the top of the tunnel excavation, is sufficient that damage from minor settlement due to tunnel construction is unlikely. The use of EPB-TBMs in conjunction with continuous monitoring should prevent settlement problems.  Distance from the top of the tunnel invert to the 407 ETR: Tunnel invert ranges from 23.2 m (south off ramp) to 19.2 (north on ramp) & tunnel crown ranges from 17 (south off ramp) to 13 (north on ramp)	Unexpected ground conditions	Use of special construction techniques as needed, suitable to overcome unexpected ground conditions.	Rare	Depending on the ground conditions and construction techniques used. Monitoring of roadway surface during construction as needed.

**Table 6-2  
Effects and Mitigation for Social Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE B: To protect and enhance the social environment in the corridor</b>												
B2	Minimize adverse effects on stakeholders and property owners directly affected by the subway (con't)	Effects on structural integrity of existing facilities (con't)		✓		Highway 407 Station area	An existing 900 mm sanitary trunk sewer owned by the City of Vaughan is located within the site limits and in conflict with the proposed station concourse level, the MTO Transitway and the proposed realigned creek.	The existing sewer will be decommissioned under Black Creek and a section of the existing pipe will be removed. The remaining pipe will be plugged and grouted with a course sand mixture to ensure that the pipe remains in place with no future maintenance needs.  A new sewer alignment up on the table lands has been reviewed with the City of Vaughan who has no objections to the proposed location.	Access for future maintenance under the future 407 Transitway	Concrete encased sewer or other specifications acceptable to the City of Vaughan.	Minor	Construction methods and protections set forth in the Fisheries and Oceans Canada (DFO) conditions for Black Creek realignment will be followed through the sewer relocation contract.
		Effect to Ontario Realty Corporation (ORC) lands	✓	✓	✓	Highway 407 Station area	407 Station and station facilities (Bus Terminal, PPUDO, Parking etc) will require property acquisition west of Jane St. between the Hydro Corridor and Hwy 407.	Permission to enter has been negotiated with the ORC and tenant notification for ongoing surveys, investigations and studies has been obtained.  Information in this EA is intended to provide a level of detail to allow the ORC to rely on this document for conveyance and/ or leasing of lands to York Region at the Highway 407 station site.	Mutual agreement required	Ongoing negotiations	Minor	Terms of property agreement to be established by Third Party Planning and Property with ORC.
		Effect on Beechwood Cemetery activities		✓		Beechwood Cemetery	Possible disruption of business activities during construction.	Early construction of bridge and the signalized intersection at the Beechwood cemetery entrance will improve traffic control of main tunnel and station construction related truck traffic. A traffic detour plan for the bridge construction will provide some measure of traffic control.	None expected	None expected	Impact on traffic will be limited to Jane Street detours during construction phase.	Traffic Management Plan will be implemented.
B3	Minimize adverse noise and vibration effects	Noise effects from construction		✓	✓	Beechwood Cemetery	Possible construction noise effects from construction equipment and truck traffic entering and leaving the site.	Signal controlled intersection will regulate traffic access to the site and may modulate noise effects. Construction site is generally located below the Jane Street elevation which may help buffer the noise.  Construction will meet requirements of applicable City of Vaughan construction Noise By-Law.	None expected	Construction noise monitoring program to meet applicable noise by-laws	Moderately significant.	Construction noise monitoring program to meet applicable noise by-laws.
		Noise effects from subway operations.			✓	Beechwood Cemetery	Possible noise effects from subway and transit facility operations.	Subway operations not expected to result in audible effects in excess of allowable levels in City of Vaughan Noise By-laws.	None expected	Complete noise analysis of subway operations prior to construction of tunnels and station.	None	Implementation of vent shaft noise control recommendations from noise analysis.



**Table 6-2  
Effects and Mitigation for Social Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE B: To protect and enhance the social environment in the corridor</b>												
B3	Minimize adverse noise and vibration effects (con't)	Vibration effects from operation		✓	✓	Beechwood Cemetery	Possible vibration effects from subway operation	Subway operations not expected to result in vibration effects in excess of allowable levels in City of Vaughan Vibration By-laws	None expected	Construction vibration monitoring program to meet applicable by-laws.	None	Construction vibration monitoring program to meet applicable by-laws.
		Construction noise effects on Black Creek Pioneer Village		✓		Black Creek Pioneer Village	Construction effects on Village operations.	Distance from construction sites to the Village is more than a kilometre away and the village is shielded by trees.	None expected	Construction effects on Black Creek Pioneer Village evaluation.	None	Construction Effects on Black Creek Pioneer Village report.
B4	Minimize adverse effects on cultural resources	Disruption of Built Heritage Features (BHF)		✓		EA Amendment Study Area	The potential introduction of subway operation may cause changes in visual, audible and atmospheric environment around built heritage features.	None required.	None expected	None necessary	Insignificant	None required.
		Disruption of Cultural Landscape Units (CLU)		✓		EA Amendment Study Area	The potential introduction of subway operation may cause changes in visual, audible and atmospheric environment to the cultural heritage features in the Cultural Landscape.	None required.	None expected	None necessary	Insignificant	None required.
		Possible impacts to areas with potential for identification of archaeological sites	✓			EA Amendment Study Area	There is potential for identification of archaeological sites within the Cherrywood-Clairville Hydro Corridor	Stage 2 Archaeological Assessment in accordance with the MOC guidelines was completed for the Hydro Corridor north of Steeles Avenue and east of Jane Street. (See <b>Appendix K</b> ). Stage 2 and 3 Archaeological Assessment was s completed for the Highway 407 Station area and The Richard Brown Historic site (H2) was identified. Stage 3 investigation of the H2 sites confirmed need for further investigation. The Stage 4 assessment field work is now complete and report in preparation. Collection of artifacts and consultation with the Ministry of Culture is underway.	Additional cultural heritage resources may be discovered during excavation.	On-site environmental inspection during excavation works as determined in the construction activities		As required during excavation: If cultural heritage resources are discovered during excavation, the following procedures will apply: <ul style="list-style-type: none"> <li>• Work shall be suspended until an assessment has been completed by the Ministry of</li> </ul>

**Table 6-2  
Effects and Mitigation for Social Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE B: To protect and enhance the social environment in the corridor</b>												
												Culture; and <ul style="list-style-type: none"> <li>TTC shall perform required measures to mitigate negative impacts on found resources as required by the Ministry of Culture.</li> </ul>
B5	Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	Landscaping	✓		✓	Highway 407 and Steeles West Station Areas	Landscaping species may not survive in winter months.	Both sites are subject to height limitations and setbacks from HONI towers. Native plant materials exclusively are proposed for the landscape re-vegetation plan along the realigned creek.	Species may still not survive	Landscaping plans will be reviewed by the City of Vaughan for both sites.	Insignificant	Monitor health of landscaping post installation.

### 6.3 Objective C: To protect and enhance the natural environment in the corridor

The effects analysis for Objective C of the proposed EA amendment is tabulated in **Table 6-3**. Only those effects attributable to the change in alignment and the Highway 407 Station location are addressed in this table.

Most of the preferred subway alignment is set in developed or developing urban environments, where natural features have already been disturbed by previous development. Nevertheless, within the Humber River watershed, the Black Creek watercourse crosses Highway 7 and Highway 407 on the east side of Jane Street and crosses under Jane Street south of Highway 407. North of Highway 407, the subway tunnel, station and surface works is outside of the watercourse and floodplain. South of the Highway 407 right-of-way, however the revised tunnel and Highway 407 Station alignment are located within the regulatory flood limit and directly beneath Black Creek.

Extensive study of the natural environment completed in 2009 provides the scientific and technical basis of support for the proposed realignment and the resulting Black Creek realignment and restoration plan. Individual objectives are met through the design process and implemented through the construction and operations phases of the project.

A stormwater management plan including erosion and sediment control plans are designed to address the Highway 407 Station area stormwater flows. Sediment settlement prior to discharge into a proposed wetland buffer, and then into Black Creek is proposed (see Stormwater Management Report in **Appendix L**). The construction contract requires best management practice by the Contractor with auditing by the TTC (Objective C1). Stormwater and backflow conditions in the Highway 407 Station area have been addressed as the station subway box location and length have been adjusted. A revised regulatory flood line is in development with TRCA based on the grading plan (refer to **Figure 6-1**). Supporting justification is found in the Hydraulic Design Report in **Appendix L**.

The meander belt and erosion analysis established that the Black Creek realignment was possible within the valley area. A preliminary re-design of Black Creek based on the meander belt of a realigned creek was prepared (**Appendix E**). Initial concepts for creek realignment based on the meander belt and erosion analysis were reviewed with TRCA specialists and design variations have been undertaken and subsequently reviewed. A request for project review of the proposed creek realignment, bridge design, 900 mm sanitary sewer relocation, and re-vegetation has been submitted to Fisheries and Oceans Canada (**Appendix M**). The results of this review will become commitments to be implemented through this EA Amendment.

Several bridge spans and abutment locations were evaluated for the new structure crossing Black Creek. Hydraulic calculations and grading plans (**Appendix L**) have evolved through consultation with the Black Creek Optimization Study (BCOS) team and the TRCA. Stormwater management plans for the Steeles West Station commuter parking lot are currently based on the BCOS information available.

Measures to protect fish habitat and to reduce barriers to fish movement are detailed in the submission to Fisheries and Oceans Canada (**Appendix M**). This submission includes proposals for construction staging, creek realignment staging, re-vegetation and monitoring and maintenance. TYSSE will implement requirements set out by Fisheries and Oceans Canada from this review as commitments to be implemented (Objective C1) through this EA Amendment.

Based on the results of the two natural environment studies for Highway 407 and Steeles West Stations (**Appendices F and G**), no further mitigation for effects on wildlife is needed. (Objective C2)

Three previously unidentified Butternut trees, a federally and provincially listed species, were found in the Highway 407 Station area (see **Appendix N**). Consultation with the Ministry of Natural Resources (MNR) began on July 30, 2009 and continues. A proposal for removal and replacement of these Butternut trees has been filed with the MNR. Restoration and monitoring requirements arising from the MNR's response to this request will become commitments of this EA Amendment (Objective C2) as noted in **Table 6-3**.

Results of the overall subway project's CEAA Screening Report indicate a net reduction in Greenhouse Gases (GhG). MOE's original approval of the underlying EA to the subway alignment includes a condition of approval for an air quality analysis. The study is underway and will be completed prior to construction. Additional commitments arising from its review and approval will be implemented (Objective C3) during construction.

A comprehensive geotechnical and hydrogeotechnical investigation of the EA Amendment study area is underway. Preliminary results (**Appendices B, C and D**) are used in the development of an Environmental Management Plan (EMP) for the area. TYSSE continues to work with TRCA to evolve an EMP for those elements of the project which require and proactive and adaptive mitigation and monitoring. Monitoring of Black Creek commenced in 2009 and continues. Existing natural heritage reports (**Appendices F and G**) document the conditions of ecological receptors which may be within dewatering zones of influence (ZOI). Monitoring programs associated with the EMP will be implanted throughout construction and post construction based on dewatering effects (Objective C4).

**Table 6-3  
Effects and Mitigation for Natural Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C1	Minimize adverse effects on Aquatic Ecosystems	Fuel spills entering the watercourses, due to accidents during construction refuelling and accidents at bus terminals during operation.		✓	✓	Highway 407 Station Area	Fish kills due to chemical spills resulting in short term population decline.	No refuelling within 30 m of a watercourse or catch basin. An Emergency Response Plan will be prepared and implemented. Oil & grit separators will be installed for stormwater drainage from station site. Inspection and maintenance control at all times during construction. Construction will be performed in the dry. Manage any spent solvents and liquid waste including collection, storage transport, and disposal in accordance with Ontario Regulation 347 and the MOE's Field Operations Exemption Policy.	Short term population decline. Some contaminants within storm-water system.	None practical	No residual significant impact anticipated.	Monitoring during the construction phase will be implemented.  Establish and implement an Emergency Response Plan for spills at the Highway 407 Station area construction sites.
		Sediment entering watercourses during construction.		✓		Highway 407 Station Area	Fish kills and loss of aquatic habitat, impairment of spawning and rearing activities that contribute to short-term population decline resulting in short term population decline.	The duration and extent of activities requiring soil exposure will be minimized. Surface water will be managed to prevent contact with exposed soil surfaces. A sediment and erosion control plan has been proposed for the station area in general and the creek realignment specifically (See <b>Appendix L</b> ).	Short term degradation of fish habitat.  Temporary impacts to water quality (TSS).	None practical	No residual significant impact anticipated.	Monitoring of implementation of stormwater management and erosion and sedimentation control plans through construction phases until impacted areas are fully stabilized.
		Sediment laden stormwater entering watercourses during operation.			✓	Highway 407 Station Area	Loss of aquatic habitat resulting in population decline.	Naturalizing the valley slope areas of the Black Creek using native trees/plants and applying bio-engineering methods (e.g. live stakes) will reduce effects during operation. Stabilizing erosion points of concern, as identified in the ongoing Black Creek Optimization Study. Removal of the existing sanitary sewer line will indirectly eliminate the potential for future impacts to the creek associated with maintenance and repair during operations. Minimize influence of existing sources of agricultural run-off and sediment inputs to Black Creek by directing all post -construction related surface runoff to the new SWM pond.	Short term population decline.	Post construction monitoring of restored areas to identify stability of surfaces and monitoring of in-stream habitats for evidence of sedimentation of fish habitats.	No residual significant impact anticipated.	Normal monitoring of drainage facilities by property owner.



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Effects and Mitigation for Natural Environment**

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			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C1	Minimize adverse effects on Aquatic Ecosystems (con't)	Loss of site-specific habitat.		✓		Black Creek and tributary watercourses within route.	<p>Proposed Black Creek realignment results in a permanent loss of 30 m (10%) loss of existing creek length.</p> <p>Proposed creek realignment will result in an increase of 38% in wetted creek area (fish habitat).</p> <p>Improved overall quality of fish habitat by developing natural pool and riffle design using appropriately size bedding material for dominant species using the creek. Will improve spawning and feeding potentials for white sucker and creek chub.</p> <p>Proposed detailed construction schedule implements best practices and timing for creek realignment.</p> <p>Usable channel length and area is recovered by permanently removing an existing pair of CSP culverts and replacing this footprint with natural stream channel.</p> <p>Meander belt width findings have been incorporated into the new channel design so that the channel realignment is not expected to have impacts to upstream or downstream habitats within Black Creek.</p> <p>The new channel will be constructed with functioning pool riffle sequences that will be immediately usable by resident white sucker and creek chub.</p> <p>TRCA and Ontario MNR classify Black Creek as a warm water habitat, a system that is somewhat stable and/or resilient to change and perturbation.</p>	<p>A net gain to fish habitat will result from proposed channel modifications to Black Creek that support fish habitat.</p>	<p>Design to date has been developed in consultation with the TRCA.</p> <p>Consultation continues with regulatory agencies during detail design to confirm no harmful alteration of fish habitat.</p>	Net gain of higher quality fish habitat.	<p>On-site environmental inspection during in-water work.</p> <p>Post-construction monitoring of fish habitat recovery measures in accordance with Fisheries and Oceans response to Request for Project Review or TRCA requirements resulting from consultation and 166/06 Permit.</p>	

**Table 6-3  
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GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C1	Minimize adverse effects on Aquatic Ecosystems (cont'd)	Fish mortality		✓		Black Creek and tributary watercourses within route.	Fish may be injured or killed during creek realignment or as a result of dewatering	<p>The new channel is intended to be constructed in the dry and water diverted to the new channel from the old channel using a staged approach.</p> <p>Species present are resilient to change and perturbation (e.g. white sucker, creek chub, pumpkinseed and blue gill).</p> <p>(See <b>Appendix L</b> for detailed creek realignment proposal and effects.)</p>	None expected.	Complete negotiations with TRCA/DFO regulatory agencies during detail design.	No residual significant impact anticipated.	<p>A qualified Environmental Inspector and Aquatic Ecologist will oversee the fish transfer in accordance with the Fisheries and Oceans Canada permit requirements. During realignment, a qualified fisheries biologist will monitor the existing channel for the presence of fish. Stranded fish will be collected by dip netting, electro fishing or live trapping and transferred to a downstream location. Transport methods and records will be done in accordance with Fisheries and Oceans Canada requirements. Inspections to occur regularly by the Environmental Inspector (EI) for the initial in/near water construction to ensure environmental compliance after which the site shall be inspected once weekly by the EI for the remainder of the in-water construction period or in advance of significant rain events.</p>

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			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C1	Minimize adverse effects on Aquatic Ecosystems (cont'd)	Barriers to fish movement	✓	✓	✓	Black Creek and tributary watercourses within route.	Net benefit to fish movement as CSP barriers to be removed as part of creek realignment.	Field evaluations indicate that the use of this portion of the creek is used for fish feeding and rearing and that it does not provide productive spawning area (See <b>Appendix L</b> Volume 1).  The positive effects of the culvert removal on fish passage will be immediate (See <b>Appendix L</b> Volume 1).	None expected.	Complete negotiations with TRCA/DFO regulatory agencies during detail design.	No residual significant impact anticipated.	Implementation of conditions of TRCA/DFO permits for the realignment of Black Creek. On-site environmental inspection in accordance with permit requirements during and post construction.
		Baseflow alterations		✓	✓	Black Creek and tributary watercourses within route.	New impervious surfaces at stations can lead to changes in the frequency, magnitude and duration of flows.	Reduce the area of impervious surfaces to the extent possible. Use stormwater management practices that encourage infiltration and recharge of groundwater.	None expected.	Continue review of proposed stormwater management facility, outlet and methods with TRCA during design phase.	No residual significant impact anticipated.	Preconstruction monitoring will be continued through construction and during commissioning phase of the project to confirm flow rates, quality and temperatures. Post-construction inspection of stormwater management facilities to evaluate their effectiveness. On-going maintenance as required.
		Increased temperature		✓	✓	Black Creek and tributary watercourses within route.	Clearing of riparian vegetation and stormwater management practices can impact temperature regimes.	Proposed landscape vegetation plan (See Appendix L, Volume 2 Drawing A40-13-L1001) includes grouped plantings of trees along the proposed realigned Black Creek to establish in the first season, some shade which will continue and expand as trees mature.  Replacement of native soils with topsoil/suitable planting medium will reduce potential.	None expected.	Consider turning over of the responsibility for maintenance of vegetation to a Fisheries and Oceans Canada acceptable organization upon completion of construction	No residual significant impact anticipated.	Post-construction inspection of riparian plantings to confirm survival and establishment.

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			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C2	Minimize adverse effects on Terrestrial Ecosystems	Loss of wildlife habitat		✓	✓	In the vicinity of surface subway facilities.	Construction of the subway and station facilities may result in the removal of vegetation and the wildlife habitat it supports.	Minimize the area of vegetation removals and grade changed to the extent possible.  Delineate work zones using construction fencing/tree protection barrier.  Clear vegetation during non-breeding seasons where possible.  Install landscaping as soon as practical during construction sequence at each station location.	None expected.	Restore natural areas disturbed during construction with native vegetation, where feasible.	No residual significant impact anticipated.	None required.
		Wildlife mortality		✓	✓	In the vicinity of surface subway facilities.	Removal of wildlife habitat may result in wildlife mortality.	Perform vegetation removals outside of wildlife breeding seasons (typically April 1 to July 31). Perform any channel realignment and culvert/bridge extension, repair and replacement outside of wildlife breeding season.	None expected.	None required.	Negligible	None required.
		Barriers to wildlife movement.		✓	✓	In the vicinity of surface subway facilities.	Limited effects on wildlife movement at in the Steeles West Station due to loss of habitat.  Realigned creek and regulatory flood lines along Black Creek provide corridor for wildlife movement from Jane Street Culvert to CN culverts.	Enhanced wildlife passage around facilities, where feasible through bridge design and re-vegetation along boundaries.  Environmental Assessment of Natural Heritage Features and Functions at the Steeles West Station (see <b>Appendix G</b> ) finds degraded wildlife corridor due to adjacent roads and human intrusion.	None expected.	None required	Negligible	None required.
		Disturbance to rare, threatened, or endangered wildlife		✓	✓	In the vicinity of surface subway facilities.	No rare, threatened or endangered wildlife species have been recorded in the project limits.	No species-specific mitigation required.	None expected.	None required.	Negligible	None required.



**Table 6-3  
Effects and Mitigation for Natural Environment**

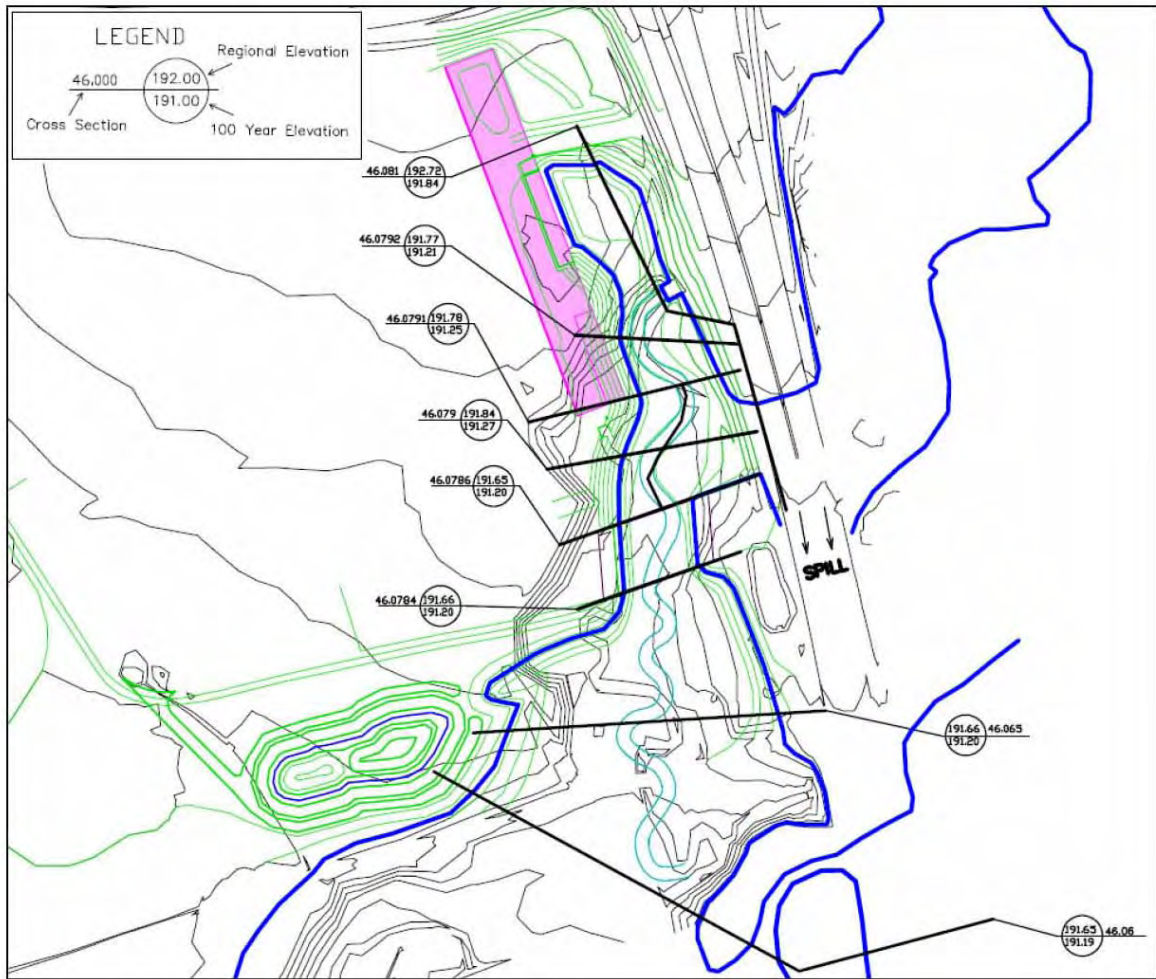
GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C2	Minimize adverse effects on Terrestrial Ecosystems	Disturbance to vegetation through edge effects, drainage modifications and road salt	✓	✓	✓	Station surface facilities.	Ditching, grading and other drainage modifications may alter local soil moisture regimes.	Re-vegetation plans will be based on detailed inventories of vegetation to be removed during construction.  Compensation plan has been developed for the Highway 407 Station areas affected by the creek realignment. (See <b>Appendix L</b> ).  Delineate work zones using construction fencing/ tree protection barrier.	Vegetation communities within the study area are primarily cultural in origin and have been impacted by Highway and 407 ETR.	Re-vegetation along watercourses and landscape treatments.	Insignificant	Maintain landscaping in accordance with Fisheries and Oceans Canada and/or MNR requirements resulting from creek realignment and Butternut tree removal.
		Disturbance to rare, threatened or endangered species	✓	✓	✓	Highway 407 Station Area	Identification of three previously unidentified pure strain Butternut trees ( <i>Juglans cinera</i> ) at station box location.	92 nuts were harvested from the identified trees in fall 2009 and delivered to MNR for propagation.  Restoration plans include the use of seed and tree stock from the harvested nuts in the request to remove and replacement plan submitted to MNR in December 2009.  Enhanced population of Butternut is expected due to MNR established compensation rates.  (See <b>Appendix N</b> – Butternut Removal and Restoration Proposal to the Ministry of Natural Resources, December 2009).	Net gain in healthy Butternut tree population in the station area.	None required upon acceptance by MNR.	None	Implementation of MNR approved compensation plan.  Five year monitoring of tree and sapling health post installation in accordance with MNR prescribed conditions of approval of the request to remove trees.  Replacement of any trees that die during post construction monitoring in accordance with MNR permit requirements.
		Disturbance to rare, threatened or endangered species		✓	✓	Steeles West Station Commuter Parking Lot	Existing Bur Oak woodlot located on ORC land in the Steeles Hydro Corridor.	Commuter parking lot design to show area of maintenance of bur oak wood lot. (See Figure 3-12 for proposed parking layout avoiding the Burr Oak Woodlot and buffer at the Steeles West Station parking lot area.)	None Expected	None	None	None

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			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C3	Improve Regional air quality and minimize adverse local effects.	Degradation of existing local and regional air quality when compared to MOE standards.			✓	York Region	Peak hour bus service is anticipated to increase in the vicinity of the Steeles West, and Highway 407 and VCC stations in the opening year of the subway (2015)	The change in alignment does not result in a change to the potential increase in emissions at the station site expected from the increased buses. There are limited sensitive receptors in the immediate vicinity of the realigned station. The fleet average emissions are still predicted to will drop significantly due to technological improvements balancing the increase in traffic volumes.	Forecast improvements expected to remain consistent with original forecasts with the new alignment.	The COA Report Condition of Approval 5 requires the preparation of an Air Quality report prior to tunnel and station construction.	Negligible	The Conditions of Approval required air quality analysis is in preparation. The realignment of the tunnel and station will not affect the results which will be incorporated, if applicable into design or construction contracts.
		Increase in emission of Greenhouse Gasses (GhG)			✓	York Region	Fewer GhGs are expected to be emitted	The change in alignment will not result in any changes to the predicted GhG emitted per commuter.  The March 2008 CEEA Screening Report prepared for Transport Canada calculated the reductions in CO2 emissions rates and a total GhG change from the entire 8.6 kilometre subway extension. The net change from subway implementation was estimated at -14,285 tonnes in the opening year.	Forecasted improvement.	None required	Positive Effect	None recommended.
C4	Minimize adverse effects on corridor hydro-geological, geological and hydrological conditions	Water quality in shallow groundwater that can affect quality in surface watercourses			✓	Areas located hydraulically down gradient of transit alignment, where receiving surface watercourses are present.	Subway PPUDO and bus loops will require de-icing salt and also will accumulate various chemical substances that can impact water quality of runoff. Impacted runoff that infiltrates can increase concentrations in shallow groundwater. Potential to affect shallow groundwater that discharges to surface watercourses.	Highway 407 Station areas to be drained through a treatment train approach (potentially using parking lot area bioswales) then to the newly proposed storm pond prior to outletting into a wetland transition area before entering into Black Creek.  Steeles West Station area SWM design developing a treatment train approach to handling of flows from parking lot and bus station areas north of Steeles Avenue. SWM design using available Black Creek Optimization study information and will be revised if BCOS recommendations are released prior to design submittal to Vaughan.	Potential effects to water quality of surface water courses. Groundwater quality effects are anticipated to be detectable.	Reduce application of road salt, where possible. Curbs and gutters to convey impacted runoff away from permeable soil areas.	Moderate	None required. Water quality effects are anticipated to remain acceptable.

**Table 6-3  
Effects and Mitigation for Natural Environment**

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase <sup>1</sup>			Location	Assessment of Effect on the Environment	Built-In Positive Attributes and/or Mitigations	Potential Residual Effects	Further Mitigation	Level of Significance after Mitigation	Monitoring and Recommendation
			P	C	O							
<b>OBJECTIVE C: To protect and enhance the natural environment in the corridor</b>												
C4	Minimize adverse effects on corridor hydro-geological, geological and hydrological conditions	Baseflow in surface water courses		✓	✓	Recharge areas within proposed alignment, particularly in areas of Newmarket Till and sand textured glacial lake deposits.	Increase of paved area at stations decreases the pervious area that existed prior to construction, resulting in proportionally decreased recharge to shallow groundwater.	N/A	Decreases in recharge can decrease baseflow in surface water course(s). Reduced baseflow in surface watercourses.	Construction of pervious surfaces where practical, including grassed areas and permeable pavements.	Negligible	None required. The degree of impact is anticipated to be undetectable.
		Increased pavement; decreased infiltration			✓	Stations and parking lot areas in EA Amendment Study Area	Minor increase in quantity of surface runoff. Minor decrease in quantity of groundwater.	SWM facilities such as bio swales and storm water ponds will be designed to meet current criteria for quality, quantity and erosion control.	None. The ponds will be designed to mitigate effects.	None		None required
		Groundwater resources and aquifers		✓		Black Creek crossing	Construction of subway tunnels and the planned Hwy 407 station could affect groundwater resources if significant dewatering is required.	The extent of dewatering and any aquifer depressurization to permit tunnel and station construction will be minimized by the use of earth pressure balancing tunnel boring equipment in areas where groundwater resources could be affected. Local dewatering and recharge will likely be required around the station which must be constructed by the cut-and-cover method. Measures to mitigate any potential effects will be identified and incorporated in the detailed design and construction contract specifications.	None anticipated.	None anticipated	Insignificant	An on-going program to monitor groundwater and creek flow conditions will be conducted during construction.



Source: AECOM. Highway 407 Station 30% Preliminary Design Report. Hydraulics Report

Figure 6-1  
Proposed Regulatory Floodline

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## 7. ENVIRONMENTAL EFFECTS UNDER THE CANADIAN ENVIRONMENTAL ASSESSMENT ACT

The TYSSE project is subject to approval under the *Canadian Environmental Assessment Act* (CEAA) due to a federal funding contribution from the Build Canada Fund. A CEAA Screening Report (March 2008) was prepared and approved by Transport Canada. The screening report (available on the TTC website) addressed cumulative effects of the entire project including:

- Air quality
- Noise and vibration
- Property and buildings
- Vegetation
- Transportation services
- Any other matters

The changes proposed by this amendment do not result in any change to the cumulative effects. Any changes to commitments resulting from related approvals by Fisheries and Oceans Canada or the Ontario Ministry of Natural Resources will be incorporated into compliance plans for the project at the appropriate federal or provincial level. Greenhouse gas emissions from the CEAA Screening Report have been reflected in Table 6-3.

On September 29, 2009 the TYSSE project received a Record of Decision from Transport Canada regarding a TYSSE request for an exemption to the preparation of an amendment to the project's Federal screening document. A copy of this Record of Decision is found in **Appendix O**.

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## 8. STAKEHOLDER CONSULTATION

The stakeholder consultation discussed in this chapter is included in **Appendix P**. Consultation with these stakeholders will continue throughout the design and construction stages.

### 8.1 Ontario Realty Corporation/Hydro One

The Ontario Realty Corporation (ORC) and Hydro One Networks Inc. (HONI) have been consulted a number of times since 2008. The four tunnel alignment alternatives that were discussed in Section 4.2 of this report, were presented to HONI/ORC on January 12, 2009. Subsequent information was provided regarding mitigation strategies. Following the presentation in January the alignment was modified to more centrally locate the tunnel alignment between Towers 158 and 153A, and HONI/ORC was provided with variations to the preferred Alternative 3 (Alternatives 3A and 3B) in a memo dated January 20, 2009. HONI provided a letter dated April 6, 2009 stating their preference of Alternative 3B, as shown in **Appendix P**.

The details associated with the Highway 407 Station including the shift in the station box, Black Creek realignment and surface facilities associated with the station were presented to HONI/ORC on September 9, 2009. A follow-up meeting took place on September 28, 2009 and a letter was sent to TYSSE on November 9, 2009 outlining their comments on various items. Consultation with HONI/ORC is ongoing and the process to date has been productive and positive.

### 8.2 Toronto and Region Conservation Authority

TYSSE has met with TRCA on January 16, 2009, April 30, 2009, July 27, 2009 and on a monthly basis beginning in September 2009. The purpose of these meetings was to obtain approval in principle for this proposed realignment of the tunnels and shift of Highway 407 Station. The topics included:

- The four (4) alignment alternatives (as described in Chapter 4);
- Geomorphology evaluation of the two Black Creek reaches between the Jane Street culvert and the CN railway;
- 100 year erosion study of the affected portion of Black Creek;
- Meander belt analysis of the affected portion of Black Creek;
- Preliminary, interim and proposed Black Creek relocation plans and details;
- Hydraulic analysis of alternative bridge spans and grading;
- Terrestrial and aquatic studies supporting the proposed relocation of Black Creek;
- Geotechnical and hydrogeological investigations of the Highway 407 Station and tunnel areas;

- Stormwater management, and erosion and settlement control concepts; and
- Environmental Management Plan approach for the Highway 407 Station area (north tunnel and station construction contract).

The TRCA provided a letter dated July 20, 2009 confirming their approval in principle of this proposed amendment subject to a number of conditions. A copy of this letter is provided in **Appendix P**. Consultation between TYSSE and TRCA continues on a monthly basis to document and review information to meet TRCA conditions.

TRCA serves as the tier 2 review agency for Fisheries and Oceans Canada review of the effects on watercourses. Therefore consultation regarding the Black Creek relocation and design have led to the filing of the Fisheries and Oceans Canada – Request for Project Review, included in **Appendix M**.

### **8.3 York Region**

York Region is a funding partner for the TYSSE project and is therefore involved in the day-to-day project development.

### **8.4 The City of Vaughan**

TYSSE consults with the City of Vaughan on an as needed basis. The following are topics that have been discussed:

- Black Creek Optimization Study: TYSSE is a stakeholder in this study attending briefings and share evolving hydraulic and geomorphologic results;
- Compatibility of Highway 407 Station facilities to the City of Vaughan land use plans and zoning designations in the EA Amendment study area;
- Proposed revisions to the regulatory flood lines and relationship to the OS1 boundaries; and
- The 900mm sanitary sewer relocation concepts to obtain acceptance of proposed relocation and associated construction permits.

### **8.5 Ministry of Transportation**

The Ministry of Transportation (MTO) has an Order-In-Council in place on the Parkway Belt Corridor, within the ORC lands, that allows them to review and approve proposed developments on the Parkway Belt. Since the preferred alignment described in this report crossed the Parkway Belt in approximately the same location as the alignment in the COA report, the development of the TYSSE alternative alignments (described in Section 4.2 of this report) was not specifically presented to the MTO.



However, MTO staff is aware of the preferred alternative and have been part of the design review and co-ordination process as the preliminary and detailed design of Highway 407 Station and the twin tunnels have progressed. MTO Staff and TYSSE staff have held multiple meetings over the course of 2009 to review and co-ordinate the design of Highway 407 Station in order to make provision for future integration with the planned MTO Highway 407 Transitway.

## **8.6 GO Transit/Metrolinx**

Since the Highway 407 Station will be integrated with the future MTO Highway 407 Transitway Station, GO Transit /Metrolinx have been involved in the resulting shift of Highway 407 Station as described in this report. Design co-ordination meetings with GO Transit/Metrolinx have been held multiple times over the course of 2009 with regards to the design of the Highway 407 Station bus terminal and the provision for integration between Highway 407 Station and the future MTO Highway 407 Transitway.

## **8.7 Ministry of Natural Resources**

Previously unidentified butternut trees (*Juglans cinera*) were located during field investigations by AECOM in the summer of 2009 on the ORC lands in the area of the Highway 407 Station. Steve Strong of the Ministry of Natural Resources (MNR) was notified of the butternut tree existence on July 31, 2009 (refer to **Appendix P**). Discussions with Steve Strong led to an onsite meeting with MNR District Forester Bohdan Kowalyk who took samples from two specimens. These were confirmed as pure strain trees with no canker present. Subsequent to this confirmation, 91 nuts were harvested and provided to Madelaine Danby of the Midhurst MNR Office for use in the MNR stewardship initiative.

A removal and replacement proposal has been submitted to MNR in December 2009 and is included in **Appendix N**.

## **8.8 Canadian National (CN) Railway**

The four tunnel alignment alternatives that were discussed in Section 4.2 of this report were presented to CN on January 22, 2009. The preferred alignment described in this report did not significantly change the orientation of the tunnels under the CN Halton Subdivision right-of-way. However, CN maintained their concern that the location of the tunnels is under sensitive switches associated with the rail line. TYSSE has provided proposed mitigation measures to CN for their review and consultation will continue.

## 8.9 407 ETR

The amended alignment as described in this report did not significantly alter the orientation of the tunnels under the 407 ETR right-of-way. Therefore, the development of the alternatives for this EA Amendment Report was not specifically presented to 407 ETR.

## 8.10 Black Creek Conservation Group

The Notice of Preparation of an Addendum Report (refer to **Appendix P**) was provided to the Black Creek Conservation Group for information purposes. They will have an opportunity to review the EA Amendment Report, under the 30 day review period, and provide comments if warranted.

## 8.11 The Humber Alliance

The Notice of Preparation of an Addendum Report (refer to **Appendix P**) was provided to the Humber Alliance for information purposes. They will have an opportunity to review the EA Amendment Report, under the 30 day review period, and provide comments if warranted.

## 8.12 General Public

A Notice of Preparation of an Addendum Report (Notice) was placed in these publications on the dates noted:

- Thornhill Liberal on Sunday, December 6, 2009
- Richmond Hill Liberal on Sunday, December 6, 2009
- Vaughan Citizen on Sunday, December 6, 2009
- North York Mirror on Wednesday, December 9, 2009

The Notice (refer to **Appendix P**) was also posted on these websites: [www.spadina.ttc.ca](http://www.spadina.ttc.ca) and [www.vivanext.com](http://www.vivanext.com).

There will be a subsequent notice prepared for the opportunity to review this EA Amendment Report. This report will be placed at various locations (Clerk's Offices and area libraries) where the general public can view the document during the 30 day review period and submit comments if warranted.

The main TTC website hosts the Toronto- York Spadina Subway Extension project webpage which provides general project information. The public can view station design development and in the future, the overall construction of the subway extension. The public is able to connect with the project and submit their questions

or comments through the TYSSE web email address [TYSSE@ttc.ca](mailto:TYSSE@ttc.ca) or the 24hour comment line of 416-393-4001.

TTC/TYSSE will host Public Open Houses for Steeles West Station on February 3, 2010 and Highway 407 Station in March 2010 to exhibit initial station design concepts in the vicinity of each station. The second Public Open House, showing detailed architectural concepts, for each of these stations, is currently scheduled for early spring. Details of the station finishes, the public art, landscaping, streetscaping along with the station construction/traffic management will be revealed at that time. Comments from the public from both open houses will be garnered for review and fed into the design development.

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